

## Smoking cessation prevalence among menthol and non-menthol smokers: findings from a national population survey

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### Abstract:

**Background:** The Food and Drug Administration currently is assessing the public health impact of menthol cigarettes. Whether menthol cigarettes pose increased barriers to quitting is a critical issue because previous declines in smoking prevalence have stalled. **Purpose:** To explore whether menthol cigarette smokers are less likely to quit than non-menthol smokers at the population level and whether this relationship differs by race/ethnicity. **Methods:** Cross-sectional analyses of the 2003 and 2006/2007 Tobacco Use Supplement to the Current Population Survey were conducted in 2010. Multiple logistic regressions were used to calculate the adjusted odds of cessation for menthol smoking relative to non-menthol smoking. Five different sample restrictions were used to assess the robustness of the findings. **Results:** In the broadest sample restriction, menthol smokers were less likely to have quit smoking (AOR=0.91, 95% CI=0.87, 0.96). This relationship holds among whites (AOR=0.93, 95% CI=0.88, 0.98) and blacks (AOR=0.81, 95% CI=0.67, 0.98). The magnitude of the relationship among Hispanics was similar to that among whites, but differed by Hispanic origin. Among those of Mexican origin, the AOR for menthol smokers was protective but not significant (AOR=1.29, 95% CI=0.99, 1.61), whereas among those of Puerto Rican origin, menthol smokers were less likely to have quit (AOR=0.57, 95% CI=0.37, 0.87). These findings were robust and significant in four of five sample restrictions. **Conclusions:** Smoking menthol cigarettes is associated with decreased cessation at the population level, and this association is more pronounced among black and Puerto Rican smokers. These findings support the recent calls to ban menthol flavoring in cigarettes.

**Keywords:** tobacco smokers | menthol cigarettes | smoking cessation | smoking prevalence

### Article:

## Introduction

The leading cause of preventable morbidity and mortality in the U.S., tobacco products are now under the regulatory authority of the newly formed Center for Tobacco Products of the Food and Drug Administration (FDA). On inception, The Center for Tobacco Products was charged to review the available scientific evidence on the public health impact of menthol cigarettes on youth initiation as well as smoking cessation for blacks, Hispanics, and other racial and ethnic minorities.

The published scientific literature examining the relationship between smoking menthol cigarettes and cessation outcomes has produced mixed findings. Some clinical and community-based studies<sup>1, 2, 3</sup> found that menthol smokers are less likely to quit than those who smoke non-menthol cigarettes. Another study<sup>4</sup> found no differences in quitting by menthol use, but it found an increased rate of relapse among menthol smokers. Yet other such studies<sup>5, 6</sup> found no differences in quitting. It should be noted, however, that these studies of clinical and community populations are not generalizable to the overall population of smokers.

In the past 2 years, a handful of studies explored the relationship between menthol cigarettes and quitting using nationally representative population surveys.<sup>7, 8, 9, 10, 11, 12, 13</sup> These findings are also mixed; some<sup>8, 9, 10</sup> found no relationship between menthol smoking and quitting, whereas others<sup>7, 11, 12, 13</sup> noted a detrimental relationship. It should be noted that among the studies<sup>8, 9, 10</sup> that found no relationship, the focus was not on successful smoking cessation but rather on quitting attempts among those that continue to smoke (i.e., current smokers). One of these studies (Fagan et al.<sup>10</sup>) found no differences in quit attempts among current smokers by menthol status but did find that menthol smokers exhibited greater signs of nicotine dependence than non-menthol smokers.

Other recent studies that included current *and* former smokers in their analyses have found that menthol smokers are more likely to consider quitting<sup>12</sup> and make quit attempts,<sup>13</sup> but they have poorer quit rates<sup>11, 12</sup> and are less successful at long-term or sustained cessation.<sup>12, 13</sup> Additionally, it is important to note that the population of interest varied considerably across these population-based surveys, potentially accounting for some of the inconsistent findings. Indeed, subgroups like young adults or seniors,<sup>9, 12</sup> someday smokers,<sup>9, 10</sup> or the unemployed<sup>8</sup> were excluded in some studies. Likewise, some analyses focused on current smokers only<sup>8, 10</sup> or smokers with a previous quit attempt,<sup>7</sup> whereas others excluded smokers who were recent quitters (i.e., at least 3 months,<sup>13</sup> or 6 months<sup>12</sup>) to focus on an outcome of “sustained cessation.”

