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### Permalink

<https://escholarship.org/uc/item/1vp7c3n8>

### Journal

Nicotine & Tobacco Research, 23(8)

### ISSN

1462-2203

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### Publication Date

2021-08-04

### DOI

10.1093/ntr/ntaa224

Peer reviewed



Original Investigation

# Menthol and Mint Cigarettes and Cigars: Initiation and Progression in Youth, Young Adults and Adults in Waves 1–4 of the PATH Study, 2013–2017

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## Abstract

**Introduction:** This study examined in youth (12–17 years), young adults (18–24 years), and adults (25+ years): (1) the prevalence of the first menthol cigarette and menthol/mint cigar use among new tobacco users; (2) association between the first menthol/mint use, subsequent tobacco use, and nicotine dependence ~1 year later compared with the first non-menthol/mint use.

**Aims and Methods:** Longitudinal analysis of data from Waves 1 to 4 of the Population Assessment of Tobacco and Health (PATH) Study (2013–2017; 10 086 youth and 21 281 adults). Main outcome measures were past 12-month and past 30-day cigarette and cigar use, and nicotine dependence.

**Results:** Youth and young adult new cigarette users are more likely to smoke a menthol cigarette or indicate that they do not know the flavor compared with adults aged 25+. A greater proportion of adults aged 25+ first used menthol/mint-flavored cigars (13.4%) compared with youth (8.5%) and young adults (7.4%). Among young adults, first use of a menthol cigarette is associated with past 12-month use of cigarettes at the subsequent wave and first use of any menthol/mint-flavored cigars is associated with past 30-day use of these products at the subsequent wave in both youth and young adults. In youth and adults, there were no significant relationships between first use of a menthol/mint cigarette or cigar and nicotine dependence scores at a subsequent wave in multivariable analyses.

**Conclusions:** The first use of menthol/mint cigarettes and cigars is associated with subsequent cigarette and cigar use in young people aged 12–24.

**Implications:** This study examined the relationship between initiation with menthol cigarettes and menthol/mint cigars, subsequent tobacco use, and nicotine dependence in US youth, young adults, and adults who participated in Waves 1–4 of the Population Assessment of Tobacco and Health study. New use of menthol cigarettes was associated with greater past 12-month cigarette use in young adults and new use of menthol/mint-flavored cigars was associated with greater past 30-day cigar use in youth and young adults compared with non-menthol use. Initiation with menthol/mint cigarette and cigar products may lead to subsequent use of those products.

## Introduction

In 2009, when the Family Smoking Prevention and Tobacco Control Act granted the United States Food and Drug Administration authority to regulate tobacco products, the market share of menthol cigarettes was 29%.<sup>1</sup> It grew to 35.5% in 2018<sup>2</sup> with concurrent increases in the prevalence of menthol cigarette use among U.S. smokers from 35% in 2008–2010 to 39% in 2012–2014<sup>3</sup> and 40% in 2018.<sup>4</sup> Sales data highlight increases in menthol little cigar sales from 2011 to 2015 as well, with menthol accounting for 19.4% of little cigar sales in 2015.<sup>5</sup>

Evidence suggests a relationship between menthol cigarette use, youth smoking initiation, and nicotine dependence.<sup>6–9</sup> Previous publications from the Population Assessment of Tobacco and Health (PATH) Study have documented the strong correlation between first use of a menthol cigarette and current exclusive cigarette use<sup>10</sup> as well as a prospective relationship between the first use of a menthol cigarette at wave 1 and subsequent cigarette use at wave 2 in all age groups.<sup>11</sup> First use of flavored cigarillos and filtered cigars (including menthol) at Wave 1 was also associated with subsequent use of these products in young adults (18–24 years) and adults (25+ years).<sup>11</sup> Other studies support a temporal relationship between menthol cigarette use and progression to established cigarette smoking in youth.<sup>12,13</sup>

The current study takes advantage of four waves of longitudinal data to extend previous analyses in examining whether there is a prospective relationship between first menthol cigarette and menthol/mint cigar use and smoking progression in youth (aged 12–17), young adults (aged 18–24), and adults (aged 25+) who are new smokers of cigarettes or cigars. The three aims of the study are to: (1) estimate the proportions of new cigarette and cigar users at Waves 2, 3, and 4 whose first use of the specified product was menthol/mint flavored; (2) among new users of cigarettes and cigars, assess the relationship between first use of a menthol/mint flavored cigarette or cigar and product-specific use at the subsequent wave (eg, past 12-month use and past 30-day use); and (3) examine the relationship

between first menthol cigarette or menthol/mint cigar use and subsequent nicotine dependence.

Our corresponding hypotheses are that (1) Youth and young adults who are new users of cigarettes or cigars will be more likely than adult new users of cigarettes or cigars to have first used a cigarette that was mentholated or cigar was menthol/mint flavored; 2) New users of cigarettes or cigars who first used menthol/mint flavored products will be more likely than new users who first used non-menthol/mint flavored products to use cigarettes or cigars, respectively, at the subsequent wave; and 3) First users of menthol cigarettes and cigars will have higher dependence scores at a subsequent wave than first users of nonflavored cigarettes or cigars. We also explored maintenance or switching of menthol cigarette and cigar use across waves.

## Methods

### Study Design and Population

The PATH study is an ongoing, nationally representative, longitudinal cohort study of adults and youth in the United States. The study uses audio computer-assisted self-interviews available in English and Spanish to collect self-reported information on tobacco-use patterns and associated health behaviors. Recruitment for the PATH study Wave 1 cohort employed a stratified address-based, area-probability sampling design at Wave 1 that oversampled adult tobacco users, young adults (18–24 years), and African-American adults.

