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Differential trends in cigarette smoking in the USA: is menthol slowing progress?

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ABSTRACT

Introduction Mentholated cigarettes are at least as dangerous to an individual's health as non-mentholated varieties. The addition of menthol to cigarettes reduces perceived harshness of smoke, which can facilitate initiation. Here, we examine correlates of menthol use, national trends in smoking menthol and non-menthol cigarettes, and brand preferences over time.

Methods We estimated menthol cigarette use during 2004–2010 using annual data on persons ≥ 12 years old from the National Surveys on Drug Use and Health. We adjusted self-reported menthol status for selected brands that were either exclusively menthol or non-menthol, based on sales data. Data were weighted to provide national estimates.

Results Among cigarette smokers, menthol cigarette use was more common among 12–17 year olds (56.7%) and 18–25 year olds (45.0%) than among older persons (range 30.5% to 34.7%). In a multivariable analysis, menthol use was associated with being younger, female and of non-Caucasian race/ethnicity. Among all adolescents, the percentage who smoked non-menthol cigarettes decreased from 2004–2010, while menthol smoking rates remained constant; among all young adults, the percentage who smoked non-menthol cigarettes also declined, while menthol smoking rates increased. The use of Camel menthol and Marlboro menthol increased among adolescent and young adult smokers, particularly non-Hispanic Caucasians, during the study period.

Conclusions Young people are heavy consumers of mentholated cigarettes. Progress in reducing youth smoking has likely been attenuated by the sale and marketing of mentholated cigarettes, including emerging varieties of established youth brands. This study should inform the Food and Drug Administration regarding the potential public health impact of a menthol ban.

INTRODUCTION

Smokers of mentholated cigarettes are just as likely to experience premature morbidity and mortality as smokers of non-mentholated varieties,¹ even though menthol smokers smoke fewer cigarettes per day than do smokers of non-mentholated brands.^{2–3} The cooling properties and flavour of menthol make these cigarettes less harsh to smoke,⁴ which can facilitate the transition from experimentation to more regular use and addiction.^{5–6}

Consistent with evidence that young smokers prefer flavoured cigarettes,⁷ studies of adolescent and adult smokers find the highest prevalences of menthol cigarette use among 12–17-year-old smokers compared to older smokers and among middle school smokers when compared with high

school smokers.^{8–10} A recent National Survey on Drug Use and Health (NSDUH) report on menthol smoking showed that trends in past month menthol use increased from 13.4% in 2004 to 15.9% in 2010 among people aged 18–25 years old, and remained relatively stable from 2004–2010 among those aged 12–17 years and 26 years and older.¹¹ Menthol cigarette use appears to be more common among more recent initiates, suggesting a role as a starter product for youth.^{4–5–11} Menthol may facilitate nicotine addiction. Several studies report increased nicotine dependence among adolescent menthol smokers compared to non-menthol smokers.^{5–12–14} Menthol has also been shown to increase oral absorption of nicotine in an animal model.¹⁵

The 2009 Family Smoking Prevention and Tobacco Control Act¹⁶ gives the Food and Drug Administration (FDA) authority to issue tobacco product standards if deemed 'appropriate for the protection of public health'.¹⁶ The Act required the FDA to ban fruit, candy, or clove characterising flavourings in cigarettes in September 2009 to reduce youth smoking initiation.¹⁷ The Act did not ban menthol flavourings at that time. Rather, it directed the FDA's Tobacco Products Scientific Advisory Committee (TPSAC) to review the scientific evidence on the impact of the use of menthol in cigarettes on the public health, including such use among children, African-Americans, Hispanics and other racial and ethnic minorities. TPSAC concluded in its July 2011 report that 'removal of menthol cigarettes from the marketplace would benefit public health in the USA'.¹⁸ TPSAC's conclusions were based in part on analyses of 2004–2008 NSDUH data.¹⁹ In this study, we update and extend these analyses with 2009 and 2010 NSDUH data to examine correlates of menthol use, trends in the prevalence of smoking menthol and non-menthol cigarettes in the USA, and changes in preference for various mentholated brands across subgroups and with increased precision.

METHODS

National Survey on Drug Use and Health

The NSDUH is a nationally representative survey that assesses tobacco, alcohol and drug use behaviours in the US civilian, non-institutionalised population that is ≥ 12 years old. It is administered to a sample of the US population living in households. Respondents include residents of non-institutional group quarters, such as college students living in dormitories, civilians residing on military bases, and persons living in group homes, shelters and rooming houses. The NSDUH is sponsored by the Substance



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Abuse and Mental Health Services Administration. Cross-sectional surveys administered annually from 2004 to 2010 were used to estimate the prevalence of menthol use among current smokers and among the entire population. NSDUH respondents are selected using a multistage probability sample. Most interviews are conducted in the respondents' homes by trained interviewers. To decrease misclassification bias, drug use questions—including tobacco questions—are administered by audio computer-assisted self-interviews (A-CASI). The overall response rate for the 2004–2010 individual survey years ranged from 66.1% to 70.0%. The NSDUH added a new question on menthol use in 2004.²⁰

Current cigarette smoking in the NSDUH was assessed by asking respondents who had ever smoked whether they had smoked part or all of a cigarette in the previous 30 days. Those who responded affirmatively were subsequently asked to report the brand of cigarettes they smoked most often. They were able to select and verify their usual brand from 2 lists with a total of 57 (60 in 2004) brand names that were presented onscreen. Once respondents selected and verified one of the brands on the screen, they were subsequently asked, 'Were the <CIGFILL> cigarettes you smoked during the past 30 days menthol?' (Note: '<CIGFILL>' was replaced by the computer programme with the name of the brand the respondent had previously reported and verified as having smoked most often.) Approximately 95% of smokers selected a brand from the lists offered. The remaining 5% were asked, 'Were the cigarettes you smoked during the past 30 days menthol?'

