

Appalachian youth e-cigarette harm perceptions and tobacco use

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ABSTRACT

INTRODUCTION E-cigarettes are the most popular tobacco product among youth. Although harm perceptions have been linked to youth e-cigarette use, little research focuses on vulnerable populations, such as Appalachian youth. This study examines associations between e-cigarette harm perceptions and tobacco use among a sample of Appalachian youth.

METHODS Using data from the 2014–2016 Youth Appalachian Tobacco Study (n=1074), distributions of six e-cigarette harm perceptions by tobacco use (never, ever non-e-cigarette, ever e-cigarette) were examined, and multivariable multinomial logistic regression was used.

RESULTS Nearly one-fourth (23.4%) of the sample were ever e-cigarette users. More e-cigarette users were male (53.4%) and in high school (57.0%). Fewer e-cigarette users strongly agreed that e-cigarettes cause health problems (15.1%), breathing problems (20.3%), and oral health

problems (18.7%) and that e-cigarettes are addictive (25.1%), compared to never and non-e-cigarette users. More e-cigarette users strongly agreed (32.3%) that e-cigarettes are healthier alternatives to cigarettes compared to never (24.1%) and non-e-cigarette (25.7%) users. Regression models indicate that e-cigarette users had greater odds of strongly disagreeing with e-cigarettes being harmful or addictive, compared to never users. E-cigarette users had approximately six-fold odds of strongly disagreeing with e-cigarettes causing health problems (OR=6.12; 95% CI: 3.16–11.90) and two times greater odds of disagreeing with e-cigarettes being addictive (OR=2.09; 95% CI: 1.07–4.08) compared to never users.

CONCLUSIONS Appalachian youth ever e-cigarette users perceive e-cigarettes as less harmful and less addictive compared to never users. Better informing youth, especially youth tobacco users, of the harms associated with e-cigarettes is vital.

INTRODUCTION

For at least the past 5 years, e-cigarettes have been the most commonly used tobacco product among youth¹. In 2019, more than a third of US middle and high students had ever used e-cigarettes and one fifth were current users². Although e-cigarettes have been marketed as healthier alternatives to conventional cigarettes, their long-term health effects are not well documented, especially for youth users, and there is no consensus regarding their utility for smoking cessation³. Preventing youth tobacco uptake and established use are public health concerns that tend to garner more attention than promoting cessation, and e-cigarette use rates demonstrate their appeal to this population^{4–7}. Because e-cigarettes normally contain nicotine, youth users are at risk

for the harms associated with nicotine consumption, such as epigenetic changes to the brain making them prone to future substance use⁸. Thus, better understanding factors that influence e-cigarette use in youth is important in preventing future use and its associated health implications, especially for youth vulnerable to tobacco use.

Appalachian youth are disproportionately exposed to tobacco. The Appalachian region has a history of tobacco culture from tobacco production to acceptance of tobacco use and celebrating this heritage (e.g. tobacco festivals)⁹. As a result, youth in Appalachia have higher smoking prevalence than youth residing in other parts of the US¹⁰. In addition to culture, rurality and poverty are associated with increased tobacco use^{11,12}, possibly contributing to higher rates of use

among Appalachia youth. Accordingly, Appalachian youth are at risk for tobacco use, including the use of e-cigarettes.

Studies have linked youth e-cigarette use to viewing e-cigarettes as less harmful or less addictive than combustible cigarettes⁵⁻⁷. Additional evidence suggests that youth perceive e-cigarettes as less harmful than other tobacco products, such as cigars and smokeless tobacco¹³. Although a relationship between perceiving e-cigarettes as less harmful or less addictive and e-cigarette use has been documented with some youth samples⁵⁻⁷, research on Appalachian youth is limited. One study found that Appalachian youth perceived e-cigarettes as causing fewer health problems and less addiction than conventional tobacco products¹⁴. Our study extends prior research by examining specific e-cigarette-related harms, such as whether e-cigarettes cause breathing and oral health problems, as well as whether these perceptions differ by tobacco use.

