Original investigation

Electronic Cigarette and Cigarette Social Environments and Ever Use of Each Product: A Prospective Study of Young Adults in Southern California

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Abstract

Background: A supportive youth cigarette social environment, for example, friends' approval of use, leads to cigarette use initiation, and cigarette users develop a more supportive social environment. Whether there is a bidirectional relationship of electronic cigarette (e-cigarette) social environment with e-cigarette use has not been studied.

Methods: Prospective data were collected from 1441 Children's Health Study participants in 2014 (median age = 17.3 years) and at follow-up 1.5 years later. Associations were examined of (1) supportive e-cigarette social environment with subsequent e-cigarette use initiation and (2) baseline e-cigarette use with supportive e-cigarette social environment at follow-up (among those with a nonsupportive baseline social environment).

Results: Participants with three to four friends using e-cigarettes at baseline (vs. no friends) had an odds ratio (OR) of 4.08 of subsequent initiation (95% confidence interval [CI] = 1.96 to 8.49); those with best friends who would have a very friendly (vs. unfriendly) reaction to e-cigarette use had an OR of 2.54 of initiation (95% CI = 1.57 to 4.10); and those with someone in the home using e-cigarettes had an OR of 1.94 of initiation (95% CI = 1.19 to 3.15). Participants who had ever used e-cigarettes at baseline developed a supportive social environment at follow-up (OR of 2.06 of having any friends who used e-cigarettes [95% CI = 1.29 to 3.30] and OR of 2.33 of having friends who were friendly toward use [95% CI = 1.32 to 4.11]). Similar bidirectional associations were observed between ever cigarette use and a supportive cigarette social environment.

Conclusions: The bidirectional relationship between a supportive e-cigarette social environment and ever use of e-cigarettes was similar to that previously observed between cigarette social environment and cigarette use.

Implications: Disrupting the social acceptability of youth e-cigarette use merits consideration as a strategy for preventing initiation of e-cigarette use, just as the social denormalization of cigarette use has proven to be effective in preventing cigarette initiation.

Introduction

The effect of a supportive cigarette social environment on cigarette use initiation in adolescents is well established. For example, prospective studies have shown that adolescents who had cigarette-using friends were more likely to initiate cigarettes, compared to adolescents whose friends did not use cigarettes.¹ Cigarette use by adolescents has also been associated with subsequent changes in the cigarette social environment. Several prospective studies have found that youth who used cigarettes were more likely to seek out peer groups that included other smokers and to influence their friends to begin smoking.²⁻⁴ Disruption of this bidirectional relationship between cigarette use and a supportive cigarette social environment has been the focus of intervention programs to encourage youth to resist peer pressure to initiate cigarette use and to encourage smokers to quit smoking by socially “denormalizing” smoking.^{1,5}

With recent increases in the prevalence of ever use of electronic cigarettes (e-cigarettes) by youth, an understanding of whether similar bidirectional relationships between e-cigarette use and the e-cigarette social environment would be useful to guide the development of preventive interventions and policy to reduce youth e-cigarette use. Some studies have found associations between a supportive e-cigarette social environment and e-cigarette use, which are similar in magnitude to associations observed between the cigarette social environment and cigarette smoking. For example, we have reported that friends’ approval of e-cigarettes was strongly associated with e-cigarette use in a cross-sectional study,⁶ results which were consistent with findings from similar studies.^{7,8} Prospective studies are now needed to determine whether a supportive e-cigarette social environment promotes the subsequent initiation of e-cigarette use and whether e-cigarette use leads to the development of a more supportive e-cigarette social environment. A bidirectional association of e-cigarette use with the e-cigarette social environment similar to that previously observed for cigarettes could contribute to the social normalization of e-cigarette use.

We used two waves of data from the southern Children’s Health Study (CHS) to examine prospectively: (1) whether the e-cigarette social environment was associated with subsequent initiation of e-cigarettes and (2) whether ever use of e-cigarettes at baseline was associated with the development of a social environment more supportive of e-cigarette use at follow-up. We also evaluated the bidirectional associations of the cigarette social environment and use, and examined whether there were cross-product associations (eg, between e-cigarette use and development of a supportive cigarette social environment).

