

# E-cigarette Use and Rhode Island High-School Students: What Providers Need to Know about the Characteristics of Initiation of E-cigarettes and Related Risk Behaviors

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## INTRODUCTION

Skyrocketing e-cigarette use gained national attention when the U.S. Surgeon General issued warnings about this youth epidemic in 2018. More recently, 2019 saw the emergence of a new clinical condition attributed to vaping nicotine-and/or tetrahydrocannabinol (THC)-containing products called E-cigarette or Vaping product use Associated Lung Injury (EVALI). The long-term health effects of e-cigarette use on youth and adults are generally unknown, but some immediate harms have been documented. Nicotine exposure during adolescence can harm the developing brain until approximately the age of 25, impacting learning, memory, and attention.<sup>1</sup> Other health risks include injuries resulting from battery explosions and accidental childhood nicotine poisonings. The prevalence of e-cigarette use in youth also increases the likelihood of exposure to secondhand smoke/aerosol for other students. Prior e-cigarette use has been associated with high school teens being more than four times likely to ever smoke combustible cigarettes,<sup>2</sup> making youth e-cigarette users more susceptible to known negative health outcomes associated with traditional tobacco cigarette use (e.g., cancer, heart, and lung diseases). Through longitudinal data, current e-cigarette use has been linked to 1.29 increased odds of acquiring respiratory disease,<sup>3</sup> emphysema, chronic bronchitis, and Chronic Obstructive Pulmonary Disease.<sup>4</sup>

Since 2015, the percent of Rhode Island high school students that both initiate and currently use e-cigarettes has significantly increased (**Figure 1**). In 2019 alone, nearly one-in-two Rhode Island high school students (49%) responded

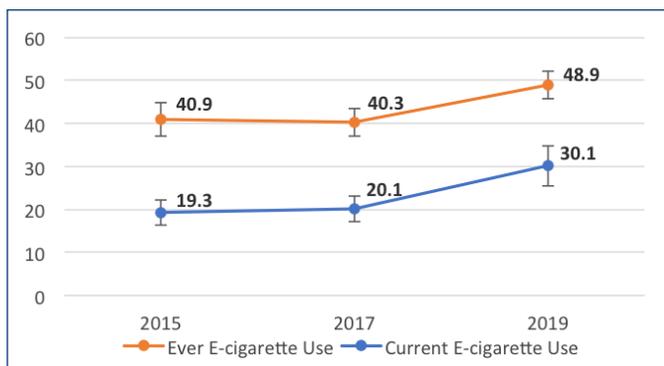
yes to “Have you ever used an electronic vapor product?” and 30% indicated *one or more days* when asked “During the past 30 days, on how many days did you use an electronic vapor product?”<sup>5</sup> When compared to the most recent adult e-cigarette use, these youth rates are alarming. In 2018, 22% of Rhode Island adults responded yes to “Have you ever used an e-cigarette or other electronic vaping product, even just one time, in your entire life?” and 6% indicated *every day or some days* when asked “Do you now use e-cigarettes or other electronic vaping products every day, some days, or not at all?”<sup>6</sup> Understanding potential drivers of youth e-cigarette use, as well as the disparities that exist between youth who have never tried and youth that have ever tried an e-cigarette may have clinical and intervention design value when combatting youth use. These analyses compare initiation characteristics and risk behaviors that are more prevalent among Rhode Island youth who “ever tried” and “never tried” e-cigarettes.

## METHODS

Data presented in the following analyses are from the 2017 and 2019 Rhode Island High School Youth Risk Behavior Survey (YRBS). Data are aggregate for purposes of these analyses to produce reportable strata sample size in addition to increasing precision and reliability of estimates. The YRBS survey is administered biennially to monitor prevalence and trends of health risk behaviors among youth (i.e., middle and high school students). The Rhode Island YRBS survey is not census-based; the sample is scientifically and efficiently drawn and is proportional to students in grades 9 through 12, attending public schools. Weighted data, using a two-stage cluster sample design,<sup>7</sup> were achieved by yielding adequate response rates (> 60%) and are representative of the Rhode Island public high school population. In total, 2,221 students from 19 public high schools in 2017 (representative of 41,114 students statewide) and 1,613 students from 21 public high schools in 2019 (representative of 44,052 students) completed the YRBS. For these analyses, ever using e-cigarettes within one’s lifetime was measured with the question “Have you ever used an electronic vapor product?”