METHODS

Study design

The Youth Appalachian Tobacco Study (n=1074), a cross-sectional survey of tobacco exposures, use patterns, and perceptions and attitudes, was conducted from 2014–2016. The Appalachian states Kentucky, North Carolina, and New York, were selected based on overall tobacco use rates (high, medium, and low, respectively). High school and middle school youth from Appalachian counties in each state were sampled, and participants completed a questionnaire during a regular school day. Detailed information on sampling and participants has been published elsewhere¹⁴. The study was approved by the University of Louisville's Institutional Review Board.

Measures

E-cigarette harm perceptions

In the Youth Appalachian Tobacco Study, youth were asked to indicate whether they strongly disagree, disagree, neither agree nor disagree, agree, or strongly agree (using 1–5 rating scales) with the following six statements indicating that use of e-cigarettes: 1) causes health problems, 2) is healthier than smoking traditional cigarettes, 3) causes breathing problems, 4) causes oral health problems, 5) is addictive, and 6) is difficult to quit.

Tobacco use

Tobacco use was categorized into three groups: never users, ever non-e-cigarette users (i.e. cigarettes, smokeless tobacco), and ever e-cigarette users. Never users were participants who had never used cigarettes, e-cigarettes, or smokeless tobacco. Ever non-e-cigarette users were participants who had ever used cigarettes or smokeless tobacco but not e-cigarettes (referred to below as non-e-cigarette users). Ever e-cigarette users were participants who had ever used e-cigarettes (referred to below as e-cigarette

users). The distribution of tobacco use is presented in Supplementary file Table S1.

Covariates

Gender (male, female), race/ethnicity (White/Caucasian, non-White/non-Caucasian), age, school type (middle, high), state (New York, Kentucky, North Carolina), and number of household tobacco users (zero, ≥ 1) were included in this analysis.

Statistical analysis

The distribution of each e-cigarette harm perception was calculated overall and by tobacco use. Pairwise comparisons were conducted between: 1) never users and e-cigarette users, 2) never users and non-e-cigarette users, and 3) non-e-cigarette users and e-cigarette users. Multivariable multinomial logistic regression models were used to estimate odds ratio (OR) and 95% confidence interval (CI) for associations between each harm perception as a categorical variable (Reference: strongly agree) and e-cigarette use (Reference: never users), adjusted for gender, race/ethnicity, school type, state, and household tobacco users. Because age may modify the association between harm perceptions and tobacco use, analyses were performed for the whole sample, followed by a sensitivity analysis excluding youth aged 11–12 years. Analyses were conducted in Stata 16.1.

RESULTS

About two-thirds (66.1%) of participants were never users, one-tenth (10.5%) were non-e-cigarette users, and one-fourth (23.4%) were e-cigarette users. The distribution of descriptive characteristics by tobacco use is provided in Supplementary file Table S2. More non-e-cigarette users were female (60.2%), and more e-cigarette users were male (53.4%). Both use groups were older than never users, and frequencies of non-e-cigarette and e-cigarette use varied by state.

Prevalence of e-cigarette harm perceptions by tobacco use is presented in Table 1. Never users strongly agreed at higher proportions that e-cigarettes cause health problems (34.5%), breathing problems (34.1%), and oral health problems (32.7%) as well as are addictive (37.3%) and difficult to quit (34.1%), compared to non-e-cigarette users and e-cigarette users. Non-e-cigarette users strongly agreed (25.7%) and agreed (29.2%) at higher proportions than never users that e-cigarettes are healthier than smoking traditional cigarettes; however, e-cigarette users most often strongly agreed (32.3%). Compared to never and non-e-cigarette users, a higher proportion of e-cigarette users strongly disagreed that e-cigarettes cause health problems (10.4%), breathing problems (9.6%), and oral health problems (11.6%) and are difficult to quit (12.0%). The distribution of harm perceptions differed between never users and e-cigarette users ($p < 0.05$). However, when comparing never users to non-e-cigarette users, harm perceptions differed only for e-cigarettes cause health problems ($p = 0.020$) and

