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E-cigarette weight and appetite control beliefs and e-cigarette initiation in young adults

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Abstract

E-cigarette use has increased among young adults, and emerging research suggests a subset of young adults report using e-cigarettes for appetite control/weight loss. The current paper examined the association of e-cigarette weight control beliefs with subsequent e-cigarette initiation. Data were collected via online surveys from a prospective cohort study of young adults in Southern California ($N=1,368$) at baseline (May-October 2020; $M[SD]_{age}= 21.2 [0.4]$) and 6 months later (January-May 2021). Binary logistic regression models were used to evaluate the association of e-cigarette weight control beliefs (i.e., perceptions that e-cigarettes help people lose weight and satisfy hunger and desire to eat unhealthy foods) with new onset e-cigarette use at follow-up. All models were adjusted for sociodemographic characteristics. Among individuals who had never used e-cigarettes at baseline, those who agreed (vs. disagreed) that e-cigarettes help people lose weight had more than three times the odds of initiating e-cigarette use by follow-up (OR [95% CI]: 3.24 [1.52, 6.62]). Similarly, those who agreed (vs. disagreed) that vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods had more than twice the odds of initiating e-cigarette use by follow-up (OR [95% CI]: 2.40 [1.15, 4.82]). Findings highlight that e-cigarette weight control beliefs are an important risk factor for vaping initiation. Future interventions and policies aiming to prevent vaping among young adults should address e-cigarette weight control beliefs and long-term health consequences from related use.

Keywords

e-cigarette initiation; weight control beliefs; young adults; appetite suppression

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INTRODUCTION

Tobacco use has long been associated with weight control, both due to the appetite suppressant and increased metabolic effects from nicotine (Chen et al., 2012), and because of a substantial history of tobacco advertising touting tobacco use as an effective weight loss tool (Amos & Haglund, 2000). *Expectancy theory*, which posits that an individual's motivation to engage in a behavior is due to beliefs about that behavior resulting in a desired outcome (Kirsch, 1997), is one framework for understanding why tobacco use for weight loss and control is so common. Unhealthy weight control practices, such as use of tobacco to suppress appetite and replace food intake, are prevalent (up to 60%) among adolescents and young adults and are associated with poorer health outcomes that are counterproductive to weight management and overall dietary health (Neumark-Sztainer et al., 2011). Yet, less is known about whether these weight and appetite control associations translate to e-cigarette use.

Nicotine is one of the most reported substances used among U.S. youth (Johnston et al., 2022; Walley et al., 2019). In 2020, nearly 22% of U.S. 10th and 12th grade students reported vaping nicotine in the past month, and 7% reported vaping nicotine daily (Miech et al., 2020). More frequent nicotine vaping has been associated with greater nicotine dependence and continued use (Boykan et al., 2019; Dobbs et al., 2020; Lanza & Vasilenko, 2015; Sidani et al., 2019; Vogel et al., 2019). Emerging research suggests that 9–14% of adolescent and young adult (AYA) current e-cigarette users report using e-cigarettes for appetite control or weight loss (Morean & L'Insalata, 2018; Morean et al., 2020; Morean & Wedel, 2017). A recent cross-sectional study also reported an association of greater sweet taste preference with use of e-cigarettes for weight control (Mason & Leventhal., 2021). Furthermore, AYAs who report using e-cigarettes for weight control are more likely to have overweight or obesity (Morean & L'Insalata, 2018; Morean et al., 2020; Morean & Wedel, 2017) and vape at a higher frequency (Bennett & Pokhrel, 2018) – all of which increases the risk of nicotine dependence and unhealthy weight control behaviors (Wang et al., 2020).

Prospective examinations of e-cigarette specific weight control beliefs and e-cigarette use initiation are lacking and could inform interventions and policies aiming to reduce the public health burden and poor health outcomes from vaping and nicotine dependence. The current study examined whether young adults with no history of e-cigarette use who held e-cigarette weight control beliefs that e-cigarettes can help people lose weight and satisfy hunger at baseline were more likely to initiate e-cigarette use at the follow-up wave. Based on recent research that found young adult current e-cigarette users reported intentionally using vaping products to suppress their appetite and control their weight (learned from peers or deduction from cigarette effects) (Kechter et al., 2022), we hypothesized participants with e-cigarette weight control beliefs would be more likely than those without to initiate e-cigarette use at follow-up.

