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Adults' E-Cigarette Flavor Use and Cigarette Quit Attempts: Population Assessment of Tobacco and Health (PATH) Study Findings

Karin A. Kasza, PhD¹, Kathryn C. Edwards, PhD², Shannon Gravely, PhD³, Blair Coleman, PhD⁴, Heather Kimmel, PhD⁵, Colm Everard, PhD^{5,6}, Maciej L. Goniewicz, PhD, PharmD¹, Geoffrey T. Fong, PhD^{3,7,8}, Andrew Hyland, PhD¹

¹Department of Health Behavior, Roswell Park Comprehensive Cancer Center, Buffalo, New York

²Behavioral Health and Health Policy Practice, Westat Inc, Rockville, Maryland ³Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada ⁴Office of Science, Center for Tobacco Products, U.S. Food and Drug Administration, Beltsville, Maryland ⁵National Institute on Drug Abuse, National Institutes of Health, Bethesda, Maryland ⁶Kelly Government Solutions, Rockville, Maryland ⁷School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, Canada ⁸Ontario Institute for Cancer Research, Toronto, Ontario, Canada

INTRODUCTION

Prevalence of use of e-cigarettes among youth¹ and adults² in the U.S. continues to rise, and flavored tobacco product use is associated with initiation and subsequent use of tobacco products.³ However, little data exist on whether flavored e-cigarettes are associated with cigarette-cessation behaviors,⁴ including attempting to quit cigarette smoking and quit success among those who attempt to quit,⁵ though Buu et al.⁶ found that, among exclusive cigarette smokers, using flavored e-cigarettes 1 year later was associated with lower quantity of cigarette smoking. This study uses U.S. nationally representative data from the Population Assessment of Tobacco and Health (PATH) Study to report on e-cigarette flavor use among adult past 30-day dual users of e-cigarettes and cigarettes, and to longitudinally evaluate the relationship between flavor use and attempting to quit cigarette smoking approximately 1 year later.

Address correspondence to: Karin A. Kasza, PhD, Department of Health Behavior, Roswell Park Comprehensive Cancer Center, Elm and Carlton Streets, Buffalo NY 14263. karin.kasza@roswellpark.org.

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METHODS

Participants

The PATH Study is an ongoing, nationally representative, cohort study of adults and youth in the U.S. Data were collected October 2015–October 2016 (Wave 3) and December 2016–January 2018 (Wave 4) using audio computer-assisted self-interviews administered in English or Spanish. The PATH Study was conducted by Westat and approved by the Westat IRB. Respondents aged 18 years provided informed consent. Details on the PATH Study design are published elsewhere⁷ and access to the data is available at <https://doi.org/10.3886/Series606>.⁸ The authors analyzed restricted use data from adults who smoked cigarettes and used e-cigarettes (dual users) at least once in the past 30 days in 2015–2016 and had follow-up data in 2016–2017 ($n=1,529$; interview interval, approximately 1 year).

Measures

In 2015–2016, regular/last e-cigarette flavor use was categorized into: (1) only tobacco; (2) only menthol/mint; (3) only non-tobacco, non-menthol/mint^a; and (4) any combination of tobacco, menthol/mint, or other flavor. In 2016–2017, attempting to quit cigarette smoking was defined as having tried to quit completely in the past 12 months or currently not smoking cigarettes at all. Further details on these and other measures are provided in Table 1.

Statistical Analysis

Among adult dual users, prevalence of e-cigarette flavor use was determined in 2015–2016, and rates of attempting to quit cigarette smoking in the past 12 months were determined in 2016–2017 for each e-cigarette flavor use category. Logistic regression analysis was used to evaluate the association between flavor use and attempting to quit, adjusting for demographics, cigarette smoking frequency, e-cigarette use frequency, and e-cigarette device type. Analyses were weighted to produce nationally representative estimates and CIs were computed using the balanced repeated replication method⁹ with Fay's adjustment set to 0.30.¹⁰ Stata, version 15 was used. Analyses were conducted in 2019–2020.