Table 1. Prevalence of e-cigarette harm perceptions by tobacco use (N=1074)

Harm perceptions	Total n (%)	Never users n (%)	Ever non-e- cigarette users* n (%)	Ever e-cigarette users n (%)	p
Population	1074 (100)	710 (66.1)	113 (10.5)	251 (23.4)	
Causes health problems					<0.001^a
Strongly disagree	65 (6.1)	31 (4.4)	8 (7.1)	26 (10.4)	0.020^b
Disagree	104 (9.7)	48 (6.8)	15 (13.3)	41 (16.3)	0.12 ^c
Neither	314 (29.2)	192 (27.0)	37 (32.7)	85 (33.9)	
Agree	278 (25.9)	194 (27.3)	23 (20.4)	61 (24.3)	
Strongly agree	313 (29.1)	245 (34.5)	30 (26.6)	38 (15.1)	
Is healthier than smoking traditional cigarettes					0.020^a
Strongly disagree	105 (9.8)	74 (10.4)	12 (10.6)	19 (7.6)	0.78 ^b
Disagree	107 (10.0)	67 (9.4)	12 (10.6)	28 (11.2)	0.69 ^c
Neither	293 (27.3)	212 (29.9)	27 (23.9)	54 (21.5)	
Agree	288 (26.8)	186 (26.2)	33 (29.2)	69 (27.5)	
Strongly agree	281 (26.2)	171 (24.1)	29 (25.7)	81 (32.3)	
Causes breathing problems					<0.001^a
Strongly disagree	57 (5.3)	26 (3.7)	7 (6.2)	24 (9.6)	0.34 ^b
Disagree	87 (8.1)	45 (6.3)	11 (9.7)	31 (12.4)	0.35 ^c
Neither	309 (28.8)	196 (27.6)	31 (27.4)	82 (32.7)	
Agree	297 (27.7)	201 (28.3)	33 (29.2)	63 (25.1)	
Strongly agree	324 (30.2)	242 (34.1)	31 (27.4)	51 (20.3)	
Causes oral health problems					<0.001^a
Strongly disagree	65 (6.1)	27 (3.8)	9 (8.0)	29 (11.6)	0.15 ^b
Disagree	99 (9.2)	53 (7.5)	10 (8.9)	36 (14.3)	0.13 ^c
Neither	350 (32.6)	219 (30.9)	37 (32.7)	94 (37.5)	
Agree	254 (23.7)	179 (25.2)	30 (26.6)	45 (17.9)	
Strongly agree	306 (28.5)	232 (32.7)	27 (23.9)	47 (18.7)	
Is addictive					<0.001^a
Strongly disagree	60 (5.6)	33 (4.7)	9 (8.0)	18 (7.2)	0.09 ^b
Disagree	86 (8.0)	46 (6.5)	12 (10.6)	28 (11.2)	0.89 ^c
Neither	268 (25.0)	162 (22.8)	29 (25.7)	77 (30.7)	
Agree	302 (28.1)	204 (28.7)	33 (29.2)	65 (25.9)	
Strongly agree	358 (33.3)	265 (37.3)	30 (26.6)	63 (25.1)	
Is difficult to quit					<0.001^a
Strongly disagree	77 (7.2)	36 (5.1)	11 (9.7)	30 (12.0)	0.002^b
Disagree	105 (9.8)	51 (7.2)	17 (15.0)	37 (14.7)	0.97 ^c
Neither	315 (29.3)	209 (29.4)	35 (31.0)	71 (28.3)	
Agree	259 (24.1)	172 (24.2)	27 (23.9)	60 (23.9)	
Strongly agree	318 (29.6)	242 (34.1)	23 (20.4)	53 (21.1)	

*Ever non-e-cigarette users include cigarette and smokeless tobacco users who have not tried e-cigarettes. a Chi-squared test comparing never users to ever e-cigarette users. b Chi-squared test comparing never users to ever non-e-cigarette users. c Chi-squared test comparing ever non-e-cigarette users to ever e-cigarette users.

are difficult to quit ($p=0.002$). Comparisons between non-e-cigarette users and e-cigarette users were not statistically significant. Additionally, sensitivity analysis results suggest that age did not play a significant role in associations between harm perceptions and e-cigarette use.

