



Nicotine vaping for relaxation and coping: Race/ethnicity differences and social connectedness mechanisms

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ABSTRACT

The current study examined race- and ethnicity-based differences in the reasons that youth report for vaping, with an emphasis on understanding the relationship between race/ethnicity and vaping for relaxation and stress/anxiety coping. This work also sought to go beyond examining race-based differences as a cause of tobacco-use disparities by assessing social connectedness factors that mediate relationships between race/ethnicity and vaping for relaxation and coping. Research questions were tested using data from the 2019–2020 California Student Tobacco Survey, a representative school-based survey of 10th and 12th grade public school students throughout schools in California. Overall, 7.78% of the sample reported using nicotine vapes in the past 30 days. The final sample included 11,112 high school student current vape users. The most important reason that youth vaped was for relaxation and stress/anxiety coping, with racial and ethnic minorities most likely to report this vaping motivation. Analyses of the structural mechanisms underlying the relationship between race/ethnicity and vaping reasons showed that minority youth reported lower school, peer, and family connectedness when compared to White youth. Lower school and family connectedness were in turn correlated with being motivated to vape to relax or relieve stress and anxiety, and lower overall mental health. Findings imply that future intervention efforts might profitably focus on reducing stressors associated with relaxation and stress/anxiety coping motivations and highlight the importance of connectedness for indirectly decreasing vape use risk by improving negative mood and mental health.

1. Introduction

Vapes, also known as electronic cigarettes (e-cigarettes), are used to inhale heated aerosol that usually can contain flavors, nicotine, and/or other chemicals (Goniewicz et al., 2014). In recent years, vapes have become the most popular tobacco product used among youth (Gentzke et al., 2019), representing a top public health concern. The use of nicotine can harm the developing adolescent brain (Abreu-Villaça, Seidler, Tate, & Slotkin, 2003), and is also associated with an increased likelihood of combustible cigarette initiation (Bold et al., 2018).

The potential health implications of youth vape use have generated a considerable interest in identifying the reasons behind why youth vape nicotine products (Evans-Polce et al., 2018; Hooper & Kolar, 2016; Kong et al., 2021; Patrick et al., 2016). Particularly, evidence suggests that relaxation and stress relief represent an important motivation underlying vaping behavior. A study of high school students found that stress

relief followed by peer influence were the most prevalent reasons for adolescent vaping (Jha & Kraguljac, 2021). Similarly, Kong and associates (2021) showed that stress relief was the most common reason for vape use among youth focus group participants. The cited findings are not surprising, given that mental health and stress represent risk factors of youth cigarette smoking (Byrne, Byrne, & Reinhart, 1995; Finkelstein, Kubzansky, & Goodman, 2006) and vaping (Fluharty, Taylor, Grabski, & Munafò, 2017). Likewise, motivational models suggest that coping motives (vaping to alleviate stress/anxiety) are construed to help regulate negative mood states, and that people who rely on substance use to cope may lack more adaptive emotional regulation methods (Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016), resulting in more frequent substance use (Lac & Donaldson, 2017b) and the poorest health outcomes (Cooper et al., 2016).

Although evidence supports the existence of complex and persistent inequalities in tobacco use across the life course (Pamplin, Susser,

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Factor-Litvak, Link, & Keyes, 2020), in addition to the important role of stress for exacerbating these disparities (Jackson, Knight, & Rafferty, 2010; Pamplin et al., 2020), less attention has been dedicated to understanding youth reasons for vaping among racial and ethnic minority populations (Hooper & Kolar, 2016; Patrick et al., 2016), and how race/ethnicity is associated with stress and anxiety coping motivations. One posited reason for the existence of racial and ethnic disparities in tobacco use is that members of stigmatized racial and ethnic groups are often exposed to a variety of stressors, including race-based discriminatory stress, which can impact overall well-being and health (Williams, 2018). Particularly, studies have made the association between experienced racism or discrimination and tobacco use for both combustible cigarette smoking (Agunwamba et al., 2017) and frequent vape use (Fahey, Morris, Robinson, & Pebley, 2021).

Markedly, perceived discrimination is negatively related with social connectedness (Duru & Poyrazli, 2011), or the strength and closeness of social ties. Connectedness is shown to represent a protective factor against stressful events (Liu, Kia-Keating, & Nylund-Gibson, 2019; Marshall-Fabien & Miller, 2016; Rose, McDonald, Von Mach, Witherspoon, & Lambert, 2019) and evidence supports that low school, peer, and family connectedness and support are linked with poor mental health and an increased likelihood of engaging in substance use (Bond et al., 2007; Donaldson et al., 2015, 2016; Moore et al., 2018). As such, there is a need for research that goes beyond examining racial difference as a determinant of tobacco-use disparities to explicitly examine the mechanisms that underly these inequities within a broad social context (Pearson et al., 2021).

