Nicotine & Tobacco Research, 2018, 1062–1068
doi:10.1093/ntr/ntx181
Original investigation
Received May 12, 2017; Editorial Decision August 7, 2017; Accepted August 11, 2017

Original investigation

Differences in Subjective Experiences to First Use of Menthol and Nonmenthol Cigarettes in a National Sample of Young Adult Cigarette Smokers

Joanne D'Silva MPH[1,2], Amy M. Cohn PhD[3,4], Amanda L. Johnson MHS[1], Andrea C. Villanti PhD MPH[1,5]

[1]Schroeder Institute at Truth Initiative, Washington, DC; [2]Department of Behavioral and Community Health, University of Maryland School of Public Health, College Park, MD; [3]Battelle Memorial Institute, Arlington, VA; [4]Department of Oncology, Georgetown University Medical Center, Washington, DC; [5]Vermont Center on Behavior and Health, Department of Psychiatry, University of Vermont, Burlington, VT

Corresponding Author: Joanne D'Silva, MPH, Schroeder Institute at Truth Initiative, 900 G Street NW, Fourth Floor, Washington, DC 20001, USA. Telephone: 202-454-5771; Fax: 202-454-5785; E-mail: jdsilva@truthinitiative.org

Abstract

Purpose: Menthol has been hypothesized to ease the harshness of cigarette smoke. Thus, sensory experiences at first cigarette use may be one mechanism by which menthol facilitates progression to regular smoking. This study examined differences in subjective experiences to the first use of a menthol versus nonmenthol cigarette among new young adult smokers.

Methods: Data were drawn from waves 5–8 of the Truth Initiative Young Adult Cohort Study, a national sample of 18–34 year olds assessed every 6 months. Analyses included a subset of young adult current smokers (n = 251) who initiated smoking in the past 6 months. Subjective responses to first cigarette use were assessed across menthol and nonmenthol initiators in bivariate analyses and adjusted models controlling for smoking correlates.

Results: Fifty-two percent of new young adult smokers used a menthol cigarette at first use. First use of a menthol cigarette was higher in those aged 18–24 (vs. 25–34). Most black smokers (93.1%) were menthol initiators compared to 43.9% of white smokers. More than half of menthol and nonmenthol initiates felt relaxed or calm, dizzy, lightheaded, liking the taste and a rush or buzz at first use. Menthol initiators were less likely in bivariate and multivariable analyses to experience feeling nauseated at first use (adjusted odds ratio = 0.45; p = .020) compared to nonmenthol initiators.

Conclusions: While few differences were found between menthol and nonmenthol initiators in their subjective experiences, fewer menthol initiates felt nauseated at first cigarette use. Future research needs to identify additional mechanisms linking menthol initiation to smoking progression.

Implications: Menthol initiators were more likely to be younger (18–24 vs. 25–34), and black (vs. white) compared to nonmenthol initiators. Our finding that menthol initiators were less likely to feel nauseated at first cigarette use compared to nonmenthol initiators suggests that menthol may reduce aversion to early cigarette use among young smokers and thus has the potential to facilitate continued experimentation. Interventions and policy approaches to reduce tobacco use initiation and progression are urgently needed in young people.

Introduction

Although cigarette smoking among young adults significantly declined between 2005 and 2015,[1] the prevalence of menthol cigarette use in this age group increased.[2] Menthol decreases respiratory irritation from inhaled cigarettes and its anesthetic properties are hypothesized to mask the harshness of smoking.[3,4] In young people, initiating smoking with menthol cigarettes is associated with progression to established smoking, and nicotine dependence and young menthol smokers have greater difficulty quitting.[5,6] Menthol in cigarettes also enhances nicotine administration and increases respiratory airflow, enabling users to inhale deeper, thus increasing exposure to toxins, which could potentially lead to more adverse tobacco-related health outcomes.[4,7,8] The increased use of menthol cigarettes in young smokers[2,9] highlights the need for further study of mechanisms linking menthol to initial smoking experiences to inform prevention efforts.

