“Young Adult EC Use and Respiratory Outcomes (K01)”

Power Analyses. For Aims 1 and 2: The use of repeated measures and longitudinal methodology allow for greater detection of moderate effect sizes associated with decreased in markers of respiratory health, increases in nicotine addiction, changes in EC and/or OTP use patterns, and frequency/quantity of EC use. For **each** repeated measures analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) we are 95% powered to find moderate effect sizes. For Aim 3: Power was calculated using MPlus Monte Carlo estimation informed by published and preliminary studies. To test power for MLM, we first examined power with Optimal Design using repeated measures. We then repeated our power analyses in MPlus Monte Carlo estimation, building on published MLM simulations and using 1000 replications to confirm stability of each model, to better capture the complexity of the separate models, including cross-level interactions. For the EMA analyses, the power of the statistical test depends on the total effective sample size (ESS) and the statistical model used. The total ESS is the number of statistically independent observations available for this study. The number of statistically independent observations is the total number of observations (number of participants x number of data collections) adjusted for within-individual correlations. As the within-individual, or intra-class, correlation (ICC) increases, the ESS decreases. The following formula illustrates this relationship, whereby the effective sample size is equal to $nm/(1+(m-1)\rho)$, where n = number of participants; m = number of repeated measures for each participant; and ρ = ICC.[94] In sum, even assuming effects as small as .10 (well below expected effect), we will be well powered (> .85) to identify effects across analyses.

Data Analytic Overview. Analyses will be conducted using SAS, R and MPlus. For Aims 1 and 2, distribution plots will be carried out on all data to assess for normality, and any non-Gaussian data were evaluated with either Wilcoxon signed rank test or, where appropriate, data will be logarithmically transformed before analysis. Comparisons of continuous data will be made by an overall analysis of variance, followed by Bonferroni corrected, multiple-range testing, to obviate multiple pairwise comparisons, with the overall α error set at .05 (2tailed). For Aim 3, as appropriate, alternate estimators to address expected and observed characteristics (e.g., Poisson distribution, zero-inflation) will be used. MPlus permits frequentist and Bayesian estimation for models with missing data. Bayesian procedures allow multiple imputation of multiple datasets subsequently used with parameter estimates averaged across imputed datasets. Multiple imputation will virtually always outperform older methods of managing missing data (e.g., listwise deletion) with regard to both accuracy and power, making it the preferred approach.[72, 73] Measurement models will be formally tested. If analyses do not support the presence of the expected unitary constructs, subsequent analyses will examine aims as defined by observed variables. Model invariance tests will also be used to assess appropriate statistical treatment of gender; if measurement invariance is not observed, analyses will be stratified by gender.

Aim 1: Hypotheses 1a and 1b: We will use two-way repeated measures ANOVA and MANOVA with Tukey adjustment to examine differences between the measures of respiratory health (pulmonary functioning, NELF samples) and EMA data (five two-week monitoring periods). For ***H1a***, two-way repeated measures ANOVA will compare mean differences between pulmonary and respiratory markers and user status (EC-exclusive vs. never-users). For ***H1b***, we will use MANOVA models to examine changes in frequency/quantity of EC use and nicotine dependence (significant increases in HONC scores) across each session with respiratory and pulmonary functioning.

Aim 2 Hypotheses 2a and 2b: We will use two-way repeated measures analysis of variance and multivariate analysis of variance with Tukey-adjustment to examine differences between the number of vape sessions per day and time spent vaping with pulmonary functioning across each EMA monitoring period. For ***H2a***, two-way repeated measures ANOVA will compare mean differences between pulmonary and frequency/quantity of EC use. For ***H2b***, we use MANOVA models to examine changes in pulmonary functioning and the experimentation of OTP in conjunction with EC-use across the 1-year monitoring period.

Exploratory Aim 3: Hypotheses H3a: We will use multilevel models (MLM) to examine the daily-level associations between the frequency/quantity of EC use experimentation and pulmonary functioning. These models will allow us to examine the within-person associations between EC use and pulmonary functioning, using Curran and Baurer's[95] procedures for disaggregating within-person and between-person effects using two level analysis in multilevel modeling. These models will also allow for the examination of cross-level interactions among between and within-person factors. Specifically, we will be able to examine the role of daily within-person fluctuations in

frequency/quantity of EC use in its links to pulmonary functioning. Further, we will be able to assess the potential differences by user status as well as baseline respiratory health. Significant interactions will be probed using Preacher, Curran, & Bauer's[96] computational tools.

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