Whether menthol cigarettes pose increased barriers to quitting is a critical public health issue of particular importance because previous declines in cigarette smoking prevalence have stalled in recent years.<sup>14</sup> The present study, which uses the Tobacco Use Supplement to the Current Population Survey (TUS–CPS), diverges from past studies of the TUS–CPS in three critical ways. First, former smokers who recently quit are not excluded from the denominator. This is important for studying menthol's potential impact on the outcome of actual smoking cessation rather than on quit attempts. Second, five population restrictions were employed to examine the robustness of the relationship between menthol smoking and cessation by race/ethnicity. Third,

given that Hispanics are a heterogeneous population<sup>15</sup> that differ with respect to their smoking behaviors,<sup>16, 17</sup> separate models for Hispanics by country of origin were generated.

## Methods

### Data Source

The CPS is a labor force survey conducted monthly by the U.S. Census for the Bureau of Labor Statistics. The Tobacco Use Supplement (TUS) to the Current Population Survey is fielded approximately every 3 years. This analysis pooled data from the 2003 and the 2006/2007 Tobacco Use Supplement (TUS). The details of the TUS–CPS sampling design and data collection methods are provided elsewhere.<sup>18, 19, 20</sup> In brief, the TUS–CPS uses an area probability sampling design to select a stratified probability sample of clusters of households and roughly 56,000 households are surveyed monthly. The response rate for the household survey ranges from 92% to 97%. Although the TUS includes both proxy and self-response data, most tobacco use and cessation measures were collected via only self-response because proxy responses can result in higher measurement error; thus only self-response cases were utilized.<sup>21</sup> The monthly self-response rates for the TUS ranged from 60.7% to 65.8%.<sup>18, 19, 20</sup>

### Study Population

The analytic sample included white, black, and Hispanic ever smokers, defined as current smokers and former smokers who quit in the past 5 years. The restriction of former smokers to those who quit within the past 5 years is due to the TUS–CPS asking menthol status of only former smokers who quit in the past 5 years.

Five sample restrictions were tested:

1. Former smokers who quit within the past 5 years and all current smokers (regardless of quit attempt history)
2. Former smokers who quit within the past 5 years and all current smokers (regardless of quit attempt history) both of whom currently do not use *other* tobacco products
3. Former smokers who quit within the past 5 years and current smokers who reported *ever* having made a quit attempt
4. Former smokers who quit within the past 5 years and current smokers who reported *ever* having made a quit attempt, both of whom currently do not use *other* tobacco products
5. Past-12-month cigarette smokers who made a quit attempt or quit (i.e., former smoker)

Sample restriction 1 represents the broadest population bearing in mind that more heavily addicted smokers may not attempt to quit because of low self-efficacy, whereas sample restriction 5, the narrowest subgroup, most closely reflects the cessation-seeking population noted in some of the research literature.<sup>1, 3, 5</sup> The use of other tobacco products, such as cigars and smokeless tobacco, was considered. Product switching under conditions of high cigarette prices and/or misperceptions of reduced risk was noted in the research literature.<sup>22, 23</sup> Thus,

sample restrictions 2 and 4 consider cigarette smoking cessation without product switching (i.e., *tobacco* cessation).

Table 1 presents sample sizes for the various models and sample restrictions. Overall, the sample size ranged from 71,193 to 24,465, whereas the race/ethnicity-stratified analyses had smaller sample sizes, the smallest being 1690 among Hispanics in sample restriction 5. The sample sizes for the analyses of Hispanic country of origin ranged from 2769 among those of Mexican origin in sample restriction 1 to 282 for those of Puerto Rican origin in sample restriction 5 (past-12-month smokers).

