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# Evaluating Cross-Sectional and Longitudinal Associations Between Anti-Smoking / Anti-Vaping Beliefs, Intentions, and Behavior in a 3-Year Rolling Nationally Representative Survey of U.S. Youth and Young Adults

## Keywords

tobacco, e-cigarettes, youth and young adults

## Disciplines

Communication | Social and Behavioral Sciences

## Comments

This is a working paper and has not yet been subject to peer review.

**Evaluating Cross-Sectional and Longitudinal Associations Between Anti-Smoking / Anti-Vaping Beliefs, Intentions, and Behavior in a 3-Year Rolling Nationally Representative Survey of U.S. Youth and Young Adults**

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**This is a working paper and has not yet been subject to peer review.**

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## Objectives

Our aim was to identify beliefs associated with not smoking and vaping among youth and young adults (ages 13-25). We used data from a two-wave nationally representative rolling phone survey, and grouped respondents based on prior experience with smoking and vaping. For each group, we assessed the following questions: What is the relationship between intentions not to smoke or vape at baseline and behavior at six-month follow up? What is the cross-sectional relationship between each smoking or vaping-related belief and intentions not to smoke or vape? What is the relationship between each smoking or vaping-related belief measured at baseline and behavior at six-month follow up?

## Methods

### *Analytic Approach*

Pulling from theories of behavior prediction (e.g. the reasoned action approach, Fishbein & Ajzen, 2015), we focus on the relationship between beliefs, intentions, and behavior; in short, we aim to identify beliefs that are strongly associated with both no intentions to smoke or vape and no smoking or vaping behavior at follow-up. In identifying these beliefs, we conducted subgroup analyses: for smoking-related beliefs, intentions, and behaviors, we performed separate analyses for **never established smokers** and **current established smokers**; for vaping-related beliefs, intentions, and behaviors, we performed separate analyses for **never, former, and current e-cigarette users**, and for **current established smokers**. We chose to conduct subgroup analyses as different beliefs may resonate with different subpopulations, and consequently allow us to pinpoint – and perhaps eventually tailor – promising campaign themes for specific audiences.

### *Sample*

We used data from a nationally representative two-wave rolling phone survey of youth and young adults (ages 13-25) conducted by Social Science Research Solutions (SSRS). Surveys were conducted from mid-June 2014 - mid-June 2017 ( $n = 11,847$ ; randomly sampled  $\sim 11$ /day; response rate = 21%) and again six months later from mid-December 2014 - mid-December 2017 ( $n = 4470$ ; randomly sampled  $\sim 4$ /day; follow-up response rate = 38%). All participants were asked about smoking and vaping beliefs, intentions, and behaviors, which were measured at both baseline (T1) and six-month follow-up (T2). Demographic information (including age, sex, race/ethnicity, respondent and parent education, and region) was also collected. SSRS developed sampling and weighting procedures (used in the following analyses) to match the Current Population Survey distribution of important demographic variables. See Kranzler, Gibson, and Hornik (2017) for more information about survey procedures.

### *Baseline Smoking Status*

We divided respondents into two groups based on their smoking status: current established smokers and never established smokers (non-smokers). We also have data on former established smokers; however, we excluded them from analysis due to low sample size (T1  $n = 402$ ; T2  $n = 124$ ). All respondents were asked “Have you ever tried smoking cigarettes, even one or two puffs?” (*Yes; No*). Respondents who responded yes were asked two additional questions to assess current smoking status: “Have you smoked at least 100 cigarettes, which is 5 packs, in your life?” (*Yes; No*) and “During the last 30 days, on how many days did you smoke cigarettes?” (*0-30*). Respondents who had smoked at least 100 cigarettes and had smoked in the prior 30 days were classified as **current established smokers**. Respondents who had smoked at least 100 cigarettes but had not smoked in the prior 30 days were classified as **former established smokers** (excluded from analyses). All others were classified as **never established**

**smokers** (had never tried smoking even one or two puffs; had not smoked at least 100 cigarettes). Notably, the never established smokers group includes respondents who had smoked in the prior 30 days; however, these respondents had not yet reported smoking more than 100 cigarettes.

### *Baseline Vaping Status*

We divided **never established smokers** into three groups based on vaping status at baseline<sup>1</sup>. First, we asked “Have you ever tried vaping or using e-cigarettes, even one or two puffs?” (*Yes; No*). Respondents who responded no were classified as **never e-cig users**. Respondents who responded yes were asked: “During the past 30 days, on how many days did you vape or use e-cigarettes?” (*0-30*). Respondents who had not used e-cigarettes on any of the past 30 days were classified as **former e-cig users**. Those who had used e-cigarettes on one or more of the past 30 days were classified as **current e-cig users**. Due to the small sample size of current established smokers in our data, we did not categorize this group based on vaping status.

### *Behavior Measures*

For each smoking and vaping status group, we re-assessed past 30-day smoking and vaping behavior at six-months follow up. For current users at baseline, no use in the prior 30 days at follow-up indicates quitting. For non-users at baseline, use in the prior 30 days at follow up indicates initiation.

### *Intention Not to Smoke or Vape Measures*

We measured non-intention as having no intentions to smoke or vape in the next six months (versus having any openness). For smoking, we asked: “How likely is it that you will smoke a tobacco cigarette, even one or two puffs, at any time in the next six months?” For

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<sup>1</sup> For the nine analyses that included only follow-up measures (follow-up only measured beliefs and follow-up intentions), we classified respondents based on smoking and vaping status at *follow-up* rather than baseline.

vaping, we asked: “How likely is it that you will vape or use an e-cigarette, even one or two puffs, in the next six months?” We measured all items on four-point scales (definitely will not – definitely will). We dichotomized responses, measuring intentions not to smoke or vape as “definitely will not” (1 = definitely will not; 0 = probably will not, probably will, definitely will).

### *Belief Measures*

Belief measures were adapted from previous survey studies identifying important belief items associated with youth tobacco and vaping prevention (see sources in Brennan et al., 2018; Sangalang et al, 2019). Baseline surveys included 17<sup>2</sup> smoking-related belief measures and 7 vaping-related belief measures. The follow-up survey included the same 24 measures with an additional 9 vaping-related belief measures (33 total). All belief items were measured using four-point scales, although the anchor point and response options varied depending on the question asked. Consistent with the dichotomized intention measure, we later classified the most anti-vaping or anti-smoking response as 1 and all other responses as 0. Twenty-five belief items began with the same stem: “If I smoke every day...” (smoking) or “If I vape or use e-cigarettes every day...” (vaping). For example, one smoking-related belief item asked respondents whether they agreed with the following statement: “If I smoke every day, I will become addicted to nicotine,” (dichotomized response: 1 = strongly agree; 0 = agree, disagree, strongly disagree). We measured the remaining beliefs using introductory stems appropriate for the question. For instance, to measure perceived friend approval, we asked, “How do you think your close friends feel or would feel about you smoking every day?” (dichotomized response: 1 = strongly disapprove; 0 = disapprove, approve, strongly approve).

