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**Vaping Identity in Adolescent E-Cigarette Users:
A Comparison of Norms, Attitudes, and Behaviors**

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Abstract

Introduction. Using the tenets underlying social identity theory and the theory of planned behavior, the current study compared the perceptions, attitudes, and behaviors of e-cigarettes users that reported vaping as self-defining (“vapers”) compared to users that denied vaping was central to their identity (“non-vapers”).

Method. Secondary analyses of data from the 2017-2018 California Student Tobacco Survey were utilized. A weighted, multivariable regression model ($N = 82,217$) compared the demographic characteristics, beliefs, and behaviors of vapers and non-vapers. A path analytic model examined whether norms and attitudes mediated the relationship between vaper identity with use behavior.

Results. Sexual orientation and gender minority youth were more likely to identify as vapers compared to heterosexual and cisgender respondents. Youth that identified as vapers viewed e-cigarette use as more normative, held more favorable attitudes (i.e., lower harm beliefs), used e-cigarettes more frequently and in greater quantities, were more likely to use fruit and mint flavored e-cigarettes, and were more likely to acquire e-cigarettes from commercial sellers (i.e., vape/tobacco shops; all $p < .05$). Additionally, descriptive norms and attitudes mediated the relationship between vaper identity and use frequency/quantity.

Conclusions. Differences in e-cigarette beliefs and behaviors were found for youth e-cigarette users that perceived vaping as self-defining versus those that did not view vaping as part of their self-concept. Future studies are needed to examine causal directionality between identity, norms, attitudes, and behavior. Tobacco control efforts might use these findings to further denormalize vaping using evidence-based media campaigns and policy implementation.

Keywords: adolescent, vaping, e-cigarette use, identity, social norms

1. Introduction

Tobacco use is the leading cause of preventable death in the U.S. (US Department of Health and Human Services, 2014). In particular, adolescence represents a developmental stage marked by self-uncertainty (Bronfenbrenner, 1979; Erikson, 1994; Hogg et al., 2011), making teenage years a critical vulnerability phase for tobacco use initiation. In recent years, the use of electronic cigarettes (e-cigarettes), colloquially termed vaping, has become the most common tobacco product used among youth (Gentzke et al., 2019). E-cigarette liquid comes in a variety of sweet flavors that are appealing to youth, and are therefore used commonly during vaping initiation (Ambrose et al., 2015; Kong et al., 2015). Accordingly, evidence suggests that e-cigarettes might be displacing combustible cigarette smoking (Hallingberg et al., 2020). Nationally representative data from the Monitoring the Future survey (2020) show that among 12th grade students, cigarette smoking prevalence was 10.5% in 2016, 7.6% in 2018, and 7.5% in 2020; whereas, rates of current vaping increased from 6.2% in 2016, to 10.4% in 2018, and 12.5% in 2020. These rates of youth vaping are alarming, as e-cigarettes contain nicotine, a known neurotoxin in the teenage brain (Abreu-Villaça et al., 2003), and are also associated with an increased risk for future combustible cigarette initiation (Bold et al., 2018).

Decades of social mobilization and anti-tobacco campaigns have focused on denormalizing the use of tobacco products (Roeseler and Burns, 2010). At the state level, the California Tobacco Control Program (CTCP) was the first comprehensive tobacco control program to implement a social norm change approach, focused on indirectly dissuading potential users from initiating tobacco use by creating a social and legal climate where tobacco is viewed as less acceptable, desirable, and accessible (California Department of Health Services Tobacco Control Section, 1998). Yet, despite these efforts, the savvy marketing of e-cigarettes as a safer

smoking alternative and cessation tool (Cahn and Siegel, 2011), and the recent shift in norms around e-cigarettes (Gostin and Glasner, 2014), has redefined the meaning of vaping as a social and cultural experience (Tokle and Pedersen, 2019). For example, people who vape, attend meetups, perform vape tricks, participate in cloud chasing competitions (Pepper et al., 2017; Tokle and Pedersen, 2019). Consequently, identifying as a vaper is likely to emerge as a motivational factor associated with pro-tobacco beliefs and sustained use.

The concept of identity has been studied using various theoretical lenses and is argued to encompass an individual's mental representation of the self, in addition to feelings attached to such representations (Cheek, 1989). In the context of tobacco use, identity has been studied as an important motivational predictor of combustible cigarette smoking in both adults (Levinson et al., 2007; Meijer et al., 2015; Tombor et al., 2015) and adolescents (Hertel and Mermelstein, 2012, 2016). Extensive research has also focused on understanding how identity beliefs are associated with social factors, such as social desirability and peer affiliation (Hogg et al., 2011). According to social identity theory (Abrams and Hogg, 1999; Tajfel, 1978; Tajfel and Turner, 1986), people develop their sense of identity based on their affiliation with social groups, and are motivated to engage in behaviors (e.g., vaping) that maintain their positive social identity and group standing. Uncertainty-identity theory (Hogg, 2000; Hogg, 2012) represents a motivational extension of social identity theory, and argues that feelings of uncertainty about one's identity are uncomfortable, and that individuals are driven to reduce this uncertainty through the process of social identification and adopting group norms.