To address need, the current study aimed to assess connectedness as a potential mediator of the relationship between race/ethnicity and vaping to relax and to relieve stress and anxiety using Williams and colleagues' (Williams & Mohammed, 2013; Williams, Lawrence, & Davis, 2019; Williams, 2018) racism and health model. This framework outlines how experiences of racism can impact health by providing multiple pathways and responses for understanding tobacco use. Specifically, the racism and health model suggests that racism represents one of the basic determinants that impacts social status. In turn, social status (which is dictated by factors such as race/ethnicity) influences proximal pathways (feelings of connectedness) that include the cultural transmission of prejudice and stereotypes, stressors, socioeconomic opportunities, and the distribution of resources. These proximal pathways (connectedness) are related to behavioral, psychological, and physiological responses (vaping to relax and for stress/anxiety relief) that result in various health outcomes (poor mental health; see the theoretical model presented in Williams & Mohammed, 2013).

The aim of the current study is twofold. It centers on better understanding potential disparities in adolescent experiences of stress and nicotine vape use by exploring race- and ethnicity-based differences in youth reasons for vaping, as well as assessing school, peer, and family connectedness that mediate relationships between race/ethnicity and vaping to relax and to relieve stress and anxiety. It was first hypothesized that minority youth will be more likely to report that they vape to relax or relieve stress/anxiety compared to White respondents. Then, using the racism and health framework, relationships between race/ethnicity (social status), connectedness (proximal pathways), relaxation and stress/anxiety relief vaping motivations (response), and mental health (health outcome) were assessed. It was posited that racial/ethnic minority youth would experience lower school, peer, and family connectedness. Given that these social resources are shown to buffer against discrimination-related stress (Boateng-Poku et al., 2020; Liu et al., 2019), experiencing lower connectedness was anticipated to be associated with vaping to relax or to relieve stress and anxiety. In turn, youth that vape relaxation and/or stress and anxiety relief were anticipated to report lower overall mental health.

2. Material and methods

2.1. Data and design

This study utilized data from the 2019–2020 California Student Tobacco Survey (CSTS), a representative school-based survey of 10th and 12th grade public school students throughout schools in California (Zhu et al., 2021). A two-stage cluster sampling design was used. 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. Since this investigation involved a secondary analysis of deidentified CSTS data, it was not subject to an IRB review.

2.2. Measures

2.2.1. Key variables

Race/ethnicity was measured by asking, "Are you of Spanish or Hispanic (Latino or Latina) origin?" (Yes/No) and "How do you describe yourself? (Select ALL that apply)" (e.g., Black or African American/White; see Supplemental Material, Appendix 1, for a full list of survey items). Responses to both questions were combined and recoded as 0 = White; 1 = Hispanic/Latinx; 2 = Black/African American; 3 = Asian; 4 = Multiple; 5 = Other. Youth that indicated they were American Indian/Alaska Native or Native Hawaiian/Pacific Islander were included in the "Other" race/ethnicity category due low sample size. Race/ethnicity was recoded as a dichotomous variable in the path model (0 = White; 1 = Non-White/Minority).

Youth reasons for vaping were scrutinized by asking youth nicotine vape users to select the most important reason they use vapes¹ (e.g., To relax or relieve stress and anxiety; see Supplemental Material, Appendix 1). Respondents were able to select one of twelve reasons. Response options "To fit in/peer pressure" and "It looks cool" were combined into one category representing social reasons prior to the descriptive analyses. A separate measure of vaping to relieve stress and anxiety was also computed—vaping to relieve stress and anxiety was recoded as 1 and all other reasons for vaping were coded as 0.

A 4-item ($\alpha = 0.81$; e.g., "I feel close to people at my school") measure of school connectedness was adapted from prior research (Fish & Russell, 2018). Peer connectedness was assessed by asking respondents about their agreement with the following statement, "I can talk about my problems with my friends." Family connectedness was evaluated using 2-items ($\alpha = 0.70$; "I have a happy home life" and "I can talk about my problems with my family"). Response options assessed on 4-point Likert-type scales (0 = Strongly disagree to 3 = Strongly agree). Mean scores of school, peer, and family connectedness were computed, with higher scores representing greater connectedness.