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<sup>2</sup> Surveys assessed 19 smoking-related beliefs; however, we chose to exclude 2 beliefs (“if I smoke every day...(1) it will change my brain; (2) I will develop smaller lungs”) due to low *n* (as these items were added later in the survey collection period).

## Analyses

We analyzed data using Stata version 15.1 (StataCorp, 2017). We used logistic regression analyses [odds ratios (OR)] to characterize the relationships between intentions and behavior, beliefs and intentions, and beliefs and behavior. First, we assessed the relationships between baseline-measured intentions not to smoke in the next six months and not smoking at six-month follow-up. We conducted a parallel analysis for intentions not to vape and not vaping at follow-up. Second, we evaluated the cross-sectional relationships between each smoking belief item at baseline and intentions not to smoke at baseline. We performed parallel analyses for the 7 vaping-related belief items measured at baseline. For the 9 vaping-related beliefs not measured at baseline, we measured the relationship between these follow-up belief measures and follow-up intentions. Finally, we assessed the relationships between all smoking and vaping beliefs measured at baseline and smoking and vaping behavior at follow-up. For all of these analyses, an OR greater than 1.0 indicates that the respondent who holds this belief is more likely to either **intend** not to smoke or vape (assessed cross-sectionally), or **actually** doesn't smoke or vape (assessed at follow-up). We conducted all of our analyses with appropriate survey weights. All of the analyses which used beliefs at baseline to predict behavior at follow-up used groups with homogenous behavior at baseline, e.g. only smokers or only non-smokers, effectively controlling for baseline behavior.

For all smoking-related analyses, we performed separate regressions for (1) all respondents, (2) baseline established smokers, and (3) baseline never-established smokers. For all vaping-related analyses, we performed separate regressions for (1) established smokers (2) all never-established smokers, and never-established smokers who were (a) current e-cig users, (b)



former e-cig users, and (c) never e-cig users (based on the survey wave when the independent variable was measured).

## Results

### *Descriptive Data*

In Tables 1-4 we provide raw and weighted descriptive data for respondents at both T1 and T2. We show demographic characteristics of our total survey sample (Table 1), the proportion of respondents in each smoking status group (Table 2), the proportion in each vaping status group (Table 3), and the overall distribution of intentions not to smoke/vape (Table 4).

**Table 1. Demographic Information for all Respondents**

Demographic Variables		T1		T2	
		N = 11, 847		N = 4,470	
		Unweighted %	Weighted %	Unweighted %	Weighted %
Male		52.9	50.9	55.3	50.6
Female		47.1	49.1	44.6	49.4
13-17		49.4	38.2	55.7	34.2
18-25 <sup>1</sup>		50.6	61.8	44.3	65.8
White Non-Hispanic		50.1	51.4	55.6	52.2
Black Non-Hispanic		14.1	14.1	11.7	13.8
Hispanic		23.4	21.3	19.9	21.3
Other		12.4	13.2	12.8	12.7
Parental education	Less than high school	6.0	7.01	4.53	6.25
	High school degree	21.6	25.9	18.7	26.0
	Some college	15.9	18.8	14.8	18.6
	College degree	31.1	26.8	31.2	25.0
	Graduate degree	25.4	21.6	30.6	24.1
Northeast		19.1	17.6	18.6	17.7
North Central		20.4	21.2	22.4	20.7
South		36.2	37.1	34.8	27.8
West		24.3	24.1	24.3	23.8

<sup>1</sup> included age 26 at T2

**Table 2. Established Smoker Status**

Use Classification	T1		T2	
	N = 11,802		N = 4,468	
	Unweighted %	Weighted %	Unweighted %	Weighted %
Never Established Smoker	87.6	83.3	91.2	87.9
Former Established Smoker <sup>1</sup>	3.4	4.5	2.8	3.8
Current Established Smoker	8.9	12.2	6.1	8.3

*Note.* Separate survey weights were applied for T1 and T2 measures.

<sup>1</sup> Due to small N, former established smokers were excluded from all analyses.

**Table 3. Vaping Status for Never Established Smokers**

Use Classification	T1		T2	
	N = 9,818		N = 4,113	
	Unweighted (%)	Weighted (%)	Unweighted (%)	Weighted (%)
Never E-cig User	80.3	25.9	76.7	12.5
Former E-cig User	12.5	40.6	15.8	48.3
Current E-cig User	7.3	33.5	7.4	39.3

*Note.* Separate survey weights were applied for T1 and T2 measures.

**Table 4. Smoking and Vaping Intentions for All Respondents at T1 and T2**

Intention Measure <sup>1</sup>		T1					T2				
		Definitely Will Not (%)	Probably Will Not (%)	Probably Will (%)	Definitely Will (%)	N	Definitely Will Not (%)	Probably Will Not (%)	Probably Will (%)	Definitely Will (%)	N
<b>Smoking</b> <sup>2</sup>	How likely is it that you will smoke a tobacco cigarette, even one or two puffs, at any time in the next 6 months? <sup>3</sup>	78.4	16.1	3.8	1.7	10,750	79.7	15.5	3.8	1.1	4,196
	How likely is it that you will try to quit smoking completely in the next 6 months?	19.5	31.7	28.6	20.2	1,043	12.2	35.8	34.4	17.6	270
<b>Vaping</b>	How likely is it that you will vape or use an e-cigarette, even one or two puffs, at any time in the next 6 months?	71.5	16.0	8.0	4.5	11,804	67.1	19.7	8.0	5.3	4,468

<sup>1</sup> In analyses, we dichotomized intentions: definitely no intentions (= 1) vs. some intentions (=0)

<sup>2</sup> Smoking intentions were assessed through two questions: current established smokers were asked about their intentions to quit, and never / former established smokers were asked about their intentions to initiate. In our analyses, we collapsed / recoded these two questions into one dichotomized intention variable.

## Smoking-Related Outcomes

### *Smoking-Related Intentions and Behavior: Over Time Associations*

We used logistic regression to assess the odds of smoking at six-months follow-up (T2) based on intentions to smoke at baseline (T1). The results for this analysis are reported in Table 5. We found that among all respondents who did not intend to smoke at T1 (compared to those with at least some intentions), the odds of not smoking (i.e. not smoking at least one cigarette in the prior 30 days) at T2 were 17.5 times higher. This pattern is largely replicated among never established smokers ( $n = 4,103$ ), with an OR of 10.2. Among current established smokers, the odds ratio is 2.24, but is not significant at the  $p < .05$  level; however, this may be because the sample is too small ( $n = 237$ ) to detect significant movement.

