Target submission deadline: original R01, 7/15, actual RFA due 10/5/2021

Statistical analysis plan for Aim 3:

The primary outcome, the mean of the 4-item PROMIS survey, will be modeled in a linear mixed model (LMM) with fixed effects for intervention group and time (3, 6, 12 months). The primary estimand of interest is the difference in the expected value for the outcome at 12-month between the two intervention groups, controlling for subject-specific intercepts and trends. Additionally, we will assess secondarily whether changes are observed at other time points or in the rate of change in the outcome over time. The LMM will include hierarchical random effects; specifically, random intercepts and slopes for each study participant nested within random school-wide intercepts to account for within-subject and within-school correlation. If this LMM is over-specified/unidentifiable and causes convergence issues, an alternat variance structure will be selected based on minimizing Akaike’s Information Criterion.

Secondary and exploratory outcomes will be modeled using a similar mixed modeling framework, except that for binary/non-normal outcomes, a generalized linear mixed model with the appropriate family and link will be utilized. Since subjects will be randomly allocated into intervention groups, we will not include other covariates in the primary models unless they are deemed to be important precision variables. However, in exploratory analyses, we will investigate whether certain covariates or combinations thereof predict better or worse response to the intervention using LMMs with treatment-covariate interactions; these exploratory hypotheses will not be considered confirmatory, rather they will provide useful preliminary data for future studies.

Power calculation: This power calculation assumes conservatively that we use a two-sample t-test for the within-participant 12-month change in the primary outcome. We plan to recruit n=75 subjects per group. If 15% of these drop-out by the 12-month time point, we will have 80% power to detect a difference of Cohen’s d = 0.50 (a medium-sized effect) at a 5% significance level. This corresponds to a difference of 1.92 points in the 4-item PROMIS score, assuming the standard deviation in our population is 3.84 points as observed in a similar population of adolescent e-cigarette users (Morean et al. 2018).