METHODS

Participants and Procedures

Data were collected via online surveys from a cohort of young adults, who were originally recruited when they were in 9th grade in 2013 from 10 schools participating in the cohort based in the Southern California area. Information about the cohort has been reported previously (Leventhal et al., 2015). The baseline survey for the current analysis was conducted after participants had become young adults, taking place from May-October 2020 ($N=1,368$; $M[SD]_{age}=21.2 [0.4]$); six-month follow-up occurred from January-May 2021 ($N=2,166$). The analytic sample was restricted to those who had never used e-cigarettes at baseline and who had complete data available for both (a) baseline e-cigarette weight loss and appetite suppression beliefs and (b) lifetime e-cigarette use at follow-up ($N=1,368$). See Figure 1.

Ethics Statement

Written informed consent was obtained from each participant prior to enrollment. All study procedures were approved by the University of Southern California Institutional Review Board.

Measures

E-cigarette weight and appetite control beliefs.—All participants were asked, “Do you agree with the following statements regarding e-cigarettes or electronic vaping devices used to vape nicotine?” A total of 17 statements were provided; of these, two asked about e-cigarette weight loss and appetite suppression beliefs including: (1) “E-cigarettes help people lose weight,” and (2) “Vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods.” Response options were 1=do not agree, 2=agree, and 3=don’t know.

E-cigarette use.—Participants were asked whether they had ever used an e-cigarette, with three response options (no, yes, but not in the past 6-months, and yes, in the past 6-months) at each wave. Analyses were restricted to those who responded ‘no’ to lifetime use at the baseline wave. Participants were considered to have ‘initiated’ e-cigarette use if they responded ‘yes’ (either option) at the follow up wave.

Covariates.—Participants provided information on their age, gender (female, male, and gender minority [includes transgender male, transgender female, gender variant, and additional gender category]), race/ethnicity (Hispanic White, Hispanic Other [includes Black, Multiracial, American Indian, Pacific Islander, Asian and Other], Non-Hispanic White, Non-Hispanic Asian, and Non-Hispanic Other [includes American Indian, Black, Pacific Islander, Multiracial, and Other]), and current enrollment in degree program as a marker of SES (yes/no/don’t know). Cigarette use (No/Yes, but not in the last 6 months/Yes, in the last 6 months) was included as a covariate due to the association of cigarette use with e-cigarette use, and the potential correlation with the two belief predictors. Current height and weight were also self-reported at baseline, which was used to calculate self-reported body mass index (BMI in kg/m^2). Self-reported BMI was coded as underweight or normal

weight (BMI < 25) and overweight or obese (BMI ≥ 25); categories were collapsed due to small sample sizes in the underweight and obese categories. BMI was included as a covariate due to the potential association with weight-related beliefs and with e-cigarette use (particularly if used for weight control).

Statistical Analyses

To determine whether agreeing (vs. disagreeing) with e-cigarette weight and appetite control statements predicted later initiation of e-cigarette use, logistic regression models were used to evaluate the association of each e-cigarette weight and appetite control belief at baseline (in separate models) with initiation (new onset, yes/no) of e-cigarette use by follow-up. Models controlled for BMI, age, race/ethnicity, gender identity, lifetime and past 6-months cigarette use, and current enrollment in degree program. Collinearity was assessed and determined to be non-problematic (generalized variance inflation factor range: 1.04–5.01). Missing data for age (n=3) was imputed by the average age of the sample (a reasonable assumption as all participants were in the same grade at recruitment) and all other missing covariate data was handled using a missing indicator approach for each variable in accordance with previous methods (Song et al., 2021). Analyses were conducted in R Statistical Software v4.1.1 stats package with binomial glm with logit link.

RESULTS

Analytic Sample Demographics

Roughly 60% of the sample was female, and 55% Hispanic; 43% met criteria for overweight or obesity. Furthermore, 45.1% reported living comfortably, 30.6% meet their needs with a little left, 20% just meet their basic expenses, and 2.7% don't meet their basic expenses. At baseline, 4.0% agreed (vs. 27.5% disagreed) with the statement: "E-cigarettes help people lose weight" and 5.4% agreed (vs. 24.4% disagreed) with the statement: "Vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods" (Table 1). A substantial proportion of the sample reported that they did not know, in response to these items. Finally, 7.5% (N=103) of the sample reported new e-cigarette use at follow-up.

