**Supplementing a survey with respondent Twitter data to measure e-cigarette information exposure**

**Online Supplemental Materials**

1. **Social Media and Health Survey - Selected Questions**

*E-cigarette use:*

Now we will ask you several questions about electronic cigarettes or other electronic “vaping” products also known as e-cigarettes, e-cigs, vape pens, hookah pens, or e-hookahs. We will refer to these products as “e-cigarettes” for the next few questions.

Do you now use e-cigarettes every day, some days, rarely, or not at all?

\_\_Every day

\_\_Some days

\_\_Rarely

\_\_Not at all

*Cigarette use:*

Do you now smoke cigarettes every day, some days, or not at all?

\_\_Every day

\_\_Some days

\_\_Rarely

\_\_Not at all

*Perceived harm:*

Do you think **e-cigarettes** are more harmful, as harmful, or less harmful to the user than regular cigarettes?

\_\_More harmful

\_\_As harmful

\_\_Less harmful

\_\_Don’t know/ not sure

*Twitter use:*

On average, how often do you use Twitter? Would you say…

\_\_Never

\_\_Less than once a month

\_\_Monthly

\_\_A few times a month

\_\_Weekly

\_\_A few times a week

\_\_Daily

\_\_Several times per day

*Twitter friends and followers:*

For the next few questions, we encourage you to check your Twitter profile to help you come up with your answers.

Thinking just about your Twitter profile, how many Twitter accounts do you currently follow?

\_\_ Not following any accounts

\_\_ 1 to 25

\_\_ 26 to 50

\_\_ 51 to 75

\_\_ 76 to 100

\_\_ 101 to 250

\_\_ 251 to 500

\_\_ More than 500

How many Twitter accounts are following you?

\_\_ Not followed by any accounts

\_\_ 1 to 25

\_\_ 26 to 50

\_\_ 51 to 75

\_\_ 76 to 100

\_\_ 101 to 250

\_\_ 251 to 500

\_\_ More than 500

*Use Twitter to learn about e-cigarettes:*

The following are some other reasons that some people use Twitter. Please rate the extent to which you agree or disagree with the following items (From strongly disagree to strongly agree).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Strongly disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly agree** |
| To learn about e-cigarette products or devices | 1 | 2 | 3 | 4 | 5 |

*Recall seeing positive/negative tweets about e-cigarettes:*

Next we are going to ask you some questions about type of information about **e-cigarettes** you’ve seen or received.

[IF RECALLED SEEING E-CIGARETTE TWEETS] Are these **e-cigarette** Tweets generally positive, neutral, or negative towards using **e-cigarettes**?

\_\_ Positive

\_\_ Neutral

\_\_ Negative

*Ethnicity:*

Are you Hispanic or Latino?

\_\_ Yes

\_\_ No

*Race:*

Which one of these groups would you say **best** represents your race?

\_\_ White

\_\_ Black or African American

\_\_ Asian

\_\_ American Indian, Alaskan Native

\_\_ Native Hawaiian or Other Pacific Islander

\_\_ Other (SPECIFY: \_\_\_\_\_) [ALLOW 60 characters]

*Education:*

What is the highest level of school you completed or the highest degree you received?

\_\_ Never attended school or only attended kindergarten

\_\_ Grades 1 through 8 (Elementary)

\_\_ Grades 9 through 12 (High school graduate)

\_\_ G.E.D.

\_\_ Some technical or vocational school

\_\_Some college, or no degree

\_\_AA; technical or vocational school

\_\_AA; academic

\_\_ BA, BS (College graduate)

\_\_At least some graduate or professional school

\_\_ Graduate or professional degree

*Age:*

What is your age? [ENTER IN YEARS] \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Gender:*

Are you:

\_\_ Male

\_\_ Female

1. **Further Methodological Details**
2. *Recruitment ads*

Recruitment ads featured images of people using laptops and phones and the following text: “Complete a survey about social media use and health and get at $10 gift card if you qualify!” Targeting criteria for ad placement included location (living in the United States), language (English speakers), age (aged ≥18 years), use of e-cigarette keywords (e-cigarette, eliquid, vaping, ejuice, etc.) and expressed interest in e-cigarette topics.[[1]](#footnote-1)

1. *Additional details on screener eligibility*

Most who completed the screener were ineligible for one or more reasons: 2,080 (60.6%) were not 18 or older; 3,657 (69.3%) did not meet the e-cigarette use criteria; 3,364 (63.8%) did not meet the Twitter use criteria; 3,254 (61.7%) would not grant permission to combine their publicly available Twitter data with survey responses.

1. *User type classification model*

The model correctly classified users with a test set F1 score of 83.3%. The F1 score is a classification model evaluation metric, though while similar in interpretation to accuracy, penalizes for poor performance in both precision and recall. Precision is the number of true positives out of all test set observations that are predicted positive and recall is the number of true positives detected by the model out of all true positive observations in the test set.

To distinguish between different user types, the classification model includes 15 variables reported directly from a Twitter account’s metadata (e.g., the number of times the account tweeted, the number of followers an account has, etc.) and 58 variables that are derived from an account’s tweeting behavior, tweet content, and e-cigarette keyword mentions in their screen names and profile descriptions (e.g., mean hashtag count in tweets, mean URL count in tweets, etc.). To create these model variables for the respondents’ friend accounts, we first collected the friends of all the respondents and then collected up to their last 200 tweets. Once the features were created, we ran the model on the friends for each respondent to get a predicted user class and normalized the predicted class over the total number of a respondent’s friends.

1. *Comparison of Twitter use from survey and Twitter data sources*

For the survey, space for detailed questions on Twitter usage was limited and we did not anticipate respondents would be able to accurately recall and differentiate time spent *posting* on Twitter vs. time spent *reading other posts* on Twitter. For analysis purposes, we chose to operationalize and define Twitter usage in the survey as time spent posting or reading. In the survey, we asked respondents to report their frequency of use on a 7-point labelled scale (less than once a month, monthly, a few times a month, weekly, a few times a week, daily, or several times a day). From the Twitter metadata, we have the exact date and time values of each tweet authored by the respondent. However, we do not have the dates and times that a respondent logged into to Twitter but did not tweet. This limitation of Twitter metadata posts a challenge to the measurement operationalization in research design. If a respondent interpreted “using” Twitter as both reading tweets and tweeting, the metadata may underestimate their use. Similarly, while the Twitter usage frequency survey question was developed to reflect the common understanding of “use,” it does not align with what we are able to capture from Twitter.

1. Targeting options vary by social media platform. See Guillory et al. (2016) for a detailed overview of Twitter recruitment procedures and ad content. [↑](#footnote-ref-1)