HHS Public Access

Author manuscript

J Adolesc Health. Author manuscript; available in PMC 2017 July 01.

Published in final edited form as:

J Adolesc Health. 2016 July ; 59(1): 75–80. doi:10.1016/j.jadohealth.2016.03.019.

The e-cigarette psychosocial environment, e-cigarette use, and susceptibility to cigarette smoking

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Abstract

Purpose—One concern regarding the recent increase in adolescent e-cigarette use is the possibility that e-cigarettes may be used by those who might not otherwise have used cigarettes, and that dual use, or transition to cigarette use alone, may follow.

Methods—Questionnaire data were obtained in 2014 from 11th/12th grade students attending schools in 12 communities included in the Southern California Children's Health Study (CHS). We evaluated the cross-sectional association between e-cigarette use, the psychosocial environment (family and friends' use and approval of e-cigarettes and cigarettes) and susceptibility to future cigarette use among never cigarette smokers (N=1694), using previously validated measures based on reported absence of a definitive commitment not to smoke.

Results—Among adolescents who had never used cigarettes, 31.8% of past e-cigarette users and 34.6% of current (past 30 day) e-cigarette users indicated susceptibility to cigarette use, compared to 21.0% of never e-cigarette users. The odds of indicating susceptibility to cigarette use were two times higher for current e-cigarette users compared to never users (OR=1.97; 95%CI:

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Financial Disclosure: We declare no financial disclosures for any authors.

Conflict of Interest Statement: We declare no conflicts of interest for any authors.

Contributors' Statement Page

Dr. Barrington-Trimis formulated the research question, completed the analyses, interpreted the results, wrote and edited the manuscript, and approved the manuscript as submitted.

Drs. Berhane, Huh, Chou, Urman, and Ms. Wang contributed to formulating the research question, interpretation of the results, statistical analyses, and to editing the manuscript, and approved the manuscript as submitted.

Mr. Howland developed the questionnaire, collected data and contributed to the draft of the manuscript, and approved the manuscript as submitted.

Drs. Cruz, Unger, Leventhal, Gilreath, Pentz, and Samet contributed to formulating the research question, interpretation of results and to editing the manuscript, and approved the manuscript as submitted.

Dr. McConnell designed the study, collected data, and contributed to formulating the research question and interpretation of the results, critically reviewed the manuscript, and approved the manuscript as submitted.

1.21, 3.22). A social environment favorable to e-cigarettes (friends' use of and positive attitudes toward use of e-cigarettes) was also associated with greater likelihood of susceptibility to cigarette use, independent of an individual's e-cigarette use.

Conclusions—E-cigarette use in adolescence, and a pro-e-cigarette social environment, may put adolescents at risk for future use of cigarettes. E-cigarettes may contribute to subsequent cigarette use via nicotine addiction or social normalization of smoking behaviors.

INTRODUCTION

In the United States, data from the National Youth Tobacco Survey (NYTS) have shown that the prevalence of current (past 30 day) cigarette use among high school students has continued to decline in recent years, from 15.8% in 2011 to 9.2% in 2014, while the prevalence of current electronic (e-) cigarette use has increased markedly from 1.5% in 2011 to 13.4% in 2014 [1–4]. In 2014, the NYTS found that current use of e-cigarettes surpassed use of cigarettes, a pattern which was also observed in several studies of adolescents in California [5], Connecticut [6], and Hawaii [7], and in data from the Monitoring the Future study, another nationally representative study [8].

Increased e-cigarette use among adolescents has led to controversy about the public health implications, with some of the tobacco control community optimistic that e-cigarettes could help smokers quit or reduce combustible cigarette use. Others, however, call for a precautionary regulatory approach in light of limited current evidence that e-cigarettes reduce cigarette smoking, limited data on e-cigarette safety, and the possibility that e-cigarettes will lead to new nicotine users who otherwise would not have used products that deliver nicotine [9]. The "gateway hypothesis" has generally referred to a transition from use of a legal substance (e.g. alcohol, tobacco) to illicit drug use. It has recently been suggested that e-cigarettes could similarly act as a gateway to nicotine addiction, either through transition from e-cigarette use to cigarette use alone or dual product use [10, 11], or directly through use of nicotine-containing e-cigarettes. Moreover, the societal 'denormalization' of cigarette smoking has been a major achievement of tobacco control efforts and is generally recognized as an important reason for the continuing decrease in the prevalence of smoking [12–15]; however, the increasing social acceptability of e-cigarette use could potentially lead to the social 'normalization' of smoking behaviors more generally, contributing to increased use of e-cigarettes and cigarettes in adolescence. We recently found that the adolescent e-cigarette psychosocial environment – a measure of the social "acceptability" of e-cigarettes (including friends' use and attitudes toward use of e-cigarettes) – was strongly associated with cigarette smoking in a cross-sectional analysis [5].

