

Original investigation

The Association of Menthol Cigarette Use With Quit Attempts, Successful Cessation, and Intention to Quit Across Racial/Ethnic Groups in the United States

Courtney Keeler PhD¹, Wendy Max PhD², Valerie Yerger ND³,
Tingting Yao PhD², Michael K. Ong MD, PhD^{4,5}, Hai-Yen Sung PhD²

¹Department of Population Health Sciences, School of Nursing, University of San Francisco, San Francisco, CA; ²Institute for Health and Aging, School of Nursing, University of California, San Francisco, CA; ³Department of Social and Behavioral Sciences, School of Nursing, University of California, San Francisco, CA; ⁴Department of Medicine, University of California, Los Angeles, CA; ⁵Department of Medicine, VA Greater Los Angeles Healthcare System, Los Angeles, CA

Corresponding Author: Courtney Keeler, PhD, Department of Population Health Sciences, School of Nursing, University of San Francisco, 2130 Fulton Street, San Francisco, CA 94117, USA. Telephone: 415-422-6683; Fax: 415-422-6877; E-mail: ckeeler@usfca.edu

Abstract

Introduction: Few studies have examined the relationship between menthol use and smoking cessation across various racial/ethnic groups; the findings were mixed. This study explored the association of menthol cigarette use with quit attempts, smoking cessation, and intention-to-quit among US adults and by race/ethnicity.

Methods: Using the 2006/2007 and 2010/2011 Tobacco Use Supplements to the Current Population Survey data, this study analyzed 54 448 recent active smokers, defined as current smokers or former smokers who quit less than 12 months ago. Three behaviors were examined: any quit attempts in the past 12 months, successful cessation for ≥ 3 months, and intention-to-quit smoking in the next 6 months. For each cessation behavior, multiple logistic regression models were estimated separately for the full-sample and stratified racial/ethnic subsamples.

Results: While 72.3% of African American recent active smokers typically smoked menthol cigarettes, this proportion was 21.7%, 21.5%, and 28.0% for whites, Asians, and Hispanics, respectively. African American menthol smokers had higher odds of quit attempts compared to non-African American, non-menthol smokers (full-sample analysis), as well as African American non-menthol smokers (subsample analysis). Menthol use was not significantly associated with quit attempts in other racial/ethnic subsamples. There was no significant difference in either successful cessation or intention-to-quit between menthol and non-menthol smokers.

Conclusions: African American menthol smokers were more likely to attempt to quit smoking than non-menthol smokers but these quit attempts did not translate into successful cessation. This study revealed no association of menthol use with quit attempts, successful cessation, and intention-to-quit among other racial/ethnic groups.

Implications: The findings suggested that African American menthol smokers were more motivated to quit smoking; yet, the results also indicated no significant differences in successful cessation between African American menthol and non-menthol smokers. Interventions targeting menthol smokers within the African American community may help bridge this gap. While more

local sales restrictions are beginning to occur (eg, Tobacco 21 efforts), additional policies restricting price discounting as well as the regulation of access to and the time, place, and/or manner of menthol tobacco advertising could also improve cessation rates. Further evaluation is needed to determine the viability of these policies.

Introduction

Between 2005 and 2014, prevalence of current smokers among US adults decreased from 20.9% to 16.8%.¹ In recent years, annual quit attempt rates, defined as the percentage of recent active smokers (including both current smokers and former smokers who quit within the last year) who had made a quit attempt within the last 12 months, remained stable ranging between 52.4% (in 2010) and 52.9% (in 2012).^{2,3}

While quit attempts represent an essential steppingstone towards successful cessation, the impact of multiple quit attempts on successful cessation remains ambiguous. Although some literature found a negative association between multiple quit attempts and successful cessation,^{4,5} other studies suggested the converse to be true.⁶ Literature exploring differences between successful and unsuccessful quitters identified major distinctions in sociodemographic characteristics, health promoting behaviors, and levels of nicotine dependence.⁷ For example, the 2010 National Health Interview Survey data showed that, compared to non-Hispanic white smokers, non-Hispanic African American smokers were more likely to have made a quit attempt in the past year (50.7% vs. 59.1%) but less likely to have successfully quit smoking (6.0% vs. 3.3%).²

Menthol cigarette use (hereafter called “menthol use”) may be one of several important factors explaining the gap between quit attempts and successful cessation. Menthol is a flavoring additive with cooling and anesthetic properties that promotes the maintenance of smoking; menthol may also make cigarettes more addictive or at the very least make it easier to become more addicted.^{8,9} National survey data indicated differences in the prevalence of menthol use across sociodemographic groups. For instance, the 2008–2010 National Survey on Drug Use and Health data showed that, among persons aged ≥ 12 who smoked cigarettes in the past 30 days, 88.5% of non-Hispanic African Americans reported using menthol cigarettes in the past 30 days compared to 25.7% of non-Hispanic whites.¹⁰

Limited research has investigated the relationship between menthol use and smoking cessation across various racial/ethnic groups; the findings were mixed. Among all smokers, both clinical trials and longitudinal cohort studies have found no difference in smoking abstinence between menthol and non-menthol smokers.^{11–13} In contrast, studies using nationally representative survey data found a negative¹⁴ or insignificant association¹⁵ between menthol use and successful cessation. Among African Americans, clinical trials and cohort studies identified both a negative^{16–18} as well as an insignificant association¹³ between menthol use and smoking abstinence. Similarly, studies based on national survey data indicated a negative^{15,19} or insignificant²⁰ relationship between menthol use and smoking cessation. Among Hispanics, some studies revealed a negative association between menthol use and successful cessation;^{15,19,20} other work found no difference in abstinence between menthol and non-menthol smokers.¹⁸ Among non-Hispanic whites, the literature was inconclusive, showing the association to be positive,²⁰ negative,¹⁹ or insignificant.^{15,18} Research among Asians and Pacific Islanders was limited, although one study found a negative relationship between successful cessation and menthol use.¹⁹

Given the lack of consistent knowledge relating to menthol use and smoking cessation across race/ethnicity, this study examined the association between menthol use and smoking cessation behaviors—quit attempts, successful cessation, and intention-to-quit—among all US adults as well as various subgroups stratified by race/ethnicity. The data were drawn from a recent, large, nationally representative survey. It was hypothesized that there would be negative associations between menthol use and smoking cessation behaviors and that these associations would be most pronounced among non-Hispanic African Americans.

Methods

Data Source

This study used data from the latest two cycles of the Tobacco Use Supplement to the Current Population Survey (TUS-CPS) (2006/2007 and 2010/2011), which collects information on individual's tobacco use, including cigarette smoking history and consumption patterns, and quitting behaviors. Each cycle of the TUS-CPS contains a nationally representative sample of about 240 000 civilian, non-institutionalized individuals aged ≥ 18 in the United States (data prior to 2007 are for individuals aged ≥ 15). About 64% of respondents completed the interview by telephone and the rest in person. When the intended respondent was unavailable, proxy respondents were interviewed (approximately 20% of all interviews). Proxy respondents were only eligible to respond to a small portion of the survey items. Details of the sampling methods have been reported elsewhere.²¹

Study Population

This study analyzed adults aged ≥ 18 who were recent active smokers, defined as current smokers or former smokers who quit less than 12 months ago. Current smokers were defined as individuals who smoked 100 cigarettes in their lifetime and currently smoke every day (daily smokers) or some days (someday smokers). Former smokers were defined as individuals who smoked 100 cigarettes in their lifetime but currently do not smoke. Among recent active smokers, 75.1% identified as daily smokers, while 16.2% and 8.8% identified as someday smokers and former smokers who quit within 12 months, respectively.