Previous research shows that smokers recall both pleasant and unpleasant experiences of their first cigarette. In a 2013 study by Klein et al.,[10] the majority of current adult smokers reported that their first cigarette was calming and relaxing, while also recalling coughing and disliking the taste. Studies examining initial smoking experiences among adolescents have found that initial pleasant experiences predict future smoking status[11,12] as well as rapid progression to regular smoking[13] and severity of nicotine dependence.[11,14] While the research is more robust for the association between pleasant experiences and future smoking behavior, the extent to which unpleasant experiences predict smoking outcomes is equivocal due to differences in samples, varied measurement of subjective response items, and individual differences in interpretation of subjective responses. For example, Urbán[11] found that initial unpleasant experiences were negatively associated with regular cigarette use in a sample of high school students whereas Baggio et al.[15] found a positive association between initial unpleasant experiences and past 12-month cigarette use in a sample of young men. Further, with respect to individual differences in interpretation of sensory experiences from smoking, feeling a "buzz" or "rush" may be perceived as pleasant for some respondents (eg, those who tend toward sensation seeking) whereas others may interpret these experiences as negative.[16] Despite the known sensory properties of menthol,[4] none of the aforementioned studies examined whether these initial subjective responses were influenced by whether the type of cigarette was menthol or nonmenthol.

Tobacco industry documents reveal that cigarette manufacturers manipulated the menthol content of cigarettes to attenuate the negative reactions typically associated with first smoking experiences.[17] As a result, menthol may facilitate smoking uptake by altering negative sensory experiences of cigarette smoking through improved airway inhalation, stimulation of cooling receptors, and suppression of respiratory irritation.[18] Given the unique sensory properties of menthol, it is possible that smoking initiates who use a menthol cigarette may report more pleasant than unpleasant experiences. However, to our knowledge, only one study has examined whether subjective responses to first cigarette use differed by menthol initiation. DiFranza et al.[19] examined first smoking experiences in a sample of seventh graders from two Massachusetts cities and found no differences in reports of pleasant (relaxation) or unpleasant (irritation, nausea, dizziness) experiences between those who reported initiating with a menthol versus a nonmenthol cigarette. Several limitations of this study are worth noting. Approximately half of respondents were unable to recall whether or not their first cigarette was mentholated.[19] Further, the sample was limited to youth who had ever inhaled a cigarette, but not those who had progressed to regular smoking.[19] Understanding the factors that link cigarette trial with regular smoking among new initiates may help identify important points for intervention to interrupt the progression to established use.

Sensory experiences at first cigarette use may be one putative mechanism by which initiation with a menthol cigarette is associated with regular smoking among young adult new smoking initiates[18]; however, little work has been done in this area. To fill this knowledge gap, this study used a national sample of young adult past 30-day cigarette smokers who had initiated in the past six months to examine (1) demographic, tobacco use, and tobacco-related risk correlates of menthol and nonmenthol initiation; (2) differences in pleasant and unpleasant subjective responses to first use of a menthol versus nonmenthol cigarette; and (3) the unique contribution of menthol initiation to subjective responses, above and beyond the contribution of demographics and other tobacco-related risk factors. Findings have the potential to inform the development of interventions that discourage experimentation with cigarettes and prevent progression to regular smoking.

Methods

Sample

Participants were drawn from waves 5 to 8 (July 2013 through July 2015) of the Truth Initiative Young Adult Cohort Study, a national cross-sectional and prospective study of young adults aged 18–34 assessed approximately every 6 months. Questions about menthol initiation were not asked in waves 1–4. Details about the study design and sample have been described elsewhere.[20] Participants were recruited from GfK's Knowledge Panel via address-based sampling, a probability-based statistically valid random sampling technique that provides a representative sample of the US population. African Americans and Hispanics were oversampled at baseline. After wave 1, the sample for each wave consisted of people who completed the previous wave plus a refresh sample to replace respondents lost to follow-up. For waves 5–8, in 64.2%–64.9% of identified households, one member was selected at random and completed a core profile survey in which the key demographic information was collected. The panel recruitment rate ranged between 13.5% and 14.4%. The household retention rate ranged from 28.9% to 35.1% and the study completion rate ranged from 61.1% to 63.1%, providing a cumulative response rate across waves 5–8 ranging from 1.6% to 2.0%.

The present study focused on a subset of $n = 251$ (unweighted) young adults aged 18–34 at study entry who were past 30-day cigarette smokers, reported initiating cigarette in the 6 months before survey response, and who provided data on subjective responses to first cigarette use (Supplementary Figure 1). This study was approved by Chesapeake Institutional Review Board, Inc.

Measures

Past 30-Day Cigarette Smoking and Subjective Responses to First Use

At each wave, participants who had initiated smoking in the past 6-months and who reported past 30-day use of cigarettes were defined as current smokers in that wave. To ascertain if the first cigarette smoked was menthol or nonmenthol, current smokers were asked

if their typical brand of cigarettes was menthol or nonmenthol and whether this was the brand they always used (yes/no). Smokers who responded "no" were then asked what brand they used when they first started, and whether that brand was menthol or nonmenthol. Smokers who said that they always used menthol or those who said their first brand was menthol were defined as "menthol initiators." Smokers who said that they always used nonmenthol or those who said their first brand was nonmenthol were defined as "nonmenthol initiators."

