

Flavoring Patterns of Exclusive and Dual-Use of Cigarettes and E-Cigarettes Among US Adults: Results from the TUS-CPS 2018-2019

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Abstract

Purpose: To describe patterns of menthol/non-menthol cigarettes with flavored e-cigarettes (tobacco, menthol, sweet/spicy, and other flavorings) use.

Design: We used cross-sectional data from the 2018-2019 Tobacco Use Supplement to the Current Population Survey (TUS-CPS).

Setting: United States.

Subjects: Adults over 18 years old.

Sample: A nationally representative sample (n = 135 329).

Measures: We generated a 15-category variable of all combinations of cigarette and e-cigarette flavoring use.

Analysis: We estimated population prevalence (PP) for the 15-category flavored cigarette and e-cigarette use variable and proportion of flavored cigarette and e-cigarette use among adults who used cigarettes or e-cigarettes (PAU) by age, sex, race/ethnicity, and income.

Results: Exclusive menthol cigarette use was higher among NH Black (PP = 8.79%, PAU = 68.96%) and low-income (PP = 4.86%, PAU = 29.09%) compared to NH White (PP = 2.63%, PAU = 18.83%) and high-income participants (PP = 1.25%, PAU = 19.02%). Exclusive sweet/spicy e-cigarette use (PP = 1.32%, PAU = 10.22%) and exclusive menthol e-cigarette use (PP = .95%, PAU = 7.40%) was higher in younger (18-34) vs older (35+) adults (PP = .34% and PAU = 2.76%, and PP = .14%, PAU = 1.11%, respectively). Older dual users tended to combine the same flavor in both products (eg, menthol cigarettes + menthol e-cigarettes), while younger adults were more likely to combine menthol and non-menthol cigarettes with sweet/spicy e-cigarettes.

Conclusion: Findings suggest that a menthol cigarette ban might be most effective in conjunction with sweet/spicy e-cigarette flavor restrictions, given these flavors are attractive for younger adults.

Keywords

tobacco control, population health, patterns of tobacco use, flavored tobacco products, health disparities

Purpose

Since 2009, the sale, marketing, and distribution of flavored cigarettes have been banned in the US. However, menthol cigarettes are exempt from this prohibition.¹ Previous studies found Non-Hispanic (NH) Black adults, young adults, adolescents, and females use menthol cigarettes at higher rates than their counterparts.²⁻⁴ Recent research concluded that a ban on menthol cigarettes would promote smoking cessation, reduce smoking initiation,⁵ and result in considerable reductions in smoking-related mortality and disparities.⁶

However, the emergence of e-cigarettes, with a wide variety of flavors, complicates flavoring regulations and the potential switching to other tobacco products under a menthol

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cigarette ban (i.e., substitutability or complementary).⁷ To our knowledge, there are no studies describing joint patterns of use of specific flavors of e-cigarettes and cigarettes among US adults. This study explores patterns of use of menthol/non-menthol cigarettes with flavored e-cigarettes (tobacco, menthol, sweet/spicy, and other flavorings) among US adults, including differences by age, sex, race/ethnicity, and income.

Methods

Data and Study Design

We analyzed data from the 2018-2019 Tobacco Use Supplement to the Current Population Survey (TUS-CPS), which collects data on the US adult (18 years and older) civilian, non-institutionalized population to monitor tobacco use and evaluate tobacco control policies.⁸ Of the 137 471 respondents, we excluded 2142 who had missing information on cigarettes, e-cigarettes, or covariates (1.6%), resulting in an analytic sample of 135 329.

Measurements

We defined current cigarette use as established (smoked 100 or more cigarettes in lifetime) every day or some day use and e-cigarette use as every day or some day use. With the question “Do you usually smoke menthol or non-menthol cigarettes?” we separated menthol from non-menthol use (including responses of “no usual type” as non-menthol). We classified e-cigarette flavors into four categories: menthol/mint, tobacco, sweet/spicy, and other flavors, using the following questions: “When you use an e-cigarette, is it usually menthol or mint-flavored? Or tobacco flavored? Or flavored like clove, spice, herb, fruit, alcohol, candy, sweets, or chocolate? Or some other type of flavor?” Because some respondents used more than one flavor, we used hierarchical coding to classify them into a single group to examine the proportion using flavoring most relevant to tobacco control policies. More details are provided in [Appendix 1](#).

