Vital Signs for Psychosis: Personalized longitudinal markers of psychosis severity using automated speech and language analysis

There is a critical need for scalable biomarkers in psychotic disorders. Our objective is to learn from individual variations to produce accurate, personalized measures of psychosis severity based on automated speech and language – i.e. "vital signs" that provide an objective measurement of psychosis severity in the moment.

TANG LAB

Human subjects aims:

Study 1

Form focus groups to gather community perspectives on automated symptoms markers, and gather clinical viewpoints to inform the development and clinical translation of this technology.

Study 2

Recruit healthy controls who will provide speech samples to normalize measures and test for feature stability over repeated measurements. This will help us calibrate the test stimuli.

Study 3

PS participants will provide speech samples that will undergo the same feature extraction as for the HC participants and will additionally be used to generate **personalized predictive measures**. A

generalizable model, trained on a large existing dataset, will be personalized to each participant using personalized adaptive modeling. Clinical ratings will also be gathered from PS participants.
Scientific aims:

Aim 1. Develop personalized, adaptive models to generate objective measures of psychosis severity. First, each COMPASS-10 item will be predicted with a generalizable model trained to maximize accuracy across all individuals. Then, for each psychosis spectrum participant, the model will be iteratively updated after each successive datapoint to adapt to trends in that person, creating a unique model for each individual. We will then compare precision among symptom severity predictions and determine how model accuracy relates to number of adaptive iterations.

Aim 2. Connect predicted symptom severity scores to concrete indicators of clinical exacerbation. We will evaluate whether fluctuations in predicted symptom severity scores are able to capture psychosis exacerbations linked to clinical events (hospitalization, ER visit). This will be evaluated with:

2A) Artificial Intelligence Approach: A Long Short-Term Memory (LTSM) machine learning algorithm will use the sequence of psychosis symptoms scores for each participant to classify each timepoint as "exacerbation" or not.

2B) "Human Intelligence" Approach: Clinicians will be asked to manually detect psychosis exacerbations based on plotted trajectories of symptom severity scores.

Aim 3. Integrate perspectives through community engagement. We will engage individuals with lived experience and community mental health clinicians at the beginning and conclusion of this work to ensure that both the study design and future development are feasible, acceptable and beneficial.

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