Letters

RESEARCH LETTER

Self-reported Marijuana Use in Electronic Cigarettes Among US Youth, 2017 to 2018

E-cigarette use is gaining popularity among US adolescents, and marijuana and other substances besides nicotine can be used in e-cigarettes. Since 2012, more states are relaxing the restrictions on marijuana use, and social acceptability of marijuana use is shifting among adolescents.1,2 This study sought to assess self-reported marijuana use in e-cigarettes among US students from 2017 to 2018.

Methods | The National Youth Tobacco Survey (NYTS) is a cross-sectional, school-based survey conducted annually using a stratified, 3-stage cluster sampling design to produce a nationally representative sample of middle school (grades 6-8) and high school (grades 9-12) students in the United States. Participating students completed the survey via pencil and paper. The overall response rates for participating schools and students were 68.1% in 2017 and 68.2%

Table. Prevalence of Marijuana Use in Electronic Cigarettes Among US Youth, 2017-2018 National Youth Tobacco Survey (N = 38 061)

<table>
<thead>
<tr>
<th>Race/ethnicityd</th>
<th>Overall</th>
<th>Sex</th>
<th>Age</th>
<th>Grade</th>
<th>Prevalence of Marijuana Use in Electronic Cigarettes, Weighted % (95% CI)a,b</th>
<th>Change Across Years</th>
<th>P Valuec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic white</td>
<td>10.8 (9.2 to 12.3)</td>
<td>Male</td>
<td>9-12</td>
<td>Middle school</td>
<td>4.5 (3.7 to 5.2)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>10.5 (8.8 to 12.3)</td>
<td>Female</td>
<td>13-15</td>
<td>Middle school</td>
<td>14.7 (13.0 to 16.4)</td>
<td>3.4 (1.5 to 5.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hispanic</td>
<td>14.1 (12.1 to 16.0)</td>
<td></td>
<td>16-17</td>
<td>High school</td>
<td>23.0 (19.1 to 26.8)</td>
<td>3.8 (1.4 to 6.1)</td>
<td>.007</td>
</tr>
<tr>
<td>Other</td>
<td>5.5 (3.4 to 7.7)</td>
<td></td>
<td>≥18</td>
<td>High school</td>
<td>28.3 (25.3 to 31.4)</td>
<td>3.8 (1.4 to 6.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ever users of e-cigarettes</td>
<td>37.2 (34.0 to 40.4)</td>
<td>No</td>
<td>20-30</td>
<td>Middle school</td>
<td>5.5 (4.5 to 6.5)</td>
<td>1.0 (−0.2 to 2.2)</td>
<td>.15</td>
</tr>
<tr>
<td>Current use of e-cigarettes</td>
<td>4.5 (3.7 to 5.2)</td>
<td>Yes</td>
<td>6-19</td>
<td>Middle school</td>
<td>11.1 (9.8 to 12.5)</td>
<td>3.8 (1.4 to 6.1)</td>
<td>.007</td>
</tr>
<tr>
<td>No. of days e-cigarettes used in past 30 d,</td>
<td>1</td>
<td>7.3 (6.3 to 8.3)</td>
<td>0</td>
<td>5.5 (4.8 to 6.2)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>43.6 (38.0 to 49.2)</td>
<td>1</td>
<td>5.5 (4.8 to 6.2)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-19</td>
<td>56.3 (47.6 to 65.1)</td>
<td>20-30</td>
<td>72.6 (64.3 to 80.8)</td>
<td>64.8 (56.2 to 73.6)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Current cigarette smoking</td>
<td>8.1 (7.1 to 9.2)</td>
<td>No</td>
<td>≥18</td>
<td>High school</td>
<td>5.5 (4.5 to 6.5)</td>
<td>1.0 (−0.2 to 2.2)</td>
<td>.15</td>
</tr>
<tr>
<td>Yes</td>
<td>56.2 (50.3 to 62.1)</td>
<td>Yes</td>
<td>16-17</td>
<td>Middle school</td>
<td>14.7 (13.0 to 16.4)</td>
<td>3.4 (1.5 to 5.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Current use of other tobacco products</td>
<td>7.3 (6.3 to 8.3)</td>
<td>No</td>
<td>9-12</td>
<td>Middle school</td>
<td>56.7 (51.3 to 62.2)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>53.3 (48.9 to 57.7)</td>
<td>Yes</td>
<td>13-15</td>
<td>Middle school</td>
<td>56.2 (52.8 to 60.4)</td>
<td>3.6 (1.6 to 5.5)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

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in 2018. Students were asked about whether they have ever used marijuana in an e-cigarette. The University of Nebraska institutional review board determined this study to be non-human subjects research.