**Table 5. Smoking Related Behavior: Odds of T2 Not Smoking (past 30 days) with T1 Intention Not to Smoke**

Cig Use Status at Baseline (N)	OR	95% CI
All Respondents (4,456)	17.5***	12.6,24.3
Never Established Smoker (4,103)	10.2***	6.46,16.2
Current Established Smoker (237)	2.24	0.88,5.71

*Note.* Survey measures represent population weighting at T2. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### *Smoking-Related Beliefs and Intentions: Cross-sectional Associations*

We used logistic regression to assess the cross-sectional association between each T1-measured anti-smoking belief and T1 measured intentions not to smoke. See Table 6 for full distribution of smoking-related beliefs. As demonstrated in Table 7, most ORs were greater than 1.0<sup>3</sup>; in short, nearly all endorsed beliefs (dichotomized, with the most anti-smoking response as 1) were associated with intentions not to smoke. Here, we report on the pattern of results for our three sets of analyses: among the total survey population; among never established smokers, and among current established smokers.

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<sup>3</sup> There is a single exception to this pattern: the OR for descriptive norms for current established smokers is 0.65.

**Table 6. Smoking Beliefs for All Respondents at T1 and T2**

Belief Measure	T1					T2				
	Strongly Disapprove (%)	Disapprove (%)	Approve (%)	Strongly Approve (%)	N	Strongly Disapprove (%)	Disapprove (%)	Approve (%)	Strongly Approve (%)	N
How do you think your close friends feel or would feel about you smoking every day?	51.3	36.7	10.2	1.8	11,670	56.0	33.2	9.6	1.2	4,451
	None (%)	A Few (%)	About Half (%)	Most (%)	N	None (%)	A Few (%)	About Half (%)	Most (%)	N
How many people your age would you guess smoke cigarettes?	6.5	39.3	31.4	22.8	11,794	3.2	44.1	34.6	18.1	4,457
	A Lot (%)	Somewhat (%)	A Little (%)	Not a Lot (%)	N	Not a Lot (%)	A Little (%)	Somewhat (%)	A Lot (%)	N
How much do you think breathing smoke from other people's cigarettes harms you?	58.8	25.1	12.4	3.7	11,812	56.8	27.5	13.2	2.5	4,467
	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	N	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	N
...I will be controlled by smoking.	4.1	13.4	46.1	36.4	11,753	3.5	9.9	42.5	44.1	4,460
...I will become addicted to nicotine.	2.5	5.5	42.2	49.8	11,778	1.5	3.3	37.1	58.0	4,465
...I will breathe in thousands of chemicals.	2.0	3.7	45.0	49.3	10,271	.7	2.3	37.4	59.6	4,463
...I will develop cancer.	2.0	6.9	50.9	40.2	11,713	.8	6.3	50.2	42.7	4,457
...I will develop headaches.	2.9	22.6	57.2	17.3	11,212	2.3	17.9	57.5	22.4	4,373
...I will develop sexual and/or fertility problems.	5.7	28.8	49.4	16.1	10,824	3.8	24.4	52.2	19.6	4,272
...I will enjoy life more.	45.2	46.5	6.0	2.5	11,741	52.7	41.6	4.6	0.1	4,454
...I will feel relaxed.	30.4	44.9	21.4	3.3	11,620	34.3	39.4	23.5	2.8	4,433
...I will get wrinkles.	3.0	15.7	56.3	25.1	11,486	1.5	11.1	56.4	31.1	4,415
...I will get yellow fingers.	4.4	26.1	52.3	18.2	11,189	2.5	24.0	51.4	22.6	4,331
...I will look uncool.	9.2	26.1	42.9	21.8	11,528	7.9	21.8	44.2	26.1	4,417
...I will lose my teeth.	2.8	15.8	54.2	27.2	11,597	1.2	12.7	53.9	32.2	4,434
...I would be able to stop if I wanted to. <sup>1</sup>	21.3	40.0	30.8	7.9	11,669	23.8	42.3	26.8	7.1	4,450
...it will be a turn off to other people.	3.7	13.6	49.8	32.9	11,620	1.5	9.5	47.8	41.2	4,423

Note. Survey measures represent population weighting at T1 and T2; All belief items beginning with ellipses were preceded by "If I smoke every day..."; Due to rounding, totals may not add up to 100

<sup>1</sup> For respondents who had smoked in the past 30 days (current smokers), the question was worded: *I would be able to stop smoking if I wanted to.*

**Table 7. Smoking-Related Beliefs and Intentions: Odds of Intending Not to Smoke by Anti-Smoking Belief Measured Cross-Sectionally by Smoking Status**

	Belief Measures	Total			Never Established Smoker			Current Established Smoker		
		OR	95% CI	N	OR	95% CI	N	OR	95% CI	N
Measured at Baseline	...I will be controlled by smoking.	2.15***	[1.93,2.40]	11,702	1.83***	[1.62,2.07]	10,226	1.53*	[1.02,2.30]	1,037
	...I will become addicted to nicotine.	1.63***	[1.48,1.80]	11,724	1.62***	[1.44,1.82]	10,250	1.51*	[1.07,2.13]	1,037
	...I will breathe in thousands of chemicals.	1.76***	[1.59,1.96]	10,221	1.76***	[1.55,1.99]	8,915	1.27	[0.88,1.83]	912
	...I will develop cancer.	2.06***	[1.86,2.29]	11,660	1.65***	[1.46,1.86]	10,221	2.00***	[1.37,2.93]	1,013
	...I will develop headaches.	2.13***	[1.83,2.48]	11,161	1.84***	[1.54,2.19]	9,731	1.50	[0.84,2.67]	1,018
	...I will develop sexual and/or fertility problems.	2.25***	[1.92,2.64]	10,779	2.05***	[1.71,2.46]	9,403	1.82*	[1.00,3.31]	983
	...I will enjoy life more. (strongly disagree)	2.38***	[2.15,2.64]	11,688	1.96***	[1.74,2.21]	10,224	1.99***	[1.37,2.90]	1,024
	...I will feel relaxed. (strongly disagree)	2.74***	[2.43,3.09]	11,566	2.10***	[1.84,2.41]	10,102	1.42	[0.83,2.44]	1,027
	...I will get wrinkles.	2.10***	[1.85,2.38]	11,437	1.90***	[1.64,2.20]	9,998	1.63*	[1.05,2.52]	1,016
	...I will get yellow fingers.	1.75***	[1.52,2.02]	11,138	1.55***	[1.32,1.83]	9,697	2.18**	[1.33,3.58]	1,024
	...I will look uncool.	2.64***	[2.29,3.04]	11,478	2.25***	[1.92,2.63]	10,059	1.71	[0.98,2.99]	997
	...I will lose my teeth.	2.14***	[1.89,2.42]	11,544	1.66***	[1.45,1.91]	10,097	2.18**	[1.33,3.55]	1,020
	...I would be able to stop if I wanted to. (strongly disagree) <sup>1</sup>	2.46***	[2.13,2.84]	11,619	2.02**	[1.72,2.37]	10,150	1.35	[0.71,2.58]	1,038
	...it will be a turn off to other people.	2.07***	[1.85,2.31]	11,568	1.82***	[1.60,2.08]	10,106	1.89**	[1.26,2.83]	1,027
	How do you think your close friends feel or would feel about you smoking every day? (strongly disapprove) <sup>2</sup>	3.16***	[2.85,3.51]	11,626	2.23***	[1.98,2.51]	10,197	2.63***	[1.76,3.92]	997
	How many people your age would you guess smoke cigarettes? (none) <sup>3</sup>	2.24***	[1.76,2.85]	11,741	1.74***	[1.34,2.26]	10,264	0.65	[0.08,5.15]	1,039
	How much do you think breathing smoke from other people's cigarettes harms you? (a lot) <sup>4</sup>	1.67***	[1.51,1.84]	11,759	1.58***	[1.41,1.78]	10,279	1.28	[0.91,1.81]	1,039