Subjective responses to first tobacco use were drawn from the Initial Use Module of the Lifetime Tobacco Use Questionnaire.[21] Participants who reported initiating cigarette smoking in the last 6 months were asked to "indicate how well these words describe how [they] felt immediately after [they] used tobacco or nicotine for the first time" from a scale of 1 (not at all) to 5 (intense): dizzy, lightheaded like fainting, nauseated, coughing or choking, difficulty inhaling, rush or buzz, relaxed or calm, liked the taste, and liked the smell. Each of the nine subjective responses was recoded as a dichotomous measure based on the distribution of the data: ratings of 1 or 2 "not at all/low" versus ratings of 3–5 "moderate-intense."

Covariates: Demographic Factors, Mental Health Symptoms, Alcohol, and Substance Use

Demographic variables were measured at study entry and included age (18–24 and 25–34 years old), gender, race/ethnicity (white non-Hispanic, black non-Hispanic, other non-Hispanic, Hispanic) and education (less than high school, high school, at least some college). Financial situation was assessed at waves 5 and 7 with the following item: "Considering your own income and the income from any other people who help you, how would you describe your overall personal financial situation?" with response options "Live comfortably," "Meet needs with a little left," "Just meet basic expenses," and "Don't meet basic expenses." Respondents who had entered the study at an even-numbered wave were asked the financial situation item at a subsequent odd-numbered wave (eg, a respondent who entered the study at wave 6 was asked about their financial situation at wave 7).

A dichotomous variable was created to assess depression and anxiety symptoms in the past 2 weeks from the two-item Patient Health Questionnaire (PHQ-2)[22,23] and the Generalized Anxiety Disorder (GAD) scale,[24,25] using data from study entry, since menthol cigarette use has been associated with mental health symptoms.[26] The PHQ-2 assesses depressed mood and loss of interest in pleasant activities while the GAD asks about uncontrollable worry and feelings of anxiety. Responses were 0 = "not at all" to 3 = "nearly every day" and scores on each scale ranged from 0 to 6. Individuals who received a score at or above the cut-off (≥3) on either scale were coded as reporting depression or anxiety symptoms as per established guidelines.[23,25]

Alcohol, marijuana, and other drug use were assessed as wave-specific variables (not based on study entry assessment) and included as covariates because substance use is robustly associated with cigarette smoking in general, and prevalent among young adult menthol smokers.[27,28] Current alcohol use was assessed differently for waves 5 and 6 versus waves 7 and 8. In waves 5 and 6, all participants were asked about the frequency of their current use, with response options "every day," "some days," and "not at all." Those who reported using alcohol "some days" or "every day" were defined as current users in that particular wave. For waves 7 and 8, current alcohol use was determined by two items. The first item asked about frequency of drinking alcohol in the past year ("never," "monthly or less," "2–4 times per month," "2–3 times per week," and "4 or more times per week"). Those who reported any use of alcohol in the past year were then queried about the frequency of use in the past 30 days, with respondents using ≥1 day in the past month defined as current alcohol users. Those with who reported no use of alcohol in the past year, 0 days in the past month, or were missing data were defined as noncurrent alcohol users in that particular wave. For current marijuana and other drug use (cocaine, ecstasy, meth, etc.), participants were asked about the frequency of their current use for each substance, with response options "every day," "some days," and "not at all," similarly across all waves. Those who reported current use some days or every day were defined as current users. Those with missing data were defined as noncurrent users in that particular wave.

Statistical Analysis

Analyses were performed using SPSS 23. Descriptive statistics were first used to examine demographic, mental health symptoms, and substance use characteristics of first use of a menthol versus nonmenthol cigarette. Next, chi-square analyses were used to examine differences in the prevalence of each of the nine subjective responses (not at all/low versus moderate/intense) for menthol and nonmenthol initiators. Finally, multivariable logistic regression was conducted to assess the relationship between menthol initiation (yes/no) and each subjective response, after controlling for demographic, mental health, and substance use characteristics. Subjective responses chosen for the outcomes of multivariable analyses were based on those that differed at the bivariate level.

Results

Sample Characteristics

Table 1 shows the sample characteristics and differences between menthol and nonmenthol initiators. Overall, respondents were primarily white and female, most had a high school education or more, and about half reported a financial status of meeting needs with a little left or living comfortably. Almost one-third (30.9%) of the sample reported symptoms consistent with anxiety or depression, 73.3% were current alcohol users, 34.7% were current marijuana users, and 9.6% current other drug users.