RESULTS

Findings reflect the behavior of 8.1 million (95% CI=7.6, 8.6 million) adult dual users in the U.S. Approximately half (4.0 million, 95% CI=3.6, 4.4 million) used only non-tobacco, non-menthol/mint flavor e-cigarettes (Table 1). There were no statistically significant differences in rates of attempting to quit cigarette smoking as a function of e-cigarette flavor use.

DISCUSSION

E-cigarette flavor use among adult dual users in the U.S. does not appear to be associated with attempting to quit cigarette smoking, though use of non-tobacco, non-menthol/mint flavor e-cigarettes, particularly fruit/candy/desserts/other sweets flavors, is most prevalent

^aFor category (3), the subset of those who used only *fruit or candy, desserts, other sweets* was also considered.

among adult dual users. Study limitations include not assessing flavor use at the time of the quit attempt. Future research can examine stability of e-cigarette flavor use, and whether flavor use is associated with cigarette quit success among quit attempters.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of HHS or any of its affiliated institutions or agencies.

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REFERENCES

1. Cullen KA, Gentzke AS, Sawdey MD, et al. E-cigarette use among youth in the United States. *JAMA*. 2019;322(21):2095–2103. 10.1001/jama.2019.18387.
2. Creamer MR, Wang TW, Babb S, et al. Tobacco product use and cessation indicators among adults - United States, 2018. *MMWR Morb Mortal Wkly Rep*. 2019;68(45):1013–1019. 10.15585/mmwr.mm6845a2.
3. Villanti AC, Johnson AL, Glasser AM, et al. Association of flavored tobacco use with tobacco initiation and subsequent use among US youth and adults, 2013–2015. *JAMA Netw Open*. 2019;2(10):e1913804 10.1001/jamanetworkopen.2019.13804. [PubMed: 31642927]
4. National Academies of Sciences Engineering and Medicine. Public health consequences of e-cigarettes. Washington, DC: The National Academies Press; 2018 10.17226/24952.
5. Kasza KA, Edwards KC, Tang Z, et al. Correlates of tobacco product cessation among youth and adults in the United States: findings from the PATH Study Waves 1–3 (2013–2016). *Tob Control*. 2020;29(suppl 3):s203–s215. 10.1136/tobaccocontrol-2019-055255. [PubMed: 32321854]
6. Buu A, Hu Y-H, Piper ME, et al. The association between e-cigarette use characteristics and combustible cigarette consumption and dependence symptoms: results from a national longitudinal study. *Addict Behav*. 2018;84:69–74. 10.1016/j.addbeh.2018.03.035. [PubMed: 29627636]
7. Hyland A, Ambrose BK, Conway KP, et al. Design and methods of the Population Assessment of Tobacco and Health (PATH) Study. *Tob Control*. 2017;26(4):371–378. 10.1136/tobaccocontrol-2016-052934. [PubMed: 27507901]
8. PATH Study series page. National Addiction & HIV Data Archive Program. 10.3886/Series606.
9. McCarthy PJ. Pseudoreplication: further evaluation and applications of the balanced half-sample technique. *Vital Health Stat* 2. 1969;(31):1–24.
10. Judkins DR. Fay's method for variance estimation. *J Off Stat*. 1990;6(3):223–229.

Table 1.

E-cigarette Flavor Use and Attempting to Quit Cigarette Smoking Among U.S. Adult Dual Users

Adult dual users ^a in 2015/2016	Attempted to quit cigarette smoking completely in the past 12 months, assessed in 2016/2017 ^e		
	% (95% CI)	AOR ^f (95% CI)	p-value
E-cigarette flavor use ^b			
Only tobacco flavor (n=337, 25% of dual users)	42.6 (37.0, 48.4)	ref	
Only menthol/mint flavor (n=246, 16% of dual users)	41.3 (34.8, 48.1)	0.9 (0.6, 1.4)	0.784
Only non-tobacco, non-menthol/mint flavor(s) ^c (n=784, 49% of dual users)	45.8 (41.2, 50.4)	1.0 (0.7, 1.4)	0.872
Any combination of tobacco, menthol/mint, or other flavor(s) ^d (n=162, 10% of dual users)	49.2 (39.8, 58.6)	1.3 (0.8, 2.0)	0.297
Overall (n=1,529)	44.6 (41.8, 47.4)	–	–

Notes: %, AOR, and 95% CIs are weighted; sample sizes are unweighted; average interview interval between 2015/2016 and 2016/2017 was 1 year.