**Table 1.** Sample counts by sample restriction and outcome, 2003 and 2006/2007 Tobacco Use Supplement to Current Population Survey

	Overall	Whites only	Blacks only	Hispanics only	Mexicans only	Puerto Ricans only
<b>Set 1</b>						
Total sample size	71,193	60,525	5827	4841	2769	735
Current smoker	54,662	46,197	4783	3682	2098	583
Former smoker	16,531	14,328	1044	1159	671	152
<b>Set 2</b>						
Total sample size	65,316	55,347	5448	4521	2577	691
Current smoker	50,030	42,147	4467	3416	1933	454
Former smoker	15,286	13,200	981	1105	644	146
<b>Set 3</b>						
Total sample size	55,322	47,672	4178	3472	1939	563
Current smoker	38,791	33,344	3134	2313	1268	411
Former smoker	16,531	14,328	1044	1159	671	152
<b>Set 4</b>						
Total sample size	50,761	43,618	3898	3245	1805	527
Current smoker	35,475	30,418	2917	2140	1161	381
Former smoker	15,286	13,200	981	1105	644	146
<b>Set 5</b>						
Total sample size	24,465	20,640	2135	1690	962	282
Current smoker	18,357	15,381	1757	1219	675	221
Former smoker	6,108	5,259	378	471	287	61

## Measures

The outcome variable was smoking cessation operationalized as current versus former smoker (0=current, 1=former). A former smoker was defined as having smoked 100 cigarettes in a lifetime and smoking “not at all” at the time of the survey. A current smoker was defined as having smoked 100 cigarettes in a lifetime and smoking “everyday” or “some days” at the time of the survey.

Menthol cigarette preference was a dichotomous variable. Current smokers self-reported whether or not their usual brand of cigarettes in the past 12 months was mentholated. Former smokers, who quit in the past 5 years, reported whether or not their usual brand 12 months before quitting was mentholated. Smokers for whom menthol brand status could not be determined were excluded (e.g., they reported “no preference”).

Race/ethnicity was coded into separate variables for non-Hispanic whites, non-Hispanic blacks, and Hispanics of any race. Blacks also included multiracial blacks. In addition, given that

Hispanics are not a homogenous group, the analyses were also stratified by country of origin (i.e., Mexican versus Puerto Rican). Socioeconomic variables included education and household income. Educational attainment refers to the highest level of school completed and was categorized into less than high school, high school graduate or GED, some college, or bachelor's degree or higher. Income refers to total household income in the past 12 months, and it was categorized as <\$25,000, \$25,000 to <\$50,000, \$50,000 to <\$75,000, and  $\geq$ \$75,000.

Demographic control variables included gender and a continuous variable for age. Given that data were pooled across several months and years, seasonality was controlled for by categorizing month of interview into January–April, May–August, and September–December and controlled for year (2003 vs 2006/2007). Lastly, for the analysis restricted to past-12-month smokers (sample restriction 5), exposure to a recent cigarette excise tax increase was included as a covariate. Sample members who lived in a state that implemented a cigarette excise tax increase in the 12 months prior to the month and year of data collection were considered exposed to a cigarette excise tax increase. Tax data were obtained from the Tax Burden on Tobacco.<sup>24</sup>

### Model Specification and Analysis

Data were analyzed in SUDAAN survey software, which corrects for the complex sampling design.<sup>25</sup> Sample weights, which correct for the varying probabilities of selection, were applied and variance was computed using replicate weights provided by the National Cancer Institute. Multiple logistic regressions were utilized to estimate the OR of being a former smoker for those who smoke menthol cigarettes relative to those who smoke non-menthol cigarettes while controlling for other independent variables. The analyses were conducted in 2010.

### Results

Table 2 presents descriptive statistics for each covariate by menthol smoking and by race/ethnicity. Overall, menthol smokers were more likely to be currently smoking, female, aged 18–24 years, and reside in a state that had a cigarette excise tax increase in the 12 months prior to data collection. These relationships held among whites, blacks, and Hispanics with one exception. There was no significant difference in being a former smoker among Hispanics. Among Hispanics, however, menthol smokers were less likely to be of Mexican origin and more likely to be of Puerto Rican origin.

Table 3 presents the prevalence of menthol smoking by covariates. Overall, menthol cigarette smoking is more common among current smokers than former smokers and among women relative to men. Menthol smoking also decreased with increasing education, income, and age and is more prevalent among blacks (71.8%) than among whites (21.0%) and Hispanics (28.1%). However, among Hispanics, menthol smoking is more prevalent among those of Puerto Rican origin (62.0%) than among those of Mexican (19.9%) and other Hispanic origins (26.5%).