Smoking Cessation Behaviors

Quit Attempts

The TUS-CPS asked current smokers separate questions about quit attempts depending on their smoking frequency.^{21,22} Daily smokers and someday smokers who smoked 12 or more of the past 30 days were asked: “During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking?” Someday smokers who smoked less than 12 of the past 30 days were asked: “During the past 12 months, have you tried to quit smoking completely?” Respondents who answered “yes” to these questions were classified as having made a quit attempt in the past 12 month.²² The prevalence of quit attempts was defined as the proportion of recent active smokers with quit attempts in the past 12 months.²

Successful Cessation

Successful smoking cessation was defined as having quit smoking for at least 3 months, a criterion used in previous cross-sectional smoking cessation studies.^{14,23,24} The prevalence of annual successful cessation rate was defined as the proportion of recent active smokers with successful cessation.^{14,24}

Intention-to-Quit Smoking

The TUS-CPS asked: “Are you seriously considering quitting smoking within the next 6 months?” Respondents who answered “yes” were classified as having intention-to-quit smoking.²⁵ The prevalence of intention-to-quit smoking was defined as the proportion of current smokers who have intention-to-quit smoking.

Menthol Use

Menthol use status was measured by the usual cigarette type instrument in the TUS-CPS questionnaire. Current smokers were asked in 2006/2007: “Is your usual cigarette brand menthol or non-menthol?” and in 2010/2011: “Do you usually smoke menthol or non-menthol cigarettes?”. Former smokers were asked in 2006/2007: “Thinking back to the year before you quit, during that time, was your usual cigarette brand menthol or non-menthol?” and in 2010/2011: “Around this time 12 months ago, were you usually smoking menthol or non-menthol cigarettes?” For all these questions, there were three choices for the answer (menthol, non-menthol, and no usual type).²¹ These response options were used to categorize our cigarette type variable.

Additional Covariates

Nicotine Dependence

This study defined nicotine dependence based on how soon a respondent reported typically smoking their first cigarette after waking.²⁶ The TUS-CPS asked smokers: “How soon after you wake up do you typically smoke your first cigarette of the day?” Those who answered “It varies” or “Don’t know,” or who refused to answer were asked the second question: “Would you say you smoke your first cigarette of the day within the first 30 minutes?” There were three choices for the answer to this question (yes, no, and varies).²¹ These response options were used to categorize our nicotine dependence variable.

Any Quit Attempts

In the intention-to-quit regression analyses, any quit attempts in the past 12 months (yes/no) was also included as a covariate.²⁷

Sociodemographic Characteristics

Sociodemographic variables included gender, age (18–34, 35–49, 50–64, and ≥65), race/ethnicity (non-Hispanic white, non-Hispanic African American, non-Hispanic Asian, Hispanic, and non-Hispanic Other), education (high school graduate [including General Education Diploma] or less, some college [including associate degree], and at least college degree), family income in the past year (<\$25 000, \$25 000–49 999, \$50 000–74 999, and ≥\$75 000), marital status (married, widowed/divorced, separated, and never married), census region of residence (Northeast, Midwest, South, and West), and survey year (2006/2007, and 2010/2011). The “non-Hispanic Other” category included non-Hispanic respondents who were multi-racial, Pacific Islander, American Indian or Alaska Native, or other races. Hereafter, the five racial/ethnic groups will be simply

referred to as whites, African Americans, Asians, Hispanics, and Other race for convenience.

Final Sample Size

From the pooled data, 61 115 self-respondents aged ≥18 met the criteria for recent active smokers (Table 1). After excluding 6667 respondents with missing values for the three cessation behavior variables ($N = 3383$) or covariates ($N = 3284$), the final study sample for the regression analyses on quit attempts and successful cessation contained 54 448 recent active smokers, including 43 062 whites, 4641 African Americans, 966 Asians, 3637 Hispanics, and 2142 of Other race/ethnicity. Among these 54 448 recent smokers, 49 437 were current smokers and constituted the final study sample for the regression analysis on intention-to-quit.

Statistical Analysis

Analyses were conducted using Stata13 (StataCorp, College Station, TX). Complex survey design was taken into consideration using the published TUS-CPS replicate weights with Fay’s balanced repeated replication.^{28,29} First, cross-tabulations were used to describe the frequency distribution of each covariate and smoking cessation behavior variable, separately for the full-sample and subsamples stratified by race/ethnicity. The comparisons of frequency distribution for whites versus African Americans, whites versus Asians, and whites versus Hispanics were assessed using bivariate analysis chi-square test. Second, the prevalence of past-year quit attempt, successful cessation, and intention-to-quit smoking were estimated for the full-sample and each subsample. Third, multiple logistic regression models on cessation behaviors were estimated separately for the full-sample and each racial/ethnic subsample; each regression control for menthol use and other covariates. In the full-sample regression models, an interaction term between cigarette type (non-menthol, menthol, and no usual type) and non-African American status (yes/no) was also included as a covariate. For multiple regression analyses, adjusted odds ratios (AOR), 95% confidence intervals (CIs), and p values were estimated.

To account for multiple testing, the estimates were considered to be statistically significant if the two-tailed p values were below the Bonferroni-adjusted significance levels. The Bonferroni adjustment divides the nominal significance level by the number of pairwise comparisons across a “family” of hypothesis tests.^{30,31} In this study, the nominal significance level was set at .01,³² which is a more stringent value than the usually adopted level at .05. For each variable in the cross-tabulation analyses, the Bonferroni-adjusted significance level for the chi-square test for the three pairwise comparisons (ie, whites vs. African Americans, whites vs. Asians, and whites vs. Hispanics) equaled .01 divided by 3. For each categorical covariate in the multiple regression analyses, the Bonferroni-adjusted significance level equaled .01 divided by the number of “comparison group versus reference group” comparisons within that covariate.³¹

Results

Sociodemographic and Smoking Characteristics

The majority of respondents were male (54.1%), between the ages of 18 and 34 (35.5%), white (74.9%), had a high school education or less (57.3%), had an annual family income below \$25 000 (34.9%), were married (41.2%), and were Southern (38.7%). Half of respondents usually smoked their first cigarette within 30 minutes of awakening (50.0%) and a majority typically smoked non-menthol cigarettes (68.6%) (Table 1).

Table 1. Demographic and Smoking Behavioral Characteristics, and Prevalence of Quit Attempts, Smoking Cessation, and Intention to Quit for the Full-Sample and Each Subsample Stratified by Race/Ethnicity^a Among Recent Active Smokers Aged ≥18, Who Participated in the Tobacco Use Supplement to the Current Population Survey, 2006/2007 and 2010/2011

	Subsamples														
	Full-sample (N = 61 115)			NH white (N = 48 196)			NHAA (N = 5339)			NH Asian (N = 1148)			Hispanic (N = 4059)		
	N	%	p value (vs. NH white)	N	%	p value (vs. NH white)	N	%	p value (vs. NH white)	N	%	p value (vs. NH white)	N	%	p value (vs. NH white)
Gender	61 115			48 196		.0254	5339			1148		<.0001*	4059		<.0001*
Female		45.9			47.8			45.9			25.6			35.1	
Male		54.1			52.2			54.1			74.5			64.9	
Age	61 115			48 196		<.0001*	5339			1148		<.0001*	4059		<.0001*
18 to 34		35.5			34.5			31.5			41.1			45.0	
35 to 49		31.5			31.2			32.6			33.2			32.6	
50 to 64		25.3			26.1			28.9			18.9			18.1	
≥65		7.7			8.3			7.1			6.8			4.3	
Race/ethnicity	61 115														
NH white		74.9													
NHAA		11.0													
NH Asian		2.3													
Hispanic		9.1													
NH Other		2.7													
Education	61 115			48 196		<.0001*	5339			1148		<.0001*	4059		<.0001*
≤High school graduate		57.3			55.2			65.2			36.2			71.3	
Some college		30.2			31.5			27.6			25.5			22.0	
At least college degree		12.5			13.3			7.2			38.2			6.7	
Family income	58 058			45 771		<.0001*	5033			1063		<.0001*	3891		<.0001*
<\$25 000		34.9			31.0			55.5			25.6			42.3	
\$25 000–\$49 999		31.3			31.8			27.5			27.9			33.3	
\$50 000–\$74 999		17.2			18.6			10.0			20.4			13.7	
≥\$75 000		16.6			18.6			7.1			26.1			10.7	
Marital status	61 115			48 196		<.0001*	5339			1148		<.0001*	4059		<.0001*
Married		41.2			43.3			25.7			49.4			42.9	
Widowed/divorced		23.0			24.5			21.5			11.4			15.5	
Separated		4.3			3.7			8.2			1.1			5.7	
Never married		31.5			28.6			44.6			38.2			36.0	
Region	61 115			48 196		<.0001*	5339			1148		<.0001*	4059		<.0001*
Northeast		16.8			17.4			15.1			18.7			16.1	
Midwest		25.8			28.8			21.9			12.6			10.0	
South		38.7			37.1			54.7			20.3			39.2	
West		18.6			16.7			8.3			48.5			34.7	
Survey year	61 115			48 196		.0073	5339			1148		.3329	4059		.0508
2006/2007		52.4			52.9			50.6			51.2			51.1	
2010/2011		47.6			47.1			49.4			48.8			48.9	