Methods

Study Design

In 2014, a total of 2097 students from 11th or 12th grade classrooms (median age: 17.3) across 12 Southern Californian communities completed in-classroom, paper-based (baseline) questionnaires, as described previously.⁶ From January 2015 to April 2016, participants were invited to complete a follow-up questionnaire online after reaching the age of 18 years. In total, 1553 participants (74.1%) completed the follow-up questionnaire. Analyses evaluating the association of the e-cigarette social environment with e-cigarette initiation were restricted to persons who had never used e-cigarettes at baseline ($N = 1164$) (Figure 1). Analyses evaluating the associations of baseline ever e-cigarette use with the number of friends who

used e-cigarettes at follow-up were restricted to participants with no friends who used e-cigarettes at baseline ($N = 1012$); analyses evaluating the association of baseline ever e-cigarette or use with friends’ reactions to e-cigarette use at follow-up were restricted to participants with friends who were unfriendly to e-cigarette use at baseline ($N = 842$). We also examined the bidirectional associations of the cigarette social environment and ever cigarette use, and the cross-product bidirectional associations of the e-cigarette and cigarette social environments and ever use of the other product (Figure 1). A total of 1441 participants contributed to at least one of these analyses.

Ethics Statement

The study was approved by the University of Southern California Institutional Review Board. Participants aged 18 or older provided an online informed consent. Written parental informed consent and student assent were obtained for all CHS participants prior to the 2014 data collection.

Measures

Tobacco Product Use

At both surveys, participants were asked the age at which they had first used e-cigarettes, cigarettes, hookah, and cigars (“even one or two puffs”). Participants who responded “I have never tried this product” were classified as “never users”; those who reported an age at first use of a product were considered “ever users” of that product.⁶ Initiation was defined as having reported use at follow-up among those who were never users at baseline.

Social Environment

For this analysis, the assessment of the e-cigarette and cigarette social environments were based on (1) friends’ use (“How many of your 4 closest friends use [cigarettes/e-cigarettes]?”: zero to four friends), (2) perceived friends’ attitudes (“How would your best friends act toward you if you used [cigarettes/e-cigarettes]?”: very unfriendly, unfriendly, friendly, or very friendly), and (3) home use (“Does anyone who lives with you now use [cigarettes/e-cigarettes]?”: yes or no).

Covariates

Self-administered questionnaires completed by parents of participants assessed gender, ethnicity (Hispanic white, non-Hispanic white, and other), parental education (highest level of education of parent completing questionnaire: high school diploma [12 years of primary/secondary education] or lower, some college, and college degree or higher), and Southern California community of residence at baseline (Alpine, Anaheim, Glendora, Lake Arrowhead, Lake Elsinore, Mira Loma, Riverside, San Bernardino, San Dimas, Santa Barbara, Santa Maria, and Upland).

Statistical Analysis

To evaluate the associations of the e-cigarette social environment with e-cigarette use, we conducted two sets of analyses. (1) We assessed the association of the baseline e-cigarette social environment (number of friends using e-cigarettes [zero, one to two, or three to four friends], perceived friends’ attitudes toward use of e-cigarettes [unfriendly, friendly, or very friendly], and the use of e-cigarettes by others in the home [no/yes]) with subsequent initiation of e-cigarette use between baseline and follow-up, among participants

Figure 1. Study design and research questions. (A) Do favorable baseline electronic cigarette (e-cigarette) and cigarette social environments influence subsequent e-cigarette or cigarette initiation among baseline nonusers? (B) Do baseline e-cigarette and cigarette use result in favorable e-cigarette or cigarette social environments among users with unfavorable social environments at baseline?

who never used e-cigarettes at baseline (Figure 1). (2) We evaluated the association between ever use of e-cigarettes at baseline (no/yes) and development of a social environment supportive of use at follow-up (number of friends using each product [zero vs. one or more friends] and perceived friends' attitudes toward e-cigarette [unfriendly vs. friendly]), among those reporting social environments not supportive of use at baseline. We conducted these same two sets of analyses examining the relationship of the cigarette social environment and ever cigarette use. In addition, we explored cross-product associations (eg, the association between the e-cigarette social environment and subsequent cigarette use initiation). Unconditional logistic regression was used to evaluate these associations. All models were adjusted for gender, ethnicity, grade, parental education, and community from which participants were recruited. Models evaluating effects of e-cigarette or cigarette social environments on e-cigarette or cigarette initiation were additionally adjusted for ever use of the other product and of hookah or cigar use at baseline. A missing indicator category was used for exposure or covariates with missing data. We also explored whether associations differed for participants

who moved out of the community of origin; no differences in the patterns of effect estimates were observed. In additional sensitivity analyses, we evaluated models that included all of the other social environment factors of the same product type (when examining initiation of e-cigarettes or cigarettes); we also included both ever use of e-cigarettes and of cigarettes at baseline in the same model when examining their associations with the subsequent change in the social environments. Differences in demographic characteristics between participants in this study and those who did not complete follow-up questionnaires were tested using chi-squared tests. All statistical analyses were based on two-sided hypotheses tested at a 0.05 level of significance, using SAS 9.4 (SAS Institute, Cary, NC).

