

# E-Cigarettes and Adolescents' Risk Status

Thomas A. Wills, PhD

The prevalence of e-cigarette use was only in the low single digits a few years ago but currently reaches  $\geq 30\%$  among high school students, and at least half are regular users.<sup>1,2</sup> This rapid explosion of e-cigarette use has caught the field by surprise, and researchers are scrambling to understand the implications for public health.

In their paper "Adolescent Risk Behaviors and Use of Electronic Vapor Products and Cigarettes," Demissie et al<sup>3</sup> provide a useful new perspective on this phenomenon. The researchers showed that 16% of the adolescent population used e-cigarettes only, 3% only smoked cigarettes, and 8% were dual users (cigarettes and e-cigarettes). The good news is that 73% of the adolescent population did not use any tobacco-related product (nonusers). However, that 27% of adolescents still do is not comforting to public health researchers and advocates. Here I bring out 3 points about how this paper helps us understand how e-cigarette use is related to adolescents' risk status overall.

## E-CIGARETTE USERS ARE INTERMEDIATE IN RISK STATUS

The pattern of results in Demissie et al<sup>3</sup> shows that youth who use e-cigarettes only are intermediate between the behavioral characteristics of nonusers and dual users. For example, 6% of the nonusers engaged in a sexual risk behavior, whereas the figures were 17% for e-cigarette-only users and 39% for dual users. Similar patterns were found for substance use (eg, illicit prescription drug use) and

behavioral problems (eg, fighting), as in our original report with social-cognitive variables.<sup>4</sup> A recent study of Iceland adolescents<sup>5</sup> observed a similar pattern; for example, the rate of drunkenness was 4% among nonusers, 17% among e-cigarette-only users, and 72% among dual users. Furthermore, a recent study of California adolescents including measures of psychopathology<sup>6</sup> showed that nonusers were well adjusted, e-cigarette-only users were slightly less adjusted, and dual users scored high on maladjustment. A plausible explanation for these results across 4 international studies is that e-cigarettes are operating to recruit lower-risk adolescents to substance use. Because e-cigarettes are perceived as fashionable and more healthy than combustible cigarettes, they seem to attract young people who are slightly elevated on risk status but not initially likely to engage in a lifestyle of substance use. E-cigarettes apparently are perceived as a behavior that may be a little deviant but is still safe.

## E-CIGARETTE USE AND BEHAVIORAL RISK STATUS—AN UNPLEASANT SURPRISE

But how safe are e-cigarettes? What are the consequences when a teen starts using them? Recent longitudinal research has provided an unpleasant surprise: among initial nonsmokers, those who use e-cigarettes are more likely to start smoking combustible cigarettes.<sup>7-10</sup> This puts a somewhat different light on the situation. If e-cigarettes are without risk, it does not matter much if they attract new users. Being related to smoking



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onset, however, puts a behavioral risk into the picture. The finding of associations with other health-risk behaviors augments concern because, as the authors note, the odds of experiencing poor health increase with the addition of each unhealthy behavior. And importantly, Demissie et al<sup>3</sup> show that among adolescent smokers, those who use e-cigarettes actually smoke more frequently, an effect that is contrary to the hopes of harm reduction advocates and has now been found internationally.<sup>11</sup>

### **BUT WEREN'T THEY GOING TO SMOKE ANYWAY?**

Critics of e-cigarette research have tried to dismiss the onset studies cited thus far, arguing that e-cigarette use is simply a marker for high-risk adolescents who were going to smoke anyway. They miss the fact that the studies controlled for variables that are defining characteristics of high-risk youth, including risk-taking, impulsiveness, negative affect, low parental support, and affiliation with deviant peers, and the effect of e-cigarette use for smoking onset was independent of these confounders.<sup>7–10</sup> Moreover, recent research with different designs has shown that e-cigarettes are most strongly related to smoking onset among lower-risk adolescents, thus specifically contradicting the confounding hypothesis.<sup>9,12</sup> Data from Demissie et al<sup>3</sup> do raise the possibility of an underlying vulnerability (not previously measured) that produces both e-cigarette use and smoking. As the authors discuss, the risk behaviors they assessed could derive from rejection of conventional social norms<sup>13</sup> or from activation of common neural pathways by nicotine,<sup>14</sup> and such hypotheses need to be tested. The jury is still out. Demissie et al<sup>3</sup> have provided

data that will guide further research testing different facets of a common-liability model.<sup>15</sup>

