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More evidence that youth e-cig use promotes cigarette smoking (not the other way around)

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One of the arguments that e-cigarette apologists have used against the strong and consistent evidence that e-cigarettes are a gateway to cigarette smoking is that, despite the fact that most of the studies on the relationship between e-cigarette use and starting to smoke cigarettes is longitudinal, is that there could still be some form of reverse causality. They argue that the kids who start with e-cigarettes might have started with cigarettes, but just didn't.

Krysten Bold and her colleagues at Yale just drove a big stake through the heart of that (already implausible) argument. In their paper "[Trajectories of e-cigarette and conventional cigarette use among youth](#)" published in *Pediatrics* they followed Connecticut high schools students over three different times and examined the relationship between e-cigarette and cigarette use *in both directions*. In particular, they looked at whether e-cigarette use at one time predicted cigarette



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use at the next time and whether cigarette use at one time predicted e-cigarette use at the next time.

What they found was a **one-way door**. Kids who used e-cigarettes were more likely to be smoking cigarettes at the next time they were observed but the opposite was not true: Kids who smoked cigarettes were not more likely to be smoking e-cigarettes at a later time.

In a related study published in *JAMA Pediatrics* entitled "[Associations of electronic cigarette nicotine concentration with subsequent cigarette smoking and vaping levels in adolescents](#)" Nicholas Goldenson and colleagues at USC found that kids who used higher nicotine e-cigarettes were more likely to progress to cigarettes (and also higher levels of e-cigarette consumption) than kids who used lower nicotine e-cigarettes.

These two studies take together and with the rest of the literature are making it ever clearer that e-cigarettes are expanding the cigarette market. And even if kids don't go on to cigarettes, the nicotine (and other stuff) in the e-cigarettes is still bad for them.

Here is the abstract for the Yale paper:

BACKGROUND: Electronic cigarette (e-cigarette) use is common among youth, and there are concerns that e-cigarette use leads to future conventional cigarette use. We examined longitudinal associations between past-month cigarette and e-cigarette use to characterize the stability and directionality of these tobacco use trajectories over time.

METHODS: High school students (N = 808, 53% female) completed surveys across 3 waves (2013, 2014, and 2015) in 3 public schools in Connecticut. Using autoregressive cross-lagged models, we examined bidirectional relationships between past-month

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FDA should reject the tobacco industry's efforts to guide e-cigarette manufacturing standards

cigarette and e-cigarette use over time. Models were adjusted for covariates related to tobacco use (ie, sex, race/ethnicity, socioeconomic status, and use of other tobacco products).

RESULTS: Past-month e-cigarette use predicted future cigarette use (wave 1-2: odds ratio [OR] = 7.08, 95% confidence interval [CI] = 2.34-21.42; wave 2-3: OR = 3.87, 95% CI = 1.86-8.06). However, past-month cigarette use did not predict future e-cigarette use (wave 1-2: OR = 2.02, 95% CI = 0.67-6.08; wave 2-3: OR = 1.90, 95% CI = 0.77-4.71). Additionally, frequency of cigarette and e-cigarette use increased over time. By wave 3, 26% of cigarette users and 20.5% of e-cigarette users reported using 21-30 days out of the past month.

CONCLUSIONS: E-cigarette use was associated with future cigarette use across 3 longitudinal waves, yet cigarette use was not associated with future e-cigarette use. Future research needs to examine mechanisms through which e-cigarette use leads to cigarette use. E-cigarette regulation and prevention programs may help prevent future use of cigarettes among youth.

The full citation is: Bold KW, Kong G, Camenga DR, Simon P, Cavallo DA, Morean ME, Krishnan-Sarin S. Trajectories of E-Cigarette and Conventional Cigarette Use Among Youth. *Pediatrics*. 2017 Dec 4. pii: e20171832. doi: 10.1542/peds.2017-1832. [Epub ahead of print]. It is available [here](#) and the accompanying editorial by Jon Klein is [here](#).

Here is the abstract of the USC paper:

Importance Research indicates that electronic cigarette (e-cigarette) use (vaping) among adolescents is associated with the initiation and progression of combustible cigarette smoking. The reasons for this association are unknown.

Objective To evaluate whether use of e-

and
formulate its
own
standard

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of Richard
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cigarettes with higher nicotine concentrations is associated with subsequent increases in the frequency and intensity of combustible cigarette smoking and vaping.