At Wave 1, the weighted response rate for the household screener was 54.0%. Among screened households, the overall weighted response rates were 74.0% for adults and 78.4% for youth at Wave 1, 83.2% for adults and 87.3% for youth at Wave 2, 78.4% for adults and 83.3% for youth at Wave 3, and 73.5% for adults and 79.5% for youth at Wave 4. Full-sample and replicate weights were created that adjust for the complex sample design (eg, oversampling at wave 1) and nonresponse at Waves 1–4. Combined with the use of a probability sample, the weights allow analyses of the PATH study data to

compute robust estimates for the US population ages 12 years and older at the time of Wave 1.

Further details regarding the PATH study design and Wave 1 methods are published elsewhere.<sup>14,15</sup> Details on interviewing procedures, questionnaires, sampling, weighting, response rates, and accessing the data are described in the PATH Study Restricted Use Files User Guide at <https://doi.org/10.3886/Series606>. The PATH study was conducted by Westat and approved by the Westat Institutional Review Board. All respondents ages 18 and older provided informed consent, with youth respondents ages 12–17 providing assent while each one's parent/legal guardian provided consent.

The current analysis reports longitudinal estimates of cases with data at all four waves from youth (ages 12–17;  $N = 10\,086$ ), young adults (ages 18–24;  $N = 5740$ ) and adults 25+ ( $N = 15\,541$ ). The sample sizes of youth and young adults at Wave 1 include respondents who “aged-into” the older age groups at subsequent waves.

## Measures

### Cigarette and Cigar Use

Ever and current use was assessed at Waves 1–4 among youth, young adults and adults for cigarettes, any cigar, traditional cigars, cigarillos, and filtered cigars (see [Supplementary material, Table 1](#)). New users were defined as youth, young adults, and adults who tried a cigarette or cigar for the first time between any adjacent waves (ie, never use at Wave 1 and new use at Wave 2, never use at Wave 2 and new use at Wave 3, never use at wave 3 and new use at Wave 4).

Following new use at either wave 2 or 3, current use was assessed in multiple ways at either wave 3 or 4, respectively (ie, past 30-day use, moderate use, frequent use, daily use, and current regular use) as outlined in [Supplementary material, Table 1](#).

### Nicotine Dependence

Nicotine dependence in youth and adults was assessed at Wave 3 or 4 following new use at either Wave 2 or 3. Nicotine dependence was based on a respondent's average score on a 16-item nicotine dependence scale created by PATH investigators.<sup>16</sup>

### Flavored Cigarette and Cigar Use

At Waves 2, 3, and 4, new cigarette users were asked whether, when they first smoked a cigarette (youth) or when they first started smoking cigarettes (adults), it was “flavored to taste like menthol, mint, clove, spice, fruit, chocolate, alcoholic drinks, candy, or other sweets.” Response options included “yes/no/I don't know.” Similarly, past 30-day cigarette smokers (both youth and adults) were asked whether any of the cigarettes they smoked in the past 30 days were “flavored to taste like menthol, mint, clove, spice, fruit, chocolate, alcoholic drinks, candy, or other sweets” (“yes/no/I don't know”). The same questions were asked of smokers who reported new use or past 30-day use of cigars.

Based on changes to the questions over time, those who reported smoking flavored cigarettes or cigars were classified differently. Smokers who reported “no” were categorized as non-menthol cigarette smokers. Smokers who reported “I don't know” were categorized into the “I don't know” response level. Smokers who reported flavor use were asked to identify specific flavor(s). Smokers who selected menthol or mint (either alone or with other flavors) were categorized as menthol cigarette smokers. The number of smokers who reported using cigarettes that were not menthol or mint flavored but flavored like other spice, fruit, chocolate, alcoholic drinks,

candy, other sweets, or some other flavor was low and was collapsed with the non-menthol cigarette smoker category. Cigar smokers who reported “no” were categorized as nonflavored [cigar product] smokers. Cigar smokers who reported using cigars that were not menthol or mint flavored, but flavored like other spice, fruit, chocolate, alcoholic drinks, candy, other sweets, or some other flavor, were categorized as other flavors [cigar product] smokers.

### Wave 1 covariates

All covariates were assessed at Wave 1 and selected based on previous work.<sup>10</sup> Sociodemographic variables included self-reported age, sex, race/ethnicity, sexual orientation, educational attainment (adults only), and annual household income (adults only; [Supplementary material, Table 1](#)). Missing data on age, sex, race/Hispanic ethnicity, and adult education were imputed as described in the PATH Study Restricted Use Files User Guide.<sup>17</sup> The PATH study did not assess sexual orientation in youth under 14 years of age. Models for nicotine dependence also controlled for past 30-day use of another tobacco product at Wave 1.

## Statistical Analyses

Analyses were conducted using SVY procedures in Stata/SE version 15.1 and PROC SURVEY procedures in SAS 9.4 to account for weighting. Prevalence of each outcome for each product (cigarettes, any cigar product, traditional cigars, cigarillos, and filtered cigars) was estimated for youth, young adults, and adults aged 25+ based on age at Wave 1. Respondents missing any response to a composite variable (eg, daily use at Wave 4 following new use at Wave 3) were treated as missing; missing data were handled with listwise deletion.