Table 1. Continued

	Subsamples																
	Full-sample (N = 61 115)			NH white (N = 48 196)			NHAA (N = 5339)			NH Asian (N = 1148)			Hispanic (N = 4059)				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	p value (vs. NH white)
How soon smoke first cigarette after awakening	59 184		46 757		5111		1084		3932								<.0001*
≥30 min		47.8		44.7		48.6		62.5		68.7							
<30 min		50.0		53.4		47.9		33.8		28.7							
No regular pattern	60 252		47 558		5242		1114		3997								<.0001*
Usual cigarette type																	
Non-menthol		68.6		75.6		24.0		69.9		65.2							
Menthol		28.0		21.7		72.3		21.5		28.0							
No usual type		3.4		2.8		3.7		8.6		6.8							
Quit attempts in past 12 months	59 314		46 867		5120		1086		3940								<.0001*
No		58.4		59.7		54.1		54.9		54.8							
Yes		41.6		40.3		45.9		45.1		45.2							
Successful cessation ≥3 months	61 115		48 196		5339		1148		4059								.1721
No		94.1		94.1		95.2		94.7		93.0							
Yes		5.9		6.0		4.8		5.3		7.1							
Intention to quit in next 6 months ^b	52 450		41 402		4596		959		3438								.6386
No		58.7		59.7		52.9		60.6		59.2							
Yes		41.3		40.3		47.1		39.4		40.8							

AA = African American; N = unweighted sample size; NH = non-Hispanic. All the percentages were estimated from the weighted analysis. *p* values were from the bivariate analysis chi-square tests to compare between non-Hispanic white and the specific racial/ethnic subgroup examined in the column.

^aNon-Hispanic Other group was not included in the subsample analysis.

^bOnly among current smokers.

* *p* value < the Bonferroni-adjusted significance level at .0033 (= two-tailed significance at .01 / # of pairwise comparisons = .01/3).

The bivariate analyses indicated that the distribution of all sociodemographic characteristics differ significantly between whites and other racial/ethnic groups except for gender between whites and African Americans. For example, while 52.2% and 13.3% of white recent active smokers were male and college graduates, respectively, the corresponding percentages were 74.4% and 38.2% for Asians. While 31.0% and 28.6% of white recent active smokers were in the lowest income group and never married, respectively, the corresponding percentages were 55.5% and 44.6% for African American smokers.

The distribution of usual cigarette type and nicotine dependence also differed significantly between whites and other racial/ethnic groups. Whereas 21.7% of whites typically smoked menthol cigarettes, this proportion was 72.3%, 21.5%, and 28.0%, respectively, for African Americans, Asians, and Hispanics. While 53.4% of whites smoked their first cigarette within 30 minutes of waking; this proportion was 47.9%, 33.8%, and 28.7%, respectively, for African Americans, Asians, and Hispanics.

Prevalence of Quit Attempts, Successful Cessation, and Intention-to-Quit

Among the full-sample, 41.6% made quit attempts in the last 12 months, 5.9% successfully quit smoking for at least 3 months, and 41.3% of current smokers intended to quit smoking in the next 6 months (Table 1). The prevalence rates for these three cessation behaviors among menthol smokers were 43.8%, 5.4%, and 43.7%, respectively, whereas the corresponding rates were 40.8%, 6.0%, and 40.9% among non-menthol smokers (Supplementary Table 1). Supplementary Table 1 also showed the detailed racial/ethnic-specific prevalence of each cessation behavior variable by usual cigarette type.

Among the white subsample, the prevalence of quit attempts, successful cessation, and intention-to quit was 40.3%, 6.0%, and 40.3%, respectively (Table 1). The bivariate analyses indicated that, compared to whites, African Americans experienced higher prevalence of past-year quit attempts (45.9%) and intention-to-quit (47.1%) but were not statistically different in terms of successful cessation (4.8%); whereas Hispanics experienced higher prevalence of past-year quit attempts (45.2%) but no statistical difference in the prevalence of successful cessation and intention-to-quit. There was no statistical difference in the prevalence of quit attempts, successful cessation, and intention-to-quit between whites and Asians.

Factors Associated With Quit Attempts

In Table 2, the full-sample multiple regression analysis showed that after controlling for other covariates, whites were not statistically different from any other racial/ethnic group in past-year quit attempts. Based on the interaction term results, compared to the reference group (ie, non-African American non-menthol smokers), African American menthol smokers were more likely to have past-year quit attempts (AOR = 1.37, 95% CI: 1.15–1.63). In the subsample analysis for African Americans, the menthol variable was statistically significant (AOR = 1.37, 95% CI: 1.16–1.61), indicating a positive association between menthol use and quit attempts. There was no significant association between menthol use and quit attempt in any other racial/ethnic subgroup.

For the full-sample and some subsamples, including whites and African Americans, compared to those who smoke their first cigarette ≥ 30 minutes of waking, those who smoke their first cigarette within 30 minutes or without regular pattern were less likely to have

past-year quit attempts. Among the full-sample, the odds of past-year quit attempts were significantly lower among males, those aged ≥ 35 , those with high school education or less, and those living in the South compared to the respective sociodemographic reference groups.

Factors Associated With Successful Cessation

In Table 3, the full-sample multiple regression analysis showed that whites were not statistically different from any other racial/ethnic group in successful cessation. The interaction term results showed no significant difference in the odds of successful cessation between non-African American non-menthol smokers and African American menthol smokers (AOR = 1.10, 95% CI: 0.79–1.55). The subsample analyses showed no significant difference in successful cessation between menthol smokers and non-menthol smokers among any racial/ethnic subgroup.

Smoking the first cigarette within 30 minutes of awakening was negatively associated with successful cessation for the full-sample and the white subsample. Among the full-sample, the odds of successful cessation were significantly lower among males than females, middle-aged adults (35–64) than young adults aged 18–34, those without a college degree than college graduates, and those who were never married than those who were married, but significantly higher among higher income groups ($\geq \$50,000$) than the lowest income group ($< \$25,000$).

Factors Associated With Intention-to-Quit

The full-sample analysis in Table 4 showed that after controlling for other covariates, whites were not statistically different from any other racial/ethnic group in intention-to-quit. The interaction term results showed no significant difference in the odds of intention-to-quit between non-African American non-menthol smokers and African American menthol smokers (AOR = 1.20, 95% CI: 1.01–1.43; $p = .0424$). The subsample analyses showed no significant difference in intention-to-quit between menthol smokers and non-menthol smokers among African Americans (AOR = 1.19, 95% CI: 0.99–1.44; $p = .0687$) and any other racial/ethnic subgroup. Compared to non-menthol smokers, non-usual-type smokers were less likely to have intention-to-quit among the full-sample and the white subsample.