Overall, 53.0% were current menthol smokers, and just over half (51.8%) reported using a menthol cigarette at first use. Menthol initiators were more likely to be black (20.8%) relative to nonmenthol initiators (1.7%) whereas nonmenthol initiators were more likely to be white (64.5%) than menthol initiators (46.9%). Most black smokers (93.1%) reported initiating smoking with menthol cigarettes compared to slightly less than half (43.9%) of white smokers. The majority of participants reported currently using the same type of cigarette that they reported at first use, with 90.9% of nonmenthol smokers and 93.8% of menthol smokers maintaining the same cigarette type since initiation.

Subjective Responses to First Cigarette by Menthol Initiation Status

Table 2 shows subjective responses to first cigarette across menthol initiators and nonmenthol initiators. Overall, two-thirds of respondents reported feeling moderately-intensely relaxed or calm (67.4%); just over half reported moderate to intense feelings of dizziness (56.7%), lightheadedness (54.4%) liking the taste (54.7%), and a rush or buzz feeling (57.1%).

Relative to nonmenthol initiators, a lower proportion of menthol initiators reported a moderate-intense feeling of nausea (26.4% vs.

Table 1. Demographic, Mental Health and Substance Use Characteristics Among Current Smokers Who Initiated Cigarette Smoking in the Past 6 Months (Truth Young Adult Cohort Waves 5–8) (n = 251)

	Full sample		Nonmenthol initiator		Menthol initiator		
	%	*n*	%	*n*	%	*n*	*p*-Value
Overall		251	48.2	121	51.8	130	.569
Demographics							
Age							**<.001**
18–24	51.6	129	40.8	49	61.5	80	
25–34	48.4	121	59.2	71	38.5	50	
Gender							.458
Male	42.2	106	44.6	54	40.0	52	
Female	57.8	145	55.4	67	60.0	78	
Race/ethnicity							**<.001**
White, non-Hispanic	55.4	139	64.5	78	46.9	61	
Black, non-Hispanic	11.6	29	1.7	2	20.8	27	
Other, non-Hispanic	7.6	19	10.7	13	4.6	6	
Hispanic	25.5	64	23.1	28	27.7	36	
Education							.100
Less than high school	14.7	37	14.9	18	14.6	19	
High school	38.2	96	44.6	54	32.3	42	
Some college or more	47.0	118	40.5	49	53.1	69	
Financial situation							.584
Do not meet basic expenses	10.3	23	11.9	13	8.7	10	
Just meet basic expenses	38.4	86	41.3	45	35.7	41	
Meet needs with a little left	34.8	78	31.2	34	38.3	44	
Live comfortably	16.5	37	15.6	17	17.4	20	
Mental health							.621
Any anxiety or depressive symptoms	69.1	172	70.6	84	67.7	88	
No anxiety or depressive symptoms	30.9	77	29.4	35	32.3	42	
Substance use							
Menthol cigarette use							**<.001**
No past 30-day use	47.0	118	90.9	110	6.2	8	
Past 30-day use	53.0	133	9.1	11	93.8	122	
Alcohol use							.179
No past 30-day use	26.7	67	30.6	37	23.1	30	
Past 30-day use	73.3	184	69.4	84	76.9	100	
Marijuana use							.607
No past 30-day use	65.3	164	66.9	81	63.8	83	
Past 30-day use	34.7	87	33.1	40	36.2	47	
Other drug use							.125
No past 30-day use	90.4	227	93.4	113	87.7	114	
Past 30-day use	9.6	24	6.6	8	12.3	16	

Percentages may not equal 100 due to rounding. Boldface indicates statistical significance. Missing observations: age (1), financial situation (27), and mental health (2).

44.8%) (p < .01). Menthol initiators were also less likely to report moderate-intense difficulty inhaling (33.3% vs. 44.3%) and liking the smell (33.9% vs. 44.8%); however, these findings were marginally significant (ps = .08). No other significant differences were found.

Multivariable logistic regression analysis of the association between menthol initiation (yes/no) and the subjective response that differed at the bivariate level (ie, nauseated) was conducted, controlling for demographic, mental health symptoms, and substance use characteristics. Menthol initiators remained significantly less likely than nonmenthol initiators to report feeling moderate-intense nausea (adjusted odds ratio = 0.45, 95% confidence interval = 0.23, 0.88; Table 3) in the adjusted model.