We combined menthol/non-menthol cigarette use with flavored (menthol, tobacco, sweet/spicy, and other) e-cigarette use to generate a mutually exclusive 15-category variable of flavoring combinations for exclusive and dual use of cigarettes and e-cigarettes. The variable included cigarette and e-cigarette non-use, six categories of exclusive use; four categories of dual use of menthol cigarettes with each flavor of e-cigarettes; and four categories of dual use of non-menthol cigarettes with each flavor of e-cigarettes.

Sociodemographic variables. We split age into two groups (18-34, 35 years and over), similar to age groupings in prior tobacco flavoring research,⁹ to differentiate flavoring preferences between younger and older adults. We also examined differences in tobacco use patterns by sex (female, male), race/ethnicity (NH White, NH Black, NH Other, Hispanic), and

annual household income (<\$50 000 (low income), \$50,000-\$99,999 (medium income), \$100,000+ (high income)).

Analysis

We estimated population prevalence for the 15-category flavored cigarette and e-cigarette use variable, as well as proportion of flavored cigarette and e-cigarette use among adults who used these products, by sociodemographic group. To adjust for the sample design, we conducted analyses using the balanced repeated replication method with Fay’s adjustment set to .4. We used 95% confidence intervals to assess statistical differences in prevalence estimates across sociodemographic strata. Statistical analyses were conducted using Stata V.16.

Results

Approximately 30% of the sample were aged 18-34 years, 52% were female, 63% were NH White, and 42% had an annual household income lower than \$50,000 ([Table 1](#)). The prevalence of exclusive or dual use of cigarettes and e-cigarettes was 11.60% and .90%, respectively. The most common use pattern was exclusive non-menthol cigarette use (6.90%), followed by exclusive menthol cigarette use (3.28%). Less than 1% reported each other flavoring pattern.

The population prevalence (PP) of exclusive use of either product (e-cigarettes or cigarettes) was similar for groups aged 18-34 (11.52%), and 35 years and over (11.62%), but the proportion of exclusive use among users (PAU) was higher for adults 35 years and over (94.4%) than adults 18-34 years (89.2%) ([Figure 1](#), [Supplemental Tables 1-2](#)). Patterns of exclusive flavored product use varied by age group ([Figure 1](#), [Supplemental Tables 1-2](#)). Exclusive non-menthol cigarette use was higher for adults 35 years and over vs adults 18-34 years (PP = 7.64% vs 5.16%, PAU = 62.08% vs 39.95%). Conversely, exclusive sweet/spicy e-cigarette use and exclusive menthol e-cigarette use was lower in adults 35 years and over than in 18-34 year-old adults. Dual use was lower among adults 35 years and over vs. adults 18-34 years old (PP = .62% vs. 1.39%, PAU 5.62% vs. 10.77%). The most common dual use combination was non-menthol cigarettes with tobacco e-cigarettes (PP = .23%, PAU = 1.89%) among adults aged 35 and over and non-menthol cigarettes with sweet/spicy e-cigarettes among adults aged 18-34 (PP = .42%, PAU = 3.27%).

Exclusive menthol cigarette use was higher among NH Black adults (PP = 8.79%, PAU = 68.96%) than NH White adults (PP = 2.63%, PAU = 18.83; [Figure 3](#), [Supplemental Tables 5-6](#)). Conversely, exclusive non-menthol cigarette use and dual use of non-menthol cigarettes and tobacco e-cigarettes was higher among NH White vs. NH Black adults. Additional results by race/ethnicity, as well as sex and income, can be found in [Figures 2-4](#) and [supplemental Tables 3-8](#).

Table 1. Sample characteristics for the Tobacco Use Supplement to the Current Population Assessment of Tobacco and Health (2018-19).