Intention-to-quit was positively associated with having any quit attempts in the past 12 months for all groups. Smoking the first cigarette within 30 minutes of awakening was negatively associated with intention-to-quit for the full-sample and some subsamples, including whites and African Americans. No regular pattern of smoking one's first cigarette was negatively associated with intention-to-quit among the full-sample and the white subsample. Among the full-sample, the odds of intention-to-quit were significantly lower among those with high school education or less than college graduates, those who were never married than those who were married, and those living in the South than those living in the Northwest; the odds were significantly higher among middle-aged adults (35–64) compared to young adults aged 18–34 and among higher income groups ($\geq \$50,000$) relative to lowest income group ($< \$25,000$).

Discussion

Our results indicated that African American menthol smokers were more likely to attempt to quit smoking than non-menthol smokers, which was consistent with the results from Levy and colleagues.¹⁴

Table 2. Multiple Logistic Regression Analysis on Having Any Quit Attempts in the Past Year for the Full-Sample and Each Subsample Stratified by Race/Ethnicity* Among Recent Active Smokers Aged ≥18, Who Participated in the Tobacco Use Supplement to the Current Population Survey, 2006/2007 and 2010/2011

	Subsamples														
	Full-sample (N = 54 448)			NH white (N = 43 062)			NHAA (N = 4641)			NH Asian (N = 966)			Hispanic (N = 3637)		
	AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p	
Gender															
Female	REF			REF			REF			REF			REF		
Male	0.94 (0.90–0.98)	.0054*		0.94 (0.90–0.99)	.0133		1.00 (0.87–1.16)	.9810		1.24 (0.88–1.75)	.2090		0.85 (0.72–1.00)	.0491	
Age															
18 to 34	REF			REF			REF			REF			REF		
35 to 49	0.71 (0.67–0.76)	<.0001*		0.70 (0.65–0.75)	<.0001*		0.82 (0.68–0.99)	.0438		0.75 (0.50–1.14)	.1830		0.73 (0.59–0.90)	.0044	
50 to 64	0.68 (0.63–0.73)	<.0001*		0.67 (0.62–0.72)	<.0001*		0.82 (0.67–1.02)	.0713		0.64 (0.37–1.08)	.0941		0.64 (0.50–0.82)	.0005*	
≥65	0.65 (0.59–0.71)	<.0001*		0.64 (0.58–0.71)	<.0001*		0.70 (0.50–0.97)	.0310		0.75 (0.38–1.49)	.4110		0.58 (0.38–0.87)	.0099	
Race/ethnicity															
NH white	REF			REF			REF			REF			REF		
NHAA	1.09 (0.94–1.27)	.2410													
NH Asian	1.01 (0.86–1.20)	.8660													
Hispanic	1.11 (1.02–1.21)	.0209													
NH Other	1.18 (1.04–1.34)	.0112													
Education															
≤High school graduate	0.79 (0.74–0.85)	<.0001*		0.81 (0.75–0.87)	<.0001*		0.66 (0.49–0.88)	.0052		0.70 (0.48–1.02)	.0633		0.86 (0.63–1.16)	.3210	
Some college	1.00 (0.93–1.08)	.9800		1.03 (0.95–1.12)	.4690		0.78 (0.58–1.05)	.1030		1.08 (0.70–1.67)	.7220		1.05 (0.76–1.46)	.7640	
At least college degree	REF			REF			REF			REF			REF		
Family income															
<\$25 000	REF			REF			REF			REF			REF		
\$25 000–\$49 999	0.98 (0.93–1.03)	.4170		0.98 (0.92–1.06)	.5720		0.95 (0.80–1.13)	.5950		1.01 (0.68–1.51)	.9420		0.98 (0.85–1.15)	.8650	
\$50 000–\$74 999	0.98 (0.92–1.05)	.5960		0.98 (0.91–1.06)	.6130		0.83 (0.63–1.10)	.1940		0.84 (0.54–1.31)	.4420		1.11 (0.87–1.40)	.4040	
≥\$75 000	1.05 (0.98–1.12)	.1940		1.03 (0.96–1.11)	.3870		1.12 (0.86–1.47)	.3870		0.90 (0.59–1.40)	.6480		1.35 (1.02–1.79)	.0383	
Marital status															
Married	REF			REF			REF			REF			REF		
Widowed/divorced	0.96 (0.91–1.02)	.2000		0.96 (0.90–1.02)	.1650		0.96 (0.77–1.18)	.6860		1.52 (0.92–2.50)	.1020		0.97 (0.78–1.20)	.7790	
Separated	0.97 (0.88–1.07)	.5250		0.92 (0.81–1.04)	.1830		0.88 (0.67–1.16)	.3640		0.52 (0.11–2.40)	.3960		1.33 (0.95–1.87)	.0938	
Never married	0.94 (0.88–1.00)	.0432		0.93 (0.87–1.00)	.0583		0.83 (0.69–1.01)	.0610		1.24 (0.85–1.81)	.2610		1.02 (0.85–1.24)	.8080	
Region															
Northeast	REF			REF			REF			REF			REF		
Midwest	0.94 (0.88–1.00)	.0448		0.93 (0.86–0.99)	.0232		0.97 (0.75–1.24)	.7780		1.15 (0.65–2.03)	.6390		0.97 (0.70–1.34)	.8530	
South	0.81 (0.76–0.86)	<.0001*		0.78 (0.72–0.84)	<.0001*		0.91 (0.73–1.13)	.3800		1.21 (0.70–2.11)	.4950		0.88 (0.68–1.13)	.3070	
West	1.00 (0.92–1.08)	.9250		1.00 (0.92–1.09)	.9670		0.79 (0.56–1.11)	.1730		0.91 (0.58–1.44)	.6850		1.08 (0.84–1.38)	.5610	
Survey year															
2006/2007	REF			REF			REF			REF			REF		
2010/2011	1.02 (0.97–1.07)	.4620		1.04 (0.99–1.10)	.1070		0.94 (0.81–1.08)	.3730		0.83 (0.60–1.15)	.2580		0.98 (0.84–1.15)	.8390	

Table 2. Continued

	Subsamples									
	Full-sample (N = 54 448)		NH white (N = 43 062)		NH AA (N = 4641)		NH Asian (N = 966)		Hispanic (N = 3637)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
How soon smoke first cigarette after awakening										
≥30 min	REF		REF		REF		REF		REF	
<30 min	0.62 (0.59–0.65)	<.0001*	0.60 (0.57–0.63)	<.0001*	0.59 (0.51–0.68)	<.0001*	0.78 (0.54–1.12)	.1750	0.79 (0.67–0.93)	.0055
No regular pattern	0.54 (0.44–0.65)	<.0001*	0.52 (0.41–0.66)	<.0001*	0.41 (0.25–0.66)	.0003*	1.22 (0.41–3.60)	.7220	0.86 (0.49–1.51)	.5940
Usual cigarette type										
Non-menthol	REF		REF		REF		REF		REF	
Menthol	0.99 (0.94–1.04)	.6690	0.97 (0.91–1.02)	.2450	1.37 (1.16–1.61)	.0002*	0.91 (0.62–1.34)	.6470	1.09 (0.91–1.30)	.3540
No usual type	0.95 (0.82–1.09)	.4310	0.96 (0.81–1.12)	.5790	0.91 (0.58–1.43)	.6900	0.42 (0.21–0.84)	.0146	1.18 (0.83–1.66)	.3550
Cigarette type × NH AA										
Non-menthol & other racial/ethnic groups ^b	REF									
Menthol & NH AA	1.37 (1.15–1.63)	.0006*								
No usual type & NH AA	0.94 (0.59–1.49)	.7960								

AA = African American; AOR = adjusted odds ratio; CI = confidence interval; N = unweighted sample size; NH = non-Hispanic. All the results are estimated from the weighted analysis. *p* value was based on the Wald Chi-Square test statistic for each coefficient in the multiple logistic regression.

