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Trends in Adolescent Vaping, 2017–2019

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To the Editor:

The rapid increase in adolescents’ use of electronic cigarettes (known as vaping) during the past decade has aroused public health concern,¹ recently heightened by potential links between vaping and acute lung injury.² Adolescents who vape use a device such as an e-cigarette to inhale a heated aerosol that typically contains nicotine. We assessed whether adolescents’ vaping of nicotine continued to increase from 2018 to 2019, after the previous year’s record increase, the largest for any substance tracked by Monitoring the Future over the past 44 years.¹

Monitoring the Future surveys nationally representative samples of 12th-, 10th-, and 8th-grade students annually.³ The project surveyed 43,703 respondents in 2017, 44,482 in 2018, and 42,531 in 2019. Overall response rates for these 3 years were 80% in 12th grade, 86% in 10th grade, and 88% in 8th grade, with most nonresponses due to students’ absence. Analyses are based on responses from participants who received questions on nicotine vaping (a randomly selected subset, one third of the total sample for that year). (Additional details on methods are provided in the Supplementary Appendix, available with the full text of this letter at [NEJM.org](https://www.nejm.org).)

Table 1 shows significant increases in 30-day nicotine vaping in samples at each of the three grade levels from 2018 to 2019. As a result of these (and previously reported¹) annual increases, vaping prevalence more than doubled in each of the three grades from 2017 to 2019. In 2019, the prevalence of use during the previous 30 days was more than 1 in 4 students in the 12th grade, more than 1 in 5 in the 10th grade, and more than 1 in 11 in the 8th grade. Students who had vaped nicotine during the previous 12 months and those who had ever vaped nicotine also significantly increased in each grade from 2018 to 2019.

Table 1 also shows the prevalence of daily nicotine vaping, which was defined as nicotine vaping on at least 20 days during the previous 30 days. These levels were 12%, 7%, and 2% in 12th, 10th, and 8th grade, respectively.

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Current efforts by the vaping industry, government agencies, and schools have thus far proved insufficient to stop the rapid spread of nicotine vaping among adolescents. Of particular concern are the accompanying increases in the proportions of youth who are physically addicted to nicotine, an addiction that is very difficult to overcome once established. The substantial levels of daily vaping suggest the development of nicotine addiction. New efforts are needed to protect youth from using nicotine during adolescence, when the developing brain is particularly susceptible to permanent changes from nicotine use⁴ and when almost all nicotine addiction is established.⁵

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Miech R, Johnston L, O'Malley PM, Bachman JG, Patrick ME. Adolescent vaping and nicotine use in 2017–2018 — U.S. National Estimates. *N Engl J Med* 2019;380:192–3. [PubMed: 30554549]
2. Layden JE, Ghinai I, Pray I, et al. Pulmonary illness related to e-cigarette use in Illinois and Wisconsin — preliminary report. *N Engl J Med*. 10.1056/NEJMoa1911614.
3. Miech RA, Johnston L, O'Malley PM, Bachman JG, Schulenberg JE, Patrick ME. Monitoring the Future national survey results on drug use, 1975–2018: volume I, secondary school students. Ann Arbor: Institute for Social Research, University of Michigan, 2019 (http://monitoringthefuture.org/pubs/monographs/mtf-vol1_2018.pdf).
4. Yuan M, Cross SJ, Loughlin SE, Leslie FM. Nicotine and the adolescent brain. *J Physiol* 2015;593:3397–412. [PubMed: 26018031]
5. Department of Health and Human Services. The health consequences of smoking — 50 years of progress: a report of the surgeon general. US Department of Health and Human Services; 2014: Citeseer (https://www.ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf).

Table 1.

Prevalence of Nicotine Vaping among Adolescents, 2017–2019.*

Reporting Interval and Grade in School	Prevalence in 2017 (95% CI)	Prevalence in 2018 (95% CI)	Prevalence in 2019 (95% CI)	Change, 2018 to 2019 (95% CI) [†]
Past 30 days				
12th grade	11.0 (9.2–13.0)	20.9 (17.7–24.5)	25.4 (22.6–28.4)	4.5 (0.9–8.1)
10th grade	8.2 (6.6–10.2)	16.1 (14.0–18.6)	20.2 (17.8–22.8)	4.1 (0.9–7.2)
8th grade	3.5 (2.9–4.2)	6.1 (5.1–7.4)	9.0 (7.6–10.5)	2.8 (1.2–4.4)
Past 12 months				
12th grade	18.8 (16.5–21.4)	29.7 (26.1–33.6)	35.1 (31.8–38.6)	5.4 (1.1–9.6)
10th grade	15.8 (13.6–18.3)	24.7 (21.9–27.7)	31.1 (28.3–34.0)	6.4 (2.7–10.1)
8th grade	7.5 (6.6–8.5)	10.9 (9.4–12.6)	16.1 (14.1–18.2)	5.2 (2.8–7.6)
Ever				
12th grade	25.0 (22.4–27.7)	34.0 (30.3–38.0)	40.5 (37.3–43.8)	6.5 (2.3–10.7)
10th grade	21.4 (19.2–23.9)	28.6 (25.8–31.6)	36.4 (33.5–39.4)	7.7 (4.0–11.5)
8th grade	10.6 (9.5–11.8)	13.5 (11.8–15.3)	20.7 (18.5–23.1)	7.2 (4.6–9.9)
Daily [‡]				
12th grade	—	—	11.7 (9.8–14.0)	—
10th grade	—	—	6.9 (5.7–8.0)	—
8th grade	—	—	1.9 (1.4–2.5)	—

* In all years, increases in prevalence are significant at $P < 0.05$. The 95% confidence intervals (CI) have not been adjusted for multiple comparisons. Unweighted sample sizes vary slightly by outcome. In 12th grade, the range is from 4077 to 4310; in 10th grade, from 4420 to 4721; and in 8th grade, from 4382 to 4909. (For trends in cigarette smoking during the previous 30 days in 2018–2019, see the Supplementary Appendix.)

[†] Values may differ slightly from the difference between the 2019 and 2018 estimates because of rounding.

[‡] Daily nicotine vaping was defined as vaping nicotine on 20 or more of the previous 30 days and was first assessed in 2019.