Preventive Medicine Reports 24 (2021) 101598

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Short communication

Vaping and COVID-19 Risk: Perceived link and its correlates among at-risk adolescents

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ARTICLE INFO

Keywords:
Adolescent
Vaping
Risk perception
COVID-19

ABSTRACT

Research shows that a significant number of adolescents and young adults quit vaping or reduced the amount of nicotine consumed since the beginning of the COVID-19 pandemic. However, there is a lack of evidence on adolescent risk perceptions regarding the link between vaping and susceptibility to contracting COVID-19. This study examined the level of perceived COVID-19 risk due to vaping among at-risk adolescents. A sample (N = 1,251) of adolescents aged 13 to 17 and susceptible to future vaping were recruited through Qualtrics to participate in an online survey. More than two thirds of the sample (68.34%) reported that vaping would increase one's risk of contracting COVID-19. Ordinal logistic regression showed that this risk perception was positively associated with perceived prevalence of vaping among peers (AOR = 1.186, 95%CI = 1.019–1.382) and prior exposure to vaping product advertising (AOR = 1.371, 95%CI = 1.221–1.539), and negatively associated with past 30-day vaping (AOR = 0.579, 95%CI = 0.406-0.825) and number of closest friends who vaped (AOR = 0.873, 95%CI = 0.779-0.978). Further analysis stratified by past 30-day vaping showed that, among those who vaped in the past 30 days, vaping-related covid risk perception was positively associated with susceptibility to future vaping (AOR = 1.562, 95%CI = 1.161–2.101) and sensation-seeking (AOR = 1.212, 95%CI = 1.003–1.463). These results are open to different interpretations because of the cross-sectional nature of the data. Additional research is needed to better understand the observed relationships and their implications for vaping prevention during the pandemic.

1. Introduction

Since the beginning of the COVID-19 pandemic, there have been speculations about the potential link between vaping, or the use of electronic cigarettes (e-cigarettes), and the risk of contracting COVID-19 as well as subsequent disease severity. This link has particular implications for adolescent health, because vaping is the most prevalent form of tobacco use among this population (Gentzke et al., 2020). Scientific evidence in this area is still emerging. A recent national survey of adolescents and young adults in the U.S. showed that ever e-cigarette users were 5 times more likely to be infected with COVID-19 compared to nonusers (Gaiha et al., 2020). Increased susceptibility to the coronavirus among young people who vape may be explained by several mechanisms including the effects of vaping on immune function of the respiratory system, the removal of masks and repeated touching of one's hand to their mouth, and the sharing of vape devices (Gaiha et al., 2020; Mahabee-Gittens et al., 2020; Majmundar et al., 2020).

There is evidence that a substantial number of youth and young adults quit vaping or reduced the amount of nicotine consumed since the beginning of the COVID-19 pandemic (Gaiha et al., 2020). Reasons documented by limited research so far include parental presence in the household and lack of access during the pandemic, as well as the potential for vaping to weaken the lungs (Gaiha et al., 2020). However, direct assessment of adolescent perceptions of the link between vaping and COVID-19 risk is largely lacking. Several studies examined risk perceptions among adults and revealed a complex picture, with evidence for both heightened concerns about vaping-related risk for COVID-19 (Majmundar et al., 2020; Soule et al., 2020; Gao et al., 2021) and unsubstantiated claims of vaping offering protection against COVID-19 (Majmundar et al., 2020; Soule et al., 2020; Soule et al., 2020).

Health behavior theory and research point to risk perceptions as an important source of motivation behind self-protective behaviors

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https://doi.org/10.1016/j.pmedr.2021.101598
Received 18 May 2021; Received in revised form 4 October 2021; Accepted 9 October 2021
Available online 11 October 2021

(Fishbein and Ajzen, 2010; Strecher and Rosenstock, 1997). In this study, we assessed perceptions of the link between vaping and risk of contracting COVID-19, as well as associations between this risk perception and demographic, behavioral, environmental, and psychological factors, among adolescents who were susceptible to future vaping.

2. Method

2.1. Data

Data reported here came from the pre-manipulation part of an online message testing study. Participants were recruited through Qualtrics' online sampling service. Qualtrics partners with over 20 online sample providers to supply diverse respondents for research needs. Most providers are actively managed, double-opt-in market research panels, and social media are occasionally used to generate respondents. For this study, Qualtrics first sent an email invitation to adult panel members with age-eligible children, informing them of the general study purpose and need for youth participants. Those interested in having their children participate were sent the survey link. Parental consent and youth assent were obtained before youth participants could begin the study.