Relatedly, behavior-specific identity has been assessed using the theory of planned behavior (TPB; Ajzen, 1991; Ajzen and Fishbein, 1970), an influential model used to understand the performance of intentional behavior. TPB argues that a person's willingness to perform a

behavior is guided by attitudes, subjective norms, and perceived behavioral control. In applying this behavioral model, research has shown that identity can impact substance use related attitudes and beliefs, which are in turn associated with behavior (Hagger et al., 2007; Willis et al., 2020). Evidence supports that vaping is perceived as less harmful and more appealing than cigarette smoking given the lack of offensive smell, reduced stigma of use, and plethora of appealing flavors (McKeganey et al., 2018), and that youth susceptibility to engaging in e-cigarette use is strongly impacted by social norms and risk perceptions (Coleman et al., 2020; East et al., 2019; Lozano et al., 2019). Thus, identifying as a vaper is likely to shape youth beliefs, with adolescent vapers possessing more favorable e-cigarette attitudes and normative perceptions compared to adolescents that do not believe e-cigarette use is self-defining.

1.1. The Current Study

Although research on cigarette smoking has established that smoker identity can shape normative beliefs about tobacco use (Choi et al., 2010), perceptions of harm (Kingsbury et al., 2016), and the quantity and frequency that cigarettes are smoked (Lee et al., 2013), research on vaping identity in youth is scarce. To fill this gap in the literature, the current investigation aimed to expand research on adolescent smoker identification to the context of youth vaping by comparing the perceptions (i.e., normative beliefs), attitudes (i.e., perceived harms), and behaviors (i.e., use frequency and quantity, use of flavored e-cigarettes, the behavior used to acquire e-cigarettes) of youth current e-cigarette users that called themselves "vapers" compared to current e-cigarette users that did not embrace a vaper identity (i.e., non-vapers).

1.1.1. Hypotheses and Research Questions

In applying a social identity theory framework, youth that identified as vapers were hypothesized to believe they had more e-cigarette using friends (i.e., descriptive social norms;

Choi et al., 2010), perceive e-cigarette use as less harmful (Kingsbury et al., 2016), report using e-cigarettes more frequently and in a greater quantity (Hertel and Mermelstein, 2012), and indicate that they use of flavored e-cigarettes (Leventhal et al., 2019) compared to non-vapers. Vaping devices differ from combustible cigarettes, in that they can be easily shared, eliminating the need for youth to own their own vaping device (Pepper et al., 2019). Thus, this work also sought to understand how youth typically obtain e-cigarettes and whether vaping identity impacted the likelihood of acquiring e-cigarettes from commercial versus social sources.

When individuals identify with a group that they value and perceive as meaningful, they often internalize the norms and attitudes that define that group, shaping their individual self-concept and subsequent behaviors (Turner et al., 1987). Guided by this rationale and prior work suggesting that social identity shapes the TPB constructs (Hagger et al., 2007; Willis et al., 2020), this study also assessed whether youth identity was related to e-cigarette normative beliefs (i.e., number of e-cigarette using friends), negative attitudes (i.e., harms of e-cigarettes), and vaping behavior (i.e., e-cigarette use frequency and quantity), and whether the relationship between e-cigarette behavior and identity is mediated by normative beliefs and attitudes. Specifically, it was hypothesized that youth vapers would have more e-cigarette using friends and perceive vaping as less harmful, which will in turn be associated with using e-cigarettes more frequently and in greater quantities.

2. Material and Methods

2.1. Data and Design

Data were drawn from the 2017-2018 California Student Tobacco Survey (CSTS), a representative, biennial, school-based survey of 10th and 12th grade public school students throughout 256 randomly selected high schools in California (Zhu et al., 2019b). The CSTS

utilizes a two-stage cluster sampling design, where school represents the primary sampling unit and classroom is the secondary sampling unit. In applying this approach, the state of California is divided into 12 stratum, and then a number of schools are randomly selected within each regional stratum in proportion to the number of students in each region (for more information on study design and data collection procedure see Zhu et al., 2019a). All survey data collection methods were approved by the University of California, San Diego Human Research Protection Program, IRB #170787 and the California State Committee for the Protection of Human Subjects, protocol 15-04-1992. The current study represents a secondary analysis of deidentified CSTS data, and was therefore not subjected to an IRB review.