Stratified models were built for youth, young adults, and adults aged 25+. Modified Poisson regression models<sup>18</sup> estimated the association between the first flavored tobacco use and current tobacco use at the subsequent wave. Bivariate analyses explored the stability of menthol cigarette use (or switching) between Waves 2 and 3 and between Waves 3 and 4 in young adult and adult cigarette smokers at both waves. Generalized estimating equations models estimated the association between the first flavored product use and mean change in nicotine dependence scale score for youth and adults (young adults and adults aged 25+ combined) over four waves (W1–W4). This statistical method allows for the inclusion of transitions from both periods in a single analysis while statistically controlling for interdependence among observations contributed by the same individuals.<sup>19,20</sup> Analyses were weighted using the Wave 4 “all-wave” weights (including full-sample and 100 replicate weights), and variances were computed using the balanced repeated replication method<sup>21</sup> with Fay's adjustment set to 0.3 to increase estimate stability.<sup>22</sup>

## Results

Of youth completing Waves 1 through 4 of the PATH study, 50.6% were aged 12–14 and 49.4% were aged 15–17 at Wave 1. Approximately half (51.2%) were male and 54.7% were non-Hispanic White, 13.9% non-Hispanic Black, 22.2% Hispanic, and 9.2% non-Hispanic other race. Of the 14–17 year olds, more than 91% were straight. Among adults completing all four PATH study waves, 13.2% were aged 18–24 and 86.8% were aged 25+ at Wave 1. Approximately (half) 47.8% were male and the racial/ethnic distribution was 65.6% non-Hispanic White, 11.6% non-Hispanic Black, 15.1% Hispanic, and 7.7%

non-Hispanic other race, and 94.8% reported being straight. Among adult participants, 40.6% had a high school education/GED or less and 33.8% reported an annual household income of <\$25 000.

### First Use of a Menthol/Mint Flavored Product Among New Cigarette and Cigar Users

Any new cigar use at Waves 2, 3, or 4 was most common (14.5% youth, 19.7% young adults, 6.3% adults 25+), followed by new use of cigarettes (14.0% youth, 7.1% young adults, 1.1% adults 25+). Comparisons across the cigar products showed new traditional cigar use as most common (8.4% youth, 13.3% young adults, 3.8% adults 25+), followed by new cigarillo use (8.1% youth, 5.9% young adults, 2.1% adults 25+), and new filtered cigar use (5.1% youth, 6.3% young adults, 2.3% adults 25+). While there was no difference in the prevalence of first menthol cigarette use, among new cigarette users at Waves 2, 3, or 4, fewer youth aged 12–17 (46.7%) or young adults aged 18–24 (44.2%) first used a non-menthol cigarette compared with adults aged 25+ (62.7%; Figure 1). A higher proportion of adults aged 25+ first used any

menthol/mint cigar (13.4% adults vs. 8.5% youth and 7.4% young adults), likely driven by 17.9% (95% CI 14.9% to 21.2%) with first use of a menthol/mint-flavored filtered cigar compared with 7.5% (95% CI 5.3% to 10.6%) in youth and 8.0% (95% CI 5.6% to 11.4%) in young adults.

Higher proportions of youth (33.2%; 95% CI 30.4% to 36.1%) and young adults (28.3%; 95% CI 25.5% to 31.2%) had the first use of any “other flavored” cigar product compared with adults aged 25+ (20.6%; 95% CI 18.4% to 23.1%). Additionally, the first use of “other flavored” cigarillos was higher in youth (39.7%; 95% CI 36.3% to 43.1%) and young adults (42.9%; 95% CI 36.7% to 49.4%) than adults aged 25+ (25.7%; 95% CI 21.6% to 30.3%). The first use of a nonflavored cigarillo was higher in young adults (42.0%, 95% CI 36.1% to 48.2%) and adults aged 25+ (49.1%, 95% CI 43.4% to 54.7%) than youth (32.1%; 95% CI 29.0% to 35.4%).

Importantly, youth had the highest proportion of uncertainty (eg, “I don’t know”) regarding first flavored product use across all products, with differences observed between youth and all adults for cigarillos and between youth and adults aged 25+ for filtered cigars (Figure 1).