**Table 2.** Descriptive statistics by race/ethnicity and menthol smoking, 2003 and 2006/2007 Tobacco Use Supplement to Current Population Survey, % (95% CI)

	Total		White		Black		Hispanic	
	Non-menthol	Menthol	Non-menthol	Menthol	Non-menthol	Menthol	Non-menthol	Menthol
<b>Smoking status</b>								
Current	76.6 (76.2, 77.0)	79.6 (78.9, 80.3)	76.5 (76.1, 77.0)	78.2 (77.3, 79.0)	79.7 (77.4, 81.9)	83.7 (82.3, 84.9)	75.9 (74.3, 77.4)	76.4 (73.7, 78.8)
Former	23.4 (23.0, 23.8)	20.4 (19.7, 21.1)	23.5 (23.0, 23.9)	21.8 (21.0, 22.7)	20.3 (18.1, 22.6)	16.4 (15.1, 17.7)	24.1 (22.6, 25.7)	23.7 (21.2, 26.3)
<b>Gender</b>								
Male	55.8 (55.4, 56.3)	44.3 (43.5, 45.1)	54.4 (54.0, 54.8)	41.1 (40.1, 42.1)	60.1 (57.5, 62.6)	48.7 (47.3, 50.1)	67.8 (66.3, 69.2)	51.8 (49.1, 54.6)
Female	44.2 (43.7, 44.6)	55.7 (54.9, 56.5)	45.6 (45.2, 46.0)	58.9 (57.9, 60.0)	39.9 (37.4, 42.5)	51.3 (49.9, 52.7)	32.2 (30.8, 33.7)	48.2 (45.4, 51.0)
<b>Education</b>								
<HS	19.8 (19.1, 20.5)	17.3 (16.8, 17.7)	14.4 (14.0, 14.8)	14.6 (13.9, 15.4)	26.7 (24.5, 29.0)	25.6 (24.0, 27.2)	40.0 (38.0, 42.0)	36.3 (33.4, 39.2)
HS/GED	39.5 (38.6, 40.4)	37.6 (37.1, 38.1)	38.6 (38.1, 39.1)	40.3 (39.2, 41.3)	36.4 (33.9, 39.0)	39.4 (37.6, 41.1)	28.6 (26.9, 30.4)	34.7 (31.9, 37.6)
Some college	29.6 (28.8, 30.4)	29.7 (29.2, 30.2)	30.6 (30.2, 31.1)	31.7 (30.6, 32.7)	26.1 (23.9, 28.5)	27.5 (26.2, 28.9)	22.4 (21.0, 24.0)	22.3 (19.9, 24.8)
BA/BS or more	11.1 (10.6, 11.7)	15.4 (15.0, 15.8)	16.3 (15.9, 16.8)	13.5 (12.8, 14.1)	10.8 (9.2, 12.7)	7.6 (6.7, 8.6)	8.9 (7.9, 10.1)	6.8 (5.5, 8.3)
<b>Income (\$)</b>								
<25,000	30.4 (29.9, 31.0)	36.8 (35.8, 37.8)	28.3 (27.7, 29.0)	27.4 (26.3, 28.5)	51.3 (48.4, 54.2)	54.6 (52.5, 56.7)	41.2 (39.1, 43.4)	45.8 (42.7, 49.0)
25,000–<50,000	31.6 (31.1, 32.1)	31.0 (30.1, 31.9)	31.6 (31.0, 32.1)	31.9 (30.8, 33.1)	27.8 (25.4, 30.3)	28.8 (27.1, 30.6)	33.5 (31.5, 35.6)	31.8 (29.1, 34.7)
50,000–<75,000	19.3 (18.9, 19.8)	16.9 (16.2, 17.7)	20.2 (19.8, 20.7)	20.9 (19.9, 21.9)	11.2 (9.4, 13.1)	9.7 (8.7, 10.9)	14.3 (12.8, 15.9)	12.1 (10.2, 14.3)
