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Statistical Design and Power

Study Title: The Healthy Aging Brain Study: A Remote Behavioral Intervention to Enhance Physical Activity in Older Adults.

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We will recruit 60 older adults over 60 years old (30 Intervention Group, 30 Control Group) from the PREVENT-AD cohort. This sample size was determined using power calculations that will allow us to identify a minimum detectable difference of 10.0%, with a common standard deviation of 14.0% (estimated from a similar physical activity intervention) with 80% power and a two-sided alpha of 0.05. Our research goal is to identify the neurobehavioral mechanisms underlying physical activity engagement in at-risk older adults and test the efficacy of a scalable, technology-based intergenerational behavior intervention on physical activity engagement. Our planned analyses and anticipated results for each Specific Aim are outlined below:

Aim 1) We will apply linear mixed effect models to determine the extent to which intergenerational social motivation enhances physical activity (primary outcome) and secondary outcomes (cognition, loneliness, self-efficacy, mood, and sleep) in at-risk older adults within the Intervention compared to the Control Group. Demographic variables (age, sex, socioeconomic status, neighborhood walkability) and AD multimodal risk score will be included as covariates of non-interest.

Aim 2) We will apply the NIH Science of Behavior Change theoretical framework to determine whether target mechanisms (social support, generativity or reward sensitivity) separately mediate the influence of the intervention on physical activity engagement. This approach will provide novel insights about target, potentially modifiable mechanisms that mediate successful behavior change in older adults at risk for AD.

Aim 3) To identify the individual differences and brain fingerprint that predict successful behavior change at the single subject level in older adults at risk for AD, we will analyze baseline behavioral and MRI data gathered during the intervention in addition to already acquired longitudinal multimodal brain and behavioral data. We will use both a-priori regions of interest (ROIs) vmPFC and salience network seed-based analyses of brain connectivity as well as data-driven whole brain multivariate pattern analyses per previous publications using data-driven approaches to predict clinical outcomes. We will apply rigorous machine-learning methods and independent linear regression models using leave-one-out cross validation (LOOCV) and bootstrap resampling to identify the brain networks that predict treatment response (physical activity engagement) at an individual level. We use methods that we published in a similar sample size of older adults. This approach will provide solid mechanistic insight into the brain basis of successful behavior change. We expect these results to be generalizable and yield single subject values.