Note. Survey measures represent population weighting at T1; All belief items beginning with ellipses were preceded by "If I smoke every day..." \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Unless otherwise indicated in the table, the "strongest anti-tobacco" response option was "strongly agree."

<sup>1</sup> For respondents who had smoked in the past 30 days (current smokers), the question was worded: *I would be able to stop smoking if I wanted to.*

<sup>2</sup> The response options for this item were: *strongly disapprove, disapprove, approve, and strongly approve.*

<sup>3</sup> The response options for this item were: *none, a few, about half, most.*

<sup>4</sup> The response options for this item were: *not at all, a little, somewhat, and a lot*

Perceived friend disapproval (or the belief that your close friends would strongly disapprove of your smoking) was the strongest predictor across the entire population, with an odds ratio of 3.16. Other social perceptions (such as not looking cool; OR = 2.64) or mood effects (not feeling relaxed; OR = 2.74 or not enjoying life; OR = 2.38) were also strong predictors; if participants strongly agreed with these beliefs, the odds of not intending to smoke were higher. In comparison, beliefs connected to addiction (OR = 1.63), secondhand smoke (OR = 1.67), and physical cosmetic effects (e.g. yellow fingers; OR = 1.75) were less strong predictors.

This pattern was largely repeated among never established smokers; however, the belief of not looking cool (OR = 2.25) was the strongest predictor among this population (edging out perceived friend disapproval; OR = 2.23). In addition, there was one physical health effects belief in the top five: the belief that one will develop sexual and/or fertility problems (OR = 2.02).

Beliefs for current established smokers fit a different mold; although perceived friend disapproval had the largest odds ratio (OR = 2.63), physical cosmetic and health effects were also strong predictors, effectively reversing the pattern for never established smokers (e.g. losing teeth; OR = 2.18, yellow fingers; OR = 2.18, cancer; OR = 2.00). If this group of respondents did not strongly agree with these beliefs, the odds of intending to smoke (or in this case, the odds of not intending to quit) were higher. On the lower end, perceived peer use (how many people your age would you guess smoke cigarettes; OR = 0.65), breathing in chemicals (OR = 1.27), and secondhand smoke (OR = 1.28) were less strong. Interestingly, only 10 / 19 beliefs were significant predictors among established smokers (although this may be driven by the small

sample of current established smokers in this study, which is less than 10% of the total survey population;  $n = 402$ ).

In short, relevant smoking-related beliefs vary widely based on experience; beliefs about social perceptions and mood effects appear to matter more for those who are **not** currently established smokers, whereas beliefs about physical cosmetic and health effects may matter more for current established smokers. However, one's beliefs about their close friends' disapproval of smoking behavior – are universally strong, predicting intentions not to smoke for both current and non-current established smokers.

#### *Smoking-Related Beliefs and Behaviors: Over Time Associations*

We used logistic regression to assess the odds of smoking at T2 based on each smoking-related belief measured at T1. Here, we restrict our analyses to never established smokers and current established smokers. As shown in Table 8, among never established smokers, all belief odds ratios were over 1.00; among current established smokers, only 9 / 19 beliefs had odds ratios over 1.00.

Among never established smokers, perceived peer use was the strongest predictor (OR = 25.3). In other words, if one believed that **none** of the people their age smoked at baseline, the odds of not smoking were 25 times higher at six-month follow-up. This relationship is remarkable not only due to the high odds ratio, but also in contrast to the cross-sectional results (predicting intentions not to smoke). At T1, if one believed that **none** of the people their age smoked, the odds of not intending to smoke were 1.74 times higher (not insignificant, but also not at the top of the pack). Mirroring the T1 cross-sectional analyses, perceived friend approval was also a strong predictor of smoking behavior at T2: if one believed that close friends would not strongly disapprove of smoking behavior, the odds of smoking at follow-up were 3.05 times