Prior research has demonstrated under-reporting of menthol status of exclusively menthol brands (eg, Newport, Salem), particularly among adolescent smokers.^{2 5 21} This has been raised as a particular concern for estimates of menthol use among young Black smokers.²¹ Because of concerns about misclassification, especially among adolescents (see online supplementary tables S1 and S2), we used sales data²² to classify major brands for which at least 99% of sales were menthol or non-menthol. Sales data were incorporated for 2008 grocery, drug and merchandise stores and for 2009 and 2010 for those types of stores and convenience stores, as well (see supplementary Appendix). Incorporating a method of Hersey and colleagues,⁵ if a respondent reported usually smoking Newport and also reported on the menthol question that the usual brand was non-menthol, the respondent's response to the menthol variable question was recoded as menthol. A similar adjustment was made for exclusively non-mentholated brands. All results reported here use this adjustment process. We note that the overall prevalence trends observed here were also observed with unadjusted data.¹¹

Statistical analyses

We used SAS V9.2 for all analyses. The SAS survey procedures took into account NSDUH's complex survey design. Survey weights were used to adjust for different probabilities of selection and for non-response, producing estimates representative of the US population. Due to small cell sizes, we restricted some of our analyses to the three largest racial/ethnic groups: non-Hispanic Caucasian, non-Hispanic Black and Hispanic.

We used data on 40 841 smokers interviewed in 2008–2010 who were aged 12 years and older to assess patterns of menthol use among smokers by age, gender, race/ethnicity, household income and the number of days smoked during the previous 30 days. Differences in point estimates were assessed using non-overlapping CIs. Logistic regression analyses were conducted to assess patterns of use in a multivariable model.

We then used data on 389 698 respondents aged 12 years and older to estimate the prevalence of smoking menthol and non-menthol cigarettes in the US population. These estimates were made by age (12–17, 18–25, 26 years and older) and in each age group by gender and race/ethnicity. The significance of the time trends was tested using a *t* test of the slope coefficients. This was performed separately for menthol and non-menthol trend lines. The difference between menthol and non-menthol time trends was estimated by including an interaction term in the model. The interaction term enabled us to estimate separate slopes for menthol and non-menthol trend lines. We tested the significance of the interaction coefficient using a *t* test of the interaction coefficient.

We also compared data on 43 616 smokers surveyed during 2004–2006 with those from the 40 841 smokers surveyed during 2008–2010 to assess changes in menthol brand preference. Our intention in this analysis was to contrast the 3 earliest years of the study with the 3 latest years. Including data from 2007 would have resulted in an unbalanced analysis. Differences in use of various brands over time were tested using the *z* test of two independent binomial proportions.

A note on terminology

Below we refer to persons aged 12–17 years old as adolescents, 18–25 years old as young adults and 26 years and older as adults. We refer to non-Hispanic Caucasian subjects as Caucasians, non-Hispanic Black subjects as Blacks and non-Hispanic Asian subjects as Asians.

Additional details on the methods used and results are presented in the online supplementary appendix.

RESULTS

Age differences in menthol cigarette use among current cigarette smokers

Table 1 presents overall and age-specific data on the use of mentholated cigarettes among current smokers during 2008–2010 by gender, race/ethnicity, household income and the number of days smoked during the previous 30 days. Menthol use was most prevalent among adolescent smokers overall (56.7%, representing 1.2 million smokers) and consistently high across all subgroups examined. Prevalence of menthol use was next highest among young adult smokers overall (45.0%, representing 5.2 million smokers) and in most subcategories. Overall, lower menthol use rates were observed among 26–34 year olds (34.7%), which were higher than among 35–49 (30.5%) and 50+ (30.7%) year olds. Among Blacks, a ceiling effect likely occurred, with menthol use rates of at least 89.9% observed in each of the 12–49-year-old age categories.

Multivariable analyses

More precise younger age categories were examined in a multivariable logistic regression analysis of correlates of menthol cigarette use among smokers (table 2). Controlling for gender, race/ethnicity, household income and days smoked in the past month, the odds of smoking mentholated brands were highest in the youngest age groups (12–15 and 16–17) of smokers. Females and racial/ethnic minority groups were more likely to smoke mentholated varieties than were males and Caucasians, respectively. Of particular note, Blacks had 25.18 times higher odds (95% CI 20.28 to 31.26) of smoking menthol cigarettes compared to Caucasians. No differences were seen across categories of household income and days smoked/month.

