RESEARCH LETTER

Trends in Reported Marijuana Vaping Among US Adolescents, 2017-2019

Adolescents who vape use portable devices with a heating element to aerosolize a liquid that they inhale. Nicotine use is most common, but tetrahydrocannabinol (the principal psychoactive constituent of marijuana) can also be vaped. Marijuana vaping produces significantly greater physiological and psychological effects compared with traditional smoking methods at the same tetrahydrocannabinol levels,[1] raising concerns about potential health effects. This study reports the prevalence of marijuana vaping for 2019 among US adolescents and the prevalence increases between 2017, 2018, and 2019.

Methods | Monitoring the Future[2] annually surveys nationally representative samples of 8th, 10th, and 12th graders between February and June. Each year schools from 368 randomly selected geographic units throughout the contiguous United States are sampled, with a school successfully recruited from 90% of these units for 2017, 2018, and 2019. Student participation rates were 88% among 8th graders, 86% among 10th graders, and 80% among 12th graders.

Analyses were based on the question "On how many days (if any) have you vaped marijuana" with the time periods of "during the last 30 days," "during the last 12 months," and "in your lifetime." In 2019, the word "days" in the stem question replaced the word "occasions," which was used in 2017 and 2018. In 2019 "near-daily" marijuana vaping was measured for the first time and indicated use on "20+ days" during the past

Table. Prevalence of Reported Marijuana Vaping by Grade and Year

	2017	2018	2019	Increase From 2017 to 2018	*P* Value	Increase From 2018 to 2019	*P* Value	Increase From 2017 to 2019[a]
Past 30 d								
No. of 8th graders[b]	4869	4465	8701					
Prevalence,% (95% CI)	1.6 (1.3-2.1)	2.6 (2.0-3.4)	3.9 (3.3-4.7)	1.0 (0.2-1.7)	.010	1.3 (0.4-2.2)	.006	2.3 (1.5-3.1)
No. of 10th graders[b]	4412	4666	9026					
Prevalence, % (95% CI)	4.3 (3.5-5.3)	7.0 (5.9-8.3)	12.6 (11.1-14.3)	2.7 (1.3-4.1)	<.001	5.6 (3.7-7.5)[c]	<.001	8.3 (6.5-10.1)
No. of 12th graders[b]	4073	4247	8314					
Prevalence, % (95% CI)	5.0 (4.1-6.0)	7.5 (6.2-8.9)	14.0 (12.6-15.5)	2.5 (1.0-4.0)	<.001	6.5 (4.7-8.4)[c]	<.001	9.0 (7.2-10.9)
Past 12 mo								
No. of 8th graders[b]	4878	4471	8701					
Prevalence, % (95% CI)	3.0 (2.5-3.7)	4.4 (3.6-5.4)	7.0 (6.0-8.2)	1.3 (0.3-2.3)	.009	2.6 (1.3-3.9)	<.001	4.0 (2.7-5.3)
No. of 10th graders[b]	4422	4671	9033					
Prevalence, % (95% CI)	8.1 (6.9-9.6)	12.4 (10.8-14.1)	19.4 (17.4-21.5)	4.2 (2.2-6.3)	<.001	7.0 (4.8-9.2)	<.001	11.3 (8.7-13.9)
No. of 12th graders[b]	4072	4253	8312					
Prevalence, % (95% CI)	9.5 (8.1-11.2)	13.1 (11.4-15.1)	20.8 (19.0-22.8)	3.6 (1.4-5.7)	<.001	7.7 (5.4-10.0)[c]	<.001	11.3 (8.7-13.9)
Lifetime								
No. of 8th graders[b]	4907	4507	8747					
Prevalence, % (95% CI)	4.0 (3.3-4.9)	5.5 (4.6-6.7)	9.0 (7.8-10.4)	1.5 (0.3-2.7)	.012	3.5 (2.0-5.0)	<.001	5.0 (3.5-6.5)
No. of 10th graders[b]	4449	4712	9068					
Prevalence, % (95% CI)	9.8 (8.5-11.4)	14.2 (12.6-16.0)	21.8 (19.8-24.0)	4.4 (2.3-6.5)	<.001	7.6 (5.3-9.9)	<.001	12.0 (9.4-14.6)
No. of 12th graders[b]	4104	4303	8365					
Prevalence, % (95% CI)	11.9 (10.2-13.8)	15.6 (13.9-17.6)	23.7 (21.7-25.9)	3.8 (1.5-6.0)	<.001	8.1 (5.7-10.5)[c]	<.001	11.8 (9.0-14.7)
Near Daily[d]								
No. of 8th graders[b]			8701					
Prevalence, % (95% CI)			0.8 (0.6-1.2)					
No. of 10th graders[b]			9026					
Prevalence, % (95% CI)			3.0 (2.3-4.0)					
No. of 12th graders[b]			8314					
Prevalence, % (95% CI)			3.5 (2.9-4.3)					