**Table 8. Smoking Related Beliefs and Behaviors: Odds of Not Smoking at T2 by Anti-Smoking Belief at T1**

Belief Measures	Never Established Smoker			Current Established Smoker		
	OR	95% CI	N	OR	95% CI	N
...I will be controlled by smoking.	2.43***	[1.51,3.93]	4,091	0.67	[0.23,1.94]	238
...I will become addicted to nicotine.	1.92**	[1.25,2.95]	4,088	0.69	[0.31,1.56]	238
...I will breathe in thousands of chemicals.	1.66*	[1.05,2.62]	3,562	1.01	[0.42,2.43]	209
...I will develop cancer.	1.63*	[1.03,2.56]	4,049	1.17	[0.47,2.91]	234
...I will develop headaches.	2.31*	[1.09,4.87]	3,906	0.86	[0.17,4.45]	232
...I will develop sexual and/or fertility problems.	2.07*	[1.11,3.88]	3,745	0.42	[0.07,2.44]	223
...I will enjoy life more. (strongly disagree)	2.88***	[1.83,4.53]	4,088	0.79	[0.33,1.90]	237
...I will feel relaxed. (strongly disagree)	2.11**	[1.26,3.54]	4,051	0.92	[0.25,3.46]	235
...I will get wrinkles.	1.45	[0.87,2.41]	4,006	1.44	[0.52,3.94]	234
...I will get yellow fingers.	1.41	[0.78,2.55]	3,871	0.89	[0.24,3.25]	235
...I will look uncool.	3.83***	[1.82,8.06]	4,009	0.74	[0.15,3.75]	226
...I will lose my teeth.	1.54	[0.93,2.56]	4,049	1.15	[0.32,4.15]	233
...I would be able to stop if I wanted to (strongly disagree) <sup>1</sup>	2.56**	[1.29,5.10]	4,049	0.41	[0.05,3.36]	237
...it will be a turn off to other people.	2.49***	[1.53,4.04]	4,020	1.25	[0.48,3.24]	236
How do you think your close friends feel or would feel about you smoking every day? (strongly disapprove) <sup>2</sup>	3.05***	[1.94,4.81]	4,087	1.75	[0.65,4.72]	231
How many people your age would you guess smoke cigarettes? (none) <sup>3</sup>	25.3**	[3.49,183]	4,097	4.26	[0.29,62.8]	237
How much do you think breathing smoke from other people's cigarettes harms you? (a lot) <sup>4</sup>	2.04**	[1.30,3.18]	4,103	0.92	[0.40,2.14]	237

Note. Survey measures represent population weighting at T2; All belief items beginning with ellipses were preceded by "If I smoke every day..." \* p<0.05, \*\* p<0.01, \*\*\* p<0.001 Unless otherwise indicated in the table, the "strongest anti-tobacco" response option was "strongly agree."

<sup>1</sup> For respondents who had smoked in the past 30 days (current smokers), the question was worded: *I would be able to stop smoking if I wanted to.*

<sup>2</sup> The response options for this item were: *strongly disapprove, disapprove, approve, and strongly approve.*

<sup>3</sup> The response options for this item were: *none, a few, about half, most.*

<sup>4</sup> The response options for this item were: *not at all, a little, somewhat, and a lot.*

higher. Other important predictors were social perceptions (uncool; OR = 3.83) and mood effects (enjoyment; OR = 2.88). Physical cosmetic effects, including yellow fingers (OR = 1.41), wrinkles (OR = 1.45), and losing teeth (OR = 1.54) were not predictive; in fact, none of these odds ratios were significant. Notably, concerns addiction (which had the lowest odds ratio at T1, predicting intentions not to smoke among never established smokers) fell in the middle of the pack (OR = 1.92); in other words, if one believed that they definitely would not become addicted to nicotine, the odds of smoking were nearly two times higher at follow-up.

The sample of current established smokers at follow-up is small ( $n = \sim 240$ ), and the pattern of belief ORs is mixed, suggesting that there is not consistent evidence that beliefs at baseline predict quitting at follow-up. This may be due to low quit rates among current smokers; consequently, there is little variation in smoking status at T2.

As with the T1 intention analyses, the power of beliefs as predictors varies based on experience. For never established smokers, social perceptions (uncool), mood effects (relaxation and enjoyment), and to a lesser extent, concerns about dependency, matter. If one believes that smoking does not lead to relaxation and enjoyment – and that they will not be able to stop if they want to – the odds of not smoking are higher. Interestingly, social perceptions (particularly those connected to specific scenarios, both perceived peer non-use and friend disapproval) matter; if one believes that peers don't smoke, and that close friends would strongly disapprove, the odds of not smoking at follow-up are much higher. The role of perceived peer use in predicting behavior is notable, as it was not a particularly strong predictor at T1. Conversely, among current established smokers, few beliefs are connected to smoking at T2.

## Vaping-Related Outcomes

### *Vaping-Related Intentions and Behavior: Over Time Associations*

In parallel to the analyses above focusing on smoking-related measures, we used logistic regression to assess the odds of not vaping at follow-up based on baseline intentions not to vape. We ran separate regressions for current established smokers and never established smokers at baseline. We further divided never-established smokers into three groups based on (past-30 day) e-cigarette use at T1 (never e-cig user, former e-cig user, and current e-cig user). The results of these analyses are reported in Table 9.

We found that T1 intention not to vape was significantly associated with T2 non-vaping behavior regardless of smoking and vaping status at T1. For established smokers ( $n = 461$ ) who had no intentions to vape at T1 (compared to those with any openness), the odds of not vaping at T2 were 4.27 higher. Among all never established smokers ( $n = 4,103$ ), the odds were 9.74. For current e-cig users ( $n = 461$ ), intention not to vape at T1 was associated with 12.0 higher odds of cessation at T2. Among never e-cig users ( $n = 3,164$ ), T1 intention not to vape was associated with 3.79 higher odds of non-initiation at T2.

**Table 9. Vaping-Related Intentions and Behavior: Odds of T2 Not Vaping (past 30 days) with T1 Intention Not to Vape**

Use Status at Baseline	OR	95% CI	N
<b>Total Never Established Smoker</b>	9.74***	[7.20,13.2]	4,103
Never E-cig User	3.79***	[2.24,6.42]	3,164
Former E-cig User	2.41***	[1.24,4.70]	478
Current E-cig User	12.0***	[5.88,24.4]	461
<b>Established Smoker</b>	4.27***	[2.06,8.87]	248

Note. Survey measures represent population weighting at T2. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### *Vaping-Related Beliefs and Intentions: Cross-Sectional Associations*

We used logistic regression to assess the cross-sectional relationships between anti-vaping beliefs and intentions not to vape. See Table 10 for full distribution of vaping-related

beliefs. We assessed the association between each of seven beliefs measured at T1 and intentions not to vape at T1. For nine additional vaping beliefs measured at T2, we assessed the association with intentions not to vape at T2. We have much smaller samples for these T2-only beliefs than the seven vaping beliefs measured at T1 and cannot assess over time associations. We report the pattern of results for established smokers, never-established smokers, and never-established smokers who were never e-cig users, former e-cig users, and current e-cig users at the time each belief was measured. The results of these analyses are shown in Table 11.