Mental health was evaluated by asking, "In general, how would you rate your mental health?" (0 = Poor to 4 = Excellent).

2.2.2. Covariates

Respondent grade (10th; 12th) and gender identity (Female/Girl; Male/Boy; and Other, including transgender) were controlled for in the multivariable analyses. Gender identity was dummy coded in the path model, with female/girl representing the control group. Parental education ("Do either of your parents have a college degree?" 0 = no; 1 = yes; 2 = I don't know) and receiving a free/reduced cost lunch at school (0 = no; 1 = yes, reduced cost lunch; 2 = yes, free lunch; 3 = I don't know) were included as proxy measures of socioeconomic status. Both variables were recoded as 0 (no/I don't know) and 1 (any yes) prior to estimating the path model.

Based on past research showing an association between participation

¹ Only respondents that had vaped nicotine in the past 30 days were included in the sample.

in extracurricular activities and school connectedness, especially for minority youth, extracurricular activity involvement was also controlled for in the analyses (Brown & Evans, 2002; Heath, Anderson, Turner, & Payne, 2018). Using a method described in prior work (Gilman, 2001), a sum score was computed (ranging from 0 to 6 activities) of all extracurricular activities that youth participated in (sports, clubs, student leadership, arts, yearbook/newspaper, other). Lifetime/ever use of other tobacco products (i.e., cigarettes, little cigars or cigarillos, big cigars, hookah, and smokeless tobacco; 0 = no lifetime use; 1 = yes, lifetime use), vaping descriptive peer norms, and vape use frequency (see Appendix 1) were also examined as model covariates.

2.3. Statistical analysis

Data were recoded and cleaned using SPSS (Version 27). Using the interpretational guidelines of Tabachnick and Fidell (2013), it was determined that all continuous variables were within the acceptable bounds (<or = ±2) of normality (skew ranged from -0.49 to 0.433; kurtosis ranged from -1.31 to 0.34).

Survey weights and sampling design (i.e., strata and cluster) variables were applied in all analyses to adjust for the complex sampling design using R Studio (Version 1.3.959) statistical software and the survey package. Descriptive analyses examined differences in youth reasons for vaping by race/ethnicity. Significant differences across racial/ethnic groups were determined using 95% confidence intervals (CIs). Bivariate relationships between each race/ethnicity group and vaping to relax/relieve stress and anxiety (1 = Yes; 0 = No) were also assessed using logistic regression modeling. Odds ratios (ORs) were calculated for each association. Weighted bivariate descriptive analyses also examined relationships between the vaping for relaxation and relieve stress/anxiety and each covariate/predictor included in the path analytic model. For categorical predictor variables, the weighted percentage of respondents within each category were estimated. Weighted means are displayed for all other predictors.

When estimating the multivariable model, there was no evidence of multicollinearity in the model—the highest generalized variance inflation factor was 1.45, a value that fell below the cutoff of 2.50 (O'Brien, 2007). A weighted path analytic model was then tested using R's lavaan package with 50 imputed datasets and diagonally weighted least square estimation. Under the condition that data was missing at random, multiple imputation with 50 imputations was implemented using the Mice package.

Paths from race/ethnicity to school, peer, and family connectedness, and then from all connectedness variables to vaping to relax/relieve stress and anxiety were estimated. A direct path from race/ethnicity to vaping to relax/relieve stress and anxiety was also specified. In turn, a path from vaping to relax/relieve stress and anxiety to mental health was evaluated. Based on the modification indices, two additional paths from school and family connectedness with mental health were also specified. Total indirect effects between race/ethnicity and mental health via connectedness and vaping to relax and relieve stress and anxiety were also assessed. Respondent grade, gender identity, parent education, receiving a free lunch, participation in extracurricular activities, lifetime use of other tobacco products, vaping peer norms, and vape use frequency were all controlled for as model covariates. Given the large sample size, paths with a *p*-value of *p* < 0.001 were determined to be statistically significant.

3. Results

The sample was comprised of 150,634 students, with 7.78% (11,664) reporting current (past 30 day) nicotine vape use. Students with complete data on the vaping reasons question and those that had vaped nicotine in the last 30 days were included in the analyses. The final sample included 11,112 current vape users (Table 1).

Reasons for vaping were as follows: 1) to relax or relieve stress and

Table 1
Sample Characteristics and Rates of Missing Data.