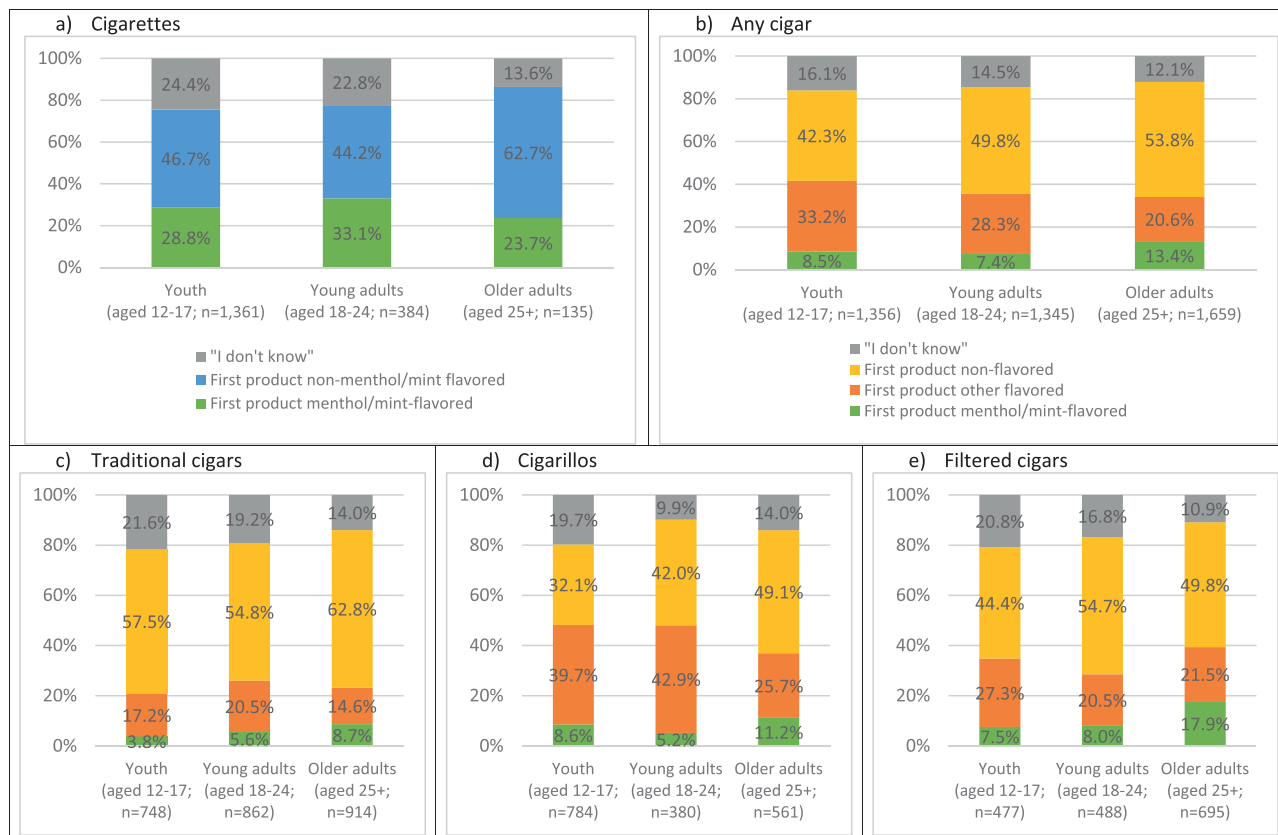


Figure 1. Prevalence of the first tobacco product menthol-flavored use among new tobacco smokers at Wave 2, 3, or 4 of the PATH study (weighted)<sup>a,b</sup>

<sup>a</sup>Age at Wave 1. Youth who aged up into the adult survey at Waves 2–4 were included in the youth sample. Young adults who were 25+ in Waves 2–4 were included in the young adult sample. The adult 25+ sample included respondents who were ages 25+ in all four waves.

<sup>b</sup>At Wave 2, new smokers of each product were asked whether their product was flavored to taste like any flavor type (menthol/mint, clove/spice, fruit, alcoholic drinks, chocolate, candy, and other sweets), and then asked to clarify the specific flavor type(s). All flavors besides menthol or mint were categorized into the “other flavored” group. At Wave 3 and Wave 4, new cigarette smokers were asked whether their first cigarette was flavored to taste like menthol/mint. At Wave 3 and Wave 4, new cigar smokers were asked whether their product was flavored to taste like any flavor type (menthol/mint, clove/spice, fruit, alcoholic drinks, chocolate, candy, and other sweets), and then asked to clarify the specific flavor type(s).



### Association Between New Use of a Menthol Cigarette or Menthol/Mint Cigar and Continued Use

The relationship between new use of a menthol/mint flavored product and subsequent use of cigarettes and cigars was estimated for new users at Wave 2 or 3 (Table 1). There were no significant relationships between first menthol cigarette or menthol/mint cigar use and past 12-month use in youth. Controlling for age (adults only), sex, race/ethnicity, sexual orientation, education (adults only), and income (adults only), young adults who first used a menthol cigarette had a significantly higher prevalence of subsequent past 12-month cigarette use (aPR 1.43; 95% CI 1.05 to 1.93) compared with those who first used a non-menthol cigarette; while the magnitude of the relationship was similar for past 30-day use, the estimate was not statistically significant. First use of a menthol/mint-flavored cigarillo was also positively associated with subsequent past 12-month cigarillo use in young adults (aPR 1.78; 95% CI 1.11 to 2.85) compared with first use of a nonflavored cigarillo.

Youth (aPR 1.72; 95% CI 1.13 to 2.62) and young adults (aPR 1.71, 95% CI 1.10 to 2.67) who first used any menthol/mint-flavored cigar had a significantly higher prevalence of past 30-day any cigar use at a subsequent wave compared to first use of a nonflavored cigar. Youth who first used a menthol/mint-flavored cigarillo had more than double the prevalence (aPR 2.25; 95% CI 1.31 to 3.85) of subsequent past 30-day cigarillo use compared with those who first used a nonflavored cigarillo. There were also positive associations between the first “other flavored” use of any cigars and subsequent any cigar use in youth, young adults, and adults, as well as product-specific associations for the first “other flavored” traditional cigar use in adults aged 25+ and cigarillo use in youth and young adults.

### Association Between First Menthol/Mint Flavored Cigarette and Cigar Use and Subsequent Nicotine Dependence

There were no significant bivariate relationships between first menthol cigarette or first menthol/mint-flavored cigar and subsequent nicotine dependence in youth (results not presented in tables). There were significant bivariate relationships between first menthol/mint-flavored cigarillo and filtered cigar use and higher levels of nicotine dependence among adults aged 18+, but not for first menthol cigarette or menthol/mint traditional cigar use. After controlling for sociodemographic variables, study wave, and past 30-day use of other tobacco products (except cigarillos) at wave 1, there were no significant relationships between first menthol/mint-flavored cigarillo or filtered cigar use (vs. non-menthol/mint flavored) and subsequent nicotine dependence in adults.

### Flavor Switching at the Subsequent Wave Among Continued Past 30-Day Cigarette Users

Table 2 presents the stability of menthol and non-menthol use in adult past 30-day cigarette smokers over time. More than half of young adult cigarette smokers used menthol cigarettes at Wave 2 or 3 (Wave 2: 54.6%; Wave 3: 54.7%), with lower menthol cigarette prevalence in adults aged 25+ (Wave 2: 34.8%; Wave 3: 39.1%). Between 75% and 91% of non-menthol and menthol flavored cigarette users at Wave 2 or 3 stayed with the same flavored product at Wave 3 or 4, respectively. This resulted in 43% of young adult cigarette smokers remaining menthol cigarette smokers from Wave 2 to Wave 3 (32% non-menthol) and 44% from Wave 3 to Wave 4 (34% non-menthol). In comparison, ~30% of adult cigarette smokers aged

25+ remained menthol cigarette smokers from Wave 2 to Wave 3 (55.5% non-menthol) and 33% from Wave 3 to Wave 4 (54.4% non-menthol).