Among established smokers, five beliefs were significantly associated with intentions not to vape. These included: strong disagreement that vaping is less harmful than combustible cigarettes (OR = 2.44), strong disagreement that vaping can help people quit smoking (OR = 2.59), the perception that breathing vapor from other people's e-cigarettes is very harmful (OR = 3.02), the assessment that no peers ("people your age") use e-cigarettes (OR = 2.03), and the view that close friends disapprove (or would disapprove) of e-cigarette use (OR = 3.78). Perceived friend disapproval was the most highly associated with intentions not to vape among established smokers

Among never-established smokers, all 16 anti-vaping beliefs measured were significantly associated with intentions not to vape cross-sectionally. For this group, strong disagreement with the statement, "If I vape or use e-cigarettes every day, I will enjoy the taste" was the most strongly associated with intentions not to use e-cigarettes (OR = 6.69), and this association was particularly high among current e-cig users (OR = 68.7). (In contrast, taste perceptions were not associated with intentions for former e-cig users nor current established smokers.) Following taste, among never-established smokers, perceived friend disapproval was the second-most highly associated belief with non-intention (OR = 4.90). A few more beliefs significantly

**Table 10. Vaping Beliefs for All Respondents at T1 and T2**

Belief Measure	T1					T2				
	Strongly Disapprove (%)	Disapprove (%)	Approve (%)	Strongly Approve (%)	N	Strongly Disapprove (%)	Disapprove (%)	Approve (%)	Strongly Approve (%)	N
How do you think your close friends feel or would feel about you vaping or using e-cigarettes every day?	32.5	41.9	22.0	3.7	11,603	36.3	41.2	19.9	2.6	4,453
	None (%)	A Few (%)	About Half (%)	Most (%)	N	None (%)	A Few (%)	About Half (%)	Most (%)	N
How many people your age would you guess vape or use e-cigarettes?	11.3	45.4	27.9	15.4	11,767	6.2	46.7	31.9	15.1	4,463
	A Lot (%)	Somewhat (%)	A Little (%)	Not a Lot (%)	N	A Lot (%)	Somewhat (%)	A Little (%)	Not a Lot (%)	N
How much do you think that breathing vapor from other people's e-cigarettes or vape pens harms you?	16.4	28.4	30.5	24.7	11,673	15.1	29.7	34.2	21.1	4,449
	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	N	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	N
If I vape or use e-cigarettes it will be less harmful to me than if I smoke tobacco cigarettes.	9.4	36.5	46.5	7.5	11,500	9.9	34.7	47.6	7.8	4,430
Vaping or using e-cigarettes can help people quit smoking tobacco cigarettes.	7.9	32.2	52.3	7.6	11,498	7.6	29.8	54.5	8.1	4,423
... I would be able to stop if I wanted to. <sup>1</sup>	8.8	39.8	44.5	6.9	11,525	10.4	45.3	37.6	6.7	4,432
... I will become addicted to nicotine.	3.9	26.9	54.3	15.0	11,449	2.6	22.7	57.5	17.2	4,415
...I will be controlled by vaping.	--	--	--	--	--	3.9	28.7	53.2	14.2	4,446
...I will enjoy life more.	--	--	--	--	--	19.9	70.2	8.9	1.0	4,437
...I will enjoy the taste.	--	--	--	--	--	9.5	39.0	47.1	4.4	4,396
...I will be more relaxed.	--	--	--	--	--	11.8	53.5	33.3	1.4	4,433
...I will look uncool.	--	--	--	--	--	4.5	30.0	49.7	15.8	4,426
...I will develop headaches.	--	--	--	--	--	2.5	29.2	58.5	9.8	4,391
...I will get wrinkles.	--	--	--	--	--	4.1	43.3	45.0	7.6	4,390
...I will lose my teeth.	--	--	--	--	--	5.3	50.5	36.3	7.97	4,400
...I will develop cancer.	--	--	--	--	--	3.5	36.8	49.8	9.9	4,271

Note. Survey measures represent population weighting at T1 and T2; All belief items beginning with ellipses were preceded by "If I smoke every day..."; Due to rounding, totals may not add up to 100

<sup>1</sup>For respondents who had vaped in the past 30 days (current e-cig users), the question was worded: *I would be able to stop vaping or using e-cigarettes if I wanted to.*

**Table 11. Vaping-Related Beliefs and Intentions: Odds of Intending Not to Vape by Anti-Vaping Belief Measured Cross-Sectionally**

Belief Measure	Never Established Smoker								Established Smoker		
	Total		Never e-cig user		Former e-cig user		Current e-cig user		OR	95% CI	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI			
	N		N		N		N		N		
Measured at T1	How do you think your close friends feel or would feel about you vaping or using e-cigarettes every day? (strongly disapprove) <sup>1</sup>	4.90***	4.22,5.69	3.09***	2.54,3.76	2.55***	1.79,3.65	8.27***	5.42,12.62	3.78***	2.38,6.00
		10,132		7,735		1,184		1,213		1,045	
	How many people your age would you guess vape or use e-cigarettes? (none) <sup>2</sup>	2.39***	1.92,2.97	1.32*	1.03,1.70	2.08	0.99,4.36	3.89***	1.98,7.66	2.03**	1.20,3.45
		10,251		7,809		1,214		1,228		1,079	
	How much do you think that breathing vapor from other people's e-cigarettes or vape pens harms you? (a lot) <sup>3</sup>	2.75***	2.27,3.34	1.68***	1.33,2.13	2.23**	1.27,3.90	2.92***	1.66,5.12	3.02***	1.82,5.01
		10,182		7,760		1,200		1,222		1,066	
	If I vape or use e-cigarettes it will be less harmful to me than if I smoke tobacco cigarettes. (strongly disagree)	3.33***	2.53,4.39	2.65***	1.81,3.88	2.53**	1.41,4.54	2.99**	1.44,6.24	2.44***	1.53,3.89
		10,032		7,622		1,202		1,208		1,056	
Vaping or using e-cigarettes can help people quit smoking tobacco cigarettes. (strongly disagree)	2.65***	1.97,3.57	1.72**	1.17,2.53	2.57*	1.25,5.26	2.45*	1.13,5.32	2.59***	1.52,4.41	
	10,009		7,598		1,199		1,212		1,065		
... I would be able to stop if I wanted to. <sup>4</sup> (strongly disagree)	3.16***	2.43,4.11	2.18***	1.56,3.05	1.54	0.81,2.96	4.31***	2.03,9.17	1.65	0.85,3.18	
	10,049		7,647		1,192		1,210		1,060		
... I will become addicted to nicotine.	2.05***	1.71, 2.46	2.08***	1.59, 2.72	2.30***	1.51, 3.50	1.79*	1.13, 2.83	1.28	0.81, 2.01	
	9,973		7,579		1,195		1,199		1,051		
Measured at T2	...I will be controlled by vaping.	3.61***	2.60,5.02	3.25***	2.02,5.22	1.74	0.89,3.39	5.67*	1.31,24.46	1.92	0.58,6.35
		4,049		3,132		625		292		272	
	...I will enjoy life more. (strongly disagree)	3.96***	2.97,5.26	3.34***	2.17,5.14	2.00*	1.10,3.63	3.74	1.00,14.01	1.34	0.54,3.32
		4,048		3,138		619		291		265	
	...I will enjoy the taste. (strongly disagree)	6.69***	4.03,11.11	3.02***	1.70,5.35	2.80	0.66,11.89	68.7*	6.28,751.55	1.44	0.33,6.33
		3,998		3,083		623		292		272	
	...I will be more relaxed. (strongly disagree)	4.24***	2.88,6.26	3.16***	1.79,5.58	2.12	0.99,4.55	6.03*	1.17,31.13	1.52	0.37,6.29
		4,037		3,125		622		290		271	
	...I will look uncool.	3.50***	2.55,4.79	2.78***	1.75,4.42	2.02*	1.11,3.66	5.17	0.93,28.71	.51	0.17,1.50
		4,032		3,120		622		290		270	
...I will develop headaches.	2.90***	1.98,4.24	2.52**	1.44,4.43	1.24	0.51,3.06	3.76	0.88,16.07	1.48	0.36,6.17	
	3,998		3,090		618		290		270		
...I will get wrinkles.	4.15***	2.61, 6.60	3.26***	1.62,6.56	1.93	0.75,4.91	14.2**	2.74,74.00	2.18	0.35,13.70	
	4,001		3,091		620		290		265		
...I will lose my teeth.	3.65***	2.29,5.82	1.98*	1.10,3.56	4.40*	1.39,13.88	10.3*	2.05,51.20	5.37	0.91,31.88	
	4,009		3,100		619		290		268		
...I will develop cancer.	2.88***	2.00,4.16	1.57	0.98,2.52	2.13	0.85,5.35	9.20**	2.30,36.77	2.79	0.80,9.73	
	3,999		3,096		616		287		272		