	Unweighted (N = 11,112)		Weighted (N = 59,974)		% Missing
	N or M	% or SE	N or M	% or SE	
Grade					0.00%
10th	4,832	43.48	24,946	41.59	
12th	6,280	56.52	35,028	58.41	
Gender Identity					3.86%
Female/Girl	5,429	50.81	29,491	51.15	
Male/Boy	4,691	43.9	25,004	43.36	
Other	565	5.29	3,165	5.49	
Parental Education					0.85%
Did not attend college	4,123	37.45	22,596	38.00	
Attended college	5,719	51.95	30,563	51.40	
I don't know	1,166	10.59	6,308	10.61	
Free School Lunch Recipient					0.85%
No	5,619	50.98	29,840	50.18	
Yes	4,276	38.80	23,429	39.40	
I don't know	1,127	10.23	6,197	10.42	
Participation in Extracurricular Activities	0.96	0.01	0.98	0.02	1.02%
Lifetime Other Tobacco Use ^a					0.00%
No	4,313	38.81	23,110	38.53	
Yes	6,799	61.19	36,864	61.47	
Race/Ethnicity					0.00%
White	3,647	32.82	19,395	32.34	
Hispanic/Latinx	4,698	42.28	25,988	43.33	
Black/African American	227	2.04	1,361	2.27	
Asian	860	7.74	4,753	7.92	
Multiple Race	1,173	10.56	5,940	9.90	
Other	507	4.56	2,537	4.23	
Vaping Reasons					0.00%
To relax or relieve stress and anxiety	4,123	37.10	22,300	37.18	
It looks cool/to fit in/peer pressure	764	6.88	4,088	6.82	
To have a good time	1,383	12.45	7,399	12.34	
For the nicotine buzz	2,762	24.86	14,668	24.46	
To focus or concentrate	381	3.43	1,982	3.31	
Because I am "hooked"	432	3.89	2,492	4.16	
Other vaping reasons ^b					
Cloud competitions	324	2.92	1,813	3.02	
To try to quit using other products	138	1.24	714	1.19	
They are available in flavors I like	256	2.30	1,293	2.16	
I can use them unnoticed at home or at school	272	2.45	1,537	2.56	
To control my weight	277	2.49	1,687	2.81	
Vaping Descriptive Peer Norms	2.56	0.01	2.55	0.01	1.04%
Vape Use Frequency	2.96	0.02	2.95	0.04	0.06%
School Connectedness	2.76	0.01	2.78	0.02	2.07%
Peer Connectedness	3.19	0.01	3.17	0.01	1.64%
Family Connectedness	2.80	0.01	2.80	0.01	1.43%
Mental Health	1.77	0.01	1.77	0.02	0.57%

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 cigarettes, little cigars or cigarillos, big cigars, hookah, and smokeless tobacco. ^bOther vaping reasons were combined in analysis due to small sample size.

anxiety (37.18%, 95% CI: 35.41%, 38.95%); 2) for the nicotine buzz (24.46%, 95% CI: 22.68%, 26.23%); 3) to have a good time with friends (12.34%, 95% CI: 11.43%, 13.24%); 4) it looks cool, to fit in, or peer pressure (6.82%, 95% CI: 6.16%, 7.48%); 5) because I am “hooked” (4.16%, 95% CI: 3.44%, 4.87%); 6) to focus or concentrate (3.31%, 95% CI: 2.83%, 3.78%); 7) cloud competitions (3.02%, 95% CI: 2.51%, 3.54%), 8) control weight (2.81%, 95% CI: 2.11%, 3.52%); 9) I can use them unnoticed at home or school (2.56%, 95% CI: 2.13%, 2.99%); 10) they are available in flavors I like (2.16%, 95% CI: 1.83%, 2.49%); 11) and to try and quit using other products (1.19%, 95% CI: 0.93%, 1.45%). Vaping reasons by race/ethnicity are shown in Fig. 1. Logistic regression modeling showing the bivariate relationship between race/ethnicity and vaping to relax or relieve stress and anxiety for each group is shown in Table 2. Bivariate analyses for variables in the path model are in Table 3.