2.2. Measures

Demographic information on age, gender identity (e.g., "What is your gender?" female/male/I identify in another way), race/ethnicity, and identification as lesbian, gay, bisexual, transgender, or queer (LGBTQ) were included as covariates in the multivariable analyses. Ever use of cigarettes and other tobacco products (i.e., little cigars or cigarillos, big cigars, hookah, and smokeless tobacco), beliefs about the respondent's number of cigarette using friends, and perceived cigarette harms were also included as model covariates.

2.2.1. Perceptions and Attitudes

Consistent with previous substance use research (Lac and Donaldson, 2016, 2018, 2020), e-cigarette descriptive normative perceptions, which represents individual beliefs about the substance use behaviors of close others (Borsari and Carey, 2001), were assessed by asking respondents, "How many of your friends use e-cigarettes?" Response options were 1 (*None*), 2 (*Some*), 3 (*Most*), and 4 (*All*).

The perceived harms of using e-cigarettes were evaluated as a proxy for negative e-cigarette attitudes (as done in Donaldson et al., 2015) by asking, “How harmful is it to vape e-cigarettes?” (1: *Not at all harmful* to 5: *Extremely harmful*).

2.2.2. Behaviors

E-cigarette use frequency was examined by asking youth, “In the last 30 days, how many days did you use e-cigarettes?” (1: *1 or 2 days* to 6: *All 30 days*). E-cigarette use quantity was measured by asking, “Approximately, how many puffs (hits) do you take EACH time? Responses ranges from 1 (*1 puff/hit*) to 9 (*More than 30 puffs/hits*).

Flavored e-cigarette use was examined by asking respondents “Were any of the e-cigarettes you used in the last 30 days flavored...?” and “Which flavor do you use MOST often?” Responses were coded as 0 (*Unflavored or tobacco flavored*), 1 (*Fruit or sweet*), 2 (*Liquor*), 3 (*Mint or menthol*), 4 (*Other flavors*).

Respondents were surveyed about where they usually get or buy their e-cigarettes or e-liquid (i.e., source of acquisition; *Someone offers them to me or I ask someone for them; I buy them from a vape or tobacco shop; I buy them from another type of store; I buy from someone or ask someone to buy them for me; Internet (including apps); Other/ I get them some other way*). Responses were recoded as 0 (*Commercial Source*), 1 (*Social Source*), and 2 (*Other/ I get them some other way*).

2.2.3. Vaper Identity

The outcome variable, *vaper identity*, was measured by asking youth that reported they used e-cigarettes in the last 30 days, “Do you call yourself a vaper?” (0: No/1: Yes). In the current research context, youth responding "yes" were classified as *vapers* and those responding "no" were categorized as *non-vapers*.

2.3. Statistical Analysis

R Studio (Version 1.3.959) statistical software was used for the analyses. Survey weights and sampling design (i.e., strata and cluster) variables were applied using the survey package (Lumley, 2004) to produce weighted population-based estimates and descriptive statistics. Findings supported that multicollinearity did not exist as the highest generalized variance inflation factor was 1.41, which fell below the cutoff of 2.50 (O'Brien, 2007). Weighted bivariate descriptive analyses assessed differences in vaper identity based on each predictor. Odds ratios (ORs) were calculated for each association. For categorical predictor variables, the weighted number (N) and percentage (%) of respondents within each category were estimated. Weighted means (M) and standard errors (SE) are displayed for all other predictors.

Multiple imputation with 50 imputations was implemented under the conditions of missing at random using the Amelia package (Honaker et al., 2011) to execute the multivariable analyses regression analyses. A weighted multivariable logistic regression model, using the imputed data and accounting for student-level clustering within schools, was tested to examine which predictor variables were associated with identification as a vaper, while simultaneously controlling for all demographic covariates. Adjusted odds ratios (aORs) and corresponding 95% confidence intervals were examined to determine statistical significance. The confidence interval for each aOR was examined to assess whether one was within the resultant interval. If the interval did not contain one, the aOR was deemed statistically significant ($p < .05$).

Two weighted path models were then tested using R's lavaan package with 50 imputed datasets, maximum-likelihood estimation, and a robust Satorra-Bentler model correction. Paths from vaper identity to e-cigarette norms (i.e., number of e-cigarette using friends) and negative attitudes (i.e., perceived harms) were estimated. In turn, relationships between all three predictor

variables with e-cigarette use behavior (frequency and quantity) were specified. Model fit was evaluated with three robust fit indices—the comparative fit index (CFI), Tucker-Lewis fit index (TFI), and root mean square error of approximation (RMSEA).

3. Results

The final weighted sample consisted of 82,217 high school student current e-cigarette users from a random sample of public high schools in California (Table 1). Approximately 22.03% ($n = 18,115$) of youth e-cigarette users called themselves vapers. Results of the weighted bivariate and descriptive analyses using the non-imputed data in Table 2 showed that all key predictor variables were significantly associated with vaper identity.