Discussion

To our knowledge, this is the first study to examine subjective responses associated with first use of menthol and nonmenthol cigarettes in a national sample of young adult smokers who recently initiated cigarette smoking. In this study, over half of the sample was current menthol smokers (53.0%), findings that are consistent with other national data.[2] Also in line with prior research,[29] we found that approximately half (51.8%) of current smokers reported initiating with menthol cigarettes and that the majority of black smokers initiated with a menthol cigarette. Menthol and nonmenthol initiators reported similar reactions to their first cigarette; however, menthol initiators were less likely to experience feeling nauseated compared to nonmenthol initiators suggesting that menthol has the potential to facilitate continued experimentation. Also, similar to the study by Rath et al.,[30] we found that the vast majority of participants continued to smoke the same type of cigarette after initiation; however, 6 months may not be a long enough time period to show switching behavior.

While this study begins to fill an important gap in the literature[18] by providing evidence that most black smokers initiate smoking with menthol cigarettes, our study did not have a sufficient sample size to conduct analyses on subjective experiences stratified by race and

Table 2. Intensity of Subjective Responses to First Cigarette Used by Menthol Versus Nonmenthol Initiators

	Overall (n = 251)		Nonmenthol initiator (n = 121)		Menthol initiator (n = 130)		
Subjective response	Not at all or low (%)	Moderate-intense (%)	Not at all or low (%)	Moderate-intense (%)	Not at all or low (%)	Moderate-intense (%)	p-Value
Dizzy	43.3	56.7	40.7	59.3	45.7	54.3	.423
Lightheaded, like fainting	45.6	54.4	44.0	56.0	47.2	52.8	.614
Nauseated	64.9	35.1	55.2	44.8	73.6	26.4	**.002**
Coughing or choking	51.6	48.4	47.5	52.5	55.4	44.6	.212
Liked the taste	45.3	54.7	46.1	53.9	44.5	55.5	.808
Relaxed or calm	32.6	67.4	32.5	67.5	32.8	67.2	.953
Rush or buzz	42.9	57.1	43.2	56.8	42.6	57.4	.926
Difficulty inhaling	61.5	38.5	55.7	44.3	66.7	33.3	.078
Liked the smell	60.9	39.1	55.2	44.8	66.1	33.9	.080

Boldface indicates statistical significance. p-Values indicate differences between menthol and nonmenthol initiators. Missing observations: dizzy (4), lightheaded (10), nauseated (6), coughing or choking (3), liked the taste (8), relaxed or calm (9), rush or buzz (4), difficulty inhaling (7), and liked the smell (8).

Table 3. Logistic Regression Model Predicting Moderate to High Intensity Nausea Versus No/Low Intensity Nausea at First Use of a Cigarette in Young Adults (n = 213)

	Nauseated		
	aOR	95% CI	p-Value
Age			
18–24	Ref.		
25–34	0.68	(0.36, 1.27)	.222
Gender			
Male	Ref.		
Female	0.61	(0.33, 1.13)	.117
Race/ethnicity			
White, non-Hispanic	Ref.		
Black, non-Hispanic	1.05	(0.35, 3.14)	.930
Other, non-Hispanic	2.32	(0.72, 7.48)	.158
Hispanic	1.28	(0.62, 2.64)	.500
Education			
Less than high school	0.77	(0.29, 2.02)	.597
High school	1.96	(1.00, 3.83)	**.049**
Some college or more	Ref.		
Financial situation			
Does not meet basic expenses	3.37	(0.99, 11.47)	.052
Just meet basic expenses	1.00	(0.40, 2.55)	.995
Meet needs with a little left	1.28	(0.51, 3.19)	.603
Live comfortably	Ref.		
Mental health problems			
No anxiety or depressive symptoms	Ref.		
Any anxiety or depressive symptoms	0.97	(0.49, 1.89)	.917
Alcohol use			
No past 30-day use	Ref.		
Past 30-day use	1.41	(0.67, 2.97)	.364
Marijuana use			
No past 30-day use	Ref.		
Past 30-day use	0.50	(0.24, 1.07)	.504
Other drug use			
No past 30-day use	Ref.		
Past 30-day use	3.86	(1.24, 12.04)	**.020**
First cigarette			
Nonmenthol	Ref.		
Menthol	0.45	(0.23, 0.88)	**.020**

Boldface indicates statistical significance. aOR = adjusted odds ratio; CI = confidence interval.

ethnicity. Given that previous studies have found that black smokers are less likely to report unpleasant experiences from smoking, these associations are important to examine in future work.[12,31] It was also surprising that despite a reported preference for menthol cigarettes because of its minty taste,[32–34] menthol initiators did not report liking the taste more than nonmenthol initiators. Previous research has shown how targeted marketing toward young adults may capitalize on young people's curiosity to try flavored products.[35,36] Thus, it is possible that preconceived notions about menthol's harm may be associated with initiation of menthol among young people and subjective responses to their first menthol cigarette;[34] however, we did not measure harm perceptions of menthol versus nonmenthol cigarettes before smoking initiation. A recent study by Wackowski et al.[34] also found that young adult menthol initiators cited perceived popularity of menthol cigarettes among peers and recognizability of menthol product marketing as primary reasons for menthol initiation. Future studies should explore how expectancies related to first smoking experiences are also influenced by social and environmental factors.