Table 1 Prevalence (%) of use of menthol cigarettes among past 30-day smokers, by age and gender, race/ethnicity, household income and the number of days smoked/month in the USA, 2008–2010

Factor	All ages		12–17		18–25		26–34		35–49		50+	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Overall	35.23	34.19 to 36.27	56.71	54.62 to 58.80	45.01	43.80 to 46.22	34.74	32.87 to 36.62	30.50	29.13 to 31.87	30.74	28.27 to 33.22
Gender												
Male	31.40	30.24 to 32.55	53.79	51.34 to 56.24	41.94	40.45 to 43.42	32.67	30.16 to 35.18	25.15	23.48 to 26.82	25.70	22.53 to 28.87
Female	39.65	38.11 to 41.19	59.87	57.15 to 62.58	48.95	47.36 to 50.53	37.42	34.90 to 39.94	36.46	34.40 to 38.52	35.87	32.51 to 39.23
Race/ethnicity												
Non-Hispanic Caucasian	25.70	24.71 to 26.69	51.30	48.84 to 53.77	36.39	35.12 to 37.66	23.58	21.96 to 25.20	20.05	18.58 to 21.53	22.63	20.53 to 24.73
Non-Hispanic Black	88.47	86.24 to 90.71	94.89	92.68 to 97.11	93.97	92.57 to 95.37	91.61	88.48 to 94.74	89.93	86.43 to 93.44	80.99	75.39 to 86.58
Non-Hispanic other	45.19	37.25 to 53.12	56.49	44.50 to 68.49	56.28	49.24 to 63.31	38.68	25.65 to 51.71	48.47	31.43 to 65.51	31.58	13.12 to 50.04
Non-Hispanic Asian	30.77	26.41 to 35.13	60.71	41.48 to 79.94	49.77	42.57 to 56.97	27.05	17.17 to 36.92	24.91	14.72 to 35.10	16.96	3.62 to 30.29
Non-Hispanic more than one race	42.16	34.57 to 49.75	59.39	49.71 to 69.07	52.81	46.09 to 59.53	30.86	23.03 to 38.69	48.16	37.89 to 58.43	33.75	14.87 to 52.63
Hispanic	38.06	35.70 to 40.43	58.18	52.20 to 64.15	47.33	44.50 to 50.16	40.45	35.38 to 45.52	31.86	26.40 to 37.32	26.82	18.23 to 35.40
Household income												
Lower tertile	40.68	38.85 to 42.51	58.32	54.59 to 62.05	45.99	43.93 to 48.06	44.95	41.20 to 48.69	38.92	35.99 to 41.85	32.97	29.09 to 36.84
Middle tertile	35.81	34.17 to 37.46	58.02	54.23 to 61.81	45.05	43.28 to 46.83	35.55	32.45 to 38.66	30.37	28.14 to 32.60	32.44	28.47 to 36.41
Higher tertile	31.20	29.75 to 32.65	55.01	51.75 to 58.27	43.99	42.42 to 45.56	28.04	25.65 to 30.43	26.42	24.13 to 28.72	27.57	24.03 to 31.10
Number of days smoked per month												
1–5 days	39.50	37.35 to 41.65	57.78	54.03 to 61.53	43.76	41.67 to 45.84	32.90	28.28 to 37.52	34.21	29.53 to 38.89	39.26	32.30 to 46.22
6–29 days	41.30	39.44 to 43.15	58.70	55.30 to 62.09	46.82	44.57 to 49.06	37.77	34.03 to 41.51	37.06	34.00 to 40.12	38.87	32.66 to 45.08
30 days	31.92	30.71 to 33.13	51.98	48.55 to 55.40	44.53	43.12 to 45.93	34.09	31.73 to 36.45	27.73	26.13 to 29.33	27.88	25.16 to 30.59

Source: National Survey on Drug Use and Health. Self-reported menthol status was adjusted if necessary using retail checkout scanner data. Sample size=40 841.

Table 2 Multivariate logistic regression analysis of correlates of use of menthol cigarettes among past 30-day smokers in the USA, 2008–2010

Factor	N	Menthol, %	AOR	95% CI	p Value
Age (years)					
12–15	1644	58.42	3.92	3.32 to 4.63	<0.0001
16–17	3251	55.82	3.62	3.25 to 4.03	<0.0001
18–21	10 095	48.37	2.61	2.34 to 2.90	<0.0001
22–25	10 172	41.58	1.85	1.69 to 2.03	<0.0001
26–34	5889	34.75	1.26	1.16 to 1.37	<0.0001
35+	9755	30.61	Reference		
Gender					
Female	19 780	39.62	1.62	1.49 to 1.76	<0.0001
Male	21 026	31.40	Reference		
Race/ethnicity					
Non-Hispanic Black	4337	88.46	25.18	20.28 to 31.26	<0.0001
Non-Hispanic Asian	787	30.76	1.35	1.10 to 1.66	0.004
Non-Hispanic more than one race	1546	42.00	2.06	1.51 to 2.80	<0.0001
Non-Hispanic other	1227	45.19	2.26	1.64 to 3.12	<0.0001
Hispanic	5137	38.09	1.81	1.62 to 2.02	<0.0001
Non-Hispanic Caucasian	27 772	25.70	Reference		
Household income					
Lower tertile	11 971	40.64	0.95	0.84 to 1.08	0.44
Middle tertile	15 253	35.81	1.02	0.92 to 1.12	0.77
Higher tertile	13 582	31.21	Reference		
Number of days smoked/month					
1–5 days	8487	39.50	1.01	0.91 to 1.13	0.82
6–29 days	10 427	41.30	1.02	0.92 to 1.12	0.73
30 days	21 892	31.92	Reference		

Source: National Survey on Drug Use and Health 2008–2010. Self-reported menthol status was adjusted if necessary using retail checkout scanner data. Sample size=40 806.

Recent trends in the prevalence of smoking menthol and non-menthol cigarettes in the USA

Figure 1 and table 3 and online supplementary table S3 show the results of analyses that examined overall trends from 2004–2010 in the prevalence of smoking menthol and non-menthol cigarettes among adolescents, young adults and adults. Note that the denominator here is all individuals in the relevant age groups, not just cigarette smokers. Overall, 5.3% of adolescents smoked mentholated cigarettes in 2004, compared to 4.5% in 2010; 6.0% smoked non-mentholated cigarettes in 2004, compared to 3.4% in 2010. The slopes of the regression lines were -0.08 ($p=0.11$) for menthol smoking and -0.47 ($p<0.001$) for non-menthol smoking. The slopes of these two lines were significantly different ($p<0.001$).