Weighted descriptive analyses shown in Table 3 examined youth reasons for vaping by race/ethnicity. As evidenced by high coefficient of variation estimates and small sample sizes for vape reasons 7 through 11 shown above, reliable differences by race/ethnicity were not attainable and were therefore grouped as “Other” reasons for vaping. As hypothesized, Hispanic/Latinx, Black/African American, Asian, and Multiple race youth were more likely to report that they vape to relax or relieve stress/anxiety compared to White youth. Hispanic/Latinx youth were more likely to report that they vaped because it looks cool, to fit in, or because of peer pressure compared to White respondents. White youth were more likely than Hispanic/Latinx youth to indicate that they vaped to have a good time. White youth were most likely to report that they vaped for the nicotine buzz than all other racial/ethnic groups. Multiple race youth were also more likely to report that they vaped for the nicotine buzz when compared to Hispanic/Latinx youth. When compared to Hispanic/Latinx respondents, White youth were also more likely to indicate that they vaped because they were hooked.

3.1. Path analytic model

The fit indices demonstrated good model fit (CFI = 0.99, TLI = 0.98, RMSEA = 0.03 [90% CI: 0.02 to 0.05], SRMR = 0.01). As shown in Fig. 2, results indicated that Non-White minority youth were more likely to report lower school, peer, and family connectedness compared to White youth. In turn, Non-White race/ethnicity and both lower school and family connectedness were significantly associated with vaping to relax or relieve stress and anxiety. Vaping for stress relief was then correlated with lower overall mental health. Direct paths between school and family connectedness with mental health were also significant and showed that higher connectedness was associated with better mental health. The total indirect effects of race/ethnicity on mental health via both family connectedness ($B = -0.12, p < 0.001$) and school connectedness ($B = -0.11, p < 0.001$) and vaping for stress and anxiety relief were statistically significant. This finding suggests that minority youth were more likely to report lower school and family connectedness, which were associated with vaping for stress relief, and in turn lower overall mental health.

4. Discussion

Under the conditions of this study, relaxation and stress/anxiety relief represented the most important reason underlying youth vaping behavior (Jha & Kraguljac, 2021; Kong et al., 2021). Racial/ethnic minority youth were most likely to report this relaxation and coping motivation. Findings point to the potential utility of prevention interventions that reduce common stressors experienced during adolescence that are associated with the need for relaxation and coping motivations. In line with prior research (Kong et al., 2019), the experience of a nicotine buzz was observed as the second most important reason that youth vaped, suggesting that policy regulations might focus