The overall burden of e-cigarette use was analyzed and then descriptive analyses comparing the prevalence of those who have ever used e-cigarettes by demographics was

**Figure 1.** Rhode Island High School Students’ E-cigarette Use



conducted. For demographic characteristics, significance was determined by a p-value <.05 using a Chi-Square Test. Bivariate analyses were calculated to examine associations between ever and never using e-cigarettes in one's lifetime and the prevalence of mental health and academic achievement characteristics as well as likelihood to engage in various risk behaviors (e.g., substance use, unsafe transportation-related behaviors, risky sexual practices among e-cigarette users compared to non-users. All analyses were performed using SAS Version 9.4 and differences between groups were considered statistically significant when 95% confidence intervals (CIs) did not overlap.

## RESULTS

Overall, a combined rate of 44.8% of Rhode Island high school students reported having ever used e-cigarettes, using the aggregate data for 2017 and 2019. Statistical significance between all demographic characteristics (Table 1) was found with the exception being sex. Non-Hispanic Black high school students significantly try e-cigarettes less than White students and students of other ethnic and racial minorities. E-cigarette initiation increases with age/grade level and is highest in the 11th and 12th grades. Students who identify as gay, lesbian, and bisexual and students who identify

**Table 1.** Prevalence of Lifetime E-cigarette Use among RI High School Students by Selected Demographics, 2017–2019

| Demographics                | Ever Used E-cigarettes |           |
|-----------------------------|------------------------|-----------|
|                             | Percent                | 95% CI    |
| <b>Sex</b>                  |                        |           |
| Male                        | 43.6                   | 40.3–47.0 |
| Female                      | 45.7                   | 41.9–49.5 |
| <b>Race/Ethnicity*</b>      |                        |           |
| Non-Hispanic White          | 47.4                   | 44.7–50.1 |
| Non-Hispanic Black          | 37.9                   | 28.6–47.3 |
| Hispanic                    | 41.1                   | 36.8–45.3 |
| Non-Hispanic Other          | 46.3                   | 40.8–51.8 |
| <b>Grade*</b>               |                        |           |
| 9th                         | 37.1                   | 33.1–41.2 |
| 10th                        | 39.9                   | 34.8–45.1 |
| 11th                        | 50.7                   | 44.0–57.4 |
| 12th                        | 53.0                   | 40.5–53.6 |
| <b>Sexual Orientation*</b>  |                        |           |
| Gay/Lesbian/Bisexual        | 54.2                   | 45.9–62.5 |
| Straight                    | 44.6                   | 42.0–47.1 |
| <b>Learning Disability*</b> |                        |           |
| Yes                         | 56.0                   | 48.2–63.9 |
| No                          | 42.6                   | 40.3–44.9 |

\*Significant difference p<.05 in chi square test

**Table 2.** Distribution of E-cigarette Use among RI High School Students, by Mental Health and Academic Achievement Characteristics, 2017–2019

|  | Never Used E-Cigarette |           | Ever Used E-Cigarette |           |
|--|------------------------|-----------|-----------------------|-----------|
|  | %                      | 95% CI    | %                     | 95% CI    |
| <b>Mental/Behavioral Health Status*</b>          |                        |           |                       |           |
| Mental health not good $\geq$ 1/30 days          | 59.0                   | 53.2–64.9 | 68.5                  | 66.1–70.9 |
| Bullied electronically or at school              | 16.3                   | 13.0–19.6 | 26.5                  | 22.5–30.5 |
| Seriously considered attempting suicide          | 10.1                   | 8.7–12.6  | 18.9                  | 15.8–22.1 |
| Felt sad or hopeless $\geq$ 14 days in past year | 22.3                   | 19.6–25.1 | 40.8                  | 36.2–45.5 |
| <b>Perception of Own Grades*</b>                 |                        |           |                       |           |
| Mostly As and/or Bs                              | 79.7                   | 74.3–85.1 | 69.7                  | 65.6–73.7 |
| Mostly Cs, Ds, or Fs                             | 20.3                   | 14.9–25.7 | 30.3                  | 26.3–34.4 |

\*Bolded percentages and 95% CIs are statistically significant when compared to never e-cigarette users.