Results

The majority of the 1441 participants contributing to these analyses were female (52.4%), and a substantial proportion were Hispanic white (48.5%; Table 1). Among the 2097 participants completing an initial questionnaire, there was some differential loss to follow-up

Table 1. Demographic Characteristics of Participants (*N* = 1441)

	<i>N</i> (%)
Gender	
Female	755 (52.4)
Male	686 (47.6)
Ethnicity	
Hispanic white	699 (48.5)
Non-Hispanic white	549 (38.1)
Other	193 (13.4)
Parental education ^a	
High school diploma or lower	422 (29.3)
Some college	506 (35.1)
College degree or higher	420 (29.1)

^aTotal varies due to missing responses.

questionnaire completion among participants who were male, Hispanic white, and who had parents with lower reported education (Supplementary Table 1).

Among those who had not used e-cigarettes at baseline, nearly 60% of adolescents who had three or four friends using e-cigarettes initiated use of e-cigarettes between baseline and follow-up, compared to 25% of adolescents who did not have friends who used e-cigarettes (odds ratio [OR]: 4.08; 95% confidence interval [CI] = 1.96 to 8.49; Table 2). Greater odds of e-cigarette initiation between baseline and follow-up were also observed among youth who reported that someone at home used e-cigarettes (OR: 1.94; 95% CI = 1.19 to 3.15) or if they perceived their friends would

have friendly or very friendly reactions toward e-cigarette use (OR: 1.76; 95% CI = 1.28 to 2.43, and OR: 2.54; 95% CI = 1.57 to 4.10, respectively). In sensitivity analyses, the pattern of associations was similar in models coadjusted for all three e-cigarette social environmental variables, and remained statistically significant for all except for the association of baseline home e-cigarette use with e-cigarette use at follow-up (OR: 1.54; 95% CI = 0.93 to 2.56; results not tabulated). Associations of similar magnitude were observed between a supportive baseline cigarette social environment and e-cigarette initiation. However, because each baseline indicator of a supportive e-cigarette social environment was highly correlated with the corresponding cigarette social environment indicator (Supplementary Table 2), it was not possible to distinguish effects of the e-cigarette and cigarette social environment on initiation of the other product.

Among those who had not used cigarettes at baseline, those with three or four friends using cigarettes were substantially more likely than those with no friends using cigarettes to initiate cigarettes between baseline and follow-up (OR: 5.60; 95% CI = 2.11 to 14.9; Table 3). Greater odds of cigarette initiation were also reported among youth who perceived their friends would have a friendly reaction toward cigarette use (OR: 1.76; 95% CI = 1.21 to 2.57). There was no evidence that youth who reported that friends would have a very friendly reaction to cigarette use had any larger risk of initiation, although there was considerable uncertainty to the estimate (OR: 1.57; 95% CI = 0.87 to 2.83). Use of cigarettes by anyone at home was not significantly associated with cigarette use initiation at follow-up. In sensitivity analyses, the estimated effects were not substantially changed in models coadjusted for all three cigarette social

Table 2. Association Between Selected Social Environment Characteristics and Subsequent Initiation of Electronic Cigarettes (E-Cigarettes) Among Persons Who Had Never Used E-Cigarettes at Baseline (*N* = 1164)