Consistent with prior research,[10] the majority of smokers in our study reported concurrently feeling relaxed or calm after first cigarette use, while also feeling dizzy and lightheaded. These seemingly contradictory experiences are consistent with previous studies[14,37] and are in line with Pomerleau's sensitivity model:[37] smokers who are highly sensitive to nicotine report more positive and negative initial sensory experiences relative to those who remain nonsmokers, underscoring a potential vulnerability to nicotine dependence. Regardless of sensitivity, at the biological level, nicotine is a powerful stimulant, and its route of administration (inhalation) allows it to cross the blood–brain barrier and reach the brain at an alarmingly fast rate thus enhancing the reinforcing effects of nicotine.[38]

This study adds to the literature on factors associated with menthol cigarette use in the following ways. First, it expands on the DiFranza et al.[19] findings by including a sample of current smoking young adults, a high-risk group that needs further attention. Second, our sample included those that had initiated cigarette smoking, in the past 6 months, thereby reducing the probability of nonresponse and recall bias in remembering first experiences. Third, our study relied on a national sample of young adult smokers whereas prior studies have used convenience samples. Although our prevalence estimates of alcohol (73.3%), marijuana (34.7%), and other drug use (9.6%) in this study seem high, these estimates

are slightly lower than those reported in the 2013 National Survey on Drug Use and Health for these behaviors among young adult cigarette users.[39]

Several limitations should be noted in interpreting these findings. First, subjective responses were assessed retrospectively. It is plausible that participants unconsciously altered their report of first experiences to match their current experiences with smoking, though this study focused on past 6 month initiates to reduce recall bias and the recall period was the same for menthol versus nonmenthol cigarette initiates. Second, the study was limited to past 30-day cigarette smokers and findings may not be representative of young adults who try smoking but discontinue cigarette use. Given the high prevalence of polytobacco use in young people,[40,41] including other combustible tobacco use, subjective response to a first cigarette may be affected by prior experiences with a noncigarette product. Future research is needed to understand differences in subjective responses to initiation with other menthol and flavored tobacco products that are increasingly popular among young adults (little cigars, e-cigarettes). Third, this study employed an existing online panel to recruit young adults, a group typically identified as hard-to-reach. The study sample's completion rate (61.1%–63.1%) and cumulative response rate (1.6%–2.0%;) are similar to that of other health studies that have relied on GfK's KnowledgePanel.[42–45] The internal validity of our results is not compromised by the panel's cumulative response rate, and other work suggests that surveys with a low response rate can still be representative of the sample population, even though the risk of nonresponse bias is higher.[46,47] Studies assessing nonresponse to panel recruitment in GfK's KnowledgePanel have found little indication of nonresponse bias on core demographic and socioeconomic variables[48,49] and previous estimates from this cohort for key outcomes of interest, such as ever and current cigarette use, are consistent with national survey data.[50]

To develop effective prevention programs, it is important to understand the complex array of factors that influence young adults' early smoking experiences. Our finding that a significantly lower proportion of menthol initiators experienced feeling nauseated suggests that menthol may reduce an aversive reaction to the first cigarette. Similarities in other subjective experiences among menthol and nonmenthol initiators suggest that other factors may play a role in the progression from experimentation toward established cigarette smoking. Future research is needed to explicate these mechanisms and to inform interventions and policies to reduce tobacco use in young people.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

Funding

This study was funded by Truth Initiative. All authors were supported by Truth Initiative. Dr Villanti was also supported by the Centers of Biomedical Research Excellence (P20GM103644 award) from the National Institute on General Medical Sciences and the Tobacco Centers of Regulatory Science (TCORS; award P50DA036114) from the National Institute on Drug Abuse and Food and Drug Administration (FDA). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Food and Drug Administration.

Declaration of Interest

None declared.