3.1. Multivariable Regression Model

Controlling for all covariates and predictor variables, results of the imputed multivariable logistic regression model¹ (see Table 3) disclosed that age, Hispanic/Latinx ethnicity, and LGBTQ identity were associated with vaper self-identity. Younger youth and those that identified as LGBTQ were more likely to self-identify as a vaper. Compared to Hispanic/Latinx youth, non-Hispanic White respondents were more likely to self-identify as vapers.

E-cigarette descriptive norms and perceived harms were significantly related with vaper identity. Youth with more e-cigarette using friends and that perceived e-cigarettes as less harmful were more likely to define themselves as vapers. E-cigarette use frequency and quantity also differentiated vapers from non-vapers, with vapers reporting that they used e-cigarettes more often and took a greater number of hits per use. Adolescents that usually vaped fruit/sweet and mint/menthol flavored e-cigarettes were more likely to self-identify as vapers compared to

¹ Analyses conducted with the non-imputed data using list-wise deletion showed a similar pattern of results across all variables.

respondents that typically vaped unflavored or tobacco flavored e-cigarettes. E-cigarette source of acquisition was also related with vaper identity. Vapers were more likely to report that they bought their e-cigarettes from a vape or tobacco shop, another type of store, or the internet rather than indicating that they acquired e-cigarettes from a non-commercial social source (i.e., "Someone offers them to me or I ask someone for them"; "I buy from someone or ask someone to buy them for me").

3.2. Path Analytic Models

The goodness of fit indices for the models examining e-cigarette use frequency (Figure 1, Model 1a; CFI = 0.98, TLI = 0.90, RMSEA = 0.04 [90% CI: 0.03 to .05]) and e-cigarette use quantity (Figure 1, Model 1b; CFI = 0.98, TLI = 0.86, RMSEA = 0.04 [90% CI: 0.03 to .05]) both demonstrated adequate fit. In both models, youth that identified as vapers viewed e-cigarette use as more normative, had more favorable attitudes about use, and also reported using e-cigarettes more frequently and in greater quantities compared to non-vapers. Additionally, norms and attitudes significantly mediated the relationships between vaper identity and e-cigarette use behavior.

4. Discussion

The current research aimed to apply the premises underlying social identity theory (Abrams and Hogg, 1999; Tajfel, 1978; Tajfel and Turner, 1986) and the theory of planned behavior (TPB; Ajzen, 1991; Ajzen and Fishbein, 1970) to better understand how identifying as a vaper might shape youth e-cigarette perceptions, attitudes, and behaviors. Results showed that youth self-identified vapers believed e-cigarette use was more normative (i.e., perceived they had more e-cigarette using friends; Choi et al., 2010), possessed more favorable e-cigarette attitudes (i.e., believed e-cigarettes were less harmful; Kingsbury et al., 2016), used e-cigarettes more

frequently and in greater quantities (Lee et al., 2013), were more likely to report the use of flavored vapes, and were also more likely to buy e-cigarettes from commercial sources (e.g., tobacco shops) compared to youth e-cigarette users that did not view vaping as self-defining. Additionally, findings supported that vaper identity was related with the TPB constructs of descriptive norms and attitudes, with these two constructs mediating relationships between identity and behavior.

Findings support the potential importance of integrating social identity into the TPB framework (Hagger et al., 2007) and highlight that youth might rely on evaluations of the self when making choices about how to act. Social identity theory (Abrams and Hogg, 1999; Tajfel, 1978; Tajfel and Turner, 1986) contends that an individual's sense of self is strongly impacted by the norms of important in-groups, and that youth are likely to conform to these group norms as a way to establish and maintain their self-concept. With the growing popularity of e-cigarette use among adolescents (Gorukanti et al., 2017), vaping is likely to represent a salient group norm for youth within the social context, supporting the mediating role of normative beliefs and positive attitudes on the relationship between vaper identity and e-cigarette use behavior. Together with prior research incorporating social identity into TPB models (Hagger et al., 2007; Terry et al., 1999), results support the importance of examining identity and its relationship with normative beliefs and attitudes to better understand vaping behavior.

This investigation might also shed light on how feelings of uncertainty during the adolescent years can represent a risk factor of unhealthy risk behavior such as using e-cigarettes (Hogg et al., 2011). There is some evidence that youth with the greatest levels of self-uncertainty have a strong need to be accepted by peers and are most willing to take risks to become well-liked and popular (Siegel et al., 2011). As such, unhealthy behaviors that define unique groups

can become attractive as identity-defining attributes that can help youth establish a distinctive identity and reduce feelings of uncertainty (Hogg et al., 2011). It is also interesting to note that youth who identified as LGBTQ were at a higher risk of identifying as a vaper compared to heterosexual and cisgender respondents. This finding might suggest that sexual orientation and gender minority youth are at risk for experiencing high levels of uncertainty about their personal identity (Reyes et al., 2015) and peer relationships, with vaping representing a possible avenue for acceptance. Given that limited research has been conducted on LGBTQ identity development, future investigations and interventions might explore the motivations for vaping among LGBTQ youth, as well as investigating the impact of targeted strategies that help reduce feelings of stress and uncertainty.