	TUC-CPS (n = 135 329)			
	95 CI			
	n	%	LB	UB
Age group				
18-34	28917	29.83	29.80	29.86
35+	106412	70.17	70.14	70.20
Sex				
Male	61419	48.12	48.05	48.20
Female	73910	51.88	51.80	51.95
Race/ethnicity				
Non-Hispanic White	98760	63.11	63.03	63.19
Non-Hispanic Black	12809	11.78	11.72	11.85
Hispanic	14692	16.53	16.47	16.60
Non-Hispanic other	9068	8.57	8.51	8.64
Household income level				
<\$50,000	58559	41.62	41.29	41.94
\$50,000-\$99,000	42504	31.28	31.01	31.55
\$100,000+	34266	27.11	26.76	27.45
Prevalence and flavoring patterns of exclusive and dual-use				
No current use of cigarettes or e-cigarettes	117791	87.51	87.40	87.71
Exclusive use of cigarettes or e-cigarettes	16380	11.60	11.40	11.80
Exclusive menthol cigarette use	4329	3.28	3.20	3.38
Exclusive non-menthol cigarette use	10462	6.90	6.75	7.05
Exclusive menthol e-cigarette use	380	.38	.34	.43
Exclusive tobacco e-cigarette use	357	.28	.25	.31
Exclusive sweet/spicy e-cigarette use	723	.63	.58	.69
Exclusive other e-cigarette flavor use	129	.11	.09	.13
Dual use of cigarettes and e-cigarettes	1158	.90	.85	.10
Menthol cigarettes and menthol e-cigarettes	188	.16	.14	.19
Menthol cigarettes and tobacco e-cigarettes	33	.02	.01	.03
Menthol cigarettes and sweet/spicy e-cigarettes	110	.10	.08	.13
Menthol cigarettes and other e-cigarettes flavors	25	.02	.02	.04
Non-menthol cigarettes and menthol e-cigarettes	67	.07	.05	.09
Non-menthol cigarettes and tobacco e-cigarettes	331	.23	.21	.26
Non-menthol cigarettes and sweet/spicy e-cigarettes	316	.24	.21	.27
Non-menthol cigarettes and other e-cigarettes flavors	88	.06	.04	.07

n = unweighted sample size, % weighted percentage. LB = Lower Bound; UB = Upper Bound.

Discussion

We found that the prevalence of exclusive sweet/spicy e-cigarette use and exclusive menthol e-cigarette use was higher among young adults (18-34 years) and that flavor preference among dual users differed by age. Young adults were more likely to combine non-menthol or menthol cigarettes with sweet/spicy e-cigarettes, while adults 35 years and over tended to use menthol cigarettes with menthol e-cigarettes or non-menthol cigarettes with tobacco-flavored e-cigarettes. Our results highlight that menthol cigarette use continues to disproportionately affect Black Americans and young adults.^{2,3} The higher prevalence and proportion of sweet/spicy e-cigarette exclusive and dual use among young

adults confirms previous studies that found that sweet/spicy flavors are attractive to youth and young adults and are associated with nicotine product initiation.¹⁰⁻¹²

The FDA is taking regulatory action regarding e-cigarettes and flavored e-cigarettes. FDA requires that all e-cigarette producers submit a premarket tobacco product application (PMTA) in which they must show that their approval is appropriate for the protection of public health.¹³ In February 2020, the FDA initiated enforcement against some e-cigarette products in the market, prioritizing enforcement vs. cartridge-based flavored e-cigarettes (other than menthol or tobacco flavored) because of their popularity among youth.¹⁴ The FDA also started reviewing e-cigarette PMTA applications in 2020

