

From The JAMA Network

Youth Experimentation With e-Cigarettes

What Can the Data Actually Tell Us?

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JAMA PEDIATRICS

Electronic Cigarettes and Conventional Cigarette Use Among US Adolescents: A Cross-sectional Study

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IMPORTANCE Electronic cigarette (e-cigarette) use is increasing rapidly among adolescents, and e-cigarettes are currently unregulated.

OBJECTIVE To examine e-cigarette use and conventional cigarette smoking.

DESIGN, SETTING, AND PARTICIPANTS Cross-sectional analyses of survey data from a representative sample of US middle and high school students in 2011 (n = 17 353) and 2012 (n = 22 529) who completed the 2011 and 2012 National Youth Tobacco Survey.

EXPOSURES Ever and current e-cigarette use.

MAIN OUTCOMES AND MEASURES Experimentation with, ever, and current smoking, and smoking abstinence.

RESULTS Among cigarette experimenters (≥ 1 puff), ever e-cigarette use was associated with higher odds of ever smoking cigarettes (≥ 100 cigarettes; odds ratio [OR] = 6.31; 95% CI, 5.39-7.39) and current cigarette smoking (OR = 5.96; 95% CI, 5.67-6.27). Current e-cigarette use was positively associated with ever smoking cigarettes (OR = 7.42; 95% CI,

5.63-9.79) and current cigarette smoking (OR = 7.88; 95% CI, 6.01-10.32). In 2011, current cigarette smokers who had ever used e-cigarettes were more likely to intend to quit smoking within the next year (OR = 1.53; 95% CI, 1.03-2.28). Among experimenters with conventional cigarettes, ever use of e-cigarettes was associated with lower 30-day (OR = 0.24; 95% CI, 0.21-0.28), 6-month (OR = 0.24; 95% CI, 0.21-0.28), and 1-year (OR = 0.25; 95% CI, 0.21-0.30) abstinence from cigarettes. Current e-cigarette use was also associated with lower 30-day (OR = 0.11; 95% CI, 0.08-0.15), 6-month (OR = 0.11; 95% CI, 0.08-0.15), and 1-year (OR = 0.12; 95% CI, 0.07-0.18) abstinence. Among ever smokers of cigarettes (≥ 100 cigarettes), ever e-cigarette use was negatively associated with 30-day (OR = 0.61; 95% CI, 0.42-0.89), 6-month (OR = 0.53; 95% CI, 0.33-0.83), and 1-year (OR = 0.32; 95% CI, 0.18-0.56) abstinence from conventional cigarettes. Current e-cigarette use was also negatively associated with 30-day (OR = 0.35; 95% CI, 0.18-0.69), 6-month (OR = 0.30; 95% CI, 0.13-0.68), and 1-year (OR = 0.34; 95% CI, 0.13-0.87) abstinence.

CONCLUSIONS AND RELEVANCE Use of e-cigarettes was associated with higher odds of ever or current cigarette smoking, higher odds of established smoking, higher odds of planning to quit smoking among current smokers, and, among experimenters, lower odds of abstinence from conventional cigarettes. Use of e-cigarettes does not discourage, and may encourage, conventional cigarette use among US adolescents.

JAMA Pediatr. doi:10.1001/jamapediatrics.2013.5488.

Dutra and Glantz¹ reported that, in US school students, those who used e-cigarettes were also likely to be smoking conventional (combustible) cigarettes. Despite the associational, rather than causal, nature of the study design, the authors drew some strong conclusions: "Use of e-cigarettes does not discourage, and may encourage, conventional cigarette use among US adolescents" and "e-cigarette use is aggravating rather than ameliorating the tobacco epidemic among youths."

Do the data support these conclusions? We think not.

The authors acknowledged that their cross-sectional study could not determine directionality of influence, that is, whether youths are initiating smoking with combustible cigarettes and then moving on to e-cigarettes or vice versa. There are at least 3 possible explanations for their findings: use of e-cigarettes (as the authors con-

cluded) causes use of conventional cigarettes; use of conventional cigarettes causes use of e-cigarettes; or there are as-yet unidentified common causes of e-cigarette and lethal combustible cigarette use. The study cannot rule out any of these explanations, but are they equally plausible?