Design, Setting, and Participants In this prospective cohort study involving students from 10 high schools in the Los Angeles, California, metropolitan area, surveys were administered during 10th grade in the spring (baseline) and 11th grade in the fall (6-month follow-up) of 2015 to students who reported using e-cigarettes within the past 30 days and the nicotine concentration level they used at baseline.

Exposures Self-report of baseline e-cigarette nicotine concentration of none (0 mg/mL), low (1-5 mg/mL), medium (6-17 mg/mL), or high (≥ 18 mg/mL) typically used during the past 30 days.

Main Outcomes and Measures Frequency of combustible cigarette smoking and e-cigarette use within the past 30 days (0 days [none], 1-2 days [infrequent], or ≥ 3 days [frequent]) and daily intensity of smoking and vaping (number of cigarettes smoked per day, number of vaping episodes per day, and number of puffs per vaping episode) at the 6-month follow-up.

Results The analytic sample included 181 students (96 boys [53.0%] and 85 girls [47.0%]; mean [SD] age, 16.1 [0.4] years).

Each successive increase in nicotine concentration (none to low, low to medium, and medium to high) vaped was associated with a 2.26 (95% CI, 1.28-3.98) increase in the odds of frequent (vs no) smoking and a 1.65 (95% CI, 1.09-2.51) increase in the odds of frequent (vs no) vaping at follow-up after adjustment for baseline frequency of smoking and vaping and other relevant covariates. Use of e-cigarettes with high (vs no) nicotine concentration was associated with a greater number of cigarettes smoked per day at follow-up (adjusted rate ratio [RR], 7.03; 95% CI, 6.11-7.95). An association with a significantly greater number of vaping episodes per day was found with use of low (adjusted RR, 3.32;

95% CI, 2.61-4.03), medium (adjusted RR, 3.32; 95% CI, 2.54-4.10), and high (adjusted RR, 2.44; 95% CI, 1.63-3.24) nicotine concentrations (vs no nicotine) at baseline. Similar results were found for the number of puffs per vaping episode for low (adjusted RR, 2.05; 95% CI, 1.41-2.70), medium (adjusted RR, 3.39; 95% CI, 2.66-4.11), and high (adjusted RR, 2.23; 95% CI, 1.42-3.03) nicotine concentrations.

Conclusions and Relevance The results of this study provide preliminary evidence that use of e-cigarettes with higher nicotine concentrations by youths may increase subsequent frequency and intensity of smoking and vaping.

The citation is Nicholas I. Goldenson, Adam M. Leventhal, Matthew D. Stone, Rob S. McConnell, Jessica L. Barrington-Trimis. Associations of Electronic Cigarette Nicotine Concentration With Subsequent Cigarette Smoking and Vaping Levels in Adolescents. *JAMA Pediatr.* 2017;171(12):1192-1199. doi:10.1001/jamapediatrics.2017.3209 and it is available [here](#).



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[Pediatrics](#). 2018 Jan;141(1). pii: e20171832. doi: 10.1542/peds.2017-1832. Epub 2017 Dec 4.

Trajectories of E-Cigarette and Conventional Cigarette Use Among Youth.

Bold KW¹, Kong G², Camenga DR³, Simon P², Cavallo DA², Morean ME⁴, Krishnan-Sarin S².

Author information

Abstract

BACKGROUND: Electronic cigarette (e-cigarette) use is common among youth, and there are concerns that e-cigarette use leads to future conventional cigarette use. We examined longitudinal associations between past-month cigarette and e-cigarette use to characterize the stability and directionality of these tobacco use trajectories over time.

METHODS: High school students ($N = 808$, 53% female) completed surveys across 3 waves (2013, 2014, and 2015) in 3 public schools in Connecticut. Using autoregressive cross-lagged models, we examined bidirectional relationships between past-month cigarette and e-cigarette use over time. Models were adjusted for covariates related to tobacco use (ie, sex, race/ethnicity, socioeconomic status, and use of other tobacco products).

RESULTS: Past-month e-cigarette use predicted future cigarette use (wave 1-2: odds ratio [OR] = 7.08, 95% confidence interval [CI] = 2.34-21.42; wave 2-3: OR = 3.87, 95% CI = 1.86-8.06). However, past-month cigarette use did not predict future e-cigarette use (wave 1-2: OR = 2.02, 95% CI = 0.67-6.08; wave 2-3: OR = 1.90, 95% CI = 0.77-4.71). Additionally, frequency of cigarette and e-cigarette use increased over time. By wave 3, 26% of cigarette users and 20.5% of e-cigarette users reported using 21-30 days out of the past month.