Among young adults, 14.0% smoked mentholated cigarettes in 2004, compared to 16.3% in 2010; 25.7% smoked non-mentholated cigarettes in 2004, compared to 17.3% in 2010. The slopes of the regression lines were $+0.45$ ($p=0.003$) for menthol smoking and -1.48 ($p<0.001$) for non-menthol. These slopes were also significantly different ($p<0.001$). Among adults aged 26 and above, 7.0% smoked mentholated cigarettes in 2004, compared to 7.4% in 2010; 17.0% smoked non-mentholated cigarettes in 2004, compared to 15.3% in 2010. The slopes of the regression lines were $+0.04$ ($p=0.46$) for menthol smoking and -0.28 ($p=0.0024$) for non-menthol. These slopes were significantly different ($p=0.0013$).

The general pattern of more rapid decline of non-menthol smoking relative to menthol smoking was consistently observed among males, females and Caucasians ($p=0.053$ for adults) and among young adult and adult Hispanics (table 3).

Trends in prevalence of various mentholated cigarette brands by US cigarette smokers

Next, we compared preference for leading mentholated varieties in 2004–2006 and 2008–2010 among smokers across age categories (see online supplementary figure S1 and table S4). Preference for Camel menthol and Marlboro menthol cigarettes increased during the study in all three age groups, but especially among adolescents and young adults. Newport use increased among young adults and adults; Salem use declined in all three age groups. Overall, the number of users of Camel menthol, Marlboro menthol and Newport increased during the study by approximately 866 000, 886 000 and 580 000 smokers, respectively (see online supplementary table S4). During 2008–2010, 1.0 million adolescents and 4.6 million young adults used Camel menthol, Marlboro menthol, or Newport.

The prevalence of Camel menthol use increased significantly among Caucasians in all age groups, among adolescent Blacks, and among Hispanic young adults and adults (figure 2 and see online supplementary table S5). The prevalence of smoking Marlboro menthol cigarettes increased among Caucasians in all age groups and among Black and Hispanic young adults. Prevalence of use of Kool and Salem declined in some age categories, and Newport use increased among adult Blacks.

DISCUSSION

The analyses in this report indicate that youth are heavy consumers of mentholated cigarettes and that overall menthol cigarette smoking has either remained constant or increased from 2004–2010 in all three age groups, while non-menthol smoking has decreased. We also document increased use of Camel