	Initiation of e-cigarettes between baseline and follow-up		
	No (%)	Yes (%)	Adj. OR (95% CI) ^a
<i>E-cigarette social environment</i>			
Best friend's reactions to e-cigarette use? ^b			
Unfriendly	607 (76.8)	183 (23.2)	Ref
Friendly	173 (62.7)	103 (37.3)	1.76 (1.28 to 2.43)
Very friendly	53 (57.6)	39 (42.4)	2.54 (1.57 to 4.10)
Number of friends who use e-cigarettes? ^b			
0	707 (74.4)	243 (25.6)	Ref
1 or 2	69 (61.1)	44 (38.9)	1.95 (1.26 to 3.02)
3 or 4	15 (41.7)	21 (58.3)	4.08 (1.96 to 8.49)
Anyone living at home use e-cigarettes? ^b			
No	779 (72.8)	291 (27.2)	Ref
Yes	54 (60.7)	35 (39.3)	1.94 (1.19 to 3.15)
<i>Cigarette social environment</i>			
Best friend's reactions to cigarette use? ^b			
Unfriendly	640 (75.3)	210 (24.7)	Ref
Friendly	147 (63.6)	84 (36.4)	1.45 (1.03 to 2.03)
Very friendly	47 (61.0)	30 (39.0)	1.90 (1.13 to 3.18)
Number of friends who use cigarettes? ^b			
0	707 (74.3)	244 (25.7)	Ref
1 or 2	70 (59.3)	48 (40.7)	1.80 (1.17 to 2.78)
3 or 4	6 (30.0)	14 (70.0)	6.37 (2.29 to 17.7)
Anyone living at home use cigarettes? ^b			
No	716 (73.7)	256 (26.3)	Ref
Yes	117 (62.6)	70 (37.4)	1.59 (1.11 to 2.28)

^aOR = odds ratio; CI = confidence interval. Models were restricted to persons who had never used e-cigarettes and were adjusted for gender, race/ethnicity, parental education, community, and baseline ever use of cigarettes, hookah, or cigars.

^bTotal varies due to missing responses.

Table 3. Association Between Selected Social Environment Characteristics and Initiation of Cigarette Use Among Persons Who Had Never Used Cigarettes at Baseline (*N* = 1266)

	Initiation of cigarettes between baseline and follow-up		
	No (%)	Yes (%)	Adj. OR (95% CI) ^a
<i>Cigarette social environment</i>			
Best friend's reactions to cigarette use? ^b			
Unfriendly	801 (86.0)	130 (14.0)	Ref
Friendly	184 (76.0)	58 (24.0)	1.76 (1.21 to 2.57)
Very friendly	66 (77.6)	19 (22.4)	1.57 (0.87 to 2.83)
Number of friends who use cigarettes? ^b			
0	879 (85.3)	151 (14.7)	Ref
1 or 2	102 (75.0)	34 (25.0)	1.57 (0.98 to 2.52)
3 or 4	11 (55.0)	9 (45.0)	5.60 (2.11 to 14.9)
Anyone living at home use cigarettes? ^b			
No	893 (84.3)	166 (15.7)	Ref
Yes	160 (79.2)	42 (20.8)	1.40 (0.93 to 2.11)
<i>E-cigarette social environment</i>			
Best friend's reactions to e-cigarette use? ^b			
Unfriendly	697 (88.2)	93 (11.8)	Ref
Friendly	257 (76.0)	81 (24.0)	1.57 (1.09 to 2.26)
Very friendly	97 (74.0)	34 (26.0)	1.56 (0.95 to 2.55)
Number of friends who use e-cigarettes? ^b			
0	817 (85.7)	136 (14.3)	Ref
1 or 2	122 (80.3)	30 (19.7)	0.97 (0.59 to 1.57)
3 or 4	52 (65.8)	27 (34.2)	1.27 (0.72 to 2.24)
Anyone living at home use e-cigarettes? ^b			
No	968 (84.5)	178 (15.5)	Ref
Yes	85 (73.9)	30 (26.1)	1.59 (0.97 to 2.59)

^aOR = odds ratio; CI = confidence interval. Models were restricted to persons who had never used cigarettes and were adjusted for gender, race/ethnicity, parental education, community, and baseline ever use of e-cigarettes, hookah, or cigars.

^bTotal varies due to missing responses.

environment variables (results not shown). Among the e-cigarette social factors, only perceived friends' reactions toward e-cigarette use were associated with cigarette initiation, and effect estimates for e-cigarette social environmental characteristics were generally smaller than those for corresponding cigarette characteristics.

Among youth who said at baseline that their best friends would not be friendly toward e-cigarette use, those who had ever used e-cigarettes at baseline were significantly more likely to report at follow-up that their best friends would have a friendly or very friendly reaction toward e-cigarette use (OR: 2.33; 95% CI = 1.32 to 4.11; Table 4). Similarly, among youth with no friends using e-cigarettes at baseline, those who had ever used e-cigarettes at baseline had greater odds of reporting having at least one close friend who used e-cigarettes at follow-up (OR: 2.06; 95% CI = 1.29 to 3.30). In sensitivity analyses also adjusted for baseline ever cigarette use, the pattern of associations of baseline ever e-cigarette use with subsequent supportive e-cigarette social environments was similar, although the association with having at least one close friend who used e-cigarettes at follow-up was moderately attenuated (OR: 1.58; 95% CI = 0.94 to 2.64; results not tabulated). Table 4 also shows positive associations of baseline e-cigarette use with a supportive cigarette social environment at follow-up, and of cigarette use at baseline with a supportive cigarette and e-cigarette social environment at follow-up.