Susceptibility to future cigarette smoking may be a useful surrogate for assessing the potential of e-cigarettes to serve as a gateway to combustible cigarettes or other tobacco products in the absence of longitudinal data. Two recent studies of adolescents evaluated the association between e-cigarette use and cognitive "susceptibility" to future cigarette smoking (i.e., lack of a firm commitment not to smoke), and found ever e-cigarette users with no history of cigarette use were more likely to indicate susceptibility to cigarette use than never e-cigarette users [16, 17]. However, one study was conducted at a time when the

prevalence of e-cigarette use in adolescents was still low (6.1% ever use), and the sample of non-smoking e-cigarette users was small (0.9% ever e-cigarette use among never cigarette smoking youth), and the other study was conducted among a younger population of youth in 9th and 10th grade with still-low rates of cigarette use. Three recent prospective cohort studies have also found that e-cigarette use was associated with increased risk of cigarette initiation [18–20]. However, the role of the psychosocial environment around e-cigarette use and susceptibility to future cigarette smoking has not been evaluated.

The state of California provides an appropriate setting for addressing the role of e-cigarettes as a gateway to cigarette smoking, as the current prevalence of e-cigarette use is high, and cigarette smoking rates have historically been among the lowest in the country. In the Southern California Children's Health Study (CHS), for example, 24% of 11th and 12th grade students had ever used e-cigarettes, and 9.6% were current users in 2014, compared with 5.7% who were current smokers [5]. Among e-cigarette users, more than 40% had never smoked a cigarette [5]. In the current analysis, we hypothesized that: a) adolescent e-cigarette users in Southern California, including users with no history of cigarette smoking, would be more susceptible to cigarette use than never e-cigarette users; and b) a psychosocial environment favorable to e-cigarette use would increase susceptibility to cigarette smoking.

METHODS

Study Sample

Adolescents enrolled in the CHS in 11th or 12th grade (N=2097; mean age=17.3, standard deviation=0.6) were surveyed in participants' schools under study staff supervision from January 2014–June 2014. Participants were initially recruited into the CHS in 2002–2003, when they were in kindergarten or 1st grade, from entire classrooms in schools in 12 communities and were surveyed annually (see supplemental material). The design of the study has been described previously [5, 21]. The current analysis excludes adolescents reporting ever use of cigarettes; the remaining sample includes 1,694 never smokers. The participation rate among study participants enrolled in study schools during the 2014 data collection period was 87.1%.

Measures

Susceptibility to cigarette use—Susceptibility to tobacco product use has been defined as the absence of a firm commitment not to smoke [22–24]. In the current study, susceptibility to future cigarette use was assessed using validated measures. Participants were asked the following questions, with four response options (definitely not, probably not, probably yes, definitely yes): a) At any time in the next year do you think you will use these products?, b) Do you think in the future you will experiment with these products?, and c) If one of your best friends were to offer you these products would you use them? For individual questions, adolescents were classified as having no susceptibility to future use if they answered "definitely not," and were susceptible if they responded "probably not," "probably yes" or "definitely yes" [22]. A composite three-measure index was also created, according to previously used methods: participants were classified as having no

susceptibility in the composite index if they responded “definitely not” to all three questions [22]. In additional sensitivity analyses, we stratified the group of susceptible individuals into those with “high susceptibility” (indicating “definitely yes” or “probably yes” to any susceptibility question) and those with “low susceptibility” (“probably no”) to future cigarette use.

Current/past e-cigarette use—Adolescents were asked whether they had ever tried cigarettes or e-cigarettes and the number of days used in the past 30 days. Participants who had “never tried” cigarettes or e-cigarettes (i.e., not “even one or two puffs”) were classified as “never users.” Those who had used e-cigarettes, but not in the last 30 days, were classified as “past users.” Participants who had used e-cigarettes on at least one of the past 30 days were classified as “current e-cigarette users” [5]. Use of any other tobacco product (cigar, pipe, hookah, or smokeless tobacco) was included as a covariate (classified as never/past/current use of any product) in sensitivity analyses.