### Discussion

Previous studies on the prospective relationship between the first use of a menthol tobacco product and subsequent use of that product have focused exclusively on cigarettes.<sup>11-13</sup> To date, no studies have restricted analyses to those who initiate product use between study waves to establish the temporal relationship between first menthol product trial and subsequent use of cigarettes and cigars. This study extends findings from a previous PATH study article,<sup>11</sup> showing that among new user youth and young adults, first use of any menthol/mint-flavored cigar and cigarillo is associated with greater continued use of these products at the subsequent wave compared with non-menthol cigars and cigarillos, even after controlling for sociodemographic variables. In young adult new users of cigarettes, first use of a menthol cigarette is also associated with greater past 12-month use of cigarettes at the subsequent wave. There was a low prevalence of flavor switching (eg, menthol to non-menthol) among adult cigarette smokers over time, indicating stability of flavor preference.

One previous study in youth documented a prospective relationship between menthol cigarette use and nicotine dependence<sup>13</sup>; the current study found no difference between the first use of menthol/mint flavored cigarettes or cigars or the first use of non-menthol cigarettes or cigars and subsequent nicotine dependence in youth. Findings suggest a bivariate relationship between the first use of a menthol/mint cigarillo or menthol filtered cigar and higher nicotine dependence scores at a subsequent wave in adults, though this relationship was attenuated after controlling for sociodemographic variables, study wave, and baseline use of other tobacco products. Additionally, this study confirms findings from other national studies showing that young adult smokers are more likely than older adults to use menthol cigarettes<sup>3,23</sup> and the stability of menthol cigarette use over time in continuing adult cigarette smokers.<sup>24-26</sup> It also reports a higher prevalence of menthol filtered cigar use among adults aged 25+ compared with youth and young adults, which may reflect substitution of cheaper cigar products for cigarettes in adult smokers.<sup>27</sup>

These findings were consistent with our study hypotheses, though not uniform across all products or outcome definitions, for several possible reasons. These limitations also affect the generalizability of our study findings. First, restricting the analysis to new cigarette or cigar users at Wave 2 or 3 and stratifying by age resulted in low sample size for some products, particularly for adults 25+ where new use of cigarettes is rare. Second, the proportion of “don’t know” responses regarding first flavored tobacco product use was higher for youth than for adults. Rather than dropping the “I don’t know” observations, we kept them as a separate category in the analyses and found no relationship between not knowing the flavor of the first cigarette or cigar used and subsequent use of those products. Third, we relied on self-report of cigarette and cigar use. In contrast to our earlier work,<sup>10,11</sup> these analyses focus on new users who are reporting on behavior in the past year, not their first use of a product years ago; this may reduce the impact of recall bias on our findings. Finally, differences between our study hypotheses and findings (eg, higher menthol/mint filtered cigar use in adults aged 25+ compared to youth and young adults) may reflect the changing prevalence of specific

**Table 1.** Association between first product-specific menthol-flavored new tobacco use at Wave 2 or 3 and continued tobacco use at subsequent wave of the PATH study