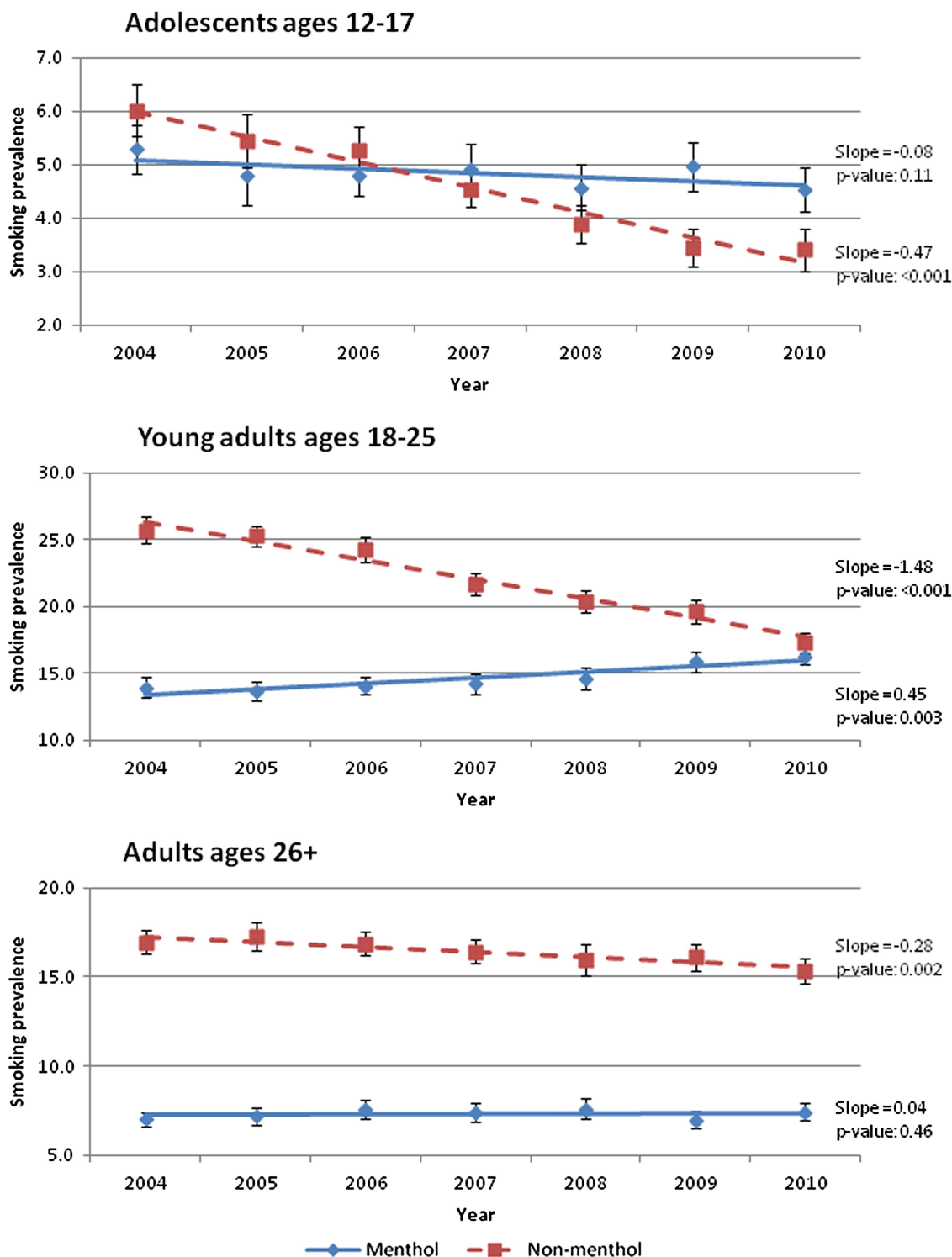


Figure 1 Trends in the prevalence of cigarette smoking (%) by type of cigarette smoked and age in the USA, 2004–2010. Source: National Survey on Drug Use and Health. Self-reported menthol status was adjusted if necessary using retail checkout scanner data. NB: Scales for y-axis are different across age groups. Menthol cigarette use represented by solid blue line; non-menthol cigarette use by broken red line. Error bars represent 95% CIs. Differences in slopes for menthol and non-menthol cigarette use in adolescents ($p < 0.001$), young adults ($p < 0.001$) and adults ($p = 0.0013$). Sample size = 389 698.

menthol and Marlboro menthol cigarettes, particularly among young Caucasians and Hispanics. Camel menthol and Marlboro menthol are emerging varieties of established youth brands.²³ Our findings address previous concerns regarding misclassification of menthol smoking status by adjusting self-reported menthol status with Nielsen retail checkout scanner data.²²

After such adjustment, we observed that more than half (56.7%) of adolescent smokers preferred menthol cigarettes. Detailed findings are discussed below.

First, after controlling for confounders, younger age, even as young as 12–15 years old, was a significant correlate of menthol cigarette use. The relationship between age and menthol use

Table 3 Trends in the prevalence of cigarette smoking (%) by type of cigarette smoked and age, gender and race/ethnicity in the USA, 2004–2010

	Percentage									
Type of cigarette smoked/factor	2004	2005	2006	2007	2008	2009	2010	Estimated slope	p Value for slope	p Value for difference in slopes
12–17 years:										
Overall										
Menthol	5.3	4.8	4.8	4.9	4.6	5.0	4.5	−0.08	0.11	<0.001
Non-menthol	6.0	5.5	5.3	4.5	3.9	3.5	3.4	−0.47	<0.001	
Gender:										
Male										
Menthol	4.6	4.3	4.3	4.8	4.4	4.8	4.4	0.00	0.95	<0.001
Non-menthol	6.2	5.7	5.4	4.9	4.0	3.9	3.8	−0.43	<0.001	
Female										
Menthol	6.0	5.3	5.3	5.0	4.8	5.1	4.7	−0.18	0.01	<0.001
Non-menthol	5.8	5.2	5.1	4.2	3.8	3.0	3.0	−0.52	<0.001	
Race/ethnicity:										
Non-Hispanic Caucasian										
Menthol	5.8	4.8	4.9	5.5	4.8	5.2	5.1	−0.02	0.79	<0.001
Non-menthol	8.1	7.5	7.2	6.3	5.2	5.0	4.2	−0.69	<0.001	
Non Hispanic Black										
Menthol	5.3	6.1	5.7	5.8	4.9	4.8	4.2	−0.23	0.04	0.11
Non-menthol	0.5	0.5	0.1	0.3	0.2	0.2	0.3	0.03	0.48	
Hispanic										
Menthol	3.7	4.3	4.2	3.1	3.8	4.6	3.8	−0.01	0.90	0.30
Non-menthol	4.4	3.4	3.5	2.8	3.1	2.2	3.4	−0.18	0.16	
18–25 years:										
Overall										
Menthol	14.0	13.7	14.1	14.2	14.6	15.9	16.3	0.45	0.003	<0.001
Non-menthol	25.7	25.3	24.2	21.6	20.4	19.6	17.3	−1.48	<0.001	
Gender:										
Male										
Menthol	14.4	14.0	14.4	14.9	15.4	16.3	17.0	0.50	0.001	<0.001
Non-menthol	29.5	28.9	27.3	25.2	23.7	23.6	20.2	−1.57	<0.001	
Female										
Menthol	13.6	13.3	13.8	13.5	13.9	15.5	15.6	0.35	0.02	<0.001
Non-menthol	21.9	21.6	21.1	18.0	17.1	15.6	14.3	−1.35	<0.001	
Race/ethnicity:										
Non-Hispanic Caucasian										
Menthol	12.3	11.8	12.7	12.5	13.1	14.5	15.6	0.56	0.01	<0.001
Non-menthol	33.0	32.5	31.5	28.1	26.8	26.0	22.8	−1.76	<0.001	
Non Hispanic Black										
Menthol	27.5	26.0	25.0	24.0	24.5	24.2	24.6	−0.44	0.04	0.13
Non-menthol	2.0	2.3	1.7	1.8	1.2	1.9	1.5	−0.10	0.21	
Hispanic										
Menthol	11.2	11.4	11.4	12.9	13.1	14.1	12.7	0.40	0.03	<0.001
Non-menthol	20.6	20.5	17.5	15.9	16.0	14.6	13.9	−1.14	<0.001	
26+ years:										
Overall										
Menthol	7.0	7.2	7.6	7.4	7.6	7.0	7.4	0.04	0.46	0.001
Non-menthol	16.9	17.2	16.8	16.4	15.9	16.1	15.3	−0.28	0.002	
Gender:										
Male										
Menthol	6.8	6.7	7.5	7.4	7.4	6.5	7.1	0.03	0.76	0.003
Non-menthol	20.3	20.7	19.9	19.4	18.8	18.5	18.2	−0.40	<0.001	
Female										
Menthol	7.3	7.7	7.6	7.3	7.8	7.4	7.7	0.02	0.65	0.04
Non-menthol	13.9	14.1	14.0	13.7	13.3	13.9	12.7	−0.17	0.07	