Psychosocial Environment—The e-cigarette social environment was evaluated based on the following questions: a) “How many of your **four** closest friends use e-cigarettes?” (0–4 friends), b) “How would your best friends act toward you if you used e-cigarettes?” (very unfriendly, unfriendly, friendly, or very friendly), and c) “Does anyone who lives with you now use e-cigarettes?” (yes/no). We additionally assessed participants’ perceptions of the harm of each product [“Do you think using e-cigarettes would be bad for your health?” (strongly agree, agree, disagree, or strongly disagree)].

Sociodemographic characteristics—Self-administered questionnaires completed by parents of participants at study enrollment in 2002–2003 assessed gender, ethnicity (Hispanic White, Non-Hispanic White, Other), family income (categorized as <$30,000 per year, $30,000–$75,000 per year, >$75,000 per year), and parental education (highest level of education of either parent; <12th grade, high school diploma or GED, some college, college degree, some graduate school or higher).

Statistical Analysis

We used unconditional logistic regression models to evaluate the association between e-cigarette use or psychosocial factors (home and friend use and approval of use) and susceptibility to future cigarette use (no v. yes) in models restricted to never cigarette users. Odds ratios (ORs) and 95% confidence intervals (CIs) were used to estimate risk of indicating susceptibility to future cigarette use. Models were adjusted for gender, ethnicity, family income, highest parental education, and community, which were factors that we hypothesized *a priori* might be associated both with e-cigarette use or psychosocial environment variables and susceptibility to cigarette use, based on previous research [25, 26]. Interactions between e-cigarette use (ever v. never) and e-cigarette psychosocial variables (dichotomized; 0 friends v. 1 or more friends; ‘unfriendly or very unfriendly’ v. ‘friendly or very friendly’) were assessed. In sensitivity analyses, polytomous regression models were used to evaluate the association between e-cigarette use or psychosocial variables and susceptibility to future cigarette use, using 3 outcome categories: no susceptibility, low susceptibility, and high susceptibility to use. All statistical analyses were

based on two sided hypotheses tested at a 0.05 level of significance. Analyses were performed using Stata v. 13.1.

Ethics Statement—The study was approved by the University of Southern California Institutional Review Board. Written parental informed consent and student assent was obtained prior to data collection; students who were 18 years of age or older provided their own written consent.

RESULTS

Overall, among youth who had never smoked a cigarette, 378 (22.5%) adolescents indicated susceptibility to future cigarette use using the 3-measure composite susceptibility index (Table 1). Males were about 40% more likely to indicate susceptibility to cigarette use than females (OR =1.38; 95%CI: 1.09, 1.74). Adolescents whose parents had completed 12th grade, but had no further education, were most likely to indicate susceptibility to cigarette use. Other sociodemographic characteristics were not associated with susceptibility.

Among never smokers, e-cigarette use was associated with increased risk of indicating susceptibility to cigarette use, and current e-cigarette use was consistently more strongly associated with susceptibility to future cigarette use than past e-cigarette use across all susceptibility questions (Table 2). For example, for the composite susceptibility index, 21.0% of never e-cigarette users, 32.3% of past e-cigarette users (OR=1.67; 95%CI: 1.12, 2.51) and 34.6% of current e-cigarette users were classified as susceptible (OR=1.97; 95%CI: 1.21, 3.22). Effect estimates were similar after adjustment for other tobacco product use (results not shown).

The social environment around e-cigarette use was also associated with greater likelihood of susceptibility to future cigarette use (Table 3). For example, the odds of indicating susceptibility to future cigarette use for adolescents with 3 or 4 friends using e-cigarettes were 2.45 (95%CI: 1.52, 3.96) times the odds for those with no friends using e-cigarettes, even after adjusting for personal e-cigarette use (never, past, current). Increased likelihood of susceptibility to cigarette use was also observed for adolescents indicating that their best friends would react positively to their use of e-cigarettes ($OR_{\text{very friendly}}$ =2.20; 95%CI: 1.51, 3.19). Effect estimates were generally larger, but the overall pattern of effects was similar, after adjustment for other tobacco product use (results not shown).