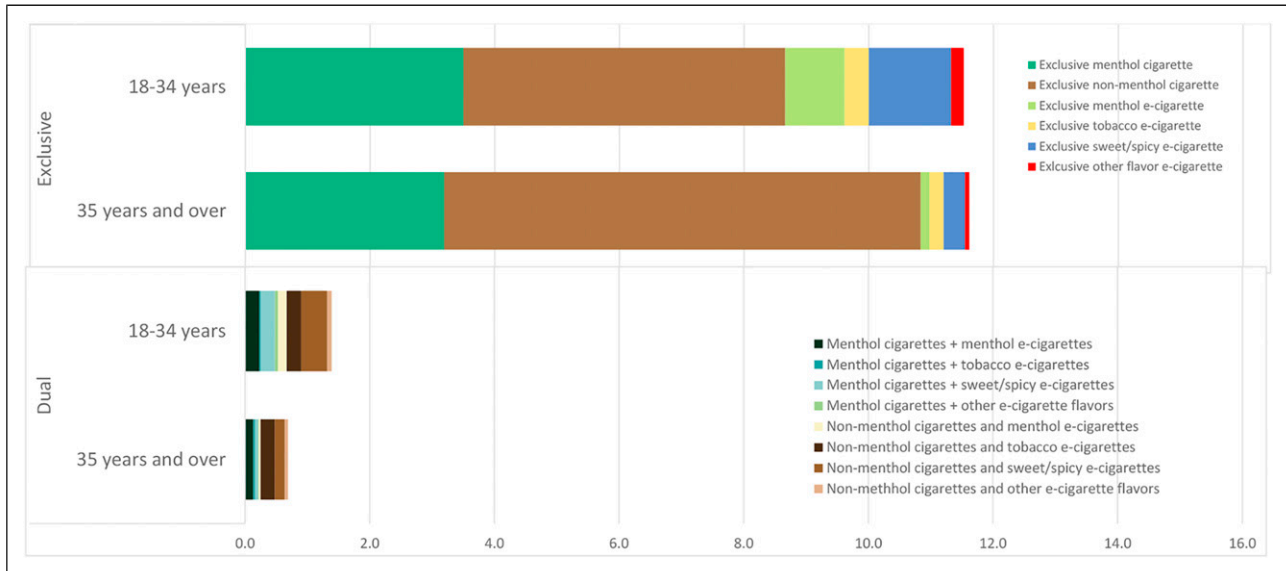


Figure 1. Patterns of exclusive and dual use of cigarettes and e-cigarettes among U.S. adults by groups of age. TUS-CPS 2018-19 (Population prevalence)

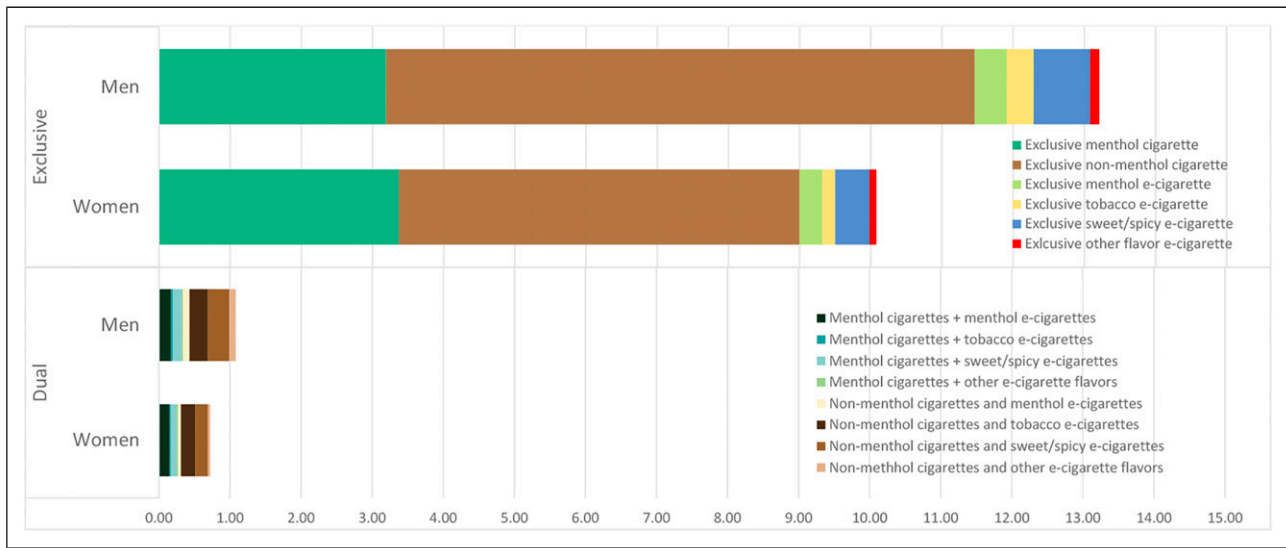


Figure 2. Patterns of exclusive and dual use of cigarettes and e-cigarettes among U.S. adults by sex. TUS-CPS 2018-19 (Population Prevalence).

and to date, has only approved three tobacco-flavored e-cigarettes, denying or rejecting over six million e-cigarette applications.¹³ An emerging challenge in this process is the rapid increase in the use of e-cigarette products using synthetic nicotine, such as Puff Bar, which some companies claim fall out [Table 1](#) side the FDA’s tobacco product regulatory scope.¹⁵ At this point, these products remain in the market, with some producers switching from tobacco-derived to synthetic nicotine with the intent to avoid FDA regulatory action.¹⁶

In this context, our findings that younger e-cigarette users prefer sweet/spicy flavors and that older dual users prefer to combine the same flavor in both products, suggests that a ban on

menthol cigarettes could be more effective if it is applied in conjunction with regulations that restrict access to sweet/spicy e-cigarette flavors, including e-cigarettes that use synthetic nicotine, while maintaining menthol/mint and tobacco e-cigarettes available as an alternative.¹¹ Given that users aged 35 and over tended to use the same flavor in cigarettes and e-cigarettes, it is possible that adults who smoke cigarettes and are trying to quit prefer e-cigarettes with the same flavor as their cigarettes (menthol or tobacco) as a cessation tool. These patterns of use could be particularly relevant for groups in which menthol cigarettes use is disproportionately high. For instance, although dual use is relatively low among