Discussion

Previous studies have found associations between the e-cigarette social environment and e-cigarette use in cross-sectional analyses.⁶⁻⁸ It was not possible in those studies to determine whether a

supportive e-cigarette social environment led to e-cigarette use or whether e-cigarette use shaped the social environment. The results from this study indicate that several supportive e-cigarette social environment factors were independently associated with subsequent initiation of e-cigarettes and that participants who indicated having ever used e-cigarettes developed a more supportive e-cigarette social environment over time. These results are consistent with extensive research showing a similar pattern of bidirectional influence between the cigarette social environment and cigarette use,⁹⁻²⁰ which we also observed in our study. In the United States, prevalence of ever e-cigarette use increased from 4.7% to 37.7% among high school students between 2011 and 2015.²¹ If this large increase is explained in part by the changing e-cigarette social environment, then intervention to help adolescents resist peer influences and campaigns to denormalize e-cigarette use in youth could help reverse the current high rates of ever use. Such programs have been successful in reducing cigarette use.^{1,5} Emerging evidence showing that e-cigarette use is associated with respiratory and other health effects²²⁻²⁵ and increases the risk of cigarette initiation²⁶⁻³⁵ and heavier smoking³⁶ provides a compelling rationale for reducing youth e-cigarette use.

The association between a supportive cigarette social environment and subsequent initiation of cigarette use among adolescents has been well studied, and several conceptual frameworks to explain the strength of these associations have been posited.^{37,38} For example, social learning theory describes a hypothesized mechanism by which adolescents learn about use of cigarettes through observation of others who engage in cigarette use, with subsequent reinforcement resulting from perceived social advantages of use (eg, acceptance by peers or identification with a particular social group).^{1,37}

Table 4. Associations Between Ever Use of Electronic Cigarettes (E-Cigarettes) or Cigarettes at Baseline and Follow-Up Social Environment Among Adolescents With Friends Unfriendly to E-Cigarette Use ($N = 842$), Friends Unfriendly to Cigarette Use ($N = 1012$), No Friends Using E-Cigarettes ($N = 1012$), and No Friends Using Cigarettes ($N = 1097$)

	E-cigarette social environment at follow-up			Cigarette social environment at follow-up		
	N (%)	N (%)	Adj. OR (95% CI) ^a	N (%)	N (%)	Adj. OR (95% CI) ^a
Baseline e-cigarette use ^b	Unfriendly reaction	Friendly reaction		Unfriendly reaction	Friendly reaction	
No	484 (61.7)	301 (38.3)	Ref	660 (79.7)	168 (20.3)	Ref
Yes	23 (40.4)	34 (59.6)	2.33 (1.32 to 4.11)	120 (65.9)	62 (34.1)	1.85 (1.29 to 2.67)
	0 friends	1 or more friends		0 friends	1 or more friends	
No	684 (73.8)	243 (26.2)	Ref	758 (81.5)	172 (18.5)	Ref
Yes	49 (57.6)	36 (42.4)	2.06 (1.29 to 3.30)	108 (65.5)	57 (34.5)	2.28 (1.57 to 3.30)
Baseline cigarette use ^b	Unfriendly reaction	Friendly reaction		Unfriendly reaction	Friendly reaction	
No	478 (61.4)	301 (38.6)	Ref	719 (79.5)	185 (20.5)	Ref
Yes	29 (46.0)	34 (54.0)	1.96 (1.14 to 3.37)	61 (57.0)	46 (43.0)	2.77 (1.80 to 4.26)
	0 friends	1 or more friends		0 friends	1 or more friends	
No	685 (74.2)	238 (25.8)	Ref	806 (80.6)	194 (19.4)	Ref
Yes	48 (53.9)	41 (46.1)	2.37 (1.49 to 3.76)	61 (63.5)	35 (36.5)	2.37 (1.49 to 3.76)

^aOR = odds ratio; CI = confidence interval. Models were adjusted for gender, race/ethnicity, parental education, and community.

^bTotal varies due to missing responses.