In multivariable models estimating the joint effects of e-cigarette use and psychosocial factors relevant to e-cigarette use, elevated risk of susceptibility to cigarette smoking was observed for each risk factor, with little additional risk conferred for those with both risk factors (Table 4). For example, in a social environment not conducive to cigarette use (friends' reactions would be "unfriendly" to cigarette use), the odds of indicating susceptibility to cigarettes were 2.39 (95%CI: 1.18, 4.84) times higher for e-cigarette users as compared to never users. Among those who had never used e-cigarettes, the odds of indicating susceptibility to cigarettes were 2.35 times (95%CI: 1.80, 3.07) higher for those whose friends' reactions would be "friendly" or "very friendly" to cigarette use than for those whose friends' reactions would be unfriendly. Adolescents with both risk factors –

individual e-cigarette use and friends who would react positively to cigarettes – were also at an increased risk of susceptibility to cigarettes; relative to adolescents with neither risk factor, those with both risk factors had 2.50 times the odds of indicating susceptibility (95%CI: 1.72, 3.64; interaction p value=0.05). The risk of indicating susceptibility to cigarette use among those with both risk factors was only slightly higher than the risk conferred by each risk factor independently, which resulted in an interaction OR below 1. Similar patterns were observed for home or friends' use of e-cigarettes but the interactions were not significant. We also evaluated interactions between e-cigarette use and the *cigarette* social environment and none were observed (results not shown).

In sensitivity analyses evaluating high or low versus no susceptibility in polytomous regression models, the odds of indicating high susceptibility to cigarette use, relative to no susceptibility, among e-cigarette users were more than four times the odds among non-users (OR=4.47), albeit with wide confidence intervals (95%CI: 2.00, 10.0; Supplemental Table 1). Psychosocial factors indicating a more favorable e-cigarette social environment were also more strongly associated with high susceptibility to future cigarette use, although elevated, statistically significant risk estimates were also observed for low susceptibility.

DISCUSSION

The psychosocial environment, as well as use of e-cigarettes, was associated with greater odds of indicating susceptibility to cigarette use. The measure of susceptibility used, defined as lacking a firm commitment not to smoke, has been shown previously to predict future cigarette smoking initiation [23]. Thus, this cross-sectional outcome measure is a useful surrogate for future use, while follow-up of the CHS participants is underway to gather needed longitudinal data.

The concept of 'susceptibility to cigarette smoking' as a surrogate for future use of cigarettes was developed from an evaluation of the natural history of nicotine addiction in adolescence, which is thought to involve four distinct phases – preparation, early experimentation, regular but nondaily cigarette smoking, and established smoking and nicotine addiction [23]. Researchers sought to develop a measure to predict which nonsmoking adolescents were more "cognitively predisposed to smoking", [23] a tool which would be useful in developing interventions to prevent at-risk youth from following the trajectory to nicotine addiction. In the current analysis, we used measures of susceptibility to evaluate whether adolescents who use e-cigarettes were more cognitively predisposed to cigarette smoking, and whether the social environment around e-cigarette use may also increase the likelihood of indicating susceptibility. There are no current data on whether this measure is a valid indicator of future cigarette use among e-cigarette users, and limited research has been published evaluating the association between e-cigarette use and susceptibility to cigarette use among nonsmoking adolescents.

One previous study of adolescents showed increased susceptibility to cigarette smoking among e-cigarette users (in 2013) [16], results which we have now shown to be robust in a population surveyed more recently (in 2014) and in which cigarette smoking prevalence was low and e-cigarette use among never smokers was much more common. We have also shown

that a psychosocial environment favorable to e-cigarettes was associated with increased susceptibility, independently of e-cigarette use. There are several pathways through which e-cigarettes or the e-cigarette environment could lead to initiation of cigarette use. E-cigarette marketing to adolescents, resulting in increased use and potentially to the social normalization of e-cigarette use, could lead to the re-normalization of smoking behaviors more generally, including cigarette smoking [27]. Alternatively, adolescent exposure to nicotine in e-cigarettes could lead to establishment of early reward-seeking behaviors [10, 28], and successively to smoking of cigarettes. Our results are consistent with the hypothesis that e-cigarettes may act as a mediator or 'gateway' to subsequent cigarette use, through either a pharmacologic pathway, or one involving social re-normalization (or both), among adolescents or young adults who may otherwise never have tried cigarettes [10, 11].