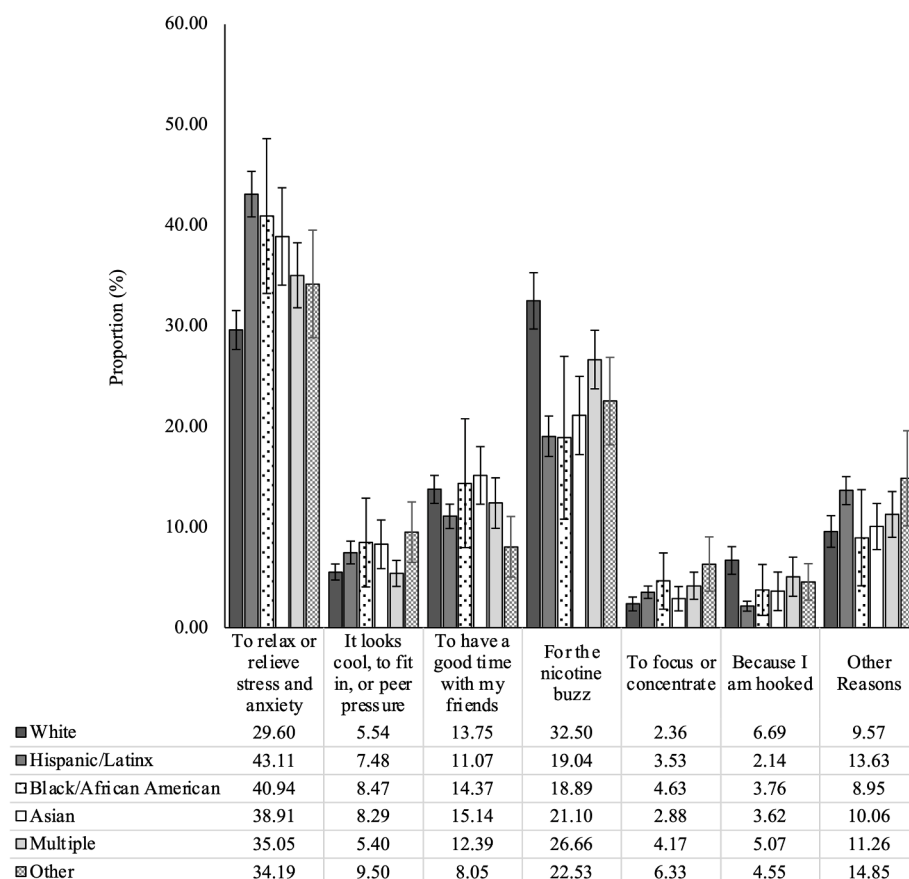


Fig. 1. Bivariate association between youth self-reported reasons for vaping and race/ethnicity. Values were estimated using the non-imputed data. Survey weights and sampling design (i.e., strata and cluster) variables were applied to generate weighted estimates. Error bars represent 95% confidence intervals. Other vaping reasons were combined in analysis due to small sample size. Youth that reported their race as American Indian/Alaska Native or Native Hawaiian/Pacific Islander were grouped in the “Other” race/ethnicity category due to low sample size.

Table 2
Weighted Bivariate Associations Between Race/Ethnicity and Vaping to Relax or Relieve Stress and Anxiety.

	Bivariate Odds Ratio	SE
<i>White</i>	<i>Reference</i>	—
Hispanic/Latinx	1.80***	0.06
Black/African American	1.65**	0.17
Asian	1.51***	0.11
Multiple Race	1.28**	0.08
Other	1.24	0.13
<i>Hispanic/Latinx</i>	<i>Reference</i>	—
White	0.55***	0.06
Black/African American	0.91	0.17
Asian	0.84	0.11
Multiple Race	0.71***	0.08
Other	0.69**	0.13
<i>Black</i>	<i>Reference</i>	—
White	0.61**	0.17
Hispanic/Latinx	1.09	0.17
Asian	0.92	0.19
Multiple Race	0.78	0.18
Other	0.75	0.20
<i>Asian</i>	<i>Reference</i>	—
White	0.66***	0.11
Hispanic/Latinx	1.19	0.11
Black/African American	1.09	0.19
Multiple Race	0.85	0.12
Other	0.82	0.16
<i>Multiple</i>	<i>Reference</i>	—
White	0.78**	0.08
Hispanic/Latinx	1.40***	0.08
Black/African American	1.28	0.18
Asian	1.18	0.12
Other	0.96	0.15
<i>Other</i>	<i>Reference</i>	—
White	0.81	0.13
Hispanic/Latinx	1.46**	0.13
Black/African American	1.33	0.20
Asian	1.23	0.16
Multiple Race	1.04	0.15

Note. Weighted bivariate statistics were estimated using the non-imputed data. Survey weights and sampling design (i.e., strata and cluster) variables were applied. Vaping to relieve stress and anxiety was coded as 1 and all other reasons for vaping were coded as 0. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

on lowering nicotine levels in vapes, in addition to increasing taxes on products with high nicotine contents (Kong et al., 2019). Social reasons, including peer influence, also represented a popular reason for teen vape use, signifying that prevention efforts might focus on educating youth about peer pressure and how to overcome it. It is also important to note that vaping to quit the use of other products (e.g., cigarettes) was the least important reason that youth selected for vaping.

Applying the racism and health framework, the current study sought to contribute to work on tobacco-related disparities by exceeding race-based main effect explanations and exploring underlying mechanisms that explain the relationship between race/ethnicity and motivations for using nicotine vapes. Reporting a Non-White racial/ethnic background was associated with lower school, peer, and family connectedness, and poor school and family connectedness were in turn correlated with a higher likelihood of vaping to relax or relieve stress/anxiety and lower overall mental health. Findings support prior research advocating that poor parental relationships are associated with emotional difficulties and conduct problems (Oldfield, Humphrey, & Hebron, 2016), impacting youth school connectedness (Shochet, Smyth, & Homel, 2007), as well as the impact of social connectedness on youth substance use and

mental health (Bond et al., 2007; Donaldson, Nakawaki, & Crano, 2015; Moore et al., 2018). Future research efforts might therefore focus on the implementation of culturally sensitive interventions that promote connectedness across multiple contexts for at risk-youth by implementing school-based policies that encourage inclusiveness, safety, and involvement, in addition to parent-based efforts designed to decrease parent stress and improve the quality of parent-child communication (Donaldson, Handren, & Crano, 2016; Liu et al., 2019; Shochet et al., 2007).