Associations between e-cigarette weight and appetite control beliefs and e-cigarette initiation

Those who had never used e-cigarettes at baseline who agreed (vs. disagreed) that e-cigarettes help people lose weight had more than three times higher odds of initiating e-cigarette use by follow-up, controlling for BMI, age, race/ethnicity, gender, lifetime and past 6-months cigarette use, and current enrollment in degree program (OR [95% CI]: 3.24 [1.52, 6.62]; Table 2). Similarly, never-users at baseline who agreed (vs. disagreed) that vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods had more than two times higher odds of reporting e-cigarette initiation by follow-up (OR [95% CI]: 2.40 [1.15, 4.82]), after adjustment. Those who reported they did not know (vs. disagreed) that e-cigarettes help people lose weight had 0.59 times lower odds of initiating e-cigarette use at follow up (OR [95% CI]: 0.59 [0.38, 0.93]). There was no difference in the odds of initiating e-cigarette use at follow up between those who reported they did not know and disagreed that certain flavors help satisfy hunger (OR [95% CI]: 0.65 [0.41, 1.05]).

DISCUSSION

This paper investigated the association of e-cigarette weight and appetite control beliefs with subsequent e-cigarette initiation among a sample of e-cigarette naïve young adults. As hypothesized, the current study found that young adults who held e-cigarette weight and appetite control beliefs were more likely (than those without such beliefs at baseline) to initiate e-cigarette use 6 months later. This belief-behavior link aligns with expectancy theory and suggests that, parallel to literature on cigarette use for weight and appetite control, these associations translate to e-cigarette use.

Findings align and extend current literature on tobacco/e-cigarette weight control beliefs by age and use status. In one study using a nationally representative sample of adolescents, those who believed tobacco use could help them control weight had a greater risk for e-cigarette initiation and maintenance (Mason et al., 2022). Previous literature had also reported that current e-cigarette users often vape for appetite control and weight loss (Ganson et al., 2021; Harrell et al., 2015a; Harrell et al., 2015b; Mantey et al., 2020; Morean et al., 2020; Morean & Wedel, 2017; Pokhrel et al., 2021; Wang et al., 2020). The current study suggests that e-cigarette weight control beliefs are a risk factor for e-cigarette initiation among young adult never-users.

Previous research reports e-cigarettes may be used to satisfy food cravings given the wide availability of flavored e-liquids, particularly in high-calorie low-nutrient food flavors such as chocolate cake (Kechter et al., 2022). This style of e-cigarette use for food replacement has negative consequences that may lead to maladaptive relationships with food and drugs. While the current study did not assess potential underlying mechanisms (e.g., eating disorders, body image concerns, or intentions to lose weight) of action for unhealthy weight control practices, it is likely that e-cigarette weight and appetite control beliefs contribute to e-cigarette initiation and are worthy of further study.

Due to the dangers of eating disorders and nicotine addiction during these pivotal developmental years between adolescence to adulthood, public health and prevention scientists should aim to (1) identify additional risk factors, trajectories, and consequences related to e-cigarette use for weight/appetite control and (2) develop prevention and treatment programs that address these beliefs and behaviors. Utilizing e-cigarette weight and appetite control belief questions as a screening tool may be one way to identify those at risk and prevent future e-cigarette initiation.

Limitations and Future Directions

While the data are from a prospective cohort study with great participant diversity, causal conclusions cannot be drawn from observational studies. Roughly 5–7% of our sample agreed with e-cigarette weight and appetite control belief statements which was lower than the approximated 14% of previous samples (Morean et al., 2020; Morean & Wedel, 2017). This difference may be due to sample restriction to never e-cigarette users at baseline in the current study, or may reflect lack of generalizability outside the Southern California region or to other ages or demographics. Furthermore, a substantial proportion of the current study sample responded don't know (vs. agree/disagree) to the e-cigarette

weight and appetite control beliefs, which may threaten the validity of the current study findings. Perhaps, people who responded don't know are people who wouldn't ever be interested in trying e-cigarettes, which could explain why they were less likely to initiate. Next, the wording of the e-cigarette expectancy questions did not explicitly ask about their intention to use e-cigarettes for weight control and appetite suppression. While self-reported BMI has limitations – using BMI categories as we did in the current study offers more accuracy (Allison et al., 2020). We were unable to examine whether associations differed by gender due to small cell sized, which should be prioritized in future research. Future scale refinement and testing is warranted.

Mixed methods research that explores how AYAs develop beliefs that e-cigarettes help control and lose weight is needed. Future research may consider whether use of e-cigarettes for weight and appetite control reduces the odds of quitting or intentions to stop using e-cigarettes as well as whether young adults who currently use e-cigarettes and hold e-cigarette weight and appetite control beliefs report decreases in BMI, hunger, food intake, and urge to eat.