^aDual users were defined as those who smoked a cigarette and used an e-cigarette product (including e-cigarettes, vape pens, personal vaporizers and mods, e-cigs, e-pipes, e-hookahs and hookah pens) at least once in the past 30 days, and smoked at least 100 cigarettes in lifetime.

^bRespondents who had used an e-cigarette product in the past 30 days were asked: *What flavor is [your regular brand/the brand you last used]*?* Choose all that apply. Response options: *tobacco-flavored, menthol or mint, clove or spice, fruit, chocolate, an alcoholic drink (such as wine, cognac, margarita or other cocktails), a non-alcoholic drink (such as coffee, soda, energy drinks, or other beverages), candy, desserts, or other sweets, some other flavor.* E-cigarette flavor(s) used were categorized into 4 mutually exclusive groups: (1) tobacco-flavor only, (2) menthol/mint-flavor only, (3) non-tobacco, non-menthol/mint flavor(s) only, and (4) any combination of tobacco, menthol/mint, other flavor(s). *Those who reported having a regular brand were asked about flavor of regular brand; those who did not have a regular brand were asked about flavor of brand last used.

^cOnly non-tobacco, non-menthol/mint flavor includes clove or spice; fruit; chocolate; an alcoholic drink (such as wine, cognac, margarita or other cocktails); a non-alcoholic drink (such as coffee, soda, energy drinks, or other beverages); candy, desserts, or other sweets; some other flavor. The majority (89%) of those who use only non-tobacco, non-menthol/mint flavor use fruit and/or candy, desserts, other sweets. Among those who used only fruit and/or candy, desserts, other sweets, prevalence of making a quit attempt was 46.7% (95% CI: 41.6, 51.9) and logistic regression analysis comparing this group to the only tobacco flavor group yielded AOR=1.0 (95% CI=0.7, 1.4).

^dAny combination of tobacco flavor, menthol/mint flavor, or other flavor(s) has the following distribution: 47% only menthol/mint flavor+non-tobacco flavor(s), 28% only tobacco flavor+non-menthol/mint flavor(s), 12% only tobacco flavor+menthol/mint flavor, 13% tobacco flavor +menthol/mint flavor+other flavor(s). The prevalence of making a quit attempt among those who used only menthol/mint flavor+non-tobacco flavor(s) was 43.7% (95% CI: 30.7, 57.6) and the prevalence of making a quit attempt among the rest of the combination group was 54.1% (95% CI: 42.0, 65.6).

^eAt follow-up in 2016/2017, respondents were asked whether they now smoke cigarettes every day, some days, or not at all. Those who were dual users in 2015/2016 and reported smoking cigarettes *not at all* in 2016/2017 were not asked about having made a cigarette quit attempt in 2016/2017 but were coded as having attempted to quit cigarette smoking completely in the past 12 months since they were no longer smoking cigarettes at all. Those who were dual users in 2015/2016 and reported smoking cigarettes *every day or some days* in 2016/2017 were asked: *In the past 12 months, have you tried to quit [cigarettes/tobacco] completely?* Those who ever used at least one other non-e-cigarette tobacco product *fairly regularly* and currently use it every day or some days were asked in reference to trying to quit *tobacco* rather than in reference to trying to quit *cigarettes*. All those who responded yes to having tried to quit cigarettes/tobacco completely were coded as having attempted to quit cigarette smoking completely in the past 12 months.

^fAdjusted for age group (18–24, 25–39, 40–54, 55 years); sex (male, female), race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic other (includes two or more races), Hispanic, not reported); sexual orientation (heterosexual, other/not reported); frequency of cigarette smoking (nondaily, daily); frequency of e-cigarette use (nondaily, daily); e-cigarette device type (disposable (i.e., not rechargeable), closed (i.e., rechargeable and uses cartridges), open (i.e., rechargeable, does not use cartridges, and refillable), not reported). All covariates assessed in 2015/2016.