Continued

Table 3 Continued

	Percentage									
Type of cigarette smoked/factor	2004	2005	2006	2007	2008	2009	2010	Estimated slope	p Value for slope	p Value for difference in slopes
Race/ethnicity:										
Non-Hispanic Caucasian										
Menthol	5.3	5.2	5.5	5.4	5.5	4.8	5.3	−0.04	0.44	0.05
Non-menthol	19.7	19.8	19.0	19.1	18.6	18.9	18.1	−0.23	<0.001	
Non Hispanic Black										
Menthol	21.7	21.9	21.7	21.4	24.0	21.1	22.0	0.05	0.81	0.40
Non-menthol	3.6	4.7	5.2	4.5	3.3	3.7	3.0	−0.18	0.26	
Hispanic										
Menthol	5.3	6.6	7.0	6.9	6.0	7.3	7.7	0.27	0.07	0.02
Non-menthol	15.2	15.7	16.6	13.7	13.3	14.4	13.6	−0.37	0.10	

Source: National Survey on Drug Use and Health, 2004–2010. Respondents aged 12 years and older. Self-reported menthol status was adjusted if necessary using retail checkout scanner data. Sample size=389 698.

was consistently observed across gender, household income, smoking days per month and in non-Hispanic Caucasians and Hispanics. Although an age gradient was not observed among Black smokers, young Black smokers were more likely than those in other racial/ethnic groups to smoke menthol cigarettes. Preference for menthol cigarettes by young people likely occurs because of marketing practices^{24–27} and product formulation.²⁸ Analyses of tobacco industry documents confirm that young smokers may pursue mentholated brands for anticipated pleasure and may experience more pleasure and less harshness from mentholated brands than from non-mentholated varieties.²⁶ Our data, which include the 12–15-year-old age category, control for household income and adjust for misclassification of menthol status, expand the knowledge base on this topic.

Secondly, differential progress has been observed, with the prevalence of smoking non-mentholated cigarettes declining relatively more rapidly than that of mentholated cigarettes. Increasing use of menthol relative to non-menthol cigarettes among adolescent and young adult Caucasians and young adult Hispanics is especially concerning, given the large numbers of young people in each of these racial/ethnic groups. Increased uptake of menthol cigarettes may have contributed to the slowing of the decline of adolescent smoking that has occurred since 2006.²⁹

Finally, there have been increases in use of several major menthol cigarette brands overall and specifically, among youth and young adults from 2004–2006 to 2008–2010. Statistically significant declines in Salem cigarette use across all age groups have been countered by dramatic increases in the use of Camel menthol, Marlboro menthol and Newport cigarettes. For example, among adolescents, Camel menthol use increased by 4.4% points and Marlboro menthol use increased by 5.5% points during the study period. It is important to note that Marlboro and Camel made stronger gains in the adolescent and young adult markets, particularly so in Caucasians and Hispanics, than Newport. This is consistent with evidence from tobacco industry documents showing that several major tobacco companies manipulated the levels of menthol in certain cigarette brands to be closer to the low menthol levels in Newport and to target younger smokers.²⁸ Increased use of several menthol brands among young smokers have also been influenced by the introduction of new products, including Marlboro Milds (2000), Camel No. 9 (2007), Marlboro Smooth (2007) and Camel Crush (2008).^{28–30} Studies have repeatedly demonstrated

the impact of menthol marketing efforts that have been targeted to African-Americans and women,^{31–34} including the marketing of Camel No. 9 which was shown to target adolescent girls.³⁵ Given high rates of internet and social media use among adolescents and young adults,^{36–38} increased use of ‘Web 2.0’ for tobacco marketing may also play an important role in use of particular brands among young smokers.^{39–40} We believe it is important for the FDA to monitor cigarette marketing for all brands targeted to all demographic subgroups via channels such as magazines, social media, the internet and direct mail, with particular attention to differentiating specific brand characteristics such as menthol.⁴¹

Kahnert and colleagues at the German Cancer Research Center have documented the recent spread, to at least 38 countries, of cigarette brands with menthol capsules in the filters.⁴² These new products enable users to change the flavour during the smoking process from regular to menthol. Their marketing targets young people. Tobacco companies involved include British American Tobacco, Japan Tobacco International, Philip Morris and RJ Reynolds, and in the US, these products are marketed as ‘Camel Crush’ and ‘Marlboro NXT’. In July 2013, the European Union moved to ban menthol and flavoured cigarettes; while the FDA has already banned flavoured cigarettes, it recently called for more scientific information prior to deciding on a menthol ban.