**Table 3.** Prevalence of Other Youth Risk Behaviors among Rhode Island High School Students Who Have Ever Used E-cigarette, 2017–2019

|  | Never Used E-Cigarette |           | Ever Used E-Cigarette |           |
|--|------------------------|-----------|-----------------------|-----------|
|  | %                      | 95% CI    | %                     | 95% CI    |
| <b>Substance Use*</b>  |                        |           |                       |           |
| Ever used marijuana  | 12.5                   | 9.4–15.6  | 67.7                  | 63.0–72.3 |
| Currently used marijuana <sup>†</sup>                                | 5.9                    | 4.2–7.7   | 44.4                  | 40.3–48.6 |
| Ever misused prescription pain meds <sup>^</sup>                     | 4.3                    | 2.9–5.7   | 15.4                  | 12.0–18.8 |
| Ever used drugs (cocaine, heroin, ,4-methylene-dioxymethamphetamine) | 1.2                    | 0.5–2.0   | 8.5                   | 6.8–10.3  |
| Ever smoked cigarettes   | 5.4                    | 4.1–6.8   | 33.8                  | 30.0–37.6 |
| Currently drank alcohol <sup>†</sup>                                 | 7.8                    | 5.7–9.9   | 41.2                  | 34.8–47.6 |
| <b>Motor Vehicle Safety*</b>   |                        |           |                       |           |
| Rode in a car where the driver had been drinking <sup>†</sup>        | 8.8                    | 7.0–10.5  | 19.1                  | 16.0–22.2 |
| Texted/checked email while driving <sup>†</sup>                      | 18.0                   | 12.9–23.1 | 49.4                  | 42.2–56.7 |
| Never or rarely wore a seatbelt                                      | 4.0                    | 2.4–5.6   | 7.9                   | 5.8–10.0  |
| <b>Sexual Practice</b>   |                        |           |                       |           |
| Didn't use a condom during last sexual encounter                     | 37.4                   | 31.0–43.8 | 46.4                  | 39.6–53.2 |

<sup>†</sup> At least once in the 30 days prior to survey administration.

<sup>^</sup> Taken prescribed pain medications differently than how a doctor told them to use it.

\*Bolded percentages and 95% CIs are statistically significant when compared to never e-cigarette users.

having a learning disability are also more likely to ever use e-cigarettes than their respective peers who identify differently.

Poor mental health status is more prevalent in those who try e-cigarettes compared to those who do not (Table 2). Self-reporting of mental health being not good, being bullied, considering suicide, and feeling sad/hopeless are all more prevalent in those who try e-cigarettes. Nearly 70% of those who have ever used e-cigarettes had at least one day in the last 30 where their mental health was not good, and 19% have seriously considered committing suicide in the past year. Those who ever use e-cigarettes were significantly more likely to report a perception of getting C/D/F grades in terms of academic achievement.

Prevalence of all risk behaviors (Table 3), except not using a condom in the last sexual encounter, are significantly higher in students that ever use e-cigarettes. There are notably larger differences present in substance use and motor vehicle safety risk behaviors. Nearly 68% of ever e-cigarette users have ever tried marijuana, compared to only 13% of never e-cigarette users.

## DISCUSSION

The current analyses suggest significant differences exist among students who have ever used e-cigarettes based on demographics, mental health and academic achievement characteristics, and engagement in other risk behaviors. Those who have ever tried e-cigarettes were more likely to report engaging in other risk behaviors, such as substance use and unsafe transportation-related behavior. Additional analyses were conducted to compare risk factors and behaviors among current (past 30 day) e-cigarette use with those who have ever tried e-cigarettes. However, there were no differences between these two groups with the exception of a newfound lack of statistical significance between the sexual orientation and perception of own grades variables. As such, the current-use group was excluded from this paper. Use of marijuana, ever in one's lifetime or currently, was much more prevalent within those who ever used e-cigarettes. While e-cigarette and marijuana use associations are an area of further study, 8.9% of all high and middle school students had ever used marijuana in an e-cigarette in 2016, according to the National Youth Tobacco Survey. The data presented that compare marijuana use between both e-cigarette groups offer support for the idea that e-cigarettes may be a vehicle for and a risk behavior of youth using marijuana.<sup>8</sup>