^aNon-Hispanic Other group was not included in the subsample analysis.

^bInclude all racial/ethnic smokers except NH AA.

**p* value < the Bonferroni-adjusted significance level at .01 (=01/1) for gender and survey year; at .005 (=01/2) for education, smoke <30 min after waking, cigarette type, and the interaction term of cigarette type × NH AA; at .0033 (=01/3) for age, family income, marital status, and region; and at .0025 (=01/4) for race/ethnicity.

Table 3. Multiple Logistic Regression Analysis on Successful Cessation for the Full-Sample and Each Subsample Stratified by Race/Ethnicity^a Among Recent Active Smokers Aged ≥18, Who Participated in the Tobacco Use Supplement to the Current Population Survey, 2006/2007 and 2010/2011

	Subsamples														
	Full-sample (N = 54 448)			NH white (N = 43 062)			NH AA (N = 4641)			NH Asian (N = 966)			Hispanic (N = 3637)		
	AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p	
Gender															
Female	REF			REF			REF			REF			REF		
Male	0.86 (0.78–0.94)	.0010*		0.88 (0.80–0.98)	.0152		1.00 (0.72–1.38)	.9900		0.93 (0.46–1.90)	.8420		0.58 (0.42–0.80)	.0009*	
Age															
18 to 34	REF			REF			REF			REF			REF		
35 to 49	0.58 (0.52–0.65)	<.0001*		0.60 (0.52–0.68)	<.0001*		0.57 (0.37–0.89)	.0128		0.30 (0.12–0.79)	.0144		0.60 (0.40–0.89)	.0122	
50 to 64	0.58 (0.52–0.66)	<.0001*		0.60 (0.52–0.69)	<.0001*		0.59 (0.39–0.89)	.0120		0.71 (0.24–2.08)	.5280		0.47 (0.29–0.78)	.0036	
≥65	0.91 (0.76–1.08)	.2580		0.92 (0.76–1.10)	.3370		0.71 (0.39–1.28)	.2520		1.22 (0.32–4.66)	.7660		0.90 (0.44–1.82)	.7580	
Race/ethnicity															
NH white	REF			REF			REF			REF			REF		
NH AA	1.03 (0.79–1.35)	.8160													
NH Asian	0.67 (0.49–0.91)	.0112													
Hispanic	1.18 (1.00–1.38)	.0446													
NH Other	0.80 (0.60–1.07)	.1280													
Education															
≤High school graduate	0.56 (0.49–0.64)	<.0001*		0.58 (0.50–0.68)	<.0001*		0.52 (0.31–0.87)	.0138		0.42 (0.17–1.00)	.0489		0.52 (0.31–0.87)	.0121	
Some college	0.78 (0.69–0.88)	.0001*		0.80 (0.69–0.92)	.0018*		0.83 (0.50–1.39)	.4730		1.21 (0.60–2.43)	.5900		0.68 (0.38–1.20)	.1790	
At least college degree	REF			REF			REF			REF			REF		
Family income															
<\$25 000	REF			REF			REF			REF			REF		
\$25 000–\$49 999	1.17 (1.04–1.31)	.0111		1.25 (1.07–1.44)	.0038		0.67 (0.44–1.00)	.0499		0.76 (0.30–1.89)	.5480		1.25 (0.85–1.85)	.2540	
\$50 000–\$74 999	1.43 (1.26–1.63)	<.0001*		1.48 (1.27–1.73)	<.0001*		1.11 (0.67–1.84)	.6860		1.07 (0.40–2.88)	.8920		1.50 (0.97–2.33)	.0681	
≥\$75 000	1.43 (1.24–1.64)	<.0001*		1.46 (1.23–1.72)	<.0001*		1.13 (0.64–2.02)	.6710		1.16 (0.46–2.92)	.7530		1.69 (1.00–2.86)	.0521	
Marital status															
Married	REF			REF			REF			REF			REF		
Widowed/divorced	0.84 (0.74–0.96)	.0080		0.82 (0.71–0.95)	.0083		0.80 (0.54–1.19)	.2640		0.68 (0.22–2.09)	.4930		0.79 (0.50–1.26)	.3230	
Separated	0.74 (0.58–0.95)	.0168		0.74 (0.55–1.01)	.0595		0.55 (0.29–1.04)	.0642		0.33 (0.02–7.43)	.4870		1.03 (0.44–2.43)	.9460	
Never married	0.80 (0.71–0.90)	.0003*		0.82 (0.72–0.93)	.0022*		0.42 (0.28–0.63)	.0001*		0.74 (0.35–1.54)	.4160		1.14 (0.78–1.67)	.4970	
Region															
Northeast	REF			REF			REF			REF			REF		
Midwest	0.93 (0.80–1.08)	.3410		0.91 (0.78–1.07)	.2510		0.85 (0.47–1.54)	.5950		1.44 (0.41–5.09)	.5670		1.02 (0.47–2.23)	.9630	
South	0.92 (0.80–1.05)	.2180		0.85 (0.73–0.99)	.0414		0.87 (0.54–1.42)	.5760		2.67 (0.89–8.04)	.0805		1.69 (0.94–3.06)	.0816	
West	1.22 (1.05–1.41)	.0102		1.18 (1.00–1.39)	.0434		1.22 (0.62–2.40)	.5690		1.00 (0.32–3.12)	.9950		2.05 (1.15–3.66)	.0156	
Survey year															
2006/2007	REF			REF			REF			REF			REF		
2010/2011	1.04 (0.96–1.13)	.3440		1.04 (0.95–1.14)	.4140		1.22 (0.88–1.68)	.2290		0.83 (0.45–1.54)	.5610		1.00 (0.74–1.36)	.9800	

Table 3. Continued

	Subsamples									
	Full-sample (N = 54 448)		NH white (N = 43 062)		NH AA (N = 4641)		NH Asian (N = 966)		Hispanic (N = 3637)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
How soon smoke first cigarette after awakening										
≥30 min	REF		REF		REF		REF		REF	
<30 min	0.82 (0.75–0.90)	<.0001*	0.81 (0.73–0.90)	.0001*	0.70 (0.52–0.93)	.0158	0.72 (0.34–1.51)	.3800	1.01 (0.71–1.44)	.9590
No regular pattern	0.95 (0.70–1.30)	.7460	0.89 (0.62–1.28)	.5330	0.65 (0.26–1.57)	.3340	3.63 (0.79–16.61)	.0962	1.52 (0.54–4.30)	.4300
Usual cigarette type										
Non-menthol	REF		REF		REF		REF		REF	
Menthol	0.92 (0.83–1.03)	.1470	0.94 (0.84–1.06)	.3190	1.03 (0.73–1.44)	.8630	0.98 (0.44–2.19)	.9540	0.88 (0.60–1.28)	.4980
No usual type	1.52 (1.20–1.93)	.0007*	1.38 (1.02–1.86)	.0344	0.81 (0.32–2.02)	.6430	0.66 (0.15–2.84)	.5690	1.96 (1.15–3.35)	.0133
Cigarette type × NH AA										
Non-menthol & other racial/ethnic groups ^b	REF									
Menthol & NH AA	1.10 (0.79–1.55)	.5640								
No usual type & NH AA	0.54 (0.22–1.33)	.1810								

AA = African American; AOR = adjusted odds ratio; CI = confidence interval; N = unweighted sample size; NH = non-Hispanic. All the results are estimated from the weighted analysis. *p* value was based on the Wald Chi-Square test statistic for each coefficient in the multiple logistic regression.

^aNon-Hispanic Other group was not included in the subsample analysis.

^bInclude all racial/ethnic smokers except NH AA.