Note. Survey measures represent population weighting for survey wave belief measurement was taken; All belief items beginning with ellipses were preceded by "If I vape or use e-cigarettes every day..." \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Unless otherwise indicated in the table, the "strongest anti-cigarette // anti-e-cigarette" response option was "strongly agree."

<sup>1</sup> The response options for this item were: *strongly disapprove, disapprove, approve, and strongly approve.*

<sup>2</sup> The response options for this item were: *none, a few, about half, most.*

<sup>3</sup> The response options for this item were: *not at all, a little, somewhat, and a lot.*

<sup>4</sup> For respondents who had vaped in the past 30 days (current e-cig users), the question was worded: *I would be able to stop vaping or using e-cigarettes if I wanted to.*

associated with non-intention across non-smokers included: strong disagreement that vaping is less harmful than combustible cigarettes (OR = 3.33), strong disagreement that vaping does not help people quit smoking (OR = 2.65), and the perception that breathing vapor from other people's e-cigarettes is very harmful (OR = 2.75). Below, we summarize other beliefs significantly associated with non-intention for non-smokers based on e-cigarette use.

For current e-cig users, concerns about physical cosmetic and health consequences (wrinkles, OR = 14.2; tooth loss, OR = 10.3; cancer, OR = 9.20) were strongly associated with intentions to stop using e-cigarettes. Other beliefs significantly associated with cessation included concerns about dependency (being controlled by vaping, OR = 3.25; anticipating not being able to stop vaping, OR = 2.18; becoming addicted to nicotine, OR = 2.08) and one anticipated negative mood effect (not expecting to feel more relaxed as a result of vaping, OR = 6.03). Among never e-cig users, concerns about physical cosmetic consequences were significantly associated with intentions not to try vaping (wrinkles, OR = 3.26; tooth loss, OR = 1.98), though the belief that vaping would lead to cancer was not significantly associated. Similar to current e-cig users, for never e-cig users, all dependency concerns, as well as not expecting to feel more relaxed, were associated with non-initiation intentions. One additional anticipated negative mood effect (not expecting to enjoy life more as a result of vaping, OR = 3.34) was also associated with non-intention among never e-cig users.

For former e-cig users, the most highly associated belief with intentions not to re-initiate e-cigarette use was that vaping would lead to tooth loss (OR = 4.40). Concerns about other physical consequences, including developing wrinkles and cancer, were not significantly associated with re-initiation intentions. In contrast to current and never e-cig users, for former e-cig users, two out of three dependency concerns (being controlled by vaping and not being able

to stop) were not associated with intentions not to re-initiate use, though concerns about becoming addicted to nicotine was significantly associated (OR = 2.30). Not expecting to enjoy life more (OR = 2.00) was also associated with intention not to re-initiate use.

In sum, perceived friend disapproval was strongly associated with having no intentions to use e-cigarettes regardless of vaping or smoking status. While beliefs about taste were strongly associated with intention across never-established smokers, taste was not significantly associated with intentions for established smokers nor former e-cigarette users. For all never established smokers, beliefs about the relative harm of e-cigarettes compared to cigarettes, the use of e-cigarettes as cessation tools, and the harm of second hand vape were significant. Within each vaping status group (i.e. current, never, former e-cig user), at least one concern about the physical consequences of vaping, dependency, and negative mood effects was significantly associated with intention not to vape.

#### *Vaping-Related Beliefs and Behaviors: Over Time Associations*

We used logistic regression to assess the odds of not vaping at six-month follow-up (T2) based on each anti-vaping belief measured at T1. Note, certain beliefs, including perceptions of e-cigarette taste, cosmetic and health effects (tooth loss, wrinkles, and cancer), mood effects (more relaxed and enjoy life more), and “being controlled by vaping,” were not measured at baseline, and therefore are not included in these longitudinal analyses. We report results for the seven original (T1 measured) belief items in Table 12.

Among established smokers, only one T1 belief was significantly associated with (non-) T2 e-cigarette use: the belief that no peers used e-cigarettes (OR = 12.1), although 5 of the 6 other beliefs had positive ORs. For never-established smokers, all seven anti-vaping beliefs measured at T1 were significantly associated with non-use at T2. Perceived friend disapproval at