Collectively, results suggest that youth who identify as vapers are at risk for sustained tobacco use and later nicotine dependence, and also have implications for tobacco control programs to adopt a programmatic philosophy that aims to target population-level social norms via media campaigns and tobacco control policy (Roeseler and Burns, 2010; Zhang et al., 2010). Given that youth susceptibility for engaging in e-cigarette use is strongly impacted by norms and risk perceptions (Coleman et al., 2020; East et al., 2019; Lozano et al., 2019), the effectiveness of evidence-based culturally sensitive media campaigns emphasizing the social unacceptability and dangers of e-cigarette use (Gorukanti et al., 2017), while also exposing the tobacco industry's unethical marketing practices, such as those used in California (Roeseler and Burns, 2010), should be experimentally tested in future research efforts.

Interventions of the future might consider measuring and targeting vaper identity to pinpoint youth that are at risk of escalating their tobacco use. By identifying at-risk youth, individuals that would benefit most from cessation efforts can be better targeted using this

strategy. Relatedly, findings also support prior research showing that campaigns targeted based on individual social identity can also help change or promote health behaviors (Moran et al., 2012; Moran and Sussman, 2014). For example, future media campaigns could emphasize strategies for endorsing different positive social identities that are incompatible with vaping, while also promoting potential harms and negative attitudes about e-cigarette use (Hertel and Mermelstein, 2012). Still, findings of this work are preliminary and highlight a need for additional research efforts that aim to understand the intersection of vaper identity with other peer group identities, and whether identifying as a vaper impacts attitude change processes, such as resistance to anti-vaping messages (Blondé and Falomir-Pichastor, 2019).

This investigation might also have implications for the importance of comprehensive tobacco control policy that restricts youth access to e-cigarettes in the retailer environment and the sale of flavored products. Youth that identified as vapers were more likely to obtain e-cigarettes from commercial sellers (i.e., vape/tobacco shops) compared to non-vapers, emphasizing the need for laws that limit youth access to e-cigarettes by commercial retailers (e.g., minimum age of purchase laws). In line with evidence suggesting that youth who use e-cigarettes in sweet and fruit flavors are more likely to continue vaping, taking more puffs per occasion (Leventhal et al., 2019), self-identified vapers were also more likely to report the use of fruit or sweet and mint or menthol flavored e-cigarettes. This finding underscores the potential positive impact of California's legislative efforts to ban the sale of flavored tobacco products (i.e., Senate Bill 793; California Legislative Information). However, it is also important to note that research on flavor bans is limited, with some studies suggesting that a ban on some flavored tobacco products might promote the use of other products (Courtemanche et al., 2017; Rose et

al., 2019; Yang et al., 2020). Thus, to better understand optimal regulatory policies that prohibit flavored tobacco products additional research is needed at the federal, state, and local levels.

Despite the implications of this work, findings should be interpreted in the context of several limitations. Data were cross-sectional, and as a result, causal conclusions could not be drawn. It is likely that the relationship between vaper identity and the predictor variables (e.g., descriptive norms, negative attitudes) are bi-directional, thus longitudinal research is needed to understand whether these variables are antecedents or consequences of embracing a vaper identity. Respondents were from a random, probability-based sample of California youth that attended public high school. Thus, findings might not be generalizable to youth living in different states and for individuals in different age groups. Due to the nature of secondary data of this study, investigators could not specify the exact questions used when surveying respondents. As a result, one-item measures of predictor variables were scrutinized. Future research efforts should therefore examine the observed relationships using reliable and valid multi-item scales. The TPB construct of perceived behavioral control could also not be examined in the path model, implying that additional research is needed to assess whether behavioral control mediates relationships between identity and tobacco use behavior.

5. Conclusions

In line with a growing body of research on combustible cigarette smoking, adolescents in the current investigation who perceived tobacco use as self-defining were more likely to escalate their tobacco usage (Hertel and Mermelstein, 2012; Lee et al., 2013), increasing the quantity and frequency of use behavior. A novel finding of this work was that LGBTQ youth were more likely to identify as vapers compared to heterosexual and cisgender respondents, highlighting a need for additional studies that explore LGBTQ identity development as it related with tobacco use.

Furthermore, self-identified vapers perceived e-cigarettes as more normative, held more favorable vaping attitudes (i.e., lower perceived harms of use), were more prone to using sweet/fruit and mint/menthol flavored e-cigarettes, and were more likely to report purchasing e-cigarettes from commercial sources compared to non-vapers. Results also support that social identity represents an encouraging extension of the TPB in the context of youth tobacco use. Together, findings highlight the necessity of using a social norms approach to reduce vaping using media campaigns and policy (Roeseler and Burns, 2010; Zhang et al., 2010), and also suggest that future intervention efforts might assess how targeting identity can help prevent youth vaping escalation.