2.2. Sample

Eligibility criteria for this study included being 13 to 17 years old, having no participation in tobacco-related research in the past six months, and screening positive for susceptibility to future vaping – regardless of current vaping status. We set soft quotas for recruitment to ensure relatively even distribution across gender and age group (13–15 and 16–17 years). Data collection occurred in November and December 2020. Overall, 5,976 youth were screened and 1,251 (20.9%) qualified and completed the study. Participants were rewarded through Qualtrics's internal incentive system. The study protocol and materials were approved by the authors' home institution's IRB.

2.3. Measures

In the study survey, participants indicated whether they had ever vaped (yes/no) and, if yes, if they had vaped during the past 30 days (yes/no). Susceptibility to future vaping was assessed using an adapted version of the Pierce et al. smoking susceptibility measure (Pierce et al., 1996). Participants reported the likelihood that they would vape "soon," "in the next year," and "if one of your best friends were to offer you a vape" on a 4-point scale (1 definitely yes, 2 probably yes, 3 probably not, 4 definitely not). Participants who did not respond "definitely not" to all three questions were deemed susceptible and qualified for the study. An overall score of susceptibility was created by averaging the three items after reverse coding. Participants also reported use of other tobacco products in the past 30 days, including cigarettes, cigars, little cigars or cigarillos, hookah, smokeless tobacco, and other products (yes/no). Cigarette smoking was treated as a standalone variable. Use of other products was combined into an overall index of other tobacco use (yes/no). Two peer use questions asked about prevalence of vaping among youth their age (1 none to 5 all) and the number of their four closest friends who currently vaped (1 none – 5 all four). Participants reported the frequency with which they had been exposed to advertising for vaping products in the past 6 months; they also answered a similar question about exposure to educational materials against vaping (1 never to 5 very often, for both questions).

Participants reported whether they thought vaping would increase or decrease a person's chance of getting COVID-19. Answers ranged from 1 "greatly increase" to 5 "greatly decrease." They also reported whether a doctor or another health professional had diagnosed them with COVID-19 (yes/no).

Demographic measures included sex (male/female/nonbinary), age, and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other). As a general risk factor, sensation seeking was measured using a validated four-item scale for youth (1 low to 5 high) (Stephenson et al., 2003).

2.4. Analyses

Descriptive statistics were used to assess sample characteristics and the distribution of perceived vaping-COVID link. Perceived vaping-COVID link had a skewed distribution with relatively few cases in the "somewhat decrease" and "greatly decrease" categories (see Table 1). Therefore, these two categories were collapsed with "neither increase nor decrease," resulting in a 3-level measure. This measure was then reverse coded such that a higher score indicated increased perceived risk. Multivariable ordinal logistic regression was used to examine associations between vaping-COVID risk perceptions and potential covariates. The multivariable models included all covariates simultaneously. The analysis was conducted first with the full sample, then with subsamples stratified by past 30-day vaping. The proportional odds assumption for ordinal logistic regression was tested and confirmed for all models using the Brant test. All analyses were performed using Stata 15.1 (College Station, TX).

3. Results

Sample characteristics are presented in Table 1. The sample overall demonstrated a high-risk profile, because only adolescents susceptible to future vaping were eligible for participation. Comparison of subsamples showed that those who reported vaping in the past 30 days were more likely to be male, somewhat older, and non-Hispanic White. They also scored consistently higher on behavioral, environmental, and psychological risk factors than those who did not vape in the past 30 days.

Results of the ordinal logistic regression models are summarized in Table 2. In full sample analysis, those who reported vaping in the past 30 days and those who had more of their closest friends currently vaping were less likely to believe that vaping would increase one's COVID-19 risk. However, those reporting greater prevalence of vaping among their age group and those reporting greater previous exposure to vaping product advertising were more likely to believe that vaping would increase risk for COVID-19. Demographic factors, past 30-day cigarette smoking, past 30-day use of other tobacco products, susceptibility to future vaping, and sensation seeking were unrelated to perceived vaping-COVID link in the full sample analysis.

In subsample analyses, the significant associations observed in the full sample persisted among those who vaped during the past 30 days. Additionally, susceptibility to future vaping and sensation seeking also emerged as positive correlates of vaping-COVID risk perception among this group. For those who did not vape in the past 30 days, only exposure to vaping product advertising remained a significant positive correlate of risk perception.