* *p* value < the Bonferroni-adjusted significance level at .01 (= .01/1) for gender and survey year; at .005 (= .01/2) for education, smoke <30 min after waking, cigarette type, and the interaction term of cigarette type × NH AA; at .0033 (= .01/3) for age, family income, marital status, and region; and at .0025 (= .01/4) for race/ethnicity.

Table 4. Multiple Logistic Regression Analysis on Intention-to-Quit in the Next 6 Months for the Full-Sample and Each Subsample Stratified by Race/Ethnicity* Among Current Smokers Aged ≥18 Who Participated in the Tobacco Use Supplement to the Current Population Survey, 2006/2007 and 2010/2011

	Subsamples									
	Full-sample (N = 49 437)		NH white (N = 39 040)		NH AA (N = 4283)		NH Asian (N = 871)		Hispanic (N = 3266)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Gender										
Female	REF		REF		REF		REF		REF	
Male	0.95 (0.91–1.00)	.0486	0.95 (0.90–1.00)	.0650	1.01 (0.87–1.17)	.9290	1.11 (0.73–1.68)	.6380	0.86 (0.71–1.04)	.1120
Age										
18 to 34	REF		REF		REF		REF		REF	
35 to 49	1.12 (1.05–1.19)	.0006*	1.14 (1.05–1.23)	.0011*	1.16 (0.92–1.45)	.2030	1.04 (0.64–1.71)	.8610	1.04 (0.84–1.28)	.7280
50 to 64	1.12 (1.04–1.20)	.0030*	1.12 (1.03–1.22)	.0080	1.21 (0.97–1.52)	.0958	0.68 (0.40–1.17)	.1630	1.00 (0.76–1.31)	.9810
≥65	0.86 (0.78–0.96)	.0050	0.86 (0.77–0.95)	.0055	0.88 (0.62–1.26)	.4890	0.52 (0.22–1.23)	.1360	1.25 (0.80–1.97)	.3270
Race/ethnicity										
NH white	REF		REF		REF		REF		REF	
NH AA	1.18 (1.01–1.37)	.0369								
NH Asian	0.83 (0.68–1.03)	.0907								
Hispanic	0.93 (0.84–1.02)	.1200								
NH Other	1.17 (1.01–1.35)	.0340								
Education										
≤High school graduate	0.80 (0.74–0.87)	<.0001*	0.78 (0.71–0.85)	<.0001*	0.82 (0.59–1.15)	.2530	0.96 (0.61–1.50)	.8410	1.01 (0.68–1.51)	.9530
Some college	0.96 (0.88–1.04)	.2990	0.95 (0.87–1.04)	.2790	0.83 (0.59–1.18)	.2950	1.45 (0.85–2.48)	.1680	1.15 (0.76–1.75)	.5160
At least college degree	REF		REF		REF		REF		REF	
Family income										
<\$25 000	REF		REF		REF		REF		REF	
\$25 000–\$49 999	1.04 (0.98–1.10)	.2210	1.04 (0.97–1.12)	.3060	1.16 (0.96–1.40)	.1180	0.80 (0.47–1.34)	.3930	0.99 (0.81–1.20)	.9210
\$50 000–\$74 999	1.15 (1.07–1.24)	.0002*	1.16 (1.07–1.25)	.0005*	1.08 (0.79–1.46)	.6330	1.37 (0.78–2.41)	.2710	0.98 (0.72–1.34)	.9140
≥\$75 000	1.13 (1.04–1.23)	.0031*	1.12 (1.02–1.21)	.0120	1.39 (0.96–2.02)	.0842	1.13 (0.66–1.94)	.6450	1.08 (0.77–1.52)	.6510
Marital status										
Married	REF		REF		REF		REF		REF	
Widowed/divorced	0.94 (0.89–0.99)	.0300	0.91 (0.86–0.97)	.0042	0.99 (0.78–1.27)	.9660	1.00 (0.48–2.10)	.9970	1.07 (0.83–1.37)	.6050
Separated	0.87 (0.78–0.98)	.0251	0.82 (0.71–0.93)	.0037	0.93 (0.67–1.28)	.6400	0.17 (0.04–0.69)	.0135	1.47 (1.00–2.16)	.0515
Never married	0.87 (0.81–0.93)	.0002*	0.84 (0.78–0.91)	<.0001*	0.92 (0.73–1.17)	.4940	0.92 (0.60–1.41)	.7080	0.98 (0.78–1.25)	.8980
Region										
Northeast	REF		REF		REF		REF		REF	
Midwest	0.91 (0.83–1.00)	.0397	0.93 (0.85–1.03)	.1640	0.95 (0.69–1.32)	.7770	1.02 (0.52–1.97)	.9640	0.57 (0.40–0.80)	.0017*
South	0.80 (0.74–0.86)	<.0001*	0.84 (0.77–0.91)	.0001*	0.66 (0.50–0.88)	.0045	0.78 (0.43–1.40)	.3940	0.66 (0.48–0.89)	.0078
West	0.98 (0.89–1.07)	.6080	1.05 (0.95–1.15)	.3520	0.90 (0.60–1.33)	.5870	0.96 (0.58–1.58)	.8680	0.70 (0.51–0.97)	.0335
Survey year										
2006/2007	REF		REF		REF		REF		REF	
2010/2011	0.79 (0.75–0.82)	<.0001*	0.78 (0.74–0.82)	<.0001*	0.74 (0.63–0.86)	.0002*	0.82 (0.57–1.19)	.3010	0.91 (0.75–1.10)	.3260

Table 4. Continued

	Subsamples									
	Full-sample (N = 49 437)		NH white (N = 39 040)		NH AA (N = 4283)		NH Asian (N = 871)		Hispanic (N = 3266)	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
How soon smoke first cigarette after awakening										
≥30 min	REF		REF		REF		REF		REF	
<30 min	0.84 (0.79–0.88)	<.0001*	0.83 (0.79–0.87)	.0000*	0.77 (0.65–0.92)	.0039*	0.79 (0.52–1.21)	.2840	0.88 (0.70–1.09)	.2400
No regular pattern	0.54 (0.44–0.67)	<.0001*	0.58 (0.45–0.76)	.0001*	0.49 (0.29–0.81)	.0058	0.11 (0.02–0.58)	.0098	0.53 (0.29–0.98)	.0424
Usual cigarette type										
Non-menthol	REF		REF		REF		REF		REF	
Menthol	1.00 (0.93–1.07)	.9590	0.99 (0.93–1.07)	.8650	1.19 (0.99–1.44)	.0687	0.95 (0.56–1.59)	.8310	0.99 (0.79–1.24)	.9350
No usual type	0.69 (0.56–0.84)	.0003*	0.68 (0.54–0.85)	.0010*	0.60 (0.39–0.93)	.0212	1.01 (0.48–2.09)	.9840	0.65 (0.42–1.00)	.0522
Quit attempts in past 12 months										
No	REF		REF		REF		REF		REF	
Yes	6.75 (6.37–7.14)	<.0001*	6.44 (6.06–6.84)	<.0001*	9.50 (8.00–11.27)	<.0001*	5.95 (4.05–8.75)	<.0001*	7.81 (6.56–9.31)	<.0001*
Cigarette type x NH AA										
Non-menthol & other racial/ethnic groups ^b	REF									
Menthol & NH AA	1.20 (1.01–1.43)	.0424								
No usual type & NH AA	0.92 (0.59–1.42)	.7050								

AA = African American; AOR = adjusted odds ratio; CI = confidence interval; N = unweighted sample size; NH = non-Hispanic. All the results are estimated from the weighted analysis. *p* value was based on the Wald

Chi-Square test statistic for each coefficient in the multiple logistic regression.

^aNon-Hispanic Other group was not included in the subsample analysis.

^bInclude all racial/ethnic smokers except NH AA.