### **CONCLUSIONS**

Are e-cigarettes going to replace traditional cigarettes, or are they operating to recruit a new audience of adolescents to tobacco products? Our wish is for the former. But at present the empirical evidence looks more like the latter. We need surveillance and mechanism research to understand what e-cigarettes will mean for youth risk status. However, there is enough evidence now to advocate programs for educating teenagers about e-cigarettes.

### **REFERENCES**

1. Singh T, Arrazola RA, Corey CG, et al. Tobacco use among middle and high school students—United States, 2011–2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(14):361–367
2. Miech RA, Johnston LD, O'Malley PM, et al. *Monitoring the Future National Survey Results on Drug Use, 1975–2015, Vol. 1: Secondary School Students*. Ann Arbor, MI: Institute for Social Research, University of Michigan; 2016
3. Demissie Z, Jones S, Clayton H, King B. Adolescent risk behaviors and use of electronic vapor products and cigarettes. *Pediatrics*. 2017;139(2):e20162921
4. Wills TA, Knight R, Williams RJ, Pagano I, Sargent JD. Risk factors for exclusive e-cigarette use and dual e-cigarette use and tobacco use in adolescents. *Pediatrics*. 2015;135(1). Available at: [www.pediatrics.org/cgi/content/full/135/1/e43](http://www.pediatrics.org/cgi/content/full/135/1/e43)
5. Kristjansson AL, Mann MJ, Sigfusdottir ID. Licit and illicit substance use by adolescent e-cigarette users compared with conventional cigarette smokers, dual users, and nonusers. *J Adolesc Health*. 2015;57(5):562–564

6. Leventhal AM, Strong DR, Sussman S, et al. Psychiatric comorbidity in adolescent electronic and conventional cigarette use. *J Psychiatr Res*. 2016;73:71–78
7. Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of electronic cigarette use with initiation of combustible tobacco smoking in early adolescence. *JAMA*. 2015;314(7):700–707
8. Wills TA, Knight R, Sargent JD, Gibbons FX, Pagano I, Williams RJ. Longitudinal study of e-cigarette use and cigarette smoking onset among high school students in Hawaii. *Tob Control*. 2017;26(1):34–39
9. Barrington-Trimis JL, Urman R, Berhane K, et al. E-cigarettes and future cigarette use. *Pediatrics*. 2016;138(1):e20160379
10. Unger JB, Soto DW, Leventhal A. E-cigarette use and subsequent cigarette and marijuana use among Hispanic young adults. *Drug Alcohol Depend*. 2016;163:261–264
11. Goniewicz ML, Leigh NJ, Gawron M, et al. Dual use of electronic cigarettes and tobacco cigarettes among adolescents in Poland: a cross-sectional study in Poland. *Int J Public Health*. 2016;61(2):89–197
12. Wills TA, Sargent JD, Gibbons FX, Pagano I, Schweitzer RJ. E-cigarette use is differentially related to smoking onset among lower-risk adolescents [published online ahead of print August 19, 2016]. *Tob Control*. 10.1136/tobaccocontrol-2016-053116
13. Jessor R, ed. *New Perspectives on Adolescent Risk Behavior*. New York, NY: Cambridge University Press; 1998
14. Kandel ER, Kandel DB. Shattuck Lecture. A molecular basis for nicotine as a gateway drug. *N Engl J Med*. 2014;371(10):932–943
15. Vanyukov MM, Tarter RE, Kirillova GP, et al. Common liability to addiction and “gateway hypothesis”: theoretical, empirical, and evolutionary perspective. *Drug Alcohol Depend*. 2012;123(suppl 1):S3–S17

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