Conclusion

The current study contributes to a growing body of literature suggesting that young adults who believe vaping can control weight and appetite are at an increased risk of using e-cigarettes within six months. These findings should be interpreted in the context that assessments occurred during the COVID-19 pandemic – a layered and complex time for many people regarding food and drug behaviors. Given the high risk for body dissatisfaction during adolescence and young adulthood (Bucchianeri et al., 2013), using e-cigarettes for weight loss and control is a risky comorbidity that public health and prevention scientists should address to help reduce the burden of vaping related consequences and dependence.

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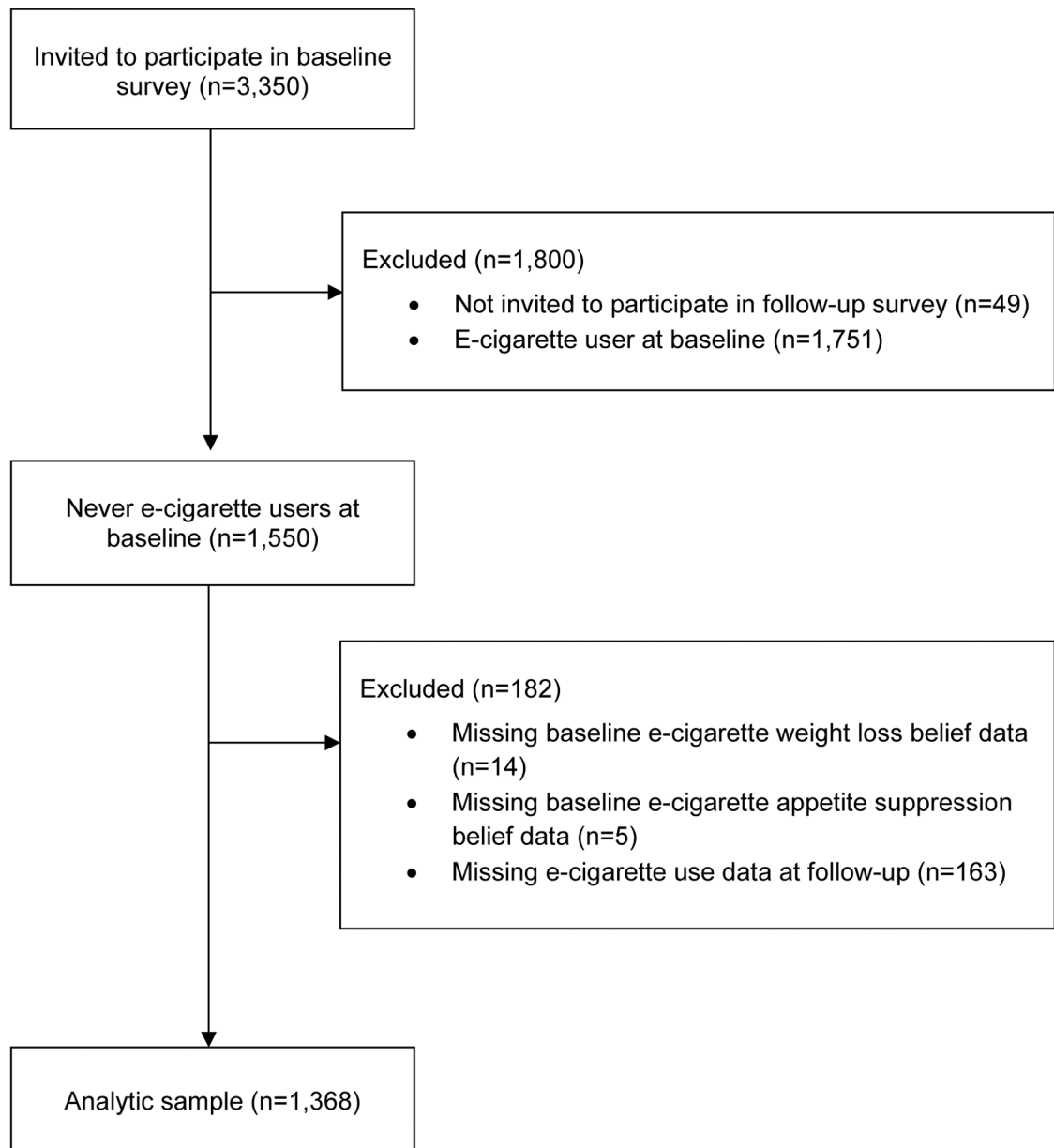


Figure 1.
Consort diagram describing the analytic sample

Table 1.