* *p* value < the Bonferroni-adjusted significance level at .01 (= .01/1) for gender, survey year, and quit attempts; at .005 (= .01/2) for education, smoke <30 min after waking, cigarette type, and the interaction term of cigarette type x NH AA; at .0033 (= .01/3) for age, family income, marital status, and region; and at .0025 (= .01/4) for race/ethnicity.

However, African American menthol smokers were not significantly different from non-menthol smokers in successful cessation, suggesting that these quit attempts did not translate into successful cessation. This study also revealed no association of menthol use with quit attempts, successful cessation, and intention-to-quit among other racial/ethnic groups.

This study built on three recent national studies,^{14,15,19} particularly one by Trinidad and colleague¹⁹; these studies drew on the 2003 and 2006/2007 TUS-CPS data. Notably, however, their study design deviated from the current work. For example, Trinidad and colleagues examined the intention to quit in the next 6 months among current smokers and successful cessation for ≥ 6 months among all former smokers regardless of how long they have quit.¹⁹ Their study sample was restricted to adults aged 20–65. While their analyses were done separately for each racial/ethnic group, the specification of these groups was different from this study: Hispanic/Latinos, whites, African Americans, Asian Americans/Pacific Islanders, and Native Americans.

Our result that menthol use was not significantly associated with smoking cessation among the full sample and whites paralleled Delveno and colleagues' result.¹⁵ This study's findings also resonated with Trinidad and colleagues' work, which showed no statistically significant association between menthol use and intention-to-quit among whites and Asian Americans, with the important caveat that Trinidad and colleagues combined Asians and Pacific Islanders into a single group where as this study did not.¹⁹

However, our findings differed from the results from these three studies in several ways. First, Trinidad and colleagues' work indicated that menthol use was negatively associated with successful cessation across all racial/ethnic groups,¹⁹ and Delveno and colleagues' study also found such a negative association among blacks, Hispanics, and Puerto Ricans.¹⁵ Levy and colleagues' study found that while menthol use was negatively associated with successful cessation in the full-sample, successful cessation was more likely among black menthol smokers compared to non-black non-menthol smokers.¹⁴ In contrast to these three studies, our study found insignificant association between menthol use and successful cessation across all racial/ethnic groups. Second, the Trinidad and colleagues' study found a positive association between menthol use and intention-to-quit among African Americans and Hispanics¹⁹ while no statistically significant association was found in the current analysis.

These differences may reflect distinctions in study design. For instance, this study deviated from previous work in terms of the age selection criteria (eg, ages ≥ 18 vs. ages 20–65),¹⁹ the study population for smoking cessation analyses (eg, all recent active smokers vs. only those with quit attempts¹⁵ or all former smokers¹⁹), the inclusion/exclusion of smokers without a preferred cigarette type,^{15,19} and the criteria for successful cessation (≥ 3 months vs. ≥ 6 months,¹⁹ or ≥ 0 months¹⁵). This study also examined a different study period, which may reveal temporal changes in cessation patterns. Moreover, none of these three studies conducted the Bonferroni correction to account for multiple testing. Instead, they relied on the usual criteria for statistical significance level at .05. If this study adopted the same statistical significance criteria, our full-sample regression results would indicate that African American menthol smokers were significantly more likely to intend-to-quit than non-menthol smokers ($p = .0424$, Table 4), which would be consistent with the result found by Trinidad and colleagues.¹⁹

A variety of factors may mediate the relationship between menthol use and smoking cessation behaviors. For example, among

recent active smokers, the literature has shown that individuals aged 18–24 were more likely to successfully quit smoking relative to their older counterparts aged 35–64,³³ which was also observed in this study (Table 3). Nonetheless, age potentially has both a direct and indirect impact on cessation, and the observed relationship may, at least in part, be explained by factors related to age rather than age itself. For instance, smoke-free households and social norms against smoking, which are positively associated with successful cessation, may also be more prevalent among younger generations.³³ On the other hand, age is also correlated with menthol use. As tobacco companies have promoted menthol cigarettes as a means of drawing a young and persistent consumer base,³⁴ literature has shown that young adults aged 18–24, especially African American, were significantly more likely to smoke menthol cigarettes compared with older adults aged ≥ 65 .^{35,36}

This study has several limitations. First, all analyses were based on cross-sectional data, which did not allow the examination of causal effects. Future research with large-scale population-based longitudinal data is needed to better understand the causal effect of menthol use on cessation behaviors across different population groups. Second, smoking status, cessation behaviors, and menthol use data were self-reported, introducing potential bias. Third, among recent quitters, it was assumed that menthol use status remained constant during the 12 months before they finally quit. However, if recent quitters tried to quit smoking by switching from menthol to non-menthol or vice versa, then this assumption would not hold. Nevertheless, switching between menthol and non-menthol cigarettes does not appear to be common.³⁷ Fourth, this study defined successful smoking cessation using ≥ 3 months criterion following previous studies,^{14,23,24} as literature indicates that 65% of quitters relapse within the first 3 months.³⁸ While successful abstinence of ≥ 6 months has been a commonly used criterion in clinical trials and longitudinal studies,^{12,13,16–18} previous cross-sectional studies have used the criterion of ≥ 0 month,¹⁵ ≥ 1 month,³⁹ ≥ 3 month,¹⁴ and ≥ 6 months.¹⁹ Fifth, this study relied on a conservative strategy to determine statistical significance. While the Bonferroni adjustment certainly reduces the risk of type I error, it may be overly conservative, increasing the risk of type II error.^{30,31}

The question of whether menthol cigarettes hinder quitting behavior and successful cessation is an important public health issue. Drawing on newer data, incorporating a distinct study design, and accounting for multiple testing, this study provides fresh evidence that menthol use is perhaps most strongly associated with quit attempts and that this relationship is particularly acute within African Americans. Intensifying this issue, the literature has suggested that African Americans suffer a disproportionate burden of smoking—in California, African Americans accounted for 6% of the adult population, but they accounted for over 8% of smoking-attributable healthcare expenditures and 13% of smoking-attributable mortality costs.⁴⁰ Therefore, for a variety of reasons, it is essential to increase smoking cessation rates, especially among African Americans.

Given that African Americans were more motivated to quit but did not appear to be more successful in doing so, interventions targeting menthol smokers within the African American community may help bridge this gap. Within this context, it is important to acknowledge that the tobacco industry targets marketing of menthol tobacco products towards African American communities, including the availability of cheaper menthol cigarettes.^{41,42} While more local sales restrictions are beginning to occur (eg, Tobacco 21 efforts), additional policies restricting price discounting as well

as the regulation of access to and the time, place, and/or manner of menthol tobacco advertising could also improve cessation rates. Nevertheless, further evaluation is needed to determine the viability of these policies.

Supplementary Material

Supplementary Table 1 can be found online at <http://www.ntr.oxfordjournals.org>

Funding

This study was funded by the Tobacco Related Disease Research Program (TRDRP) grant #22RT-0112.

Declaration of Interests

None declared.

Acknowledgments

The authors thank Drs. Teh-wei Hu and Theodore Keeler for their invaluable input on early drafts of the manuscript and Dr. Steve Paul for providing statistical consultation on the Bonferroni correction.

