Statistical analysis plan

Randomized Clinical Trial Evaluating the Impact of E-cigarette Device Warnings

NCT05714982

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Hypotheses
This trial evaluates the impact of e-cigarette health warnings by randomly assigning vapers to have their devices and refills labeled with control messages, text warnings, or pictorial warnings.

The primary hypotheses are about the main trial outcome of vaping quit intentions across the 4 weeks of the trial. We hypothesize that text warnings will elicit higher vaping quit intentions than control messages. We also hypothesize that pictorial warnings will elicit higher vaping quit intentions than text warnings.

For secondary outcomes, we hypothesize that text warnings will elicit higher consumer understanding, information seeking and sharing, and vaping behavior change than control messages, and that pictorial warnings will elicit higher scores on these measures than text warnings. We do not have hypotheses about the impact of the warnings on unintended effects.

Analytic plan
Statistical analyses will use two-tailed tests and a critical alpha of .05.

Primary trial outcome
Vaping quit intentions will be measured using a 3-item scale at 5 time points: post-labeling (Visit 1) and at 1, 2, 3, and 4 weeks (Visits 2-5). The 3 items will be averaged to create a composite quit intention score for each time point. The primary trial outcome will be an average vaping quit intentions score across the 5 time points (i.e., grand mean of quit intentions). We will use all available data in computing 1) the quit intention score at each time point and 2) the aggregate quit intention score across time points. Because the quit intention survey items are forced response, missingness will be uncommon, and the use of two layers of averaging will naturally address most missingness. In the unexpected situation of having no intentions data for a participant, we will set their value to the grand mean for the trial overall (ignoring trial arm).

We will estimate a general linear model with quit intentions as the continuous outcome and trial arm as a 3-level categorical, between-subjects predictor (pictorial, text, control; text arm will be the reference group). We will not adjust for demographic or other baseline characteristics per CONSORT recommendations (Consort, 2010). We will examine the following variables measured pre-randomization as potential moderators by adding categorical main effects for these terms and their interaction with trial arm: age, education, income, gender, sexual orientation, race, vaping frequency (some days or every day), and current cigarette smoking status. We will probe statistically significant interactions by examining the effect of trial arm within strata of the moderator, using Bonferroni corrections for the post-hoc tests.

We estimated sample size for a 3 arm trial using the following inputs: 80% power, α set at .05, an effect size Cohen's *d* of .16, number of measurements set at 4.2 time points (estimated average number of completed sessions based on our previous cigarette pack labeling trial; Brewer et al., 2016), and an interclass correlation (ICC) of .7 (based on an observed ICC in that trial; Brewer et al., 2016). The previous effect size estimate is based on the average observed *d* in two online experiments (Brewer et al., 2019; Brewer et al., in prep) between pictorial vs text warnings; control vs. text comparisons were larger in these two experiments.

For descriptive purposes, we will examine mean vaping quit intentions at each trial visit, calculating the mean and standard error. We will compare the trial arms graphically at each time point, examining whether means for each trial arm fall outside of the confidence interval for the other arms.

Secondary trial outcomes
Except as noted below, we will again estimate a general linear model for each secondary outcome shown in Table 1, with trial arm as a 3-level categorical, between-subjects predictor (pictorial, text, control; text arm will be the reference group). We will handle missingness as we did for the primary outcome.

Vaping quit attempt and cigarette smoking quit attempts will each be dichotomous outcomes (any quit attempt during the trial). We will estimate a logistic regression model with quit attempt as the outcome and trial arm as the categorial predictor with text arm as the reference group.

Table 1. Secondary outcomes

Construct	Variable type, range
Consumer understanding	
Knowledge	Continuous, 0-100%
Cognitive elaboration	Continuous, 1-5
Perceived likelihood of illness from vaping	Continuous, 1-5
Negative affect	Continuous, 1-5
Information seeking and sharing	
Attention to warning	Continuous, 1-5
Information seeking	Continuous, 0-6
Number of conversations in past week	Continuous, 0-100
Vaping behavior change	
Vaping reinforcement attitudes	Continuous, 1-5
Uncontrolled vaping	Continuous, 1-5
Number of times forgoing a vape in past week	Continuous, 0-6 times
Made vaping quit attempt (for 24 hours) in past 4 weeks	Dichotomous, 0 or 1
Successful quitting of vaping (at last survey)	Dichotomous, 0 or 1
Unintended effects	
Inaccurate risk perception	Continuous, 0% to 100%
Stigma	Continuous, 1-5
Smoking quit intentions among dual users	Continuous, 1-5
Made smoking quit attempt (for 24 hours) in past 4 weeks among dual users	Dichotomous, 0 or 1

Edit 6/24/2024: In Table 1, changed range of values for information seeking from "Continuous, 1-5" to "Continuous, 0-6". Changed range of values for number of conversations in past week from "Continuous, 1-5" to "Continuous, 0-100". These updates align this document with the main trial registry.

References
Brewer, N. T., Queen, T., Sheldon, J. M., Lazard, A. J., Ribisl, K. M., Ebrahimi Kalan, M., & Hall, M. G. (In preparation). Impact of e-cigarette warnings on perceived message effectiveness.
Brewer, N. T., Jeong, M., Hall, M. G., Baig, S. A., Mendel, J. R., Lazard, A. J., ... & Ribisl, K. M. (2019). Impact of e-cigarette health warnings on motivation to vape and smoke. *Tobacco Control*, *28*, e64-e70.
Brewer, N. T., Hall, M. G., Noar, S. M., Parada, H., Stein-Seroussi, A., Bach, L. E., ... & Ribisl, K. M. (2016). Effect of pictorial cigarette pack warnings on changes in smoking behavior: A randomized clinical trial. *JAMA Internal Medicine*, *176*, 905-912.