Baseline Never E-Cigarette User Participant Demographics

	Total N (%)	“E-cigarettes help people lose weight.”			“Vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods.”		
		Agree N (row %)	Disagree N (row %)	Don't know N (%)	Agree N (row %)	Disagree N (row %)	Don't know N (row %)
Overall	1368	55 (4.0)	376 (27.5)	937 (68.5)	74 (5.4)	334 (24.4)	960 (70.2)
Age, Mean(SD)	21.18 (0.40)	21.05 (0.39)	21.22 (0.43)	21.17 (0.39)	21.12 (0.43)	21.20 (0.42)	21.18 (0.39)
Gender identity							
Male	489 (35.7)	23 (4.7)	165 (33.7)	301 (61.6)	24 (4.9)	141 (28.8)	324 (66.3)
Female	825 (60.3)	32 (3.9)	191 (23.2)	602 (73.0)	49 (5.9)	173 (21.0)	603 (73.1)
Gender minority	21 (1.5)	0 (0.0)	7 (33.3)	14 (66.7)	0 (0.0)	7 (33.3)	14 (66.7)
Race/Ethnicity							
Hispanic White	144 (10.5)	5 (3.5)	31 (21.5)	108 (75.0)	6 (4.2)	31 (21.5)	107 (74.3)
Hispanic Other	613 (44.8)	19 (3.1)	165 (26.9)	429 (70.0)	30 (4.9)	148 (24.1)	435 (71.0)
Non-Hispanic White	140 (10.2)	7 (5.0)	35 (25.0)	98 (70.0)	6 (4.3)	32 (22.9)	102 (72.9)
Non-Hispanic Asian	256 (18.7)	14 (5.5)	78 (30.5)	164 (64.1)	22 (8.6)	61 (23.8)	173 (67.6)
Non-Hispanic Other	204 (14.9)	10 (4.9)	61 (29.9)	133 (65.2)	10 (4.9)	56 (27.5)	138 (67.6)
Current enrollment in degree program							
Yes	865 (63.2)	38 (4.4)	213 (24.6)	614 (71.0)	54 (6.2)	193 (22.3)	618 (71.4)
No	431 (31.5)	17 (3.9)	142 (32.9)	272 (63.1)	20 (4.6)	117 (27.1)	294 (68.2)
Don't know	61 (4.5)	0 (0.0)	16 (26.2)	45 (73.8)	0.0 (0.0)	19 (31.1)	42 (68.9)
BMI							
Underweight/normal	754 (55.1)	37 (4.9)	204 (27.1)	513 (68.0)	46 (6.1)	177 (23.5)	531 (70.4)
Overweight/obesity	583 (42.6)	17 (2.9)	164 (28.1)	402 (69.0)	26 (4.5)	150 (25.7)	407 (69.8)
Cigarette use							
None	1283 (93.8)	51 (4.0)	356 (27.7)	876 (68.3)	66 (5.1)	318 (24.8)	899 (70.1)
Lifetime	49 (3.6)	2 (4.1)	12 (24.5)	35 (71.4)	3 (6.1)	9 (18.4)	37 (75.5)
Past 6 months	36 (2.6)	2 (5.6)	8 (22.2)	26 (72.2)	5 (13.9)	7 (19.4)	24 (66.7)

Note. Available data for gender, race/ethnicity, current enrollment in degree program, and BMI ranges across variables (Ns=1335–1368).

Hispanic Other includes Black, Multiracial, American Indian, Pacific Islander, Asian, Other, Non-Hispanic Other includes American Indian, Black, Pacific Islander, Multiracial, and Other

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Gender minority includes transgender male, transgender female, gender variant, and additional gender category

Lifetime cigarette use respondents answered "Yes, but not in last 6 months."

Table 2.

Logistic regressions of associations between baseline e-cigarette weight and appetite control beliefs and new e-cigarette use initiation ($N=1,368$)

	New onset of e-cigarette use (N, %)		Odds Ratio (95% CI)	p-value
	No	Yes		
“E-cigarettes help people lose weight.”				
Disagree	340 (90.4%)	36 (9.6%)	ref	---
Agree	42 (76.4%)	13 (23.6%)	3.24 (1.52, 6.62)	0.002
Don't know	883 (94.2%)	54 (5.8%)	0.59 (0.38, 0.93)	0.022
“Vaping certain e-cigarette flavors help satisfy hunger and desire to eat unhealthy foods.”				
Disagree	303 (90.7%)	31 (9.3%)	ref	---
Agree	60 (81.1%)	14 (18.9%)	2.40 (1.15, 4.82)	0.016
Don't know	902 (94%)	58 (6.0%)	0.65 (0.41, 1.05)	0.072

Note. Models restricted to baseline never e-cigarette users. Reference group is “disagree” with statements. Logistic regression models control for BMI, age, race/ethnicity, gender identity, cigarette use, and current enrollment in degree program.