≥75,000	18.6 (18.2, 19.1)	15.2 (14.6, 15.9)	19.9 (19.3, 20.4)	19.8 (19.0, 20.7)	9.8 (8.2, 11.6)	6.8 (6.0, 7.8)	11.0 (9.9, 12.2)	10.2 (8.3, 12.5)
<b>Age (years)</b>								
18–24	13.7 (16.4, 14.1)	16.6 (15.9, 17.3)	13.7 (13.3, 14.2)	17.0 (16.2, 17.9)	10.7 (9.1, 12.7)	14.5 (13.4, 15.8)	15.1 (13.8, 16.6)	20.1 (17.9, 22.5)
25–44	44.1 (43.7, 44.6)	40.3 (39.5, 41.1)	43.7 (43.2, 44.1)	36.7 (35.8, 37.6)	32.8 (30.4, 35.3)	44.0 (42.6, 45.5)	54.0 (52.2, 55.7)	52.3 (49.6, 54.9)
45–64	33.9 (33.4, 34.3)	36.5 (35.8, 37.2)	34.2 (33.8, 34.7)	38.2 (37.3, 39.2)	42.9 (40.2, 45.7)	36.9 (35.6, 38.2)	26.2 (24.7, 27.7)	24.1 (21.7, 26.6)
≥65	8.3 (8.1, 8.5)	6.6 (6.3, 7.0)	8.4 (8.2, 8.6)	8.0 (7.6, 8.5)	13.5 (12.1, 15.0)	4.6 (4.1, 5.1)	4.7 (4.0, 5.5)	3.6 (2.7, 4.7)
<b>Tax increase<sup>a</sup></b>								
Yes	21.2 (20.7, 21.6)	23.3 (22.6, 24.0)	22.0 (21.6, 22.5)	23.8 (22.9, 24.8)	20.3 (18.3, 22.4)	24.0 (22.7, 25.4)	13.0 (11.6, 14.5)	17.7 (15.5, 20.1)
No	78.9 (78.4, 79.3)	76.7 (76.0, 77.4)	78.0 (77.5, 78.4)	76.2 (75.2, 77.1)	79.7 (77.6, 81.8)	76.0 (74.7, 77.3)	87.0 (85.5, 88.4)	82.3 (80.0, 84.5)
<b>Year</b>								
2003	49.6 (49.0, 50.1)	49.6 (48.6, 50.5)	49.7 (49.1, 50.3)	49.5 (48.4, 50.7)	48.1 (45.2, 51.0)	50.2 (48.5, 51.9)	48.9 (47.1, 50.7)	48.1 (45.0, 51.2)
2006/2007	50.4 (49.9, 51.0)	50.4 (49.5, 51.4)	50.3 (49.7, 50.9)	50.5 (49.4, 51.6)	51.9 (49.0, 54.8)	49.8 (48.1, 51.5)	51.1 (49.3, 52.9)	51.9 (48.8, 55.0)
<b>Month</b>								
January–April	33.4 (32.9, 33.8)	33.1 (32.3, 33.9)	33.3 (32.9, 33.8)	33.1 (32.2, 34.1)	32.9 (30.6, 35.3)	33.6 (32.1, 35.1)	33.8 (32.1, 35.5)	31.7 (29.0, 34.6)
May–August	50.4 (50.0, 50.9)	50.3 (49.5, 51.1)	50.4 (49.9, 50.9)	50.6 (49.6, 51.6)	51.6 (49.0, 54.1)	49.4 (47.8, 51.0)	49.9 (48.2, 51.5)	51.4 (48.3, 54.4)
September–December	16.2 (15.9, 16.6)	16.6 (16.0, 17.2)	16.3 (15.9, 16.6)	16.3 (15.6, 17.0)	15.6 (13.8, 17.5)	17.0 (16.0, 18.0)	16.4 (15.2, 17.6)	16.9 (14.9, 19.3)
<b>Hispanic origin</b>								
Mexican	—	—	—	—	—	—	65.2 (63.2, 67.1)	41.5 (38.5, 44.5)
Puerto Rican	—	—	—	—	—	—	8.1 (7.2, 9.1)	33.8 (31.0, 36.8)
Other	—	—	—	—	—	—	26.7 (25.0, 28.6)	24.7 (22.2, 27.3)