**Table 12. Odds of Not Vaping at T2 by T1 Anti-Vaping Belief**

Belief Measure	Never Established Smoker												Established Smoker		
	Total			Never e-cig user			Former e-cig user			Current e-cig user			OR	95% CI	N
	OR	95% CI	N	OR	95% CI	N	OR	95% CI	N	OR	95% CI	N			
How do you think your close friends feel or would feel about you vaping or using e-cigarettes every day? (strongly disapprove) <sup>1</sup>	7.72***	[4.74,12.5]	4,055	4.23***	[2.44,7.33]	3,131	3.28*	[1.09, 9.89]	470	7.81**	[1.86,32.82]	454	1.20	[0.49,2.96]	242
How many people your age would you guess vape or use e-cigarettes? <sup>2</sup> (none)	3.80**	[1.66,8.73]	4,097	1.36	[0.54,3.46]	3,154	NA <sup>5</sup>		467	6.43	[0.81,51.01]	463	12.1*	[1.53,95.21]	248
How much do you think that breathing vapor from other people's e-cigarettes or vape pens harms you? (a lot) <sup>3</sup>	2.71***	[1.41,5.21]	4,071	1.45	[0.74,2.87]	3,135	1.25	[0.16,9.54]	475	1.88	[0.42,8.47]	461	1.29	[0.42,3.94]	245
If I vape or use e-cigarettes it will be less harmful to me than if I smoke tobacco cigarettes. (strongly disagree)	3.41***	[1.81,6.43]	4,017	1.46	[0.65,3.29]	3,091	2.01	[0.56,7.26]	472	14.9***	[3.20,69.41]	454	1.08	[0.42,2.75]	242
Vaping or using e-cigarettes can help people quit smoking tobacco cigarettes. (strongly disagree)	2.72**	[1.27,5.82]	4,011	1.51	[0.62,3.70]	3,083	5.82	[0.75,45.12]	474	1.34	[0.26,6.83]	454	1.59	[0.48,5.21]	244
... I would be able to stop if I wanted to. <sup>4</sup> (strongly disagree)	4.19***	[2.12,8.29]	4,020	2.42*	[1.02,5.72]	3,095	1.08	[0.27,4.22]	467	9.28*	[1.20,71.63]	458	0.53	[0.14,1.99]	239
... I will become addicted to nicotine.	1.60*	[1.06,2.40]	3,987	1.13	[0.59,2.17]	3,065	1.57	[0.67,3.66]	471	1.37	[0.64,2.97]	451	0.46	[0.20,1.07]	241

Note. Survey measures represent population weighting for T2. All belief items beginning with ellipses were preceded by "If I vape or use e-cigarettes every day..." \* p<0.05, \*\* p<0.01, \*\*\* p<0.001 Unless otherwise indicated in the table, the "strongest anti-cigarette // anti-e-cigarette" response option was "strongly agree."

<sup>1</sup> The response options for this item were: *strongly disapprove, disapprove, approve, and strongly approve.*

<sup>2</sup> The response options for this item were: *none, a few, about half, most.*

<sup>3</sup> The response options for this item were: *not at all, a little, somewhat, and a lot.*

<sup>4</sup> For respondents who had vaped in the past 30 days (current e-cig users), the question was worded: *I would be able to stop vaping or using e-cigarettes if I wanted to.*

<sup>5</sup> We excluded this regression from our analyses, due to low variance in responses among the former e-cig user group. Only 13 (2.71%) of former e-cig users said none of their peers vape. None of these respondents re-initiated vaping at T2. While we could have combined respondents who said "none" with those who said "a few" for this measure, this would not have paralleled the rest of the analyses.

T1 was most strongly associated with non-use at T2 (OR = 7.72), and this was the only belief significantly associated with T2 behavior *within* each T1 vaping status group. Among current e-cig users at T1, two additional beliefs were significantly associated with cessation: strong disagreement that e-cigarettes are less harmful than combustible cigarettes (OR = 14.9) and anticipating not being able to stop vaping (OR = 9.28). For never e-cig users at T1, anticipating not being able to stop was also significantly associated with non-initiation at T2 (OR = 2.42). Across all non-smokers, the beliefs that no peers use e-cigarettes (OR = 3.80), breathing vapor from other people's vape pens is very harmful (OR = 2.71), e-cigarettes cannot help people quit smoking (OR = 2.72), and e-cig use will lead to nicotine addiction (OR = 1.60) were all significantly associated with not using e-cigarettes at T2. None of these beliefs were significant within each T1 vaping status group.

To summarize, we found unfavorable social perceptions at T1 were strong predictors of not using e-cigarettes at T2 among both smokers and non-smokers. T1 disagreement that e-cigarettes are less harmful than combustible cigarettes was the strongest predictor of cessation for current users but was not significant within any other T1 vaping status group. T1 concern with not being able to stop vaping was important for both cessation (for T1 current users) and non-initiation (for T1 never e-cig users) at T2. Several other beliefs related to the harms of e-cigarette use increased odds of non-use across all never-established smokers, though association strength and significance varied based on T1 vaping status.

## **Conclusions**

Across both domains of smoking and vaping, non-intentions to use cigarettes (smoking) or e-cigarettes (vaping) at baseline (T1) were strong predictors of behavior (non-use in the last 30 days) at six-month follow-up (T2). Among never established smokers, 17 anti-smoking

beliefs measured at T1 were significantly cross-sectionally associated with non-intentions, and 14 anti-smoking beliefs measured at T1 were significantly associated with non-smoking behavior at T2. Among established smokers, nine T1 anti-smoking beliefs were significantly cross-sectionally associated with intentions not to smoke, but no T1 beliefs were significantly predictive of smoking behavior measured at T2. Similarly, among never established smokers, 16 anti-vaping beliefs were significantly cross-sectionally associated with intentions not to vape, and of the seven items measured at T1, all were significantly associated with not vaping at T2. Among established smokers, five vaping-related beliefs were significantly cross-sectionally associated with intentions not to vape, and one T1 belief was associated with not vaping at T2. In short, beliefs matter.

But what beliefs matter the most? Among never established smokers, smoking beliefs related to social perceptions, mood effects, and dependency concerns were most strongly predictive of smoking and vaping-related non-intentions (T1) and non-behavior (T2). Although social perceptions play a role in predicting smoking and vaping across all respondents, perceptions of cosmetic and health consequences, like losing teeth, developing wrinkles, or increasing risk of cancer were predictive of having intentions to not smoke, particularly among current users (established smokers for smoking and current e-cig users for vaping). We also saw key differences in relevant vaping beliefs based on vaping and smoking status. For example, while disagreement with the belief that e-cigarettes taste good was associated with non-intention to use e-cigarettes for never established smokers, and was particularly strong for current e-cigarette users, this belief was not significantly associated with intentions to vape for established smokers. In short, personal experience with smoking or vaping often moderates the effects of beliefs.

Most notably – and consistently, across both smokers and non-smokers – specific social perceptions (perceptions of peer use and friend approval) predicted smoking and vaping intentions and behavior. In other words, those who perceived that smoking or vaping was not widespread or acceptable were more likely not to **intend** to use these products *and* not to **actually** use these products at six-month follow-up. What does this mean for communication research (and more specifically, for the design of successful health campaigns)? One promising area to target is social perceptions, particularly for those around youth and young adults. These perceptions are driven by one’s surrounding social environment, and are unlikely to be impacted by a single video PSA. However, if leveraged carefully and correctly, anti-tobacco social influence could impact both non-smokers and smokers alike.

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