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Table 1. Sample Characteristics and Rates of Missing Data

Covariates	Unweighted	Weighted	% missing
	(N = 13,107)	(N = 82,217)	
	N (%) or M (SE)	N (%) or M (SE)	
Age	16.58 (0.01)	16.62 (0.02)	1.88%
Gender Identity			11.61%
Female	5,648 (48.47%)	35,138 (48.35%)	
Male	5,480 (47.03%)	34,299 (47.20%)	
Other	525 (4.51%)	3,234 (4.45%)	
Race/Ethnicity			12.06%
White	4,819 (41.63%)	28,070 (38.82%)	
African American	340 (2.94%)	1,996 (2.76%)	
Hispanic/Latinx	5,056 (43.68%)	33,948 (46.95%)	
Asian	993 (8.58%)	6,100 (8.44%)	
Other	368 (3.18%)	2,190 (3.03%)	
Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ)			13.42%
No	9,998 (87.79%)	62,496 (87.80%)	
Yes	1,390 (12.21%)	8,687 (12.20%)	
Cigarette Ever Use			1.18%
No	8,420 (64.24%)	51,743 (63.68%)	
Yes	4,527 (34.54%)	29,508 (36.32%)	
Other Tobacco Ever Use ^a			0.02%
No	5,556 (42.40%)	33,709 (41.01%)	
Yes	7,547 (57.60%)	48,491 (58.99%)	
Number of Cigarette Using Friends (Descriptive Norms)	1.61 (.01)	1.62 (.01)	4.29%
Cigarette Perceived Harms (Negative Attitudes)	4.44 (.01)	4.41 (.01)	5.16%
E-Cigarette Perceptions and Attitudes			
Number of E-Cigarette Using Friends (Descriptive Norms)	2.65 (.01)	2.62 (.02)	4.40%
E-Cigarette Perceived Harms (Negative Attitudes)	2.84 (.01)	2.84 (.02)	5.12%
E-Cigarette Behaviors			
E-Cigarette Use Frequency (Days Used)	2.80 (.02)	2.75 (.04)	3.80%
E-Cigarette Use Quantity (Puffs Taken)	3.51 (.02)	3.51 (.03)	5.70%
Most Common E-Cigarette Flavor Used			5.13%
Unflavored or tobacco flavored	1,850 (14.88%)	12,631 (16.19%)	
Fruit or sweet	8,330 (67.00%)	51,717 (66.30%)	
Liquor	104 (0.84%)	613 (.79%)	
Mint or menthol	1,718 (13.82%)	10,282 (13.18%)	
Other flavors	431 (3.47%)	2,759 (3.54%)	
E-Cigarette Source of Acquisition			24.68%
Commercial source	1,931 (19.48%)	11,908 (19.23%)	
Social source	6,850 (69.09%)	42,47(68.59%)	
Other/ I get them some other way	1,134 (11.44%)	7,544 (12.18%)	

Note. Values were estimated using the non-imputed data. Survey weights and sampling design (i.e., strata and cluster) variables were applied to generate weighted estimates.

^aOther tobacco use included ever use of little cigars or cigarillos, big cigars, hookah, and smokeless tobacco.