BA, Bachelor of Arts; BS, Bachelor of Science; GED, General Educational Development test; HS, high school

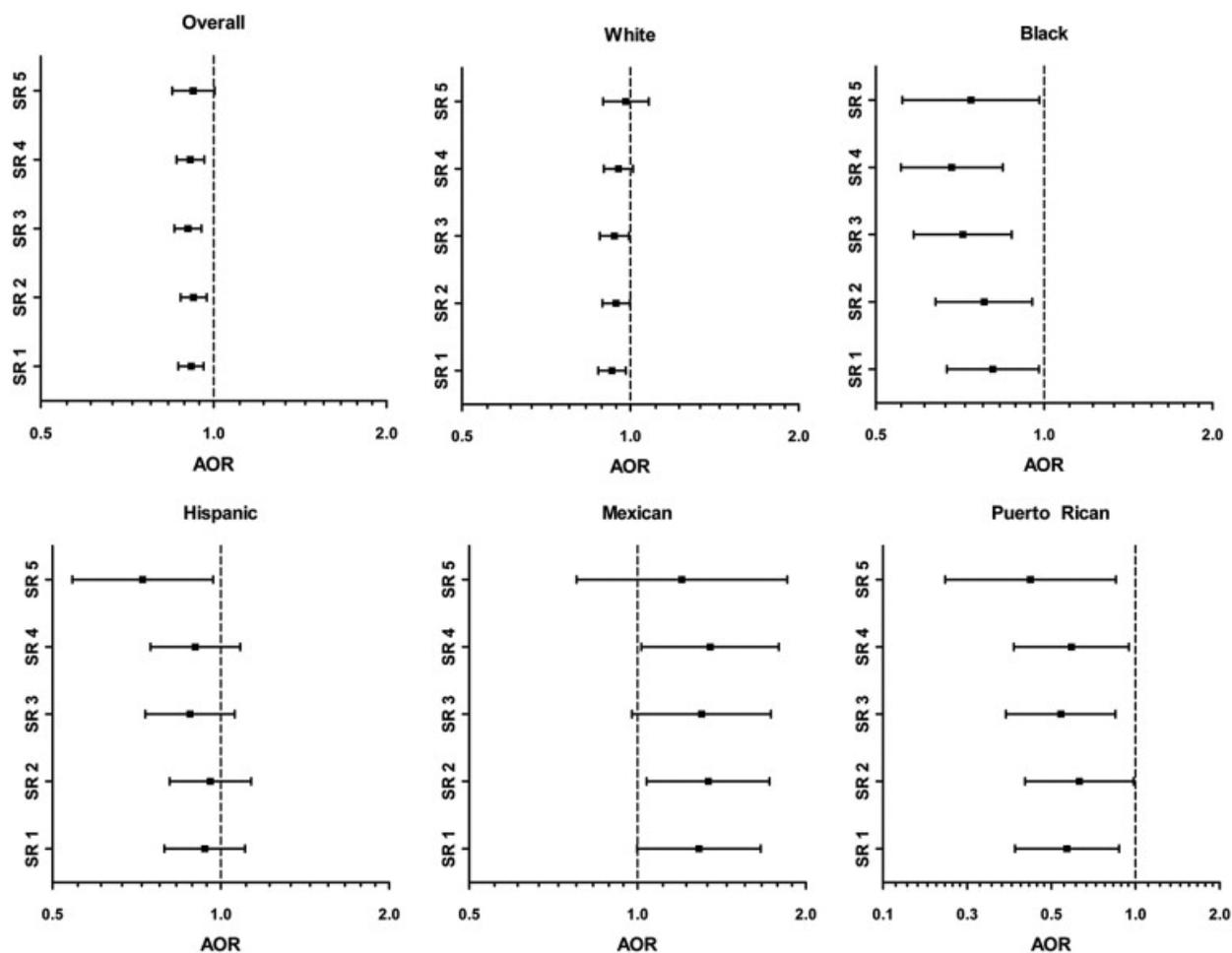
<sup>a</sup> Restricted to those who quit or made a quit attempt in past 12 months