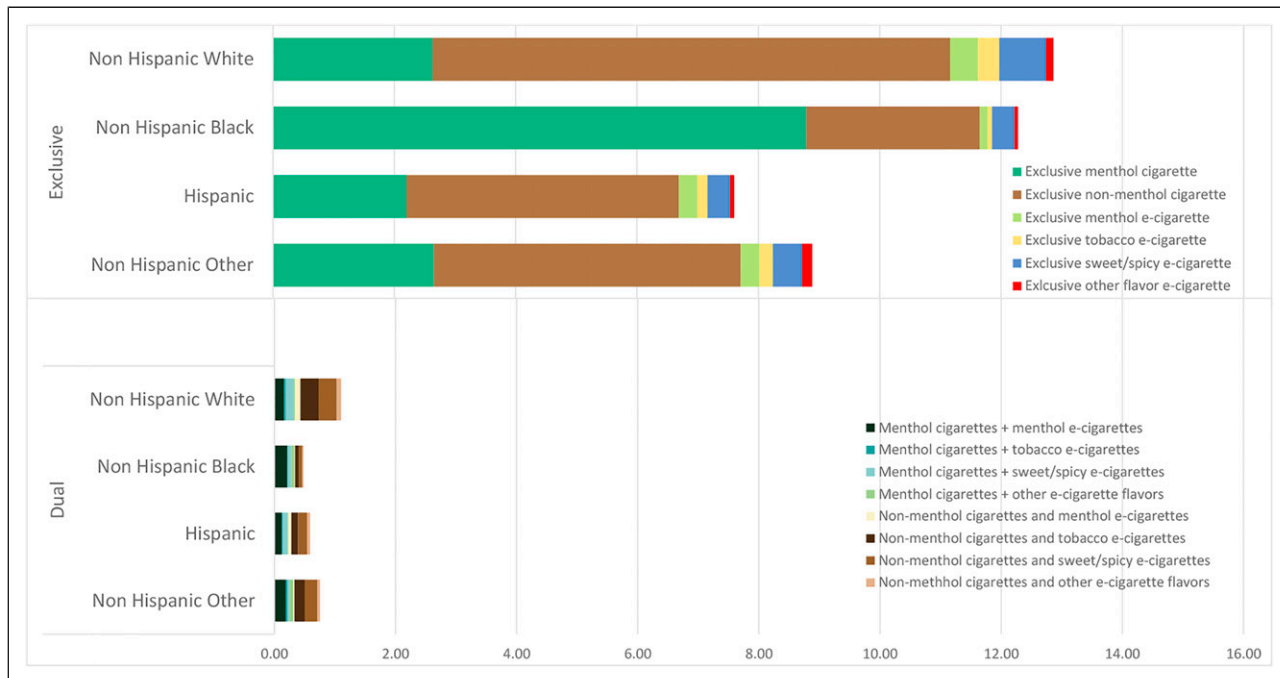


Figure 3. Patterns of exclusive and dual use of cigarettes and e-cigarettes among U.S adults by race/ethnicity. TUS-CPS 2018-19 (Population prevalence).

