



# Disparities in Flavored Electronic Nicotine-Delivery System (ENDS) Use Among Youth in Rhode Island

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## INTRODUCTION

The recent decline in current e-cigarette use among US high school students is a significant public health achievement, from 10% in 2023 to 7.8% in 2024.<sup>1</sup> Despite a decline in overall youth tobacco product use, electronic nicotine-delivery systems (ENDS) or e-cigarettes remain the most popular product, specifically flavored. Per the 2024 National Youth Tobacco Survey, 1.63 million youth nationwide were current e-cigarette users, and of those 1.63 million youth, 87.6% reported using flavored products.<sup>1</sup>

Tobacco use often starts and is established in adolescence. Most e-cigarettes contain nicotine, which is highly addictive. Nicotine can harm the parts of an adolescent's brain that control attention, learning, mood, and impulse control. Research demonstrates that flavors are significant contributors to high youth e-cigarette use rates, as youth e-cigarette users report flavors as a primary reason to use e-cigarettes.<sup>2,3</sup> While studies have found that flavored tobacco use is significantly higher among some youths than others, tobacco products are harmful across all racial/ethnic groups, especially as a quarter of youth who try e-cigarettes remain e-cigarette users. These disparities highlight the need for targeted tobacco control interventions for different youth populations.<sup>4</sup>

The purpose of this study is two-fold. First, to examine disparities in flavored tobacco use among youth using a statewide representative survey of high school students in Rhode Island. Second, to use the findings to highlight the most promising prevention strategies to reduce flavored tobacco use among youth. All references to tobacco in this article refer to commercial tobacco, not sacred and ceremonial tobacco used by many American Indian communities.

## METHOD

Data are from the 2021 (N = 2,153), and 2023 (N = 1,932) Rhode Island Youth Risk Behavior Survey (RI-YRBS).<sup>5</sup> Two years were combined for a reportable strata sample size to increase precision and reliability of estimates. The aggregated state sample size was 4,085 after combining two years. RI-YRBS is an anonymous and voluntary, self-administered survey conducted every two years among random samples

of high school and middle school students in Rhode Island. Its purpose is to monitor risk behaviors related to the major causes of mortality, disease, injury, and social problems among youth in the United States.

Current flavored ENDS use is defined as use of an ENDS flavored to taste like menthol, mint, clove or spice, alcoholic drinks, candy, fruit, chocolate, or any other non-tobacco flavor on at least one day during the 30 days before the survey. Youth were categorized as a sexual and/or gender minority (SGM) if they identified their gender identity as transgender, and/or reported their sexual orientation as lesbian, gay, homosexual, bisexual, or something else. Students who did not know what the questions on sexual orientation or transgender identity were asking or who did not answer these questions were excluded. Food insecurity is defined as experiencing hunger in the past 30 days of survey because there was not enough food at home. Neighborhood safety is defined as not feeling safe and secure in one's neighborhood most of the time or always. Current marijuana use is defined as use of marijuana on at least one day during the 30 days before the survey, while current alcohol use as use of alcohol on at least one day during the 30 days before the survey. Experiencing poor mental health most of the time or always (including stress, anxiety, and depression) during the 30 days before the survey was coded with a dichotomous response (yes/no).

Findings are presented for flavored ENDS products. Descriptive statistics showed few differences in prevalence of current ENDS product use vs. current flavored ENDS product use when examined by study variables. Most of the youth (approximately 95%) using ENDS tobacco products were found to use flavored ENDS products. Flavored ENDS use was analyzed by individuals' sociodemographic characteristics. Significance was determined by a p-value <.05 using the chi-square test. Multivariable logistic regression examined associations between study variables and flavored ENDS products. All variables were entered into the model simultaneously; adjusted odds ratios (AORs) are presented. Data were weighted to adjust for survey nonresponse and to provide state-level representative estimates. All analyses were performed using SAS Version 9.4.

## RESULTS

Demographic Characteristics,  
2021–2023 Combined

**Table 1** shows the prevalence of current flavored ENDS use overall and by selected characteristics among Rhode Island high school students. In 2021–2023, the percentage of Rhode Island high school youth who used flavored ENDS was 15.6 (95% CI: 14.5, 16.7).

Compared to high school students who did not currently use flavored ENDS products, a higher percentage of high school students who currently used flavored ENDS products were female (62.0% vs. 47.6%), reported being food insecure in the past 30 days (36.8% vs. 2.8%), and experienced homelessness in the past 30 days (9.6% vs. 2.8%).

High school students who currently used flavored ENDS products also were more likely to report drinking alcohol on one or more days in the past 30 days (62.8%) and use marijuana one or more times in the past 30 days (66.2%) than high school students who did not report recent use of flavored ENDS products (9.7% and 8.2%, respectively).

**Figure 1** displays alcohol and marijuana use by grade among youth who use flavored ENDS products. Over 50% of current flavored ENDS users in each grade stated that they currently use alcohol or marijuana.