Additionally, associating with other adolescents who use cigarettes provides access and opportunities to use cigarettes.³⁹ Adolescents who have friends who use e-cigarettes may similarly perceive social advantages of e-cigarette use and supportive social norms, and have increased access to use, thereby increasing the likelihood of initiation. However, this has not been well studied among e-cigarette users or in the context of the current changing tobacco-use landscape.

The formation of social groups in which friends share the same views of cigarettes can occur because persons using cigarettes may seek out others also using cigarettes (also referred to as selection) or they may have influenced the cigarette use behaviors of their friends (also referred to as socialization or peer pressure).^{4,40} In the set of analyses looking at how the social environment changed with respect to baseline ever e-cigarette use (Table 4), it was not possible to identify which of these mechanisms were more likely with the information available. Prospective studies of cigarette users suggest that both mechanisms are likely.⁴⁰ Although many studies suggest that the acquisition of new friends and social groups with similar smoking behaviors and attitudes may be a strong driver of an individual's changing cigarette social environment, youth who smoke also are likely to influence at least some nonsmoking friends to initiate cigarette use.^{1,40}

Peer use of e-cigarettes in this study was a stronger risk factor for subsequent e-cigarette initiation than use of e-cigarettes by others in the home. These findings are consistent with prior literature, suggesting that the influence of friends during adolescence might be more important than that of parents in increasing the risk of cigarette use initiation.^{14,41–43} Studies have shown that adolescents are more likely to obtain cigarettes from peers than from adults.^{44–47} The weaker influence of the e-cigarette or cigarette home environment on initiation of each product may also have reflected the reduced exposure to the baseline home environment as participants graduated high school and moved out of the home or went to university. However, we found no consistently different patterns of associations between movers and nonmovers.

We also observed cross-product associations, for example, between e-cigarette use and a supportive cigarette social environment at follow-up. This raises the possibility that ever e-cigarette use,

which is known to increase the risk of cigarette initiation,³⁵ may also be contributing to the social renormalization of cigarette use (Table 4). Further research is warranted to explore this hypothesis. The e-cigarette social environment was associated with subsequent increased risk of cigarette use. However, the high correlations of the cross-product social environments make it difficult to distinguish between cigarette and e-cigarette social environments effects and outcomes (Supplementary Table 2).

There are some limitations to this study. Participants who did not complete a follow-up questionnaire differed on key sociodemographic characteristics. Although the estimated effects were robust to adjustment for these characteristics, it is possible that selection bias could have helped explain the results observed. We only collected information about the use of e-cigarettes or cigarettes by the four closest friends of each participant and not by a larger peer group, which has also been shown to be an important determinant of cigarette use.⁴⁰ It is possible that the influence of larger social networks would provide an alternate explanation for the associations we observed. Other characteristics of participants, such as depression, and personality traits such as impulsive behavior have been linked with experimentation and risky behavior and could potentially influence how the social factors we studied relate to product use.⁴⁸ There are also other factors that likely contributed to the use of e-cigarettes and cigarettes such as exposure to the marketing of these products and the strength of local youth access ordinances. Finally, this cohort has not been followed long enough to assess regular or dependent use of either e-cigarettes or cigarettes. Future follow-up of this cohort could identify the role of the social environment in these public-health relevant outcomes.

Conclusion

This study found that a supportive e-cigarette social environment was associated with future initiation of e-cigarettes and that ever use of e-cigarettes was associated with subsequent reports of a social environment more supportive of e-cigarette use. This bidirectional pattern of effects was similar to what previously has been

reported between the cigarette social environment and cigarette use, which was also observed in our study. Additional study is needed to determine whether the use of e-cigarettes among youth and the accompanying formation of social groups based on similar use patterns will lead to a renormalization of cigarette use, to a normalization of e-cigarette use, and to progression to regular use of either product and nicotine dependence. Disrupting the social acceptability of youth e-cigarette use merits consideration as a strategy for preventing initiation of e-cigarette use, just as the social denormalization of cigarette use has proven to be effective in preventing cigarette initiation.

Supplementary Material

Supplementary data can be found online at <http://www.ntr.oxfordjournals.org>.

Funding

This research was supported by grant number P50CA180905 from the National Cancer Institute at the National Institutes of Health (NIH) and the Food and Drug Administration (FDA) Center for Tobacco Products (CTP) and by grant number K01DA042950 from the National Institute for Drug Abuse at NIH. 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.

Declaration of Interests

None declared.

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