Results from regression analyses can be found in Table 2, and values of OR with 95% CI are reported below. Compared to never users, e-cigarette users had greater odds of strongly disagreeing (OR=6.12; 95% CI: 3.16–11.90) and disagreeing (OR=4.78; 95% CI: 2.71–8.41) that e-cigarettes cause health problems. Also, compared to never users, non-e-cigarette users had greater odds of disagreeing (OR=2.30; 95% CI: 1.11–4.75) that e-cigarettes cause health problems. E-cigarette users also had more than fourfold odds of strongly disagreeing (OR=4.40; 95% CI: 2.26–8.56) and over threefold odds of disagreeing (OR=3.14; 95% CI: 1.76–5.60) that e-cigarettes cause breathing problems, compared to never users; no associations were found for non-e-cigarette users. Similarly, e-cigarette users (OR=6.01; 95% CI: 3.16–11.44) and non-e-cigarette users (OR=3.34; 95% CI: 1.37–8.15) had greater odds of strongly disagreeing that e-cigarettes cause oral health problems, compared to never users. Both e-cigarette and non-e-cigarette users had elevated odds of strongly disagreeing or disagreeing that e-cigarettes are addictive and difficult to quit. Associations for e-cigarettes being difficult to quit were similar with both groups having at least threefold odds of strongly disagreeing or disagreeing compared to never users.

Table 2. Multivariable multinomial logistic regression modeling associations between harm perceptions and ever non-e-cigarette use and harm perceptions and ever e-cigarette use (N=1074)

Harm perceptions	Ever non-e-cigarette use* vs never use OR (95% CI)	Ever e-cigarette use vs never use OR (95% CI)
Causes health problems		
Strongly disagree	2.39 (0.97–5.92)	6.12 (3.16–11.90)
Disagree	2.30 (1.11–4.75)	4.78 (2.71–8.41)
Neither	1.63 (0.95–2.80)	2.72 (1.74–4.25)
Agree	0.95 (0.52–1.72)	1.86 (1.17–2.97)
Strongly agree	Ref.	Ref.
Is healthier than smoking traditional cigarettes		
Strongly disagree	0.99 (0.47–2.12)	0.58 (0.32–1.05)
Disagree	0.96 (0.45–2.05)	0.86 (0.50–1.49)
Neither	0.79 (0.44–1.41)	0.54 (0.36–0.82)
Agree	1.04 (0.59–1.83)	0.74 (0.50–1.11)
Strongly agree	Ref.	Ref.

