**SPECIFIC AIMS**

Perinatal depression, defined as major or minor depressive episodes during pregnancy or in the first year postpartum, affects an estimated 13% of peripartum women globally, with adverse consequences for women and their infants. Access to clinic-based mental health care is limited, especially in resource-limited settings. Mobile health (mHealth) interventions such as interactive SMS text messaging with healthcare workers (HCW) have been proposed as resource-efficient, accessible adjuncts to in-person care, but important gaps and opportunities remain to realizing their full potential at scale. First, the potential of patient SMS communication patterns to provide real-time assessment of health status to inform care has been under-explored. Second, it is unclear what core components of SMS interventions are essential for efficacy, limiting their adaptation and dissemination. Third, intervention affordability and scalability may be maximized by automating aspects of messaging, but methods to optimize efficiency while preserving efficacy have not been validated.

***Mobile WACh*** is a unique open-source mHealth platform developed by our team of researchers at the University of Washington and University of Nairobi. *Mobile WACh* is a human-computer hybrid system, sending pre-composed, automated messages to clients and prompting them to communicate concerns in real-time. Incoming client messages are responded to by a live HCW, leading to personalized dialog. We employed the platform in two clinical trials and one demonstration project in peripartum women in Kenya and found that it improved continuation of exclusive breastfeeding and contraceptive use. Preliminary data suggest that participants felt emotionally supported by the interventions and experienced reduction in depressive symptoms. **To date, *Mobile WACh* has hosted SMS dialog with 1200 women, with 96,000 SMS sent to women and 34,000 received from them, in 4 different languages. Enrollment of an additional 2500 women is planned in 2019-2020** (R01HD098105)**. This provides a rich dataset in which to evaluate real-time assessment of mental health status, identify core intervention components, and test automation methods to streamline workflow.**

Natural language processing (NLP), the extraction and encoding of meaning from unstructured human language, combined with machine learning, can be used to automate message review and inform message composition in *Mobile WACh*. Few studies have taken this approach for non-English and mixed language text. In this K18 award application, Dr. Ronen seeks to augment her training as an epidemiologist with training in machine learning and NLP methods for analysis of digital communication and paired clinical data. The skills acquired through the proposed training and mentoring activities will enable her to address the following Specific Aims.

**Aim 1. To develop a computational model that uses *Mobile WACh* participants’ SMS messages to predict their depression symptoms.**

Approach: Rule-based and machine learning NLP methods will be used to define features of SMS sent by participants in past and ongoing *Mobile WACh* studies. A supervised model will be trained and tested that uses these features to predict depressive symptoms assessed at study visits using validated diagnostic scales.

*Hypothesis: Infrequent participant SMS and specific words will predict depressive symptoms. The model with the highest sensitivity and specificity will use machine learning word embeddings.*

**Aim 2. To determine core components of SMS messages sent to participants that are associated with improvement in longitudinal depression symptoms in *Mobile WACh* studies.**

Approach: Rule-based features of study automated and personalized SMS will be defined. Marginal structural models will be used to model linked SMS, client characteristics and symptom data to determine adjusted estimates of associations between study SMS features and subsequent improvement in depression symptoms.

*Hypothesis: Mobile WACh SMS containing specific words conveying empathy and inquiry will be associated with improvement in depression symptoms. Personalized study messages sent within a short time of client messages and in matched dialect will be associated with the greatest improvement.*

**Aim 3. To develop and pilot a just-in-time adaptive variant of *Mobile WACh* that identifies participant SMS indicating depression and directs HCW response.**

Approach:Models from Aims 1-2 will be implemented in the *Mobile WACh* software to identify participant SMS that indicate depression and provide response suggestions to the responding HCW. The intervention’s feasibility and acceptability will be assessed in a 3-month pilot with 80 women with elevated depressive symptoms.

*Hypothesis: The modified platform will sensitively identify participant SMS indicating depression symptoms. Adaptive Mobile WACh will be feasible and acceptable to HCW and participants.*

This proposal is highly responsive to PAR-18-882’s goal of supporting interdisciplinary *cross-training* in mobile health data analytics, and development of *adaptive interventions* to support mental health. Completion of this proposal will provide training and preliminary data to enable the candidate to become a leader in development of scalable, efficient mHealth interventions that support mental health in resource-constrained settings.