This study is limited in several ways. First, the definition of menthol use is based on brand preference. We did not estimate the number of mentholated and non-mentholated cigarettes smoked during a period of time by each smoker. Rather, we estimate the menthol status of the brand smoked most often. Consistent with our findings, market share of menthol increased during the study period.⁴³ Second, we measured prevalence of use and not incidence of initiation. However, prevalence in young people is largely driven by initiation rather than migration, cessation, or death. Third, we did not assess sales data prior to 2008. Nevertheless, brands such as Kool, Newport and Salem have long been classified as mentholated brands.²² Finally, our data (table 1) indicate that the use of menthol cigarettes among older smokers was less common than among adolescent and young adult smokers. It is impossible to discern with serial cross-sectional data from 2004–2010 whether smokers switched away from menthol cigarettes as they aged. The findings might simply indicate higher rates of menthol use among more recent birth cohorts. Cohort surveys, with

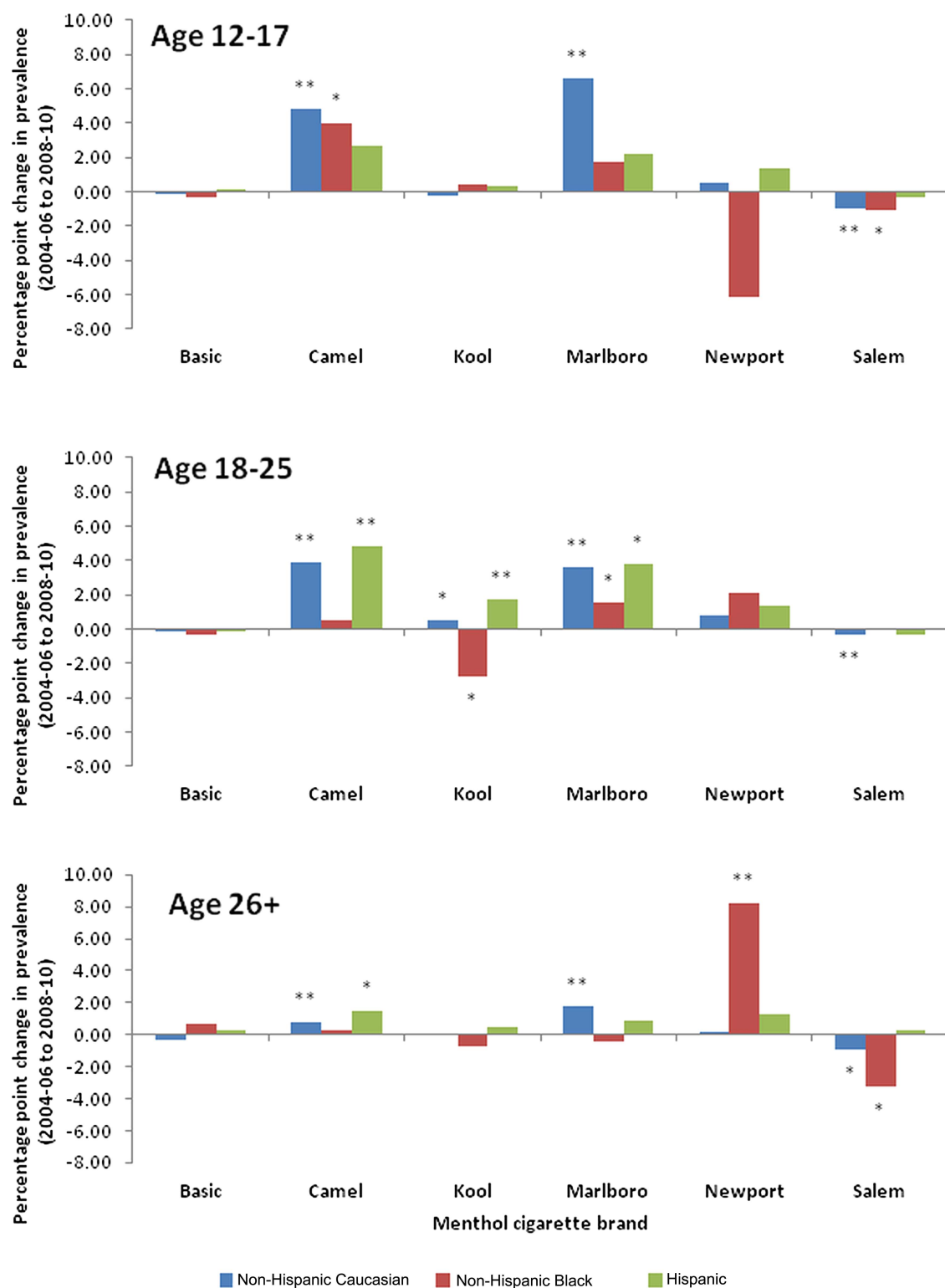


Figure 2 Percentage point change in prevalence of smoking various mentholated cigarette brands among past 30-day smokers by age and race/ethnicity in the USA, 2004–2006 to 2008–2010. Source: National Survey on Drug Use and Health. Self-reported menthol status for Kool, Newport and Salem was adjusted if necessary using retail checkout scanner data. NB: non-Hispanic Caucasians represented by blue bars; non-Hispanic Blacks represented by red bars; Hispanics represented by green bars. * $p < 0.05$, ** $p < 0.001$ for difference in prevalence between 2004–2006 and 2008–2010. Sample size= 84 457; 43 616 for 2004–2006 and 40 841 for 2008–2010.

appropriate age groups, would facilitate the study of switching behaviours.