[a] *P* < .001 for all prevalence increases from 2017 to 2019.

[b] The sample sizes were unweighted.

[c] One-year prevalence increases from 2018 to 2019 were significantly larger (*P* < .05) than the increases from 2017 to 2018 for all 10th grade and 12th grade outcomes for past 30-day use.

[d] This was the first year near daily use was measured (near daily was defined as use on >20 days during the 30-day period).

30 days. A randomly selected two-thirds sample received the marijuana vaping questions in 2019, and a randomly selected one-third sample received the questions in 2017 and 2018.

Analyses used version 15.1 of Stata MP software (StataCorp) with *svy:* commands to take into account the weights, clustering, and strata of the complex sampling design.[3] Prevalence increases across adjacent years, as well as differences in magnitude of these increases during the study period, were tested for statistical significance with Wald tests using Stata's *lincom* command. Statistical significance was defined as $P < .05$ (2-sided).

The University of Michigan institutional review board approved the study. Informed consent (active or passive per school policy) was obtained from the parents for students who were younger than 18 years and from the students who were aged 18 years or older.

Results | The number of students randomly selected to receive the marijuana vaping questions was 14 560 of 43 703 in 2017, 14 857 of 44 482 in 2018, and 28 346 of 42 531 in 2019.

In 2019, past 30-day prevalence of marijuana vaping was reported by 3.9% (95% CI, 3.3%-4.7%) of 8th graders, 12.6% (95% CI, 11.1%-14.3%) of 10th graders, and 14.0% (95% CI, 12.6%-15.5%) of 12th graders (**Table**).

Reported past 30-day prevalence levels significantly increased from 2018 to 2019. The absolute increases were 1.3% (95% CI, 0.4%-2.2%; $P = .006$) in 8th graders, 5.6% (95% CI, 3.7%-7.5%; $P < .001$) in 10th graders, and 6.5% (95% CI, 4.7%-8.4%; $P < .001$) in 12th graders. Among 12th graders, this increase was significantly larger than the increase from 2017 to 2018 by an absolute difference of 4.0% (ie, 6.5% − 2.5% [95% CI, 1.3%-6.8%]; $P = .004$). Among 10th graders, the increase was by 2.9% (ie, 5.6% − 2.7% [95% CI, 0.1%-5.7%]; $P = .04$).

Results were similar for use during the past 12 months and lifetime use. Prevalence increases in every year were statistically significant for all grades. For all reporting intervals, the prevalence increases among 12th graders were larger from 2018 to 2019 than from 2017 to 2018 (Table).

In 2019, near daily marijuana vaping was reported by 0.8% (95% CI, 0.6%-1.2%) of 8th graders, 3.0% (95% CI, 2.3%-4.0%) of 10th graders, and 3.5% (95% CI, 2.9%-4.3%) of 12th graders (Table).

Discussion | Reported adolescent marijuana vaping increased from 2018 to 2019. The absolute increases from 2018 to 2019 among 12th graders for past 30-day use are the second largest, single-year increases ever tracked by Monitoring the Future for any substance in its 45-year history (increased nicotine vaping from 2017 to 2018 ranks first).[2]

Study limitations include potential for reporting error and the absence of high-school dropouts.

As the number of adolescents who vape marijuana increases, so too does the scope and effect of any associated health consequences, which may include lung injury when using black market formulations.[4] The rapid rise of marijuana vaping indicates the need for new prevention and intervention efforts aimed specifically at adolescents.

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