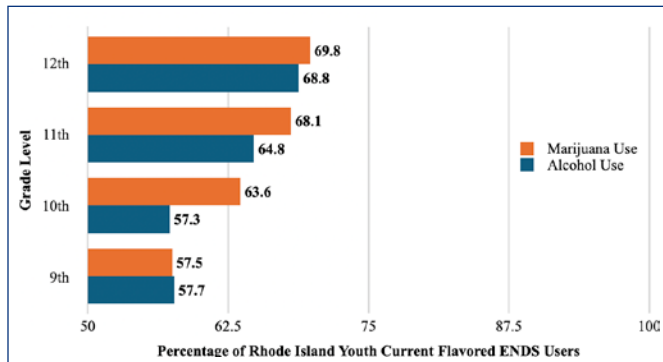
In a multivariable logistic regression model (**Table 2**), students experiencing poor mental health most of the time or always in the past 30 days (AOR 1.83; 95% CI: 1.44–2.32), and recent use of alcohol or marijuana (AOR 6.59; 95% CI 4.34–9.99; AOR 9.30; 95% CI 6.0–14.32; respectively) were positively associated with using flavored ENDS products, adjusted for all study variables. Students who reported being food insecure were five times as likely to use flavored ENDS products than students who were not food insecure (AOR 5.13; 95% CI 3.34–7.90) when controlling for all other variables. Students in 12th grade were 51% less likely to report using current flavored ENDS products than students in 9th grade (AOR 0.49; 95% CI: 0.25–0.98), and students who self-identified as LGBT (sexual gender minority) were 29% less likely to use flavored ENDS products than students who self-identified as heterosexual (AOR 0.7; 95% CI: 0.52–0.99).

**Table 1.** Current use of flavored ENDS products by selected characteristics of Rhode Island high school students, 2021–2023 combined Rhode Island Youth Risk Behavior Survey

Characteristics	Current Flavored ENDS Use	
	Yes N (%; 95% CI)	No N (%; 95% CI)
Overall	618 (15.6; 14.5, 16.7)	3,340 (84.4; 83.3, 85.5)
<b>Age</b>		
15 years old or younger	223 (34.5; 28.3–40.7)	1,440 (41.9; 36.6–47.2)
16 years old	152 (24.1; 19.2–28.9)	826 (24.7; 21.1–28.2)
17 years old	174 (28.1; 20.9–35.3)	766 (22.6; 17.4–27.8)
18 years old or older	69 (13.3; 9.7–17.0)*	302 (10.9; 8.3–13.5)
<b>Sex</b>		
Female	380 (62.0; 56.9–67.1)*	1,571 (47.6; 44.6–50.7)
Male	236 (38.0; 32.9–43.1)	1,741 (52.4; 49.3–55.4)
<b>Hispanic/Latino</b>		
Yes	220 (29.1; 20.2–38.0)*	1,231 (29.8; 19.8–39.7)
No	397 (70.9; 62.0–79.8)	2,099 (70.2; 60.3–80.2)
<b>Grade</b>		
9th grade	150 (23.0; 16.3–29.7)	1,002 (28.4; 21.9–34.8)
10th grade	147 (24.3; 16.6–31.9)	810 (25.6; 19.5–31.8)
11th grade	169 (25.0; 19.1–30.9)	851 (23.5; 17.2–29.7)
12th grade	148 (27.7; 19.9–35.6)	646 (22.5; 17.8–27.3)
<b>Sexual Gender Minority</b>		
Yes	236 (39.0; 31.7–46.4)	989 (29.9; 27.7–32.0)
No	371 (61.0; 53.6–68.3)*	2,261 (70.1; 68.0–72.3)
<b>Food insecure past 30 days</b>		
Most of the time or always	215 (36.8; 31.5–42.0)*	93 ( 2.8; 2.1–3.5)
Sometimes, rarely, or never	377 (63.2; 58.0–68.5)	3,072 (97.2; 96.5–97.9)
<b>Homeless past 30 days</b>		
Yes	58 (9.6; 7.0–12.2)*	83 (2.8; 1.5–4.1)
No	528 (90.4; 87.8–93.0)	3,101 (97.2; 95.9–98.6)
<b>Feel unsafe and not secure in your neighborhood*</b>		
Most of the time or always	153 (24.1; 17.3–30.8)*	552 (15.8; 11.1–20.6)
Sometimes, rarely, or never	438 (75.9; 69.2–82.7)	2,677 (84.2; 79.4–88.9)
<b>Alcohol use past 30 days</b>		
>= 1 days	330 (62.8; 55.7–69.8)*	299 ( 9.7; 7.7–11.7)
0 days	199 (37.2; 30.2–44.3)	2,862 (90.3; 88.3–92.3)
<b>Marijuana use past 30 days</b>		
>= 1 times	385 (66.2; 61.3–71.1)*	258 ( 8.2; 6.8–9.6)
0 times	208 (33.8; 28.9–38.7)	3,007 (91.8; 90.4–93.2)
<b>Mental health not good past 30 days</b>		
Most of the time or always	275 (47.5; 42.9–52.2)	792 (24.7; 23.2–26.3)
Sometimes, rarely, never	310 (52.5; 47.8–57.1)	2,369 (75.3; 73.7–76.8)

\* Significant differences for current flavored tobacco use (yes) based on non-overlapping 95% confidence intervals for population sub-groups. Sample sizes unweighted. Percentages weighted.