New tobacco use at Wave 2 or Wave 3*	Past 12-month use at subsequent wave						Past 30-day use at subsequent wave								
	Youth (aged 12–17) <sup>†</sup>			Adults (aged 25+) <sup>‡</sup>			Youth (aged 12–17) <sup>†</sup>			Young adults (aged 18–24) <sup>‡</sup>			Adults (aged 25+) <sup>‡</sup>		
	n	%	aPR (95% CI) <sup>§</sup>	n	%	aPR (95% CI) <sup>§</sup>	n	%	aPR (95% CI) <sup>§</sup>	n	%	aPR (95% CI) <sup>§</sup>	n	%	aPR (95% CI) <sup>§</sup>
Cigarette use	509			40			299			99			28		
Non-menthol	230	67.1	Ref.	21	52.8	Ref.	138	39.2	Ref.	44	33.4	Ref.	13	24.6†	Ref.
Menthol	157	67.9	1.03 (0.93, 1.14)	61	66.8	1.43 (1.05, 1.93)	98	42.8	1.09 (0.88, 1.34)	39	43.9	1.44 (0.88, 2.35)	8	33.4†	1.44 (0.88, 2.35)
“I don’t know”	122	63.6	0.97 (0.85, 1.11)	27	52.3	1.00 (0.63, 1.59)	63	33.1	0.84 (0.66, 1.07)	16	34.6	1.06 (0.57, 1.98)	7	31.5†	1.06 (0.57, 1.98)
Any cigar use	460			461			212			248			343		
Nonflavored	172	53.0	Ref.	217	39.5	Ref.	73	21.4	Ref.	112	17.5	Ref.	153	21.5	Ref.
Menthol/mint	47	62.7	1.20 (0.97, 1.49)	37	49.7	1.33 (0.99, 1.78)	27	34.2	1.72 (1.13, 2.62)	25	30.0	1.71 (1.10, 2.67)	73	29.0	1.26 (0.88, 1.80)
Other flavors	182	60.6	1.14 (0.99, 1.32)	164	55.0	1.45 (1.19, 1.77)	86	28.7	1.47 (1.09, 1.99)	88	27.4	1.52 (1.13, 2.06)	91	33.5	1.78 (1.35, 2.33)
“I don’t know”	59	47.1	0.88 (0.68, 1.13)	43	28.9	0.77 (0.56, 1.07)	26	20.0	0.99 (0.60, 1.62)	23	12.7	0.80 (0.51, 1.25)	26	15.7	0.81 (0.47, 1.37)
Traditional cigar use	223			271			81			131			151		
Nonflavored	141	57.9	Ref.	149	40.2	Ref.	52	20.5	Ref.	66	15.1	Ref.	79	16.8	Ref.
Menthol/mint	11	51.9	1.04 (0.67, 1.60)	14	36.1†	0.81 (0.46, 1.45)	4	19.5†	0.87 (0.52, 1.45)	7	14.9†	0.93 (0.34, 2.51)	16	17.6†	0.99 (0.51, 1.93)
Other flavors	40	46.6	0.89 (0.66, 1.19)	73	48.1	1.28 (0.98, 1.66)	54	46.5	1.74 (1.27, 2.39)	40	22.2	1.32 (0.89, 1.97)	35	29.5	2.03 (1.31, 3.14)
“I don’t know”	31	40.3	0.74 (0.52, 1.06)	35	31.2	0.79 (0.55, 1.13)	30	32.6	1.07 (0.74, 1.56)	10	13.7†	1.00 (0.60, 1.66)	21	21.4	1.30 (0.75, 2.25)
Cigarillo use	243			136			118			85			105		
Nonflavored	71	50.4	Ref.	46	42.4	Ref.	29	19.9	Ref.	31	27.6	Ref.	53	30.1	Ref.
Menthol/mint	21	56.9	1.12 (0.77, 1.64)	11	59.1†	1.78 (1.11, 2.85)	18	30.0†	0.64 (0.32, 1.29)	15	40.4	2.25 (1.31, 3.85)	9	52.2†	0.78 (0.34, 1.76)
Other flavors	109	57.2	1.10 (0.89, 1.38)	65	60.1	1.47 (1.01, 2.14)	51	42.1	0.98 (0.65, 1.49)	54	28.2	1.58 (1.02, 2.43)	37	30.4	1.09 (0.66, 1.79)
“I don’t know”	42	51.6	0.97 (0.73, 1.29)	14	45.9†	1.37 (0.84, 2.24)	13	24.1†	0.53 (0.28, 1.02)	20	24.1	1.24 (0.69, 2.21)	8	23.7†	0.30 (0.12, 0.74)
Filtered cigar use	127			141			49			68			149		
Nonflavored	36	36.7	Ref.	81	35.8	Ref.	16	15.4†	Ref.	38	15.8	Ref.	65	25.2	Ref.
Menthol/mint	17	54.7	1.39 (0.87, 2.23)	12	35.5†	0.96 (0.56, 1.64)	54	43.5	1.10 (0.78, 1.55)	8	20.9†	1.23 (0.44, 3.40)	44	35.8	1.59 (0.99, 2.54)
Other flavors	49	53.9	1.32 (0.85, 2.03)	35	35.5	1.00 (0.67, 1.48)	48	42.9	1.05 (0.77, 1.44)	13	12.7†	0.97 (0.38, 2.45)	14	11.8	1.05 (0.62, 1.76)
“I don’t know”	25	44.5	1.20 (0.73, 1.96)	13	23.0	0.61 (0.33, 1.11)	18	32.6†	0.83 (0.46, 1.48)	12	19.5	1.48 (0.63, 3.46)	7	8.9†	1.12 (0.59, 2.10)

<sup>†</sup>Age at Wave 1. Youth who aged up into the adult survey at Waves 2–4 were included in the youth sample. Young adults who were 25+ in Waves 2–4 were included in the young adult sample. The adult 25+ sample included respondents who were ages 25+ in all four waves.

<sup>‡</sup>At Wave 2, new smokers of each product were asked whether their product was flavored to taste like any flavor type (menthol/mint, clove/spice, fruit, alcohol, chocolate, candy, and other flavors), and then asked to clarify the specific flavor type(s). All flavors besides menthol or mint were categorized into the “other flavored” group. At Wave 3, new cigarette smokers were asked whether their first cigarette was flavored to taste like menthol/mint. At Wave 3, new cigar smokers were asked whether their product was flavored to taste like any flavor type (menthol/mint, clove/spice, fruit, alcohol, chocolate, candy, and other flavor), and then asked to clarify the specific flavor type(s).

<sup>§</sup>Multivariable modified Poisson regression models controlled for age (adults 25+ only), sex, race/ethnicity, sexual orientation, education (adults only), and income (adults only). Bold denotes significant adjusted prevalence ratios at  $p < .05$ .

<sup>†</sup>Estimate should be interpreted with caution because it has low statistical precision. It is based on a denominator sample size of  $<50$ , or the coefficient of variation of the estimate or its complement is  $>30\%$ .

—: Insufficient observations to compute balanced repeated replication standard errors.

**Table 2.** Prevalence of past 30-day flavored cigarette use status from W2 to W3 and W3 to W4 in young adults and adults aged 25+ with past 30-day use at both waves (weighted cell percentages and 95% CI) in the PATH study<sup>a</sup>