**Table 3.** Prevalence of menthol smoking among ever smokers by covariates, % (95% CI)

	<b>Total</b>
<b>Smoking status</b>	
Current	27.9 (27.4, 28.4)
Former	24.5 (23.7, 25.3)
<b>Gender</b>	
Male	22.8 (22.3, 23.4)
Female	32.0 (31.4, 32.6)
<b>Education</b>	
<HS	30.0 (28.9, 31.1)
HS/GED	28.1 (27.5, 28.8)
Some college	27.0 (26.3, 27.8)
BA/BS or more	21.2 (20.3, 22.0)
<b>Income (\$)</b>	
<25,000	30.9 (30.1, 31.8)
25,000 to <50,000	26.6 (25.9, 27.4)
50,000 to <75,000	24.5 (23.6, 25.4)
≥75	23.2 (22.4, 24.1)
<b>Age (years)</b>	
18–24	30.9 (29.6, 32.3)
25–44	25.3 (24.7, 25.9)
45–64	28.5 (27.9, 29.2)
≥65	22.8 (21.7, 24.0)
<b>Year</b>	
2003	27.1 (26.5, 27.8)
2006/2007	27.1 (26.5, 27.8)
<b>Month</b>	
January–April	27.0 (26.3, 27.7)
May–August	27.1 (26.5, 27.7)
September–December	27.6 (26.6, 28.6)
<b>Race/ethnicity</b>	
White	21.0 (20.5, 21.4)
Black	71.8 (70.4, 73.2)
Hispanic	28.1 (26.6, 29.7)
<b>Hispanic origin</b>	
Mexican	19.9 (18.3, 21.7)
Puerto Rican	62.0 (58.0, 65.8)
Other	26.5 (23.7, 29.5)
<b>Total</b>	27.1 (26.7, 27.6)

BA, Bachelor of Arts; BS, Bachelor of Science; GED, General Educational Development test; HS, high school

Figure 1 presents the ORs contrasting menthol and non-menthol smokers for each sample restriction, overall, and stratified by race/ethnicity. Using the least restrictive sample restrictions (sample restriction 1), overall menthol smokers were less likely to be former smokers than were non-menthol smokers (AOR=0.91, 95% CI=0.87, 0.96). This overall finding was robust against various sample restrictions, ranging from an AOR of 0.90 for sample restriction 3 to a high of 0.92 for sample restriction 2. Among past-year smokers (sample restriction 5) only was the finding not significant, although the direction of the relationship was consistent with the other sample restrictions.



**Figure 1.** AOR with 95% CI of being a former smoker for menthol smoking vs non-menthol (referent) by race/ethnicity

Note: AOR with 95% CI is SR 1–4 controlling for gender, age, income, education, race/ethnicity (overall only), year, and month; SR 5 controlling for gender, age, income, education, race/ethnicity (overall only), year, month, and past-year cigarette tax increase.

SR, sample restriction

In stratified analyses, this relationship held among whites (AOR=0.93, 95% CI=0.88, 0.98) and blacks (AOR=0.81, 95% CI=0.67, 0.98). For blacks, the relationship was always significant, with an AOR ranging from 0.68 in sample restriction 4 to 0.81 in sample restriction 1. The magnitude of the relationship among Hispanics was similar to that among whites but was not significant (AOR=0.94, 95% CI=0.79, 1.11). The relationship was significant among past-year smokers (sample restriction 5) only, although it was substantial in sample restrictions 3 and 4 as well. However, differences by Hispanic country of origin were found. Among those of Mexican origin, menthol smokers are substantially more likely to have quit smoking, although this was significant only in sample restrictions 2 (AOR=1.34, 95% CI=1.04, 1.72) and 4 (1.35, 95% CI=1.02, 1.79). In contrast, among those of Puerto Rican origin, smokers of menthol cigarettes were substantially *less* likely to have quit relative to smokers of non-menthol cigarettes, with AORs ranging from 0.42 in sample restriction 5 to 0.63 in sample restriction 2. This relationship was significant in all 5 sample restrictions, although the CIs were fairly wide.

## Discussion

The analyses presented here suggest that there is a robust menthol effect on cessation at the population level. Specifically, there was a small but consistent relationship between menthol cigarettes and cessation, whereby smokers of menthol cigarettes were significantly less likely to have quit smoking than smokers of non-menthol cigarettes. Moreover, there was substantial variability in the menthol–cessation relationship for blacks and across Hispanic subgroups, with Puerto Ricans being the least likely of all minority groups to be former smokers.