References

- Jamal A, Homa DM, O'Connor E, et al.; Centers for Disease Control and Prevention (CDC). Current Cigarette Smoking Among Adults — United States, 2005–2014. *MMWR*. 2015;64(44):1233–1240. www.cdc.gov/mmwr/preview/mmwrhtml/mm6444a2.htm. Accessed May 31, 2016.
- Centers for Disease Control and Prevention (CDC). Quitting smoking among adults — United States, 2001–2010. *MMWR*. 2011;60(44):1513–1519. www.cdc.gov/mmwr/preview/mmwrhtml/mm6044a2.htm. Accessed May 31, 2016.
- Agaku IT, King BA, Dube SR. Current Cigarette Smoking Among Adults — United States, 2005–2012. *MMWR*. 2014;63(2):29–34. www.cdc.gov/mmwr/preview/mmwrhtml/mm6302a2.htm. Accessed May 31, 2016.
- Borland R, Owen N, Hill D, Schofield P. Predicting attempts and sustained cessation of smoking after the introduction of workplace smoking bans. *Health Psychol*. 1991;10(5):336–342.
- Murray RP, Gerald LB, Lindgren PG, Connert JE, Rand CS, Anthonisen NR. Characteristics of participants who stop smoking and sustain abstinence for 1 and 5 years in the Lung Health Study. *Prev Med*. 2000;30(5):392–400.
- Hymowitz N, Cummings KM, Hyland A, Lynn WR, Pechacek TF, Hartwell TD. Predictors of smoking cessation in a cohort of adult smokers followed for five years. *Tob Control*. 1997;6(suppl 2):S57–S62.
- Goren A, Annunziata K, Schnoll RA, Suaya JA. Smoking cessation and attempted cessation among adults in the United States. *PLoS One*. 2014;9(3):e93014.
- Yerger VB. Menthol's potential effects on nicotine dependence: a tobacco industry perspective. *Tob Control*. 2011;20(suppl 2):ii29–ii36.
- Ahijevych K, Garrett BE. Menthol pharmacology and its potential impact on cigarette smoking behavior. *Nicotine Tob Res*. 2004;6(suppl 1):S17–S28.
- 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. doi:10.1136/tobaccocontrol-2013-051159.
- Fu SS, Okuyemi KS, Partin MR, et al. Menthol cigarettes and smoking cessation during an aided quit attempt. *Nicotine Tob Res*. 2008;10(3):457–462.
- Pletcher MJ, Hulley BJ, Houston T, Kiefe CI, Benowitz N, Sidney S. Menthol cigarettes, smoking cessation, atherosclerosis, and pulmonary function: the Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Arch Intern Med*. 2006;166(17):1915–1922.
- Hyland A, Garten S, Giovino GA, Cummings KM. Mentholated cigarettes and smoking cessation: findings from COMMIT. Community Intervention Trial for Smoking Cessation. *Tob Control*. 2002;11(2):135–139.
- 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.
- Delnevo CD, Gundersen DA, Hrywna M, Echeverria SE, Steinberg MB. Smoking-cessation prevalence among U.S. smokers of menthol versus non-menthol cigarettes. *Am J Prev Med*. 2011;41(4):357–365.
- Okuyemi KS, Ahluwalia JS, Ebersole-Robinson M, Catley D, Mayo MS, Resnicow K. Does menthol attenuate the effect of bupropion among African American smokers? *Addiction*. 2003;98(10):1387–1393.
- Okuyemi KS, Faseru B, Cox LS, et al. Relationship between menthol cigarettes and smoking cessation among African American light smokers. *Addiction*. 2007;102(12):1979–1986.
- Gandhi KK, Foulds J, Steinberg MM, et al. Lower quit rates among African American and Latino menthol cigarette smokers at a tobacco treatment clinic. *Int J Clin Pract*. 2009;63(3):360–367.
- Trinidad DR, Pérez-Stable EJ, Messer K, White MM, Pierce JP. Menthol cigarettes and smoking cessation among racial/ethnic groups in the United States. *Addiction*. 2010;105(suppl 1):84–94.
- Gundersen DA, Delnevo CD, Wackowski O. Exploring the relationship between race/ethnicity, menthol smoking, and cessation, in a nationally representative sample of adults. *Prev Med*. 2009;49(6):553–557.
- US Department of Commerce, Census Bureau. National Cancer Institute-sponsored Tobacco Use Supplement to the Current Population Survey (2010–11). 2012. <http://appliedresearch.cancer.gov/tus-cps/>. Data files and technical documentation: http://thedataweb.rm.census.gov/ftp/cps_ftp.html#cpssupps. Accessed May 31, 2016.
- Emery S, Kim Y, Choi YK, Szczypka G, Wakefield M, Chaloupka FJ. The effects of smoking-related television advertising on smoking and intentions to quit among adults in the United States: 1999–2007. *Am J Public Health*. 2012;102(4):751–757.
- Burns D, Anderson C, Johnson M, et al. Cessation and cessation measures among daily adult smokers: National- and State-specific data. In: Institute NC, ed. *Population-based Smoking Cessation: A Conference on What Works to Influence Smoking in the General Population. Smoking and Tobacco Control Monograph No. 12*. Bethesda, MD: National Cancer Institute, NIH; 2000:113–304.
- Chang FC, Sung HY, Zhu SH, Chiou ST. Impact of the 2009 Taiwan tobacco hazards prevention act on smoking cessation. *Addiction*. 2014;109(1):140–146. doi:10.1111/add.12344.
- Fagan P, Augustson E, Backinger CL, et al. Quit attempts and intention to quit cigarette smoking among young adults in the United States. *Am J Public Health*. 2007;97(8):1412–1420.
- Heatheron TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. *Br J Addict*. 1991;86(9):1119–1127.
- Tsoh JY, Tong EK, Gildengorin G, et al. Individual and family factors associated with intention to quit among male Vietnamese American smokers: implications for intervention development. *Addict Behav*. 2011;36(4):294–301.
- Gibson T. "Tobacco Use Supplement to The Current Population Survey Users' Workshop - Tips and Tricks of Handling the TUS Data". 2009. http://appliedresearch.cancer.gov/archive/tus-cps/tusuw_gibson.pdf. Accessed May 31, 2016.
- Judkins DR. Fay's method for variance estimation. *J Official Stat*. 1990;6(3):223–239.
- Maxwell SE, Delaney HD. *Designing Experiments and Analyzing Data: A Model Comparison Perspective*. 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates; 2004.
- Glantz SA, Slinker BS. *Primer of Applied Regression and Analysis of Variance*. 2nd ed. New York, NY: McGraw-Hill, Inc; 1990.

32. Cubbin C, Soobader MJ, LeClere FB. The intersection of gender and race/ethnicity in smoking behaviors among menthol and non-menthol smokers in the U.S. *Addiction*. 2010;105(1S):32–38.
33. Messer K, Trinidad DR, Al-Delaimy WK, Pierce JP. Smoking cessation rates in the United States: a comparison of young adult and older smokers. *Am J Public Health*. 2008;98(2):317–322.
34. Klausner K. Menthol cigarettes and smoking initiation: a tobacco industry perspective. *Tob Control*. 2011;20(suppl 2):ii12–ii19.
35. Lawrence D, Rose A, Fagan P, Moolchan ET, Gibson JT, Backinger CL. National patterns and correlates of mentholated cigarette use in the United States. *Addiction*. 2010;105(suppl 1):13–31.
36. Fernander A, Rayens MK, Zhang M, Adkins S. Are age of smoking initiation and purchasing patterns associated with menthol smoking? *Addiction*. 2010;105(suppl 1):39–45.
37. 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.
38. Gilpin EA, Pierce JP, Farkas AJ. Duration of smoking abstinence and success in quitting. *J Natl Cancer Inst*. 1997;89(8):572–576.
39. Centers for Disease Control and Prevention (CDC). Smoking cessation during previous year among adults--United States, 1990 and 1991. *MMWR Morb Mortal Wkly Rep*. 1993;42(26):504–507.
40. Max W, Sung HY, Tucker LY, Stark B. The disproportionate cost of smoking for African Americans in California. *Am J Public Health*. 2010;100(1):152–158.
41. Henriksen L, Schleicher NC, Dauphinee AL, Fortmann SP. Targeted advertising, promotion, and price for menthol cigarettes in California high school neighborhoods. *Nicotine Tob Res*. 2012;14(1):116–121.
42. Seidenberg AB, Caughy RW, Rees VW, Connolly GN. Storefront cigarette advertising differs by community demographic profile. *Am J Health Promot*. 2010;24(6):e26–e31.