Table 2. Weighted Bivariate and Descriptive Analyses

Covariates	Bivariate Odds Ratio	Non-Vaper <i>n</i> = 64,102			Self-Identified Vaper <i>n</i> = 18,115		
		<i>n</i> (%) or <i>M</i> (<i>SE</i>)	95% CI		<i>n</i> (%) or <i>M</i> (<i>SE</i>)	95% CI	
			Lower	Upper		Lower	Upper
Age	0.94*	16.64 (0.02)	16.60	16.68	16.56 (0.03)	16.49	16.62
Gender Identity							
Female	Reference	28,432 (50.00%)	48.56%	51.46%	6,706 (42.40%)	39.52%	45.28%
Male	2.66*	26,594 (46.78%)	45.40%	48.15%	7,704 (48.71%)	45.61%	51.81%
Other	0.81*	1,828 (3.21%)	2.74%	3.69%	1,407 (8.90%)	7.24%	10.55%
Race/Ethnicity							
White	Reference	20,952 (36.97%)	33.54%	40.41%	7,118 (45.52%)	41.65%	49.39%
African American	0.68*	1,622 (2.86%)	2.36%	3.37%	374 (2.39%)	1.78%	3.01%
Hispanic/Latinx	0.67*	27,677 (48.84%)	45.47%	52.21%	6,271 (40.10%)	36.92%	43.28%
Asian	0.78*	48,16 (8.50%)	6.79%	10.21%	1,283 (8.20%)	6.05%	10.36%
Other	1.09	1,599 (2.82%)	2.40%	3.24%	591 (3.78%)	2.93%	4.63%
Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ)							
No	Reference	49,656 (89.13%)	88.20%	90.06%	12,840 (83.00%)	80.79%	85.20%
Yes	1.68*	6,056 (10.87%)	9.94%	11.80%	2,631 (17.00%)	14.80%	19.21%
Cigarette Ever Use							
No	Reference	42,370 (66.79%)	65.15%	68.42%	9,372 (52.63%)	49.64%	55.61%
Yes	1.81*	21,070 (33.21%)	31.58%	34.85%	8,437 (47.37%)	44.39%	50.36%
Other Tobacco Ever Use ^a							
No	Reference	28,372 (44.27%)	42.40%	46.13%	5,337 (29.47%)	26.94%	32.00%
Yes	1.90*	35,720 (55.73%)	53.87%	57.60%	12,771 (70.53%)	68.00%	73.06%
Number of Cigarette Using Friends (Descriptive Norms)	1.62*	1.56 (0.01)	1.54	1.59	1.84 (0.03)	1.79	1.89
Cigarette Perceived Harms (Negative Attitudes)	0.79*	4.47 (0.02)	4.44	4.51	4.19 (0.03)	4.13	4.26
E-Cigarette Perceptions and Attitudes							
Number of E-Cigarette Using Friends (Descriptive Norms)	2.15*	2.51 (0.02)	2.46	2.56	2.99 (0.03)	2.94	3.04
E-Cigarette Perceived Harms (Negative Attitudes)	0.68*	2.96 (0.02)	2.91	3.00	2.45 (0.04)	2.37	2.52

E-Cigarette Behaviors							
E-Cigarette Use Frequency (Days Used)	1.61*	2.40 (0.04)	2.33	2.47	3.98 (0.06)	3.86	4.10
E-Cigarette Use Quantity (Puffs Taken)	1.35*	3.18 (0.03)	3.12	3.24	4.62 (0.06)	4.50	4.75
Most Common E-Cigarette Flavor Used							
Unflavored or tobacco flavored	Reference	10,929 (18.11%)	16.60%	19.63%	1701 (9.63%)	8.21%	11.05%
Fruit or sweet	2.02*	39,348 (65.21%)	63.31%	67.11%	12369 (70.03%)	67.60%	72.47%
Liquor	5.37*	334 (.60%)	0.37%	0.74%	279 (1.58%)	0.65%	2.51%
Mint or menthol	2.23*	7,630 (12.64%)	10.88%	14.41%	2652 (15.01%)	13.00%	17.03%
Other flavors	2.02*	2,098 (3.48%)	2.93%	4.02%	661 (3.74%)	2.89%	4.59%
E-Cigarette Source of Acquisition							
Commercial source	Reference	6727 (13.85%)	12.68%	15.02%	5182 (38.78%)	35.62%	41.95%
Social source	0.24*	35937 (74.00%)	72.46%	75.53%	6535 (48.92%)	46.12%	51.73%
Other/ I get them some other way	0.36*	5902 (12.15%)	10.83%	13.47%	1642 (12.29%)	10.30%	14.29%

Note. Weighted bivariate and descriptive statistics for non-vapers and vapers were estimated using the non-imputed data. Percentages (%) reflect the % of participants in each respective group (non-vaper, vaper). Survey weights and sampling design (i.e., strata and cluster) variables were applied. ^aOther tobacco use included ever use of little cigars or cigarillos, big cigars, hookah, and smokeless tobacco. * $p < 0.05$

Table 3. Multivariable Logistic Regression Model Results

Covariates	Adjusted Odds Ratio (aOR)	95% CI	
		Lower	Upper
Age	0.89	0.84	0.94*
Gender Identity			
Female	Reference	---	---
Male	1.29	0.96	1.74
Other	1.13	0.98	1.29
Race/Ethnicity			
White	Reference	---	---
African American	0.82	0.58	1.17
Hispanic/Latinx	0.86	0.75	0.99*
Asian	0.98	0.77	1.25
Other	0.99	0.70	1.41
Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ)			
No	Reference	---	---
Yes	1.46	1.21	1.76*
Cigarette Ever Use	1.02	0.88	1.17
Other Tobacco Ever Use ^a	1.07	0.92	1.23
Number of Cigarette Using Friends (Descriptive Norms)	1.03	0.93	1.16
Cigarette Perceived Harms (Negative Attitudes)	1.02	0.95	1.09
E-Cigarette Perceptions and Attitudes			
Number of E-Cigarette Using Friends (Descriptive Norms)	1.43	1.29	1.58*
E-Cigarette Perceived Harms (Negative Attitudes)	0.77	0.72	0.82*
E-Cigarette Behaviors			
E-Cigarette Use Frequency (Days Used)	1.37	1.31	1.42*
E-Cigarette Use Quantity (Puffs Taken)	1.17	1.14	1.20*
Most Common E-Cigarette Flavor Used			
Unflavored or tobacco flavored	Reference	---	---
Fruit or sweet	1.59	1.33	1.90*
Liquor	0.99	0.39	2.52
Mint or menthol	1.36	1.06	1.75*
Other flavors	1.17	0.78	1.76
E-Cigarette Source of Acquisition			
Commerical source	Reference	---	---
Social source	0.56	0.47	0.66*
Other/ I get them some other way	0.61	0.48	0.78*

Note. Regression results were estimated using survey weights and sampling design (i.e., strata and cluster) variables, using the imputed data. ^aOther tobacco use included ever use of little cigars or cigarillos, big cigars, hookah, and smokeless tobacco. * $p < 0.05$

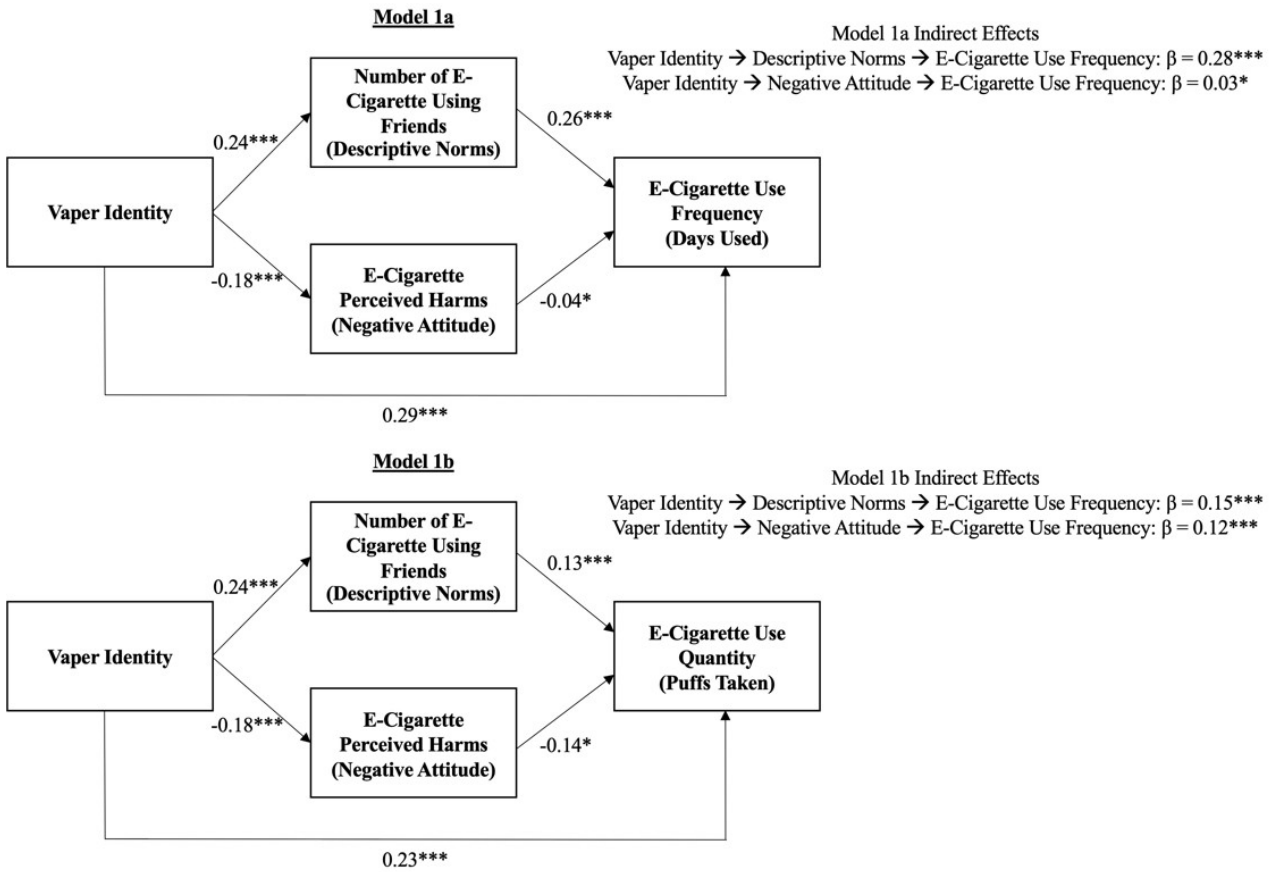


Figure 1. Path analytic model of the indirect relationship between vaper identity and e-cigarette use behavior via number of e-cigarette using friends (descriptive norms) and e-cigarette perceived harms (negative attitudes). Estimates are standardized.

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.