CONCLUSIONS: E-cigarette use was associated with future cigarette use across 3 longitudinal waves, yet cigarette use was not associated with future e-cigarette use. Future research needs to examine mechanisms through which e-cigarette use leads to cigarette use. E-cigarette regulation and prevention programs may help prevent future use of cigarettes among youth.

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Associations of Electronic Cigarette Nicotine Concentration With Subsequent Cigarette Smoking and Vaping Levels in Adolescents

Nicholas I. Goldenson, BA¹; Adam M. Leventhal, PhD^{1,2}; Matthew D. Stone, BA¹; [et al](#)

» [Author Affiliations](#)

JAMA Pediatr. 2017;171(12):1192-1199. doi:10.1001/jamapediatrics.2017.3209



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Key Points

Question Is the use of electronic cigarettes with higher nicotine concentrations prospectively associated with greater frequency and intensity of combustible cigarette smoking and vaping in adolescents?

Findings In this cohort study of 181 adolescent electronic cigarette users, use of electronic cigarettes with higher nicotine concentrations at baseline was associated with greater levels of combustible cigarette and electronic cigarette use in the past 30 days at the 6-month follow-up and greater intensity of daily use after controlling for baseline use.

Meaning Use of electronic cigarettes with higher nicotine concentrations may contribute to the progression to smoking and vaping at higher levels of frequency and intensity among youths.

Abstract

Importance Research indicates that electronic cigarette (e-cigarette) use (vaping) among adolescents is associated with the initiation and progression of combustible cigarette smoking. The reasons for this association are unknown.

Objective To evaluate whether use of e-cigarettes with higher nicotine concentrations is associated with subsequent increases in the frequency and intensity of combustible cigarette smoking and vaping.

Design, Setting, and Participants In this prospective cohort study involving students from 10 high schools in the Los Angeles, California, metropolitan area, surveys were administered during 10th grade in the spring (baseline) and 11th grade in the fall (6-month follow-up) of 2015 to students who reported using e-cigarettes within the past 30 days and the nicotine concentration level they used at baseline.

Exposures Self-report of baseline e-cigarette nicotine concentration of none (0 mg/mL), low (1-5 mg/mL), medium (6-17 mg/mL), or high (≥ 18 mg/mL) typically used during the past 30 days.

Main Outcomes and Measures Frequency of combustible cigarette smoking and e-cigarette use within the past 30 days (0 days [none], 1-2 days [infrequent], or ≥ 3 days [frequent]) and daily intensity of smoking and vaping (number of cigarettes smoked per day, number of vaping episodes per day, and number of puffs per vaping episode) at the 6-month follow-up.

Results The analytic sample included 181 students (96 boys [53.0%] and 85 girls [47.0%]; mean [SD] age, 16.1 [0.4] years). Each successive increase in nicotine concentration (none to low, low to medium, and medium to high) vaped was associated with a 2.26 (95% CI, 1.28-3.98) increase in the odds of frequent (vs no) smoking and a 1.65 (95% CI, 1.09-2.51) increase in the odds of frequent (vs no) vaping at follow-up after adjustment for baseline frequency of smoking and vaping and other relevant covariates. Use of e-cigarettes with high (vs no) nicotine concentration was associated with a greater number of cigarettes smoked per day at follow-up (adjusted rate ratio [RR], 7.03; 95% CI, 6.11-7.95). An association with

a significantly greater number of vaping episodes per day was found with use of low (adjusted RR, 3.32; 95% CI, 2.61-4.03), medium (adjusted RR, 3.32; 95% CI, 2.54-4.10), and high (adjusted RR, 2.44; 95% CI, 1.63-3.24) nicotine concentrations (vs no nicotine) at baseline. Similar results were found for the number of puffs per vaping episode for low (adjusted RR, 2.05; 95% CI, 1.41-2.70), medium (adjusted RR, 3.39; 95% CI, 2.66-4.11), and high (adjusted RR, 2.23; 95% CI, 1.42-3.03) nicotine concentrations.

Conclusions and Relevance The results of this study provide preliminary evidence that use of e-cigarettes with higher nicotine concentrations by youths may increase subsequent frequency and intensity of smoking and vaping.

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