Cigarettes	Past 30-day use at wave 3				Past 30-day use at wave 4				
	Weighted percentage (95% CI)				Weighted percentage (95% CI)				
	Menthol flavored use	Non-menthol flavored use	"I don't know"	Total	Menthol/mint flavored use	Non-menthol/mint flavored use	"I don't know"	Total	
<b>Past 30-day use at Wave 2</b>	<b>Past 30-day use at Wave 3</b>								
Young adults ( <i>n</i> = 1659)	Young adults ( <i>n</i> = 1609)								
Menthol flavored	42.7 (40.0, 45.5)	11.4 (9.8, 13.3)	0.4† (0.2, 0.9)	54.6 (51.6, 57.4)	Menthol/mint flavored	44.0 (41.0, 47.0)	10.2 (8.8, 11.8)	0.5† (0.2, 0.9)	54.7 (51.8, 57.5)
Nonmenthol flavored	10.1 (8.6, 11.8)	31.7 (29.0, 34.5)	0.5† (0.3, 1.0)	42.3 (39.4, 45.3)	Nonmenthol/mint flavored	8.5 (7.0, 10.3)	34.2 (31.3, 37.2)	1.1† (0.6, 1.9)	43.7 (40.8, 46.7)
"I don't know"	1.5 (1.0, 2.4)	1.1 (0.7, 1.8)	0.4† (0.2, 1.1)	3.1 (2.3, 4.3)	"I don't know"	0.3† (0.1, 0.7)	1.1 (0.6, 2.0)	0.2† (0.1, 0.7)	1.6 (1.0, 2.5)
Total	54.4 (51.6, 57.2)	44.3 (41.5, 47.1)	1.3 (0.9, 2.1)	100.0	Total	52.8 (49.8, 55.8)	45.4 (42.5, 48.5)	1.8 (1.2, 2.6)	100.0
Adults 25+ ( <i>n</i> = 5,854)	Adults 25+ ( <i>n</i> = 5,694)								
Menthol flavored	30.0 (28.7, 31.3)	4.4 (3.8, 5.0)	0.4 (0.2, 0.6)	34.8 (33.4, 36.2)	Menthol/mint flavored	33.3 (31.8, 34.9)	5.3 (4.8, 6.0)	0.5 (0.3, 0.7)	39.1 (37.5, 40.7)
Non-menthol flavored	7.9 (7.0, 8.9)	55.5 (54.0, 57.0)	0.6 (0.4, 0.9)	64.0 (62.6, 65.4)	Non-menthol/mint flavored	4.9 (4.4, 5.6)	54.4 (52.7, 56.1)	0.7 (0.4, 1.1)	60.0 (58.4, 61.6)
"I don't know"	0.5 (0.3, 0.8)	0.7 (0.5, 1.0)	0.1† (0.0, 0.4)	1.2 (0.9, 1.7)	"I don't know"	0.4 (0.2, 0.6)	0.4 (0.3, 0.6)	0.2† (0.0, 0.3)	0.9 (0.7, 1.2)
Total	38.4 (36.9, 39.9)	60.5 (59.0, 62.0)	1.1 (0.8, 1.4)	100.0	Total	38.6 (37.0, 40.2)	60.1 (58.5, 61.7)	1.3 (1.0, 1.7)	100.0

<sup>a</sup>Cigarette smokers at Wave 2 were first asked whether their cigarette was flavored to taste like any flavor type (menthol/mint, clove/spice, fruit, alcohol, chocolate, candy, and other flavor), and then asked to clarify the specific flavor type(s). At Wave 3 and 4, cigarette smokers were asked whether their cigarette was flavored to taste like menthol or mint. All cigar product smokers were asked whether their product was flavored to taste like any flavor type at Waves 2–4.

<sup>b</sup>Age at Wave 1. Youth who aged up into the adult survey at Waves 2–4 were included in the youth sample. Young adults who were 25+ in Waves 2–4 were included in the young adult sample. The adult 25+ sample included respondents who were ages 25+ in all four waves.

<sup>c</sup>Respondents had to have reported past 30-day use at Waves 2 and 3 or at Waves 3 and 4.

<sup>d</sup>Estimate should be interpreted with caution because it has low statistical precision. It is based on a denominator sample size of <50, or the coefficient of variation of the estimate or its complement is >30%.



menthol products in the marketplace (ie, traditional cigars and cigarillos)<sup>5</sup> and the likelihood of exposure to these products as a function of one's cohort. Our study also does not capture differences in local flavored tobacco policies enacted during the data collection period which may have affected initiation and progression of menthol and mint cigarette and cigar use.

## Conclusions

As seen in previous studies in youth,<sup>11–13</sup> this study supports that initiation with a menthol cigarette is associated with past 12-month cigarette use in young adults compared with initiation with a non-menthol cigarette. In addition to cigarettes, initiation with any menthol/mint cigar is associated with past 30-day use of those products in youth and young adults. These findings extend previous research in youth to highlight the impact of menthol cigarettes and menthol/mint cigars on cigarette and cigar use trajectories in young adults, consistent with the potential for initiation with a menthol cigar product to facilitate subsequent use of cigars over time.

## Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

## Funding

This manuscript was supported with Federal funds from the National Institute on Drug Abuse, National Institutes of Health, and the Center for Tobacco Products, Food and Drug Administration, Department of Health and Human Services, under a contract to Westat (Contract No. HHSN271201100027C). Scientists from NIDA and FDA contributed to the interpretation of the data and participated in the preparation, review and approval of the manuscript.

## Data Access, Responsibility, and Analysis

ACV and ALJ had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

## Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Department of Health and Human Services or any of its affiliated institutions or agencies. This article was initiated while Amanda Johnson was employed at the Office of Science, Center for Tobacco Products, Food and Drug Administration, Silver Spring, MD.

## Declaration of Interests

KMC provides expert testimony on the health effects of smoking and tobacco industry tactics in lawsuits filed against the tobacco industry. He has also received payment as a consultant to Pfizer, Inc., for services on an external advisory panel to assess ways to improve smoking cessation delivery in health care settings. GTF has a Senior Investigator Award from the Ontario Institute for Cancer Research and a Prevention Scientist Award from the Canadian Cancer Society Research Institute. WC reports long-term stock holdings in General Electric, 3M Company, and Pfizer Incorporated, unrelated to this manuscript. RN receives funding from the Food and Drug Administration Center for Tobacco Products via contractual mechanisms with Westat and the National Institutes of Health. Within the past 3 years, he has served as a

paid consultant to the Government of Canada via a contract with Industrial Economics Inc. and has received an honorarium for a virtual meeting from Pfizer Inc. No financial disclosures were reported by the other authors of this paper.