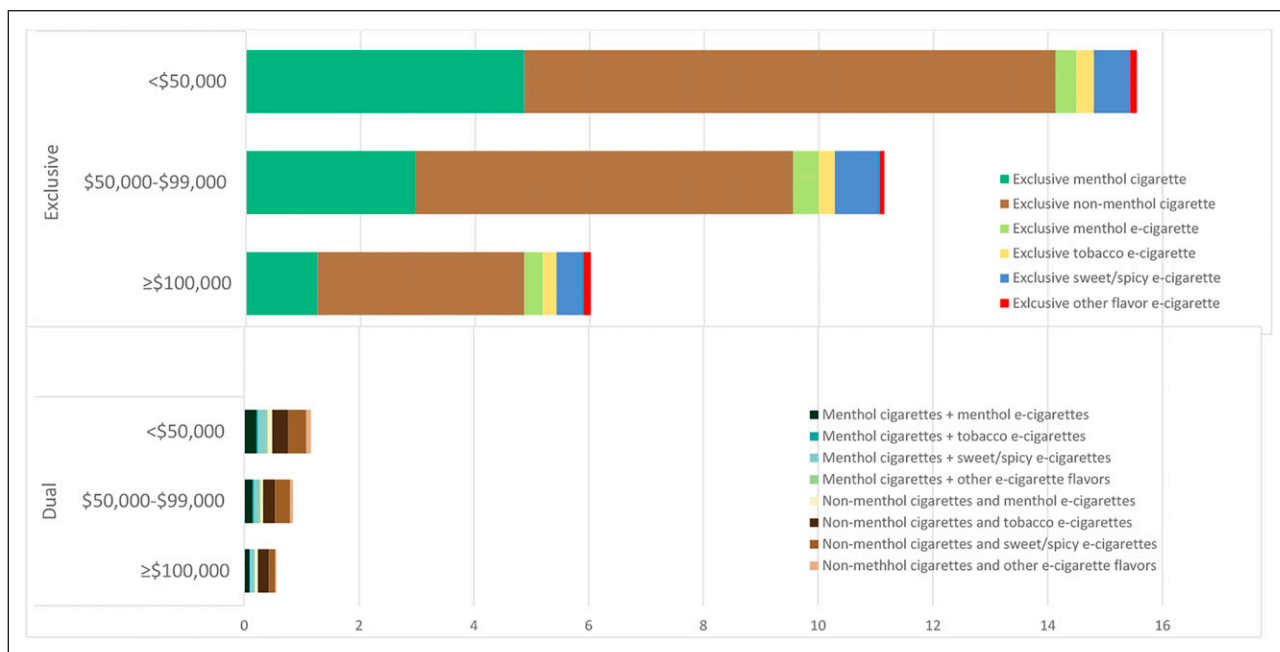


Figure 4. Patterns of exclusive and dual use of cigarettes and e-cigarettes among U.S adults by annual household income. TUS-CPS 2018-19 (Population prevalence).

Non-Hispanic Black adults, the most common combination of dual use in this group was menthol cigarettes with menthol e-cigarettes. Therefore, if a cigarettes menthol ban is enacted, one important consideration is whether menthol e-cigarettes can serve as an alternative or cessation tool. Findings from

discrete choice experiments suggest that banning menthol cigarettes and allowing some flavored e-cigarettes would be more effective in reducing the prevalence of cigarette use, while a ban of flavored e-cigarettes alone with no prohibition of menthol cigarettes potentially could lead to an increase in cigarette use.⁷

Limitations

We used the established current use definition for people who used cigarettes (i.e., 100 or more cigarettes in lifetime) but no established use criteria for e-cigarettes. Understanding differences in flavor use between experimental and established tobacco product use should be the focus of future research. Also, sample size restrictions limited our ability to further refine the analysis age groupings, which is relevant to evaluate flavored tobacco patterns among younger adults (i.e., 18-24 vs. 25-34 years old).

Significance

We found important differences in patterns of flavored cigarette and e-cigarette use by age, sex, race/ethnicity, and income. Our findings suggest that a cigarette menthol ban might be most effective in conjunction with a regulation that restrict access to sweet/spicy e-cigarettes. It is unclear if menthol e-cigarettes should be restricted, although there is a risk that younger adults and youth may initiate nicotine product use through menthol e-cigarettes. These findings will be directly relevant to tobacco control policies that maximize the potential of e-cigarettes for smoking cessation while reducing the likelihood of youth initiation.

So What?

What is already known on this topic?

Previous studies have evaluated flavored e-cigarette and cigarette use separately. However, there is limited research describing the joint patterns of flavored cigarette and e-cigarette use.

What does this article add?

We report the prevalence and proportion of exclusive and dual use for the 15-category flavored cigarette and e-cigarette use variable. Exclusive menthol cigarette use were higher among NH Black compared to NH White. Exclusive sweet/spicy e-cigarette use and exclusive menthol e-cigarette use was higher in younger (18-34) vs. older (35+) adults. Older dual users tended to combine the same flavor in both products.

What are the implications for health promotion practice or research?

This study provides information to policymakers of current and potential future restrictions on tobacco product flavoring. Particularly, our findings suggest that a ban of menthol cigarettes could be more effective if it is applied in conjunction with a regulation restricting access to sweet/spicy e-cigarette flavors, including e-cigarettes that use synthetic nicotine.

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Author's contribution

LZ-A, NF and RM conceived the research, LZ-A and JH conducted the statistical analyses, RM, JH and, NF assisted with data interpretation and critically reviewed the manuscript. All authors approved the submitted version for publication.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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