Regarding youth initiation nationally, flavors are cited to appeal to youth with approximately 31% of both middle and high school students reporting that flavor availability was a reason they used e-cigarettes.<sup>9</sup> In 2017–2018, nearly 68% of high school students nationwide reporting current use of e-cigarettes said they used flavors.<sup>10</sup> Research also supports that fruit/candy flavors perpetuate the misperception that such products are less harmful than tobacco-flavored

e-cigarettes.<sup>11</sup> In light of recent data, the State of Rhode Island promulgated emergency regulations in October that prohibit flavored e-cigarette products – including menthol – to curb youth use. In November 2019, Massachusetts passed legislation that prohibited the sale of flavored tobacco products. Federal T-21 legislation raising the minimum legal age for tobacco and nicotine sales to 21 years of age and older was signed into law on December 20, 2019. On January 2, 2020, the FDA finalized an enforcement policy on “unauthorized flavored cartridge-based e-cigarettes that appeal to children, including fruit and mint.” Rhode Island, through the Governor's Vaping Advisory Committee, is developing policy recommendations for consideration locally. A summary of policy options developed by the Association of State and Territorial Health Officials can be found online. On January 16, 2020, a budget article was released in Rhode Island by Governor Raimondo that included policies associated with curbing youth e-cigarette use.

As of January 16, 2020, Rhode Island has reported six cases of EVALI to the CDC, inclusive of two cases age 18 years and under. This investigation remains concerning as youth disproportionately use e-cigarettes compared to the 6% of adults who reported current use in 2018. Nationally, as of January 7, 2020, 76% of hospitalized EVALI patients were under 35 years old, with an age range starting at 13 years old. Further, 57% of hospitalized EVALI patients reported using nicotine-containing products with 13% citing exclusive use of nicotine. While vitamin E acetate in THC cartridges has been strongly linked to the EVALI outbreak, CDC has noted there may be other chemicals of concern related to EVALI and recommends that individuals consider refraining from all e-cigarette or vaping product use.<sup>12</sup>

Understanding the risk factors and risk behaviors of youth e-cigarette use in Rhode Island carries important clinical and public health significance. These data can inform clinical screening guidance and practices to detect and address e-cigarette use, poor mental health, and potentially injurious health behaviors early. The need for increased Screening, Brief Intervention, and Referral to Treatment (SBIRT) for youth across community and clinical settings is also highlighted. Resources for providers to help youth quit as they begin to experience withdrawal from prohibition on flavored e-cigarettes are available. The Rhode Island Nicotine Helpline (1-800-QUIT-NOW) provides a simple, no-cost point-of-access to telephonic cessation services in Spanish and English for tobacco/nicotine users 13 years of age and older. This service provides screening, assessments of readiness to quit, counseling/advice, nicotine replacement therapy (NRT – for those 18 years of age and older, support materials, and local community-based cessation services information. The Truth Campaign's “This is Quitting” free mobile program helps young people quit vaping. By texting DITCHJUUL to 88709, individuals will receive messages from other young people who have attempted to or quit e-cigarettes along

with evidence-based tips and strategies to help. Both are valuable assets for clinicians. While no NRT guidelines currently exist in the U.S. for youth vaping cessation, the American Academy of Pediatrics is developing materials and recommends using existing tobacco guidelines and clinical judgment on a patient-by-patient basis.

### Study Limitations

These analyses have several limitations. All data from the YRBS are self-reported by students and subject to recall bias. Underrepresentation of data due to stigma with engaging in illegal activity is possible. YRBS data on marijuana use is inclusive of all types of products (e.g., edible, combustible, e-liquid, and others) and is not vaping-specific. Use of prevalence estimates in these analyses do not represent causality and further analysis is needed to estimate measures of association between the data presented.

### CONCLUSION

In 2019 alone, nearly one-in-two Rhode Island high school students (49%) have ever used e-cigarettes. Poor mental/behavioral health status, hopelessness, and suicide contemplation are more prevalent in students who ever use e-cigarettes. A major difference between students who ever and never use e-cigarettes is that 68% of students who ever used e-cigarettes reported marijuana use. Substance use and motor vehicle safety risk behaviors also have a higher prevalence among those who try e-cigarettes. Understanding the risk factors and risk behaviors of youth e-cigarette use carries important clinical and public health significance to improve upon existing resources for cessation, including the Rhode Island Nicotine Helpline and This is Quitting mobile application.

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