References

1. Jamal A, King BA, Neff LJ, Whitmill J, Babb SD, Graffunder CM. Current cigarette smoking among adults—United States, 2005–2015. *MMWR Morb Mortal Wkly Rep*. 2016;65(44):1205–1211.
2. 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.
3. Ahijevych K, Garrett BE. The role of menthol in cigarettes as a reinforcer of smoking behavior. *Nicotine Tob Res*. 2010;12(suppl 2):S110–S116.
4. Lawrence D, Cadman B, Hoffman AC. Sensory properties of menthol and smoking topography. *Tob Induc Dis*. 2011;9(suppl 1):S3.
5. Nonnemaker J, Hersey J, Homsi G, Busey A, Allen J, Vallone D. Initiation with menthol cigarettes and youth smoking uptake. *Addiction*. 2013;108(1):171–178.
6. Levy DT, Blackman K, Tauras J, et al. Quit attempts and quit rates among menthol and nonmenthol smokers in the United States. *Am J Public Health*. 2011;101(7):1241–1247.
7. Biswas L, Harrison E, Gong Y, et al. Enhancing effect of menthol on nicotine self-administration in rats. *Psychopharmacology*. 2016;233(18):3417–3427.
8. Wang T, Wang B, Chen H. Menthol facilitates the intravenous self-administration of nicotine in rats. *Front Behav Neurosci*. 2014;8:437.
9. Giovino GA, Villanti AC, Mowery PD, et al. Differential trends in cigarette smoking in the USA: is menthol slowing progress? *Tob Control*. 2015;24:28–37.
10. Klein H, Sterk CE, Elifson KW. Initial smoking experiences and current smoking behaviors and perceptions among current smokers. *J Addict*. 2013;2013:1–9. doi:10.1155/2013/491797.
11. Urbán R. Early smoking experience in adolescents. *Addict Behav*. 2010;35(6):612–615.
12. Ríos-Bedoya CF, Pomerleau CS, Neuman RJ, Pomerleau OF. Using MIMIC models to examine the relationship between current smoking and early smoking experiences. *Nicotine Tob Res*. 2009;11(9):1035–1041.
13. Sartor CE, Lessov-Schlaggar CN, Scherrer JF, et al. Initial response to cigarettes predicts rate of progression to regular smoking: findings from an offspring-of-twins design. *Addict Behav*. 2010;35(8):771–778.
14. DiFranza JR, Savageau JA, Fletcher K, et al. Susceptibility to nicotine dependence: the Development and Assessment of Nicotine Dependence in Youth 2 study. *Pediatrics*. 2007;120(4):e974–e983.
15. Baggio S, Studer J, Deline S, Mohler-Kuo M, Daeppen J-B, Gmel G. The relationship between subjective experiences during first use of tobacco and cannabis and the effect of the substance experienced first. *Nicotine Tob Res*. 2014;16(1):84–92.
16. Dar R, Kaplan R, Shaham L, Frenk H. Euphoriant effects of nicotine in smokers: fact or artifact? *Psychopharmacology*. 2007;191(2):203–210.
17. Kreslake JM, Wayne GF, Connolly GN. The menthol smoker: tobacco industry research on consumer sensory perception of menthol cigarettes and its role in smoking behavior. *Nicotine Tob Res*. 2008;10(4):705–715.
18. Alexander LA, Trinidad DR, Sakuma K-LK, et al. Why we must continue to investigate menthol's role in the African American smoking paradox. *Nicotine Tob Res*. 2016;18(suppl 1):S91–S101.
19. DiFranza JR, Savageau JA, Fletcher K, et al. Recollections and repercussions of the first inhaled cigarette. *Addict Behav*. 2004;29(2):261–272.
20. Rath JM, Villanti AC, Williams VF, Richardson A, Pearson JL, Vallone DM. Correlates of current menthol cigarette and flavored other tobacco product use among U.S. young adults. *Addict Behav*. 2016;62:35–41.
21. Brigham J, Lessov-Schlaggar CN, Javitz HS, McElroy M, Krasnow R, Swan GE. Reliability of adult retrospective recall of lifetime tobacco use. *Nicotine Tob Res*. 2008;10(2):287–299.
22. Löwe B, Kroenke K, Gräfe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *J Psychosom Res*. 2005;58(2):163–171.

23. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care*. 2003;41(11):1284–1292.
24. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med*. 2007;146(5):317–325.
25. Skapinakis P. The 2-item Generalized Anxiety Disorder scale had high sensitivity and specificity for detecting GAD in primary care. *Evid Based Med*. 2007;12(5):149.
26. Cohn AM, Johnson AL, Hair E, Rath JM, Villanti AC. Menthol tobacco use is correlated with mental health symptoms in a national sample of young adults: implications for future health risks and policy recommendations. *Tob Induc Dis*. 2016;14(1):1.
27. Cohn A, Villanti A, Richardson A, et al. The association between alcohol, marijuana use, and new and emerging tobacco products in a young adult population. *Addict Behav*. 2015;48:79–88.
28. Cohn A, Johnson A, Pearson J, et al. Determining non-cigarette tobacco, alcohol, and substance use typologies across menthol and non-menthol smokers using latent class analysis. *Tob Induc Dis*. 2017;15(1):5.
29. Substance Abuse and Mental Health Services Administration. *The NSDUH Report: Recent Trends in Menthol Cigarette Use*. Rockville, MD: SAMHSA; 2011.
30. 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.
31. Finkenauer R, Pomerleau CS, Snedecor SM, Pomerleau OF. Race differences in factors relating to smoking initiation. *Addict Behav*. 2009;34(12):1056–1059.
32. Richter P, Beistle D, Pederson L, O'Hegarty M. Small-group discussions on menthol cigarettes: listening to adult African American smokers in Atlanta, Georgia. *Ethn Health*. 2008;13(2):171–182.
33. Unger JB, Allen B, Leonard E, Wenten M, Cruz TB. Menthol and non-menthol cigarette use among black smokers in Southern California. *Nicotine Tob Res*. 2010;12(4):398–407.
34. Wackowski OA, Evans KR, Harrell MB, et al. In their own words: young adults' menthol cigarette initiation, perceptions, experiences and regulation perspectives. *Nicotine Tob Res*. 2017. doi: 10.1093/ntr/ntx048.
35. Carpenter CM, Wayne GF, Connolly GN. The role of sensory perception in the development and targeting of tobacco products. *Addiction*. 2007;102(1):136–147.
36. Anderson SJ. Marketing of menthol cigarettes and consumer perceptions: a review of tobacco industry documents. *Tob Control*. 2011;20(suppl 2):ii20–ii28.
37. Pomerleau OF, Hariharan M, Pomerleau CS, Cameron OG, Guthrie SK. Differences between smokers and never-smokers in sensitivity to nicotine: a preliminary report. *Addiction*. 1993;88(1):113–118.
38. Le Houezec J. Role of nicotine pharmacokinetics in nicotine addiction and nicotine replacement therapy: a review. *Int J Tuberc Lung Dis*. 2003;7(9):811–819.
39. Substance Abuse and Mental Health Services Administration. *Results from the 2013 National Survey on Drug Use and Health: Detailed Tables*. Rockville, MD: SAMHSA; 2013.
40. Villanti AC, Pearson JL, Glasser AM, et al. Frequency of youth e-cigarette and tobacco use patterns in the US: measurement precision is critical to inform public health. *Nicotine Tob Res*. 2016. doi: 10.1093/ntr/ntw388.
41. Soneji S, Sargent J, Tanski S. Multiple tobacco product use among US adolescents and young adults. *Tob Control*. 2016;25(2):174–180.
42. Kelly B, Squiers L, Bann C, Stine A, Hansen H, Lynch M. Perceptions and plans for prevention of Ebola: results from a national survey. *BMC Public Health*. 2015;15(1):1136.
43. Grande D, Mitra N, Shah A, Wan F, Asch DA. Public preferences about secondary uses of electronic health information. *JAMA Intern Med*. 2013;173(19):1798–1806.
44. Kumar S, Quinn SC, Kim KH, Daniel LH, Freimuth VS. The impact of workplace policies and other social factors on self-reported influenza-like illness incidence during the 2009 H1N1 pandemic. *Am J Public Health*. 2012;102(1):134–140.
45. Fowler FJ Jr, Gerstein BS, Barry MJ. How patient centered are medical decisions?: Results of a national survey. *JAMA Intern Med*. 2013;173(13):1215–1221.
46. Brick JM. The future of survey sampling. *Public Opin Q*. 2011;75(5):872–888.
47. Halbesleben JR, Whitman MV. Evaluating survey quality in health services research: a decision framework for assessing nonresponse bias. *Health Serv Res*. 2013;48(3):913–930.
48. Heeren T, Edwards EM, Dennis JM, Rodkin S, Hingson RW, Rosenbloom DL. A comparison of results from an alcohol survey of a prerecruited Internet panel and the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcohol Clin Exp Res*. 2008;32(2):222–229.
49. Garrett J, Dennis JM, DiSogra CA. *Non-response bias: Recent findings from address-based panel recruitment*. Annual Conference of the American Association for Public Opinion Research; 2010; Chicago, IL.
50. Rath JM, Villanti AC, Abrams DB, Vallone DM. Patterns of tobacco use and dual use in US young adults: the missing link between youth prevention and adult cessation. *J Environ Public Health*. 2012;2012:679134.