## References

1. Federal Trade Commission. Federal Trade Commission Cigarette Report for 2016. 2018; <https://www.ftc.gov/reports/federal-trade-commission-cigarette-report-2016-federal-trade-commission-smokeless-tobacco>. Accessed April 3, 2018.
2. Delnevo CD, Giovenco DP, Villanti AC. Assessment of menthol and nonmenthol cigarette consumption in the US, 2000 to 2018. *JAMA Netw Open*. 2020;3(8):e2013601.
3. Villanti AC, Mowery PD, Delnevo CD, Niaura RS, Abrams DB, Giovino GA. Changes in the prevalence and correlates of menthol cigarette use in the USA, 2004–2014. *Tob Control*. 2016;25(suppl 2):ii14–ii20.
4. United States Department of Health and Human Services, Substance Abuse and Mental Health Services Administration (SAMHSA), Center for Behavioral Health Statistics and Quality. National Survey on Drug Use and Health, 2018. 2019; <https://pdas.samhsa.gov/#/survey/NSDUH-2018-DS0001>. Accessed November 14, 2019.
5. Kuiper NM, Gammon D, Loomis B, et al. Trends in sales of flavored and menthol tobacco products in the United States during 2011–2015. *Nicotine Tob Res*. 2018;20(6):698–706.
6. Villanti AC, Collins LK, Niaura RS, Gagosian SY, Abrams DB. Menthol cigarettes and the public health standard: a systematic review. *BMC Public Health*. 2017;17(1):983.
7. Tobacco Products Scientific Advisory Committee. *Menthol Cigarettes and Public Health: Review of the Scientific Evidence and Recommendations*. Rockville, MD: Center for Tobacco Products, Food and Drug Administration; 2011.
8. U.S. Food and Drug Administration. *Preliminary Scientific Evaluation of the Possible Public Health Effects of Menthol versus Nonmenthol Cigarettes*. Silver Spring, MD: Center for Tobacco Products, Food and Drug Administration; 2013.
9. U.S. Food and Drug Administration. *Reference Addendum: Preliminary Scientific Evaluation of the Possible Public Health Effects of Menthol versus Nonmenthol Cigarettes*. Silver Spring, MD: Center for Tobacco Products, Food and Drug Administration; 2013.
10. Villanti AC, Johnson AL, Ambrose BK, et al. Flavored tobacco product use in youth and adults: findings from the first wave of the PATH study (2013–2014). *Am J Prev Med*. 2017;53(2):139–151.
11. 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.
12. Nonnemaker J, Feirman SP, MacMonegle A, et al. Examining the role of menthol cigarettes in progression to established smoking among youth. *Addict Behav*. 2019;98:106045.
13. Nonnemaker J, Hersey J, Homsy G, Busey A, Allen J, Vallone D. Initiation with menthol cigarettes and youth smoking uptake. *Addiction*. 2013;108(1):171–178.
14. 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.
15. Tourangeau R, Yan T, Sun H, Hyland A, Stanton CA. Population Assessment of Tobacco and Health (PATH) reliability and validity study: selected reliability and validity estimates. *Tob Control*. 2019;28(6):663–668.
16. Strong DR, Pearson J, Ehlke S, et al. Indicators of dependence for different types of tobacco product users: descriptive findings from wave 1 (2013–2014) of the Population Assessment of Tobacco and Health (PATH) study. *Drug Alcohol Depend*. 2017;178:257–266.
17. National Addiction & HIV Data Archive Program. Population Assessment of Tobacco and Health (PATH) Study Series. 2018; <https://doi.org/10.3886/Series606>. Accessed April 12, 2018.

18. Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol.* 2004;159(7):702–706.
19. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika.* 1986;73(1):13–22.
20. Hardin JW, Hilbe JM. *Generalized Estimating Equations.* Boca Raton, FL: Chapman and Hall/CRC; 2002.
21. McCarthy P. *Pseudoreplication: Further Evaluation and Application of the Balanced Half-Sample Technique.* *Vital and Health Statistics.* Washington, DC: National Center for Health Statistics, Public Health Service; 1969.
22. Judkins DR. Fay's method for variance estimation. *J. Off. Stat.* 1990;6(3):223–239.
23. Giovino GA, Villanti AC, Mowery PD, et al. Differential trends in cigarette smoking in the USA: is menthol slowing progress? *Tob Control.* 2015;24(1):28–37.
24. Villanti AC, Giovino GA, Barker DC, Mowery PD, Sevilimedu V, Abrams DB. Menthol brand switching among adolescents and young adults in the National Youth Smoking Cessation Survey. *Am J Public Health.* 2012;102(7):1310–1312.
25. Rath JM, Villanti AC, Williams VF, Richardson A, Pearson JL, Vallone DM. Patterns of longitudinal transitions in menthol use among US young adult smokers. *Nicotine Tob Res.* 2015;17(7):839–846.
26. Kasza KA, Hyland AJ, Bansal-Travers M, et al. Switching between menthol and nonmenthol cigarettes: findings from the U.S. cohort of the international tobacco control four country survey. *Nicotine Tob Res.* 2014;16(9):1255–1265.
27. Delnevo CD, Hrywna M. “A whole ‘nother smoke’” or a cigarette in disguise: How RJ Reynolds reframed the image of little cigars. *Am J Public Health.* 2007;97(8):1368–1375.