An alternative interpretation of these results is that e-cigarette use is an intermediate step between non-use and cigarette smoking or dual use for adolescents who would have smoked cigarettes absent the availability of e-cigarettes, or that adolescents who would have smoked are instead only using e-cigarettes. Prospective follow-up of this cohort will help determine whether most e-cigarette users are adolescents who would otherwise be smoking cigarettes or who would have gone on to smoke in the absence of e-cigarettes. However, historical data from four earlier CHS cohorts in many of these same communities and schools [29, 30] demonstrated a steady decline in prevalence of current cigarette smoking among 12th grade students from 21.1% in 1995 to 10.1% in 2004 and to 8.0% in the present cohort[31]. The combined past 30-day prevalence of cigarettes and e-cigarettes in 2014 was 14.1%, 4% higher than cigarette smoking rates in 2004 when e-cigarettes were not yet available. This apparent increase in overall prevalence of products delivering nicotine implies that not all e-cigarette users in the cohort are substituting them for cigarettes.

Our findings are subject to some limitations. Because the analysis uses cross-sectional data, it is possible that adolescents who were more susceptible to cigarettes were more likely to use e-cigarettes, rather than that e-cigarette use increased susceptibility to cigarette use. While the susceptibility measure that we used is well validated and has been shown to have a relatively high positive predictive value for experimentation with cigarettes among nonsmoking, younger children and adolescents, this measure has not been validated in recent years, in older adolescents, or in e-cigarette users, and the positive predictive value for established cigarette smoking is low [22].

Longitudinal data are needed to assess further the causal relationship between adolescent e-cigarette use and subsequent cigarette use. The two prospective studies examining this association have both observed increased risk of cigarette initiation following e-cigarette use [18, 19], but have not examined the risk of cigarette initiation with sufficient sample size among older adolescents in 11th and 12th grade, as they transition to adulthood and an age at which purchase of tobacco products is legal. Research is also needed to assess prospectively the predictive value of baseline measures of susceptibility to cigarette smoking in adolescent non-smoking e-cigarette users, and to validate these measures. Additionally, other risk factors for transition to higher levels of nicotine use and nicotine dependence, and to cigarette and other tobacco product use, need to be identified, particularly among adolescents using e-cigarettes, in order to target preventive interventions to high-risk youth.

CONCLUSION

These results suggest that adolescent e-cigarette use and a psychosocial environment with exposure to e-cigarette use and acceptance of use by peers is associated with susceptibility to future cigarette use. Although longitudinal data are needed to evaluate the complex relationship between e-cigarette use and cigarette use in adolescence, our findings suggest that a potential increase in cigarette use may follow the recent increase in e-cigarette use in adolescent populations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding Source: Research reported in this publication was supported by the National Cancer Institute at the National Institutes of Health and the Food and Drug Administration (FDA) Center for Tobacco Products (P50CA180905). The funder had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

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IMPLICATIONS & CONTRIBUTION

A high proportion of e-cigarette users have never smoked cigarettes. Among never-smoking adolescents in this study, both individual e-cigarette use and approval and use of e-cigarettes among friends and family were strongly associated with intention to use cigarettes.

Table 1

Association between selected demographic characteristics and susceptibility to future cigarette use based on the composite susceptibility index among never cigarette users, Children's Health Study, N=1694[*]

		Overall Susceptibility to Cigarettes *(composite index)*		
	Total N(Column%)[*]	**No N(Row %)**	**Yes N(Row %)**	**OR (95%CI)[†]**
Gender				
Female	851 (50.2)	679 (80.3)	167 (19.7)	Ref
Male	843 (49.8)	624 (74.7)	211 (25.3)	1.37 (1.08, 1.74)
Race/ethnicity				
Hispanic White	859 (50.7)	631 (74.0)	222 (26.0)	Ref
Non-Hispanic White	604 (35.7)	479 (80.1)	119 (19.9)	0.78 (0.58, 1.07)
Other	231 (13.6)	193 (83.9)	37 (16.1)	0.58 (0.39, 0.88)
Family income				
<$30,000	353 (20.8)	261 (74.4)	90 (25.6)	Ref
$30,000–$74,000	493 (29.1)	382 (77.8)	109 (22.2)	0.91 (0.63, 1.31)
$75,000+	554 (32.7)	438 (79.9)	110 (20.1)	0.85 (0.56, 1.29)
Education (highest parental)				
<12th grade	305 (18.0)	230 (75.9)	73 (24.1)	Ref
12th grade	244 (14.4)	169 (69.6)	74 (30.4)	1.59 (1.06, 2.39)
Some college	580 (34.2)	456 (79.4)	118 (20.6)	1.04 (0.69, 1.56)
College degree	221 (13.1)	169 (77.2)	50 (22.8)	1.28 (0.76, 2.13)
Some graduate school	218 (12.9)	176 (81.1)	41 (18.9)	1.02 (0.59, 1.74)

[*] Total varies due to missing values

[†] Adjusted for community and co-adjusted for gender, ethnicity, income, and highest parental education, as appropriate.