The authors do not explain how they can conclude that e-cigarettes encourage conventional cigarette use or that using e-cigarettes make one less likely to quit combustible cigarettes. For e-cigarettes to be a starter product, they would have to hold a special allure for youth—something different or better than lethal cigarettes. It's possible: e-cigarettes are a new "high tech" product, and they may be perceived as less harmful than cigarettes. If e-cigarettes were a gateway product, additional numbers of youth, who otherwise would never have used any tobacco, would first have

to try e-cigarettes and then turn to combustible cigarettes, for some reason: Better taste? More efficient nicotine delivery? The survey data are limited and do not document movement from e-cigarettes to combustible cigarettes.

It's equally plausible that use of combustible cigarettes leads to use of e-cigarettes, because they are perceived as a less harmful alternative for smokers who are not able or willing to go without nicotine. The cross-sectional survey data do not prove that this is the process that explains the association, but they are just as consistent with it as with the authors' proposed explanation.

Other factors may explain the association. Although demographic factors were controlled statistically in the study, any number of other unmeasured factors that distinguish e-cigarette experimental users from nonusers could explain the association between use of combustible cigarettes and e-cigarettes. Consistent with this, the National Youth Tobacco Survey (NYTS)² on which the study was based shows that most users of e-cigarette were also using combustible cigarettes. Especially likely as explanatory factors are those, such as impulsivity and sensation-seeking, that incline youth toward experimentation and risky behavior—that is, to use of combustible cigarettes and other tobacco products.³ It would be natural to observe that youth who are sensation-seeking and rebellious would be inclined to try both combustible cigarettes and novel e-cigarettes. This subset of youth who choose to try e-cigarettes may be different from those who have not tried e-cigarettes.

A number of unmeasured factors could also predispose youth to nicotine dependence, heavier smoking, difficulty quitting, or simply having greater curiosity to explore novel products. These factors can "travel together" with clusters of other risky behaviors such as use of alcohol and marijuana. The data in the article simply do not address these alternative relationships, because they cannot disentangle common factors that lead to use of both products. More informative surveys and, ideally, longitudinal data following the same individuals over time, are required before anything close to the strong causal inference that the authors make in their study can be achieved.

The context in which the study results were observed is also telling. In the NYTS,² overall tobacco use, including use of combustible cigarettes, actually declined from 2011 to 2012. Another major national survey⁴ likewise shows a steady annual decline of about 10%

in combustible cigarette smoking by teens from 2010 to 2013, even as e-cigarette use was doubling. This is consistent with the idea that some youth who would otherwise have taken up combustible cigarettes may have taken up e-cigarettes instead. For uptake of e-cigarettes to threaten public health, it would need to be as dangerous as smoking combustible cigarettes (implausible)⁵ and to occur in millions of youth who would never otherwise have smoked combustible cigarettes. The uptake of e-cigarettes should be monitored within a nationally representative longitudinal study, and the Food and Drug Administration is already doing so.⁶

In addition, the authors noted that the association of use of e-cigarettes with more time spent using tobacco products, which they believe "...call[s] into question claims that e-cigarettes are effective as smoking cessation aids." Users of e-cigarettes also had higher intention to quit. This connection may indicate that e-cigarette users are more health-concerned than those who only use combustible cigarettes. In any case, the survey had no information on motives for e-cigarette use; users may have adopted e-cigarettes for harm reduction. Therefore, e-cigarettes may become a gateway out of smoking lethal cigarettes.

Cross-sectional surveys provide us with valuable descriptive information that prompt us to watch carefully how many youth are using tobacco products and e-cigarettes but do not provide explanations for use. Prematurely overinterpreting or misinterpreting data, perhaps based on ideology, does not help the cause of tobacco control or public health. Implying causal explanations in the absence of appropriate data can lead the health care community and policy makers down false paths on the road to relieving the horrific toll imposed on society by addictive and lethal combustible cigarettes. If properly regulated, e-cigarettes have the potential to greatly improve the public health, by providing users of combustible cigarettes who cannot "just quit" a way to get nicotine without suffering the devastating health consequences inflicted on them by inhaling smoke, with its numerous toxins.⁷

The introduction of e-cigarettes raises fears of possible risks, and they need to be watched and managed, but trying to kill e-cigarettes in the cradle with misinterpretation of data does not serve the public health.

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Published Online: May 29, 2014.
doi:10.1001/jama.2014.6894.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

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