4. Discussion

The current data show that adolescents at risk for future vaping tend to perceive vaping to be a significant risk factor for COVID-19. More than two-thirds of the sample believed that vaping would somewhat or greatly increase one's risk for contracting the virus. This risk perception was inversely correlated with past 30-day vaping. Contrary to public health expectations, the association between risk perception and susceptibility to future vaping was positive among those who had vaped in the past 30 days; for those who had not vape in the past 30 days, this association was not significant.

The positive relationship between risk perception and vaping susceptibility among those who had recently vaped is an interesting finding. Because of the cross-sectional nature of the data, the causal direction in this relationship is not clear. One possibility is that a vicious

Table 1
Sample characteristics.

	Full Sample (N = 1,251)		Past 30-Day Vaping = Yes (n = 706)		Past 30-Day Vaping = No (n = 545)		
	n	%	n	%	n	%	p[1]
Male	642	51.32	433	61.33	209	38.35	<0.001
Female	600	47.96	271	38.39	329	60.37	
Nonbinary or other	9	0.72	2	0.28	7	1.28	
13	180	14.39	74	10.48	106	19.45	<0.001
14	187	14.95	99	14.02	88	16.15	
15	278	22.22	180	25.50	98	17.98	
16	272	21.74	175	24.79	97	17.80	
17	334	26.70	178	25.21	156	28.62	
Non-Hispanic White	946	75.62	564	79.89	382	70.09	<0.001
Non-Hispanic Black	99	7.91	40	5.67	59	10.83	
Hispanic	183	14.63	96	13.6	87	15.96	
Other race/ ethnicity	51	4.08	18	2.55	33	6.06	
Ever vaping	921	73.62	706	100	215	39.45	<0.001
Past 30-day vaping	706	56.43	–	–	–	–	–
Past 30-day cigarette smoking	466	37.25	421	59.63	45	8.26	<0.001
Past 30-day other tobacco use	515	41.17	473	67.00	42	7.71	<0.001
COVID diagnosis	147	11.75	119	16.86	28	5.14	<0.001
Vaping greatly increases COVID risk	462	36.93	264	37.39	198	36.33	0.021
Vaping somewhat increases COVID risk	393	31.41	205	29.04	188	34.50	
Vaping neither increases nor decreases COVID risk	320	25.58	182	25.78	138	25.32	
Vaping somewhat decreases COVID risk	37	2.96	25	3.54	12	2.20	
Vaping greatly decreases COVID risk	39	3.12	30	4.25	9	1.65	
	Mean	SD					
Susceptibility to future vaping (1 definitely not – 4 definitely yes)	2.89	0.90	3.51	0.55	2.09	0.60	<0.001
Peer vaping (1 none – 5 all)	3.29	0.82	3.52	0.77	2.99	0.78	<0.001
Close friends vaping (1 none – 5 all four)	3.12	1.28	3.76	0.96	2.30	1.17	<0.001
Exposure to vaping advertising (1 never – 5 often)	3.03	1.12	3.30	1.07	2.70	1.10	<0.001
Exposure to vaping education (1 never – 5 often)	3.03	1.17	3.15	1.15	2.89	1.17	<0.001
Sensation seeking (1 low – 5 high)	3.73	0.87	3.96	0.79	3.45	0.88	<0.001

[1] P-values of tests comparing those who did and did not vape in the past 30 days.

circle exists between risk perception and interest in continued vaping among youth who had recently vaped. That is, the greater the perceived risk, the more they were willing to play with fire, so to speak. This perspective appears to be congruent with our finding on sensation seeking, which was positively associated with risk perception among those who had vaped in the past 30 days. Another possibility is that youth with recent vaping experience simply do not perceive COVID as a severe threat. Because of that, they still intend to vape in the future despite perceiving a link between vaping and COVID-19 risk. Either of these possibilities would be much reason for concern.

Other findings from this study also presented interesting puzzles. Among those who had vaped during the past month (and in the full sample), closest friends vaping was associated with lower risk perception regarding the vaping-COVID link. On the other hand, greater perceived prevalence of vaping among one's broader age group was associated with stronger perceptions that vaping would increase one's COVID-19 risk. These findings seem to suggest that risk perception was inversely associated with social distance. But it is difficult to reconcile this interpretation with the positive association between risk perception and personal susceptibility as noted earlier. These patterns do not appear to be statistical artifacts as they emerged in both bivariate and multivariable models of varying specifications. More research is needed to replicate and illuminate the nature of these relationships.