Table 2

Association between e-cigarette use and susceptibility to future cigarette use, restricted to never cigarette users, Children's Health Study, N=1694*

	Susceptibility to Cigarettes	
	N (Row %)	**OR (95%CI)†**
At any time in the next year do you think you will use cigarettes?		
Never Users[a]	138 (9.4)	Ref
Past E-Cigarette Users[b]	19 (14.5)	1.56 (0.91, 2.69)
Current E-Cigarette Users[c]	11 (13.6)	1.58 (0.80, 3.12)
Do you think in the future you will experiment with cigarettes?		
Never Users[a]	263 (17.9)	Ref
Past E-Cigarette Users[b]	33 (25.2)	1.41 (0.92, 2.17)
Current E-Cigarette Users[c]	25 (30.9)	2.07 (1.25, 3.42)
If one of your best friends were to offer you cigarettes would you use them?		
Never Users[a]	205 (13.9)	Ref
Past E-Cigarette Users[b]	26 (19.9)	1.51 (0.94, 2.43)
Current E-Cigarette Users[c]	21 (25.9)	2.17 (1.27, 3.71)
Overall susceptibility (composite index)		
Never Users[a]	308 (21.0)	Ref
Past E-Cigarette Users[b]	42 (32.3)	1.67 (1.12, 2.51)
Current E-Cigarette Users[c]	28 (34.6)	1.97 (1.21, 3.22)

*Total varies due to missing values

[a]Never used e-cigarettes

[b]Ever used e-cigarettes but not in the past 30 days

[c]Use of e-cigarettes in the past 30 days

†Adjusted for community and co-adjusted for gender, ethnicity, income, and highest parental education, as appropriate.

Table 3

Association between the e-cigarette social environment and susceptibility to future cigarette use using the composite susceptibility index, restricted to never cigarette users, Children's Health Study, N=1694 *

	Susceptibility to Cigarettes *(composite index)*		
	N (Row %*)	**OR (95%CI)†**	**OR (95%CI)††**
Anyone living at home use e-cigarettes?			
No	333 (21.8)	Ref	Ref
Yes	45 (30.0)	1.65 (1.13, 2.42)	1.50 (1.01, 2.21)
Number of friends who use e-cigarettes			
0	227 (18.2)	Ref	Ref
1 or 2	64 (31.1)	2.10 (1.49, 2.95)	1.96 (1.38, 2.79)
3 or 4	45 (40.9)	2.91 (1.91, 4.42)	2.45 (1.52, 3.96)
Best friends' reactions to e-cigarette use			
Unfriendly[a]	178 (16.7)	Ref	Ref
Friendly	139 (32.3)	2.26 (1.73, 2.96)	2.15 (1.63, 2.84)
Very friendly	60 (33.7)	2.35 (1.64, 3.37)	2.20 (1.51, 3.19)

*Total varies due to missing values

†Adjusted for gender, ethnicity, income, highest parental education, and community

††Additionally adjusted for e-cigarette use (never, non-current, current)

[a]Very unfriendly or unfriendly

Table 4

Association between e-cigarette use and susceptibility to future cigarette use by psychosocial variables, restricted to never cigarette users, Children's Health Study, N=1694 *

	Susceptibility to Cigarettes *(composite index)*		
	OR (95%CI)†	**OR (95%CI)†**	***P-Interaction***
Use of e-cigarettes by others in the home	***No***	***Yes***	
Never Users[a]	Ref	1.65 (1.04, 2.60)	0.47
Ever E-Cigarette Users[b]	1.79 (1.25, 2.57)	2.15 (1.11, 4.14)	
Number of friends who use e-cigarettes	***0 Friends***	***1–4 Friends***	
Never Users[a]	Ref	2.26 (1.60, 3.19)	0.33
Ever E-Cigarette Users[b]	1.70 (0.97, 2.99)	2.66 (1.76, 4.01)	
Friends' attitudes toward e-cigarettes	***Unfriendly***	***Friendly***	
Never Users[a]	Ref	2.35 (1.80, 3.07)	0.05
Ever E-Cigarette Users[b]	2.39 (1.18, 4.84)	2.50 (1.72, 3.64)	

* Total varies due to missing values

[a] Never used e-cigarettes

[b] Ever used e-cigarettes

† Adjusted for community and co-adjusted for gender, ethnicity, income, and highest parental education, as appropriate.