Continued

Table 2. Continued

Harm perceptions	Ever non-e-cigarette use* vs never use OR (95% CI)	Ever e-cigarette use vs never use OR (95% CI)
Causes breathing problems		
Strongly disagree	2.13 (0.82–5.50)	4.40 (2.26–8.56)
Disagree	1.94 (0.88–4.28)	3.14 (1.76–5.60)
Neither	1.21 (0.69–2.11)	1.85 (1.22–2.81)
Agree	1.24 (0.72–2.15)	1.34 (0.87–2.06)
Strongly agree	Ref.	Ref.
Causes oral health problems		
Strongly disagree	3.34 (1.37–8.15)	6.01 (3.16–11.44)
Disagree	1.69 (0.75–3.82)	3.15 (1.80–5.51)
Neither	1.51 (0.87–2.62)	2.00 (1.32–3.03)
Agree	1.41 (0.79–2.52)	1.1 (0.69–1.78)
Strongly agree	Ref.	Ref.
Is addictive		
Strongly disagree	2.26 (0.95–5.42)	2.09 (1.07–4.08)
Disagree	2.31 (1.07–5.02)	2.31 (1.30–4.09)
Neither	1.34 (0.75–2.37)	1.67 (1.11–2.50)
Agree	1.30 (0.75–2.25)	1.14 (0.76–1.72)
Strongly agree	Ref.	Ref.
Is difficult to quit		
Strongly disagree	3.21 (1.39–7.41)	3.61 (1.98–6.58)
Disagree	3.77 (1.82–7.82)	3.21 (1.86–5.54)
Neither	1.52 (0.85–2.72)	1.27 (0.83–1.93)
Agree	1.61 (0.88–2.97)	1.45 (0.94–2.25)
Strongly agree	Ref.	Ref.

*Ever non-e-cigarette users include cigarette and smokeless tobacco users who have not tried e-cigarettes. Models adjusted for gender, race/ethnicity, school type, state, and number of household tobacco users. Ref.: reference group.

DISCUSSION

Compared to never users, Appalachian youth e-cigarette users and non-e-cigarette users perceive e-cigarettes to be less harmful, less addictive and less difficult to quit, with harm-related associations stronger for e-cigarette users. E-cigarette users disagreed that problems with breathing and oral health were caused by e-cigarette use, despite recent evidence of a potential link between e-cigarette use and respiratory disease¹⁵. Associations were less clear for non-e-cigarette users, illustrating ways that perceptions vary by type of health issue and use pattern. Among e-cigarette

users, associations appear to be stronger for health-related harms, and addiction-related harms were similar among non-e-cigarette and e-cigarette users.

Our findings corroborate previous research that reports associations between perceiving e-cigarettes as less harmful or less addictive and tobacco use among youth^{5,6}. Specifically, among youth never cigarette users, perceiving e-cigarettes as less harmful was associated with e-cigarette use⁵. Similarly, among a sample of Florida youth, perceiving e-cigarettes as easy to quit was associated with more e-cigarette use including concurrent use of e-cigarettes and other tobacco products⁶. In our study, Appalachian youth views on whether e-cigarettes are harmful or addictive varied by tobacco use patterns. Although e-cigarette users indicated less concern about harms than did non-e-cigarette users, results for the latter group, who already use tobacco, suggest risk for e-cigarette uptake.

To combat e-cigarette use, health campaigns must inform youth of the associated harms and potential for addiction. Given evidence that perceiving e-cigarettes as less harmful predicts subsequent use among never users⁷, efforts must better explicate factors that predict youth susceptibility to trying e-cigarettes. Further, targeted messaging to e-cigarette users, who tend to perceive e-cigarettes as less dangerous, is needed to raise awareness and increase understanding, as these youth are especially vulnerable to continued use.

Limitations

Our study has limitations. First, responses were self-reported and thus are susceptible to associated biases. Second, the study is cross-sectional; thus, directionality cannot be determined. Third, the study was conducted prior to the COVID-19 pandemic, which may have altered harm perceptions related to tobacco use. Despite these limitations, our study is among the first to observe associations between perceiving e-cigarettes as less harmful or less addictive and e-cigarette use in a sample of Appalachian youth.

CONCLUSIONS

Compared to never users, Appalachian youth non-e-cigarette and e-cigarette users perceive e-cigarettes as less harmful, with associations greater in magnitude for e-cigarette users. These users disagree that e-cigarettes are harmful, cause oral health problems, are addictive, and are difficult to quit. Our findings, which support previous work indicating that perceiving e-cigarettes as less harmful or less addictive is associated with e-cigarette use, provide insights on Appalachian youth tobacco views and use. Health communication messaging should address increasing youth understanding of the health dangers of these products, especially for vulnerable youth.

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CONFLICTS OF INTEREST

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