**Figure 1.** Polysubstance Use Among Current Flavored ENDS Users, YRBS 2021–2023



**Table 2.** Adjusted odds ratios for current flavored ENDS use

Characteristic	Adjusted OR (95% CI)
<b>Age</b>	
15 years old or younger	1.00 (ref)
16 years old	0.98 (0.70, 1.42)
17 years old	1.48 (1.05, 2.09)*
18 years old or older	1.80 (1.46, 2.23)*
<b>Grade</b>	
9th grade	1.00 (ref)
10th grade	0.93 (0.59, 1.47)
11th grade	0.69 (0.43, 1.12)
12th grade	0.49 (0.25, 0.98)*
<b>Sexual Gender Minority</b>	
Yes	0.71 (0.52, 0.99)*
No	1.00 (ref)
<b>Food insecure past 30 days</b>	
Most of the time or always	5.13 (3.34, 7.90)*
Sometimes, rarely, or never	1.00 (ref)
<b>Alcohol use past 30 days</b>	
>= 1 days	6.59 (4.34, 9.99)*
0 days	1.00 (ref)
<b>Marijuana use past 30 days</b>	
>= 1 times	9.30 (6.04, 14.32)*
0 times	1.00 (ref)
<b>Mental health not good past 30 days</b>	
Most of the time or always	1.83 (1.44, 2.32)*
Sometimes, rarely, never	1.00 (ref)

Other variables adjusted but not shown are sex, Hispanic/Latino, homeless past 30 days, feel unsafe and not secure in your neighborhood.

\*Results of the chi-squared test were statistically significant ( $p < 0.05$ )

## DISCUSSION

In this study, the finding that most Rhode Island youth who use ENDS products, use flavored products represents a significant public health concern. Youth who start with flavored tobacco products are more likely to use e-cigarettes more frequently, given the diversity in the types of products, brands, and flavors advertised and marketed to youth. This study examined potential predictors of flavored ENDS use to inform regulatory and prevention efforts. Our study is the first to examine food insecurity in relationship to flavored ENDS use in a statewide population of high school students. The intersection of food insecurity and tobacco use has been reported in other studies, particularly for cigarette use, but not for flavored tobacco use among youth.<sup>6</sup> Food insecurity, as well as factors such as substance use (alcohol and/or marijuana use) and poor mental health included in our study highlight the importance of a multi-faceted approach to addressing flavored ENDS use among high school students. Reducing flavored ENDS use will require a combination of mental health and substance use support, social supports, greater access to cessation services, targeted prevention strategies, and directed policy changes.

Schools can serve as a crucial starting point in preventing the use of flavored ENDS products among students as a significant portion of youth life occurs within the school setting and with their peers. Schools can use a variety of resources and programs to help students quit ENDS. In Rhode Island, youth can seek resources for quitting smoking or vaping through My Life, My Quit with their online program and live coaches.<sup>7</sup> This youth-focused tobacco cessation service provides free confidential counseling to help young people to quit tobacco and nicotine products. The program is designed for individuals of age 13 to 17 to have immediate access to support. Furthermore, according to the Centers for Disease Control and Prevention (CDC), counseling and education are the most effective approaches for tobacco and nicotine cessation among youth as punitive measures tend to exacerbate the problem. Implementing alternatives to suspension programs among students using tobacco and nicotine products at school helps to promote positive behavior change and decrease negative academic outcomes.<sup>8,9</sup>

Tobacco product restrictions and taxation are effective policy strategies for reducing tobacco use.<sup>10,11</sup> As of September 2024, eight states and 402 U.S. jurisdictions have enacted flavor policies.<sup>12</sup> Rhode Island's 2019 regulatory restrictions<sup>13</sup> on flavored ENDS products led to significant decreases in overall e-cigarette and flavored e-cigarette sales. According to the CDC Foundation, monthly ENDS total unit sales decreased 55.3% between October 2019 to September 2024 from 109,700 units to 49,000 and flavored ENDS sales decreased by 92.2% from 70,100 to 5,500. Monthly sales of flavored e-cigarettes rose slightly between September 2022 to

September 2024 from 96 units to 5,500.<sup>14</sup> Rhode Island codified its flavor regulations other than menthol and tobacco flavors, effective January 1, 2025, including a new excise tax on ENDS products.<sup>15</sup> These policies, along with ongoing support of education and enforcement, are promising efforts for reducing tobacco use, particularly among youth. Future efforts should focus on expanding flavor restrictions for all flavors and tobacco products and move towards tax parity across all tobacco products, complemented by coordinated prevention and cessation programming.<sup>3</sup>

The findings of our study have several limitations, importantly self-reported data that may have recall bias and social desirability bias. Another is that data are cross-sectional, and causality cannot be inferred from survey results. Nevertheless, the findings highlight the importance of the roles of schools, robust policy support with strong enforcement mechanisms, and connections to cessation services among youth in reducing flavored ENDS use.

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