Personal COVID-19 diagnosis was not significantly associated with risk perception in any of the analyses. However, prior exposure to vaping product advertising was consistently a significant positive predictor of risk perception in both full sample and subsample analyses. Prior exposure to vaping educational materials, on the other hand, was not significant in any of the models, potentially due to substantial shared variance with exposure to product advertising. It is not entirely clear why exposure to product advertising would be associated with increased risk perception. One possibility is that such exposure to advertising led to the inference that more peers were vaping, thus putting the age group as a whole at greater risk of vaping-related COVID-19. This conjecture is supported by the positive association between exposure to product advertising and perceived peer use ($r = 0.32$) in our data.

The limitations of this study should be noted. First, although the sample came from diverse sources, it was not representative in nature. Second, our measure of the perceived link between vaping and COVID-19 risk was relatively simple. It did not offer deep insights into why such a link should exist. It also did not tap in perceived severity of COVID-19, thus unable to speak to the overall significance of the risk. Third, the data were cross-sectional in nature and could not support causal interpretations of the observed associations.

Despite these limitations, this study provides useful information on at-risk adolescents' perspective on vaping-related COVID-19 risk. Although epidemiological evidence on the link between vaping and COVID-19 outcomes is still emerging (Gaiha et al., 2020; Gaiha et al., 2020), what adolescents currently believe matters in their health decision making, even though the belief-behavior link is not always strong or straightforward. Our data indeed raised more questions than answers, urging additional research in this area. To date, only limited research has investigated the utility of incorporating COVID-19 risk information into tobacco education messaging (Grummon et al., 0000). The current findings, particularly the positive association between COVID-19 risk perception and susceptibility to future vaping among those with recent vaping experience, suggest caution in so doing for youth-targeting vaping prevention. Careful testing is needed to ensure that such a messaging approach would not be counterproductive with at-risk youth audiences.

Funding

This study was supported by the Virginia Foundation for Healthy Youth (#8521239 - FP00009039_SA003).

Table 2
Ordinal logistic regression models of associations between perceived vaping-COVID link and correlates.

	Full Sample (N = 1251)			Past 30-Day Vaping = Yes (n = 706)			Past 30-Day Vaping = No (n = 545)		
	AOR	95% CI		AOR	95% CI		AOR	95% CI	
Age	0.995	0.920	1.075	0.996	0.891	1.112	0.982	0.877	1.101
Female	0.930	0.746	1.161	0.945	0.701	1.273	0.950	0.675	1.337
Hispanic	1.125	0.837	1.513	1.015	0.674	1.528	1.363	0.879	2.113
Non-Hispanic Black	1.001	0.674	1.488	0.884	0.470	1.665	1.179	0.704	1.974
Other race/ethnicity	0.764	0.452	1.292	1.206	0.479	3.039	0.626	0.327	1.199
Past 30-day vaping	**0.579**	**0.406**	**0.825**						
Past 30-day cigarette smoking	1.010	0.770	1.325	1.008	0.739	1.376	0.721	0.394	1.322
Past 30-day other tobacco use	1.180	0.890	1.563	1.191	0.861	1.645	0.903	0.484	1.684
Peer vaping	**1.186**	**1.019**	**1.382**	**1.272**	**1.033**	**1.565**	1.080	0.857	1.362
Close friends vaping	**0.873**	**0.779**	**0.978**	**0.746**	**0.631**	**0.883**	1.028	0.877	1.205
Exposure to vaping advertising	**1.371**	**1.221**	**1.539**	**1.463**	**1.233**	**1.736**	**1.277**	**1.087**	**1.501**
Exposure to vaping education	1.042	0.940	1.156	0.980	0.844	1.138	1.088	0.937	1.264
Susceptibility to future vaping	1.169	0.952	1.436	**1.562**	**1.161**	**2.101**	0.934	0.694	1.257
COVID diagnosis	1.380	0.982	1.940	1.387	0.931	2.065	1.188	0.589	2.397
Sensation seeking	1.033	0.906	1.178	**1.212**	**1.003**	**1.463**	0.894	0.741	1.079

Note. Significant associations are bolded. AORs adjusted for all other covariates in the model.

CRediT authorship contribution statement

Xiaomei Cai: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Formal analysis, Writing – original draft. **Xiaoquan Zhao:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Matthew E. Rossheim:** Formal analysis, Writing – review & editing. **Hong Xue:** Formal analysis, 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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