Weighted estimates and 95% CIs of the prevalence of ever marijuana use in e-cigarettes in 2017 and 2018 were reported using the Taylor series variance estimation. Multivariable logistic regression tested the changes of self-reported ever marijuana use in e-cigarettes between 2017 and 2018, in which year was the predictive variable and covariates included demographics (age, sex, and race/ethnicity) and tobacco use by a household member. Other variables, including ever and current (past 30-day) e-cigarette use, frequency of current e-cigarette use, current cigarette smoking, current other tobacco use, and the number of tobacco products currently used by students, were included in the stratified analysis. Statistical analysis was performed using SAS 9.4 (SAS Institute Inc.). P < .05 (2-sided) was used as the threshold for statistical significance.

**Results** | This pooled sample from the 2017-2018 NYTS (n = 38 061) included 49.1% female, 55.9% high school, 56.5% non-Hispanic white, 13.0% non-Hispanic black, and 24.6% Hispanic students; 23.6% ever e-cigarette users; and 10.9% current e-cigarette users.

From 2017 to 2018, the reported prevalence of ever marijuana use in e-cigarettes among all students increased (11.1% [95% CI, 9.8%-12.5%] vs 14.7% [95% CI, 13.3%-16.1%]; difference, 3.6% [1.6%-5.5%]; P < .001) (**Table**). The increases were observed across some demographic groups, including male and female students, adolescents aged 13 to 17 years, high school students, and non-Hispanic white and Hispanic students. The largest increases were observed among current users of 1 tobacco product (33.2% to 40.6%; difference, 7.4% [95% CI, 1.8%-13.1%]; P < .02) and those who lived with a household member using e-cigarettes (22.7% to 29.5%; difference, 6.8% [95% CI, 2.2%-11.4%]; P < .007).

In 2018, 42.7% (95% CI, 40.2%-45.3%) of ever e-cigarette users, 53.5% (95% CI, 50.2%-56.8%) of current e-cigarette users, and 71.6% (95% CI, 67.7%-75.4%) of poly tobacco users reported ever using marijuana in e-cigarettes.

**Discussion** | This study identified a significant increase in self-reported ever marijuana use in e-cigarettes from 2017 to 2018 among US students, using the most current data available at the national level. Prevalence estimates reported for all students (14.7%) and current e-cigarette users (53.5%) in 2018 were also much higher than those reported in 2016 (8.9% and 39.5%, respectively), although changes in the wording and placement of survey questions about marijuana use in e-cigarettes after 2016 may limit direct comparisons.

The increase in marijuana use in e-cigarettes could be attributable to the increase of sales of pod-mod-style e-cigarette products, access to marijuana through informal sources (eg, friends, family members, illicit dealers), and reduced perception among adolescents of the harms of marijuana use. Marijuana use in adolescence could lead to adverse effects on brain development, mental health, and academic performance. E-Cigarette use has also been related to severe respiratory diseases, with 2290 vaping-related lung injury cases reported and 47 deaths confirmed as of November 20, 2019; approximately 77% of cases were in people with a history of vaping tetrahydrocannabinol-containing products. Longitudinal studies are needed to assess the acute and long-term health effects of vaping marijuana in e-cigarettes.

Study limitations are that self-reported information is subject to recall and social desirability biases. Continuous surveillance of youth vaping of marijuana is warranted.

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**Author Contributions:** Dr Dai had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Concept and design:** Dai.

**Acquisition, analysis, or interpretation of data:** Dai.

**Drafting of the manuscript:** Dai.

**Critical revision of the manuscript for important intellectual content:** Dai.

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**Supervision:** Dai.

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