The mixed findings in the literature may be partially attributed to methodologic differences in the study population and cessation outcomes studied. However, it should also be noted that the menthol effect found in the present study is of a small magnitude and, thus, it is plausible that some of the prior nonsignificant findings may be attributed to sample sizes with reduced power to detect differences. Despite the overall small associations, the present results are nontrivial. On the contrary, small but robust findings for smoking cessation are clinically meaningful because of the public health gains that accrue from stopping smoking.<sup>26</sup> Indeed, Levy and colleagues<sup>27</sup> have modeled the effect of a menthol ban and estimate that over the next 40 years, 300,000 to 600,000 tobacco-caused deaths could be avoided under a ban.

The magnitude of the relationship between menthol smoking and poorer cessation differed considerably by race/ethnicity and would have been masked in models that adjust only for race/ethnicity. Specifically, a significant relationship between menthol and cessation was found among whites in three of the five sample restrictions. Among blacks, the effect was more pronounced in all five sample restrictions. This was not the case among Hispanics. Although the magnitude of the relationship was similar to that for whites, it was not significant and the findings differed by country of origin. Historically, smoking-cessation research generally has grouped Hispanics together and contrasted them with non-Hispanic whites. This prevailing approach ignores the vast heterogeneity of the Hispanic population. When country of origin explicitly was modeled, there was either no effect or a “protective” effect among Mexican menthol smokers, whereas Puerto Rican menthol smokers were substantially less likely to be a former smoker relative to non-menthol smokers.

The finding of heterogeneity by Hispanic ethnicity supports a growing body of evidence<sup>16, 28</sup> indicating substantial health differences among Hispanic subgroups. We are not aware of any study that specifically has examined Hispanic ethnic group differences in menthol smoking and cessation. The reasons for observed differences by Hispanic ethnic group are not well understood. Some possible explanations for the heterogeneity found in the present study could be differences in actual social, physiological, and/or genetic expression that differentially influence cessation when smoking menthol cigarettes, which were not captured in the TUS–CPS data. For example, Puerto Ricans, who overwhelmingly reside in the Northeast, may live in areas where menthol cigarettes have been marketed more heavily. These factors may also explain the results observed for blacks as they generally followed the same trend as that for Puerto Ricans. The opposite finding for Mexicans compared to Puerto Ricans and blacks warrants further research.

In March 2011, the report by the FDA's Tobacco Products Scientific Advisory Committee (TPSAC)<sup>29</sup> concluded that the availability of menthol cigarettes results in reduced cessation and

recommended that the “removal of menthol cigarettes from the marketplace would benefit public health in the United States.” Their recommendation, however, is not binding, nor does it outline specific action by the FDA.

The debate over the removal of menthol cigarettes is politically charged given its sizeable share of the cigarette market. Supporting the claim that menthol flavoring makes it harder to quit smoking, particularly for certain subgroups, may be unpopular in some circles. However, the findings from the current study are broadly consistent with other research<sup>2, 3, 7, 11, 12, 13, 30</sup> on menthol flavoring and smoking-cessation outcomes. The evidence suggests that menthol may be one of the mechanisms that drives observed differences in cessation outcomes. Indeed, the prevalence of cigarette smoking cessation for blacks has lagged behind whites for decades.<sup>31, 32</sup> It follows from these results that recent calls to ban menthol flavoring would be prudent and evidence-based. The FDA must meet a new standard for the tobacco product regulation that is “appropriate for the protection of public health” and, thus, this standard must include efforts that promote smoking cessation for all.

Limitations of the present study include the retrospective and self-reported nature of the data. However, self-reported measures of tobacco use have shown to produce valid results,<sup>33</sup> and menthol smoking reports had 98% agreement with stated brands' Universal Product Codes in the COMMIT study.<sup>6</sup> In addition, the TUS–CPS asked only former smokers who quit in the past 5 years whether or not they smoked menthol, presumably to minimize recall bias. Also, the TUS only collected data on cigarettes per day for current smokers and former smokers who smoked daily for at least 6 months. A notable proportion of the cigarette smoking population are nondaily smokers, and blacks and Hispanics are over-represented among nondaily smokers.<sup>34</sup> Consequently, this variable was not included in these analyses.

In summary, this study demonstrates that at the population level, menthol cigarette smoking is associated with lower levels of smoking cessation compared to non-menthol smokers, and this relationship is more pronounced among black and Puerto Rican smokers. Moreover, these findings suggest the need to consider country of origin among Hispanic smokers as the relationship between menthol and cessation overall is masked by differences among subgroups such as Mexicans and Puerto Ricans.

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