The findings of this study complement previous research on flavoured cigarettes,⁷ nicotine dependence,^{5 12 13} and menthol use among new smokers. The trend analyses reported here raise

important concerns about the deleterious effects of the sale and marketing of mentholated cigarettes on progress in reducing youth smoking. Overall decreases in non-menthol cigarette use from 2004–2010 were not found for menthol use, indicating that the presence of menthol cigarettes in the marketplace is

slowing progress in the reduction of population smoking prevalence. Concerns about menthol cigarette use in the USA have previously focused on Blacks, who primarily have smoked Newport cigarettes in most recent years.² The data presented here also raise concerns about the increasing use of Camel menthol and Marlboro menthol cigarettes among Caucasian and Hispanic youths. Data from this study should be used to inform the FDA's decision-making processes regarding the potential public health impact of a menthol ban and to raise concern in multiple countries about the marketing of mentholated cigarettes, particularly to young people.

What this paper adds

- This study provides more precision than previous research on the use of mentholated cigarettes among young people. In the multivariable model, menthol use was found to be most likely in 12–15 year olds and 16–17 year olds. The multivariable analysis also controlled for household income, taking socioeconomic status into account.
- Previous work addressed trends in the percentage of cigarette smokers who smoked menthol cigarettes. This work presents trends in smoking menthol and non-menthol cigarettes among all persons (not just cigarette smokers) in each of the demographic categories examined, permitting the conclusion that non-menthol cigarette use is declining more rapidly than menthol cigarette use.
- Finally, the paper documents the rise of Camel Menthol and Marlboro Menthol brands among young people, particularly Caucasians and Hispanics. The information presented here should be useful to the US Food and Drug Administration and also to many other countries, where menthol cigarettes are being marketed to young people.

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Correction notice This article has been corrected since it was published Online First. In the Results section of the Abstract, the percentage at the end of the sentence 'Among cigarette smokers, menthol cigarette use was more common among 12–17 year olds (56.7%) and 18–25 year olds (45.0%) than among older persons (range 30.5% to 32.9%)' has been corrected from "32.9%" to "34.7%."

Contributors GAG: conceived of the study. GAG and ACV: wrote the initial draft of the manuscript. PDM and VS: conducted the data analysis. GAG, ACV, PDM, VS, RSN, DMV and DBA: contributed to the analysis, interpretation of the data and to the review, revision and approval of the final article.

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**Differential trends in cigarette smoking in the United States:
Is menthol slowing progress?**

SUPPLEMENTARY APPENDIX

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MEASURES

Demographics

Age, gender and race/ethnicity were collected as part of NSDUH's core demographics. To assess age, respondents provided their date of birth, which they are asked to confirm prior to confirming the age on the date of the interview calculated by the computer program.

Respondents aged 12 and older are eligible to respond to the remainder of the survey. In line with the categories used by NSDUH to weight the data, we refer to persons aged 12-17 years old as adolescents, 18-25 years old as young adults, and 26 years and older as adults. NSDUH interviewers record the respondent's gender as male or female. To assess ethnicity, respondents were asked whether they were of "Hispanic, Latino or Spanish origin of descent." To assess race, respondents were asked to identify "Which of these groups describes you?" with the opportunity to select more than one of the following response choices "White," "Black/African American," "American Indian or Alaska Native (American Indian includes North American, Central American, And South American Indians)," "Native Hawaiian," "Other Pacific Islander," "Asian (for example, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese)" and "Other (specify)." We coded race/ethnicity categories as "Non-Hispanic Caucasian," "Non-Hispanic Black," "Non-Hispanic Other," "Non-Hispanic Asian," "Non-Hispanic more than one race," and "Hispanic." These categories are mutually exclusive. The "Non-Hispanic Other" group included respondents identifying as "American Indian or Alaska Native," "Native Hawaiian," "Other Pacific Islander," and "Other." Due to small cell sizes, we restrict some of our analyses to the three largest racial/ethnic groups: Non-Hispanic Caucasians, Non-Hispanic Blacks, and Hispanics.

Household income was assessed as part of NSDUH's back-end demographics. Respondents were asked whether the total combined family income in the previous year was "\$20,000 or more" or "less than \$20,000." For those answering "less than \$20,000," respondents were then asked to enter the number that best represented the total combined family income as "less than \$1,000 (including loss)," followed by \$1,000 increments from "\$1,000-\$1,999," to "\$19,000 - \$19,999." Respondents reporting a total combined family income of "\$20,000 or more" were asked to enter the number that best represented the income in \$5,000 increments from "\$20,000-\$24,999" to "40,000-\$49,999," then "\$50,000-\$74,999," "75,000-\$99,999," and "\$100,000 or more." Based on responses to these three questions, we categorized household income according to tertiles (lower, middle, and higher). Cutoffs for the tertiles were less than \$10,000 (including loss) to \$19,999 (lower), \$20,000 - \$49,999 (middle) and \$50,000 and more (higher).

Assessment of smoking and menthol cigarette use

Current cigarette smoking in the NSDUH was assessed by asking respondents who had ever smoked whether they smoked part or all of a cigarette in the previous 30 days.¹ Those who responded affirmatively were subsequently asked to estimate the number of days they smoked part or all of a cigarette in the past 30 days. Respondents who did not provide a number between 1 and 30 were then asked to provide their best estimate of the number of days they smoked part or all of a cigarette in the past 30 days with response choices "1 or 2 days," "3 to 5 days," "6 to 9 days," "10 to 19 days," "20 to 29 days," and "all 30 days." Using these two variables, we classified number of days smoked per month as "1-5 days," "6-29 days