In line with studies on motivational models of substance use (Lac & Donaldson, 2017a), this investigation also has implications about the role of coping motivations in the context of youth tobacco use. Adolescence represents a transitional developmental phase where emotional and behavioral changes occur and mental health problems are common (Low et al., 2012). Vaping nicotine is likely to provide immediate mental health benefits, including an alleviation of negative feelings of stress, anxiety, and depression. Youth might turn to vaping as a coping mechanism and self-mediation strategy to regulate the quality of their emotional well-being (Khantzian, 1997), and in turn, vape users are likely to experience worse mood states during nicotine depletion, reinforcing the need to vape to alleviate negative emotions (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). The relationship between nicotine vape use and mental health is therefore likely reinforcing and bidirectional, with vaping nicotine negatively impacting mental health, and negative emotionality leading to vaping as a coping response, reinforcing feelings of stress relief from nicotine vape use (Lechner, Janssen, Kahler, Audrain-McGovern, & Leventhal, 2017). As such, future prevention efforts might focus on decreasing tobacco use indirectly by improving negative mood states and reducing stressors associated with relaxation and stress coping motivations.

Findings should be interpreted in terms of several limitations. Although a growing body of work supports the important relationship between discrimination and minority stress (Brody et al., 2014; Priest et al., 2013), experiences of discrimination were not directly assessed in this work. Future investigations should develop and implement reliable and valid measures of perceived discrimination with youth and should also explore the complex structural mechanisms between race/ethnicity, discrimination, and tobacco-related health outcomes using the racism and health framework. Data were cross-sectional and correlational in nature. Thus, causal inference and directionality cannot be made with high confidence. Due to the low sample size of American Indian/Alaska Native and Native Hawaiian/Pacific Islander youth across vaping reasons categories, these groups were included in the "Other" race/ethnicity category, representing another limitation. Future studies should focus on understanding vaping motives in these priority populations.

Given the secondary nature of the data utilized in this study, researchers also had no control over the specific questions used, including the measure of vaping reasons. Future efforts might center on refining the measurement of vaping reasons and could employ qualitative methodologies and/or free text responses in quantitative surveys to acquire an extensive list of all youth vaping reasons. Similarly, the measurement of extracurricular activities, operationalized as a sum score of different activity types, might also represent a limitation. Involved youth could have spent many hours immersed in one activity, which would not have been captured by the assessment used in this work. Hourly participation likely represents a better measure of involvement and should be included in future studies. Bivariate analyses demonstrated differences in youth vaping reasons based on specific racial/ethnic group. To be included as a predictor in the path model, race/ethnicity was dichotomized (White/Non-White), representing another limitation. As such, future research should further assess how the pattern of relationships differs across racial/ethnic groups using sophisticated multi-group models.

Table 3
Weighted Bivariate and Descriptive Analyses Based on Youth Self-Reports of Vaping to Relax or Relieve Stress and Anxiety.

	Bivariate Odds Ratio	Vaping to Relax/Relieve Stress and Anxiety					
		No/Other Motivations (N = 37,674)			Yes (N = 22,300)		
		% or M	95% CI		% or M	95% CI	
		Lower	Upper		Lower	Upper	
Grade							
10th	Reference	59.52%	57.00%	62.03%	40.48%	37.97%	43.00%
12th	0.79***	65.17%	63.39%	66.95%	34.83%	33.05%	36.61%
Gender Identity							
Female/Girl	Reference	60.11%	57.81%	62.41%	39.89%	37.59%	42.19%
Male/Boy	0.81***	65.18%	63.19%	67.17%	34.82%	32.83%	36.81%
Other	0.69**	68.66%	63.61%	73.71%	31.34%	26.29%	36.39%
Parental Education							
Did not attend college	Reference	57.69%	54.65%	60.73%	42.31%	39.27%	45.35%
Attended college	0.68***	66.63%	64.91%	68.35%	33.37%	31.65%	35.09%
I don't know	0.82*	62.51%	57.98%	67.05%	37.49%	32.95%	42.02%
Free School Lunch Recipient							
No	Reference	67.87%	66.12%	69.62%	32.13%	30.38%	33.88%
Yes	1.64***	56.32%	53.71%	58.93%	43.68%	41.07%	46.29%
I don't know	1.22*	63.39%	59.22%	67.56%	36.61%	32.44%	40.78%
Participation in Extracurricular Activities	0.95	0.10	0.96	1.04	0.94	0.87	1.00
Lifetime Other Tobacco Use ^a							
No	Reference	60.02%	57.61%	62.44%	39.98%	37.56%	42.39%
Yes	0.82***	64.57%	62.65%	66.48%	35.43%	33.52%	37.35%
Race/Ethnicity							
White	Reference	70.40%	68.47%	72.34%	29.60%	27.66%	31.53%
Non-White/Minority	1.64***	59.19%	57.29%	61.09%	40.81%	38.91%	42.71%
Vaping Descriptive Peer Norms	0.94	2.57	2.54	2.60	2.53	2.49	2.57
Vape Use Frequency	0.97	2.98	2.89	3.07	2.88	2.78	2.99
School Connectedness	0.79***	2.83	2.80	2.87	2.69	2.65	2.72
Peer Connectedness	0.91***	3.20	3.17	3.24	3.12	3.08	3.16
Family Connectedness	0.81***	2.86	2.83	2.90	2.69	2.65	2.74
Mental Health	0.87***	1.86	1.82	1.90	1.62	1.57	1.68

Note. Weighted bivariate and descriptive statistics were estimated using the non-imputed data. Survey weights and sampling design (i.e., strata and cluster) variables were applied. ^aOther tobacco use included ever use of cigarettes, little cigars or cigarillos, big cigars, hookah, and smokeless tobacco. **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

5. Conclusions

Evidence from the current representative study of California youth suggests that relaxation and coping motives represent the most popular reason underlying youth nicotine vape use, with racial and ethnic minorities most likely to report this motivation. In response to a need for research transcending main effect explanations of race/ethnicity on tobacco-related disparities, this research also examined connectedness mechanisms that might help explain why youth vape for relaxation and coping reasons. Racial/ethnic minority youth were shown to report lower levels of school, peer, and family connectedness, and in turn, low school and family connectedness were associated with vaping for relaxation and coping reasons and with poor mental health. Future prevention efforts might use findings of this work to design interventions that center on reducing stressors associated with relaxation and stress/anxiety coping motivations and highlight the importance of school and family connectedness for potentially decreasing tobacco use risk via improvements in negative mood and mental health.

6. Author disclosures

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6.2. Contributors

All authors were involved in the process of conceptualizing and designing the study and formulating research questions. C. Donaldson and D. Stuppelbeen were responsible for conducting the literature search and writing the introduction. C. Donaldson conducted the data analysis and wrote a first draft of the manuscript. All authors contributed to interpreting the data and critically reviewing the manuscript for important intellectual content. C. Donaldson edited the final manuscript version after implementing contributions from all authors. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

CRediT authorship contribution statement

Candice D. Donaldson: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **David A. Stuppelbeen:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Cassandra L.**

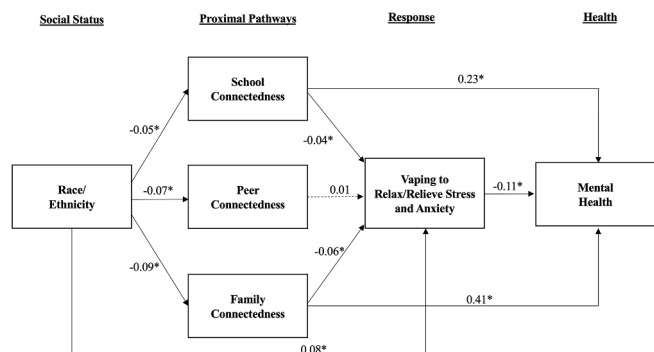


Fig. 2. Weighted path analytic model of the proposed study relationships. Survey weights and sampling design (i.e., strata and cluster) variables were applied to generate weighted estimates using the imputed data. Presented estimates are standardized. Covariances between school, peer, and family connectedness were specified in the model but are not pictured to maintain conceptual clarity. Grade, gender identity, parent education, receiving a free lunch, participation in extracurricular activities, lifetime use of other tobacco products, vaping peer norms, and vape use frequency were all controlled for as model covariates. Race/ethnicity was coded as 0 = *White*; 1 = *Non-White/Minority*. Vaping to relax or relieve stress and anxiety was coded as 0 = *no/all other reasons for vaping*; 1 = *yes, reported vaping for stress and anxiety relief*. * $p < 0.001$. Note, column labels “social status,” “proximal pathways,” “response,” and “health” from Williams and Mohammed (2013).

Fecho: Conceptualization, Methodology, Writing – review & editing. **Tiffany Ta:** Conceptualization, Methodology, Writing – review & editing. **Xueying Zhang:** Conceptualization, Methodology, Supervision, Writing – review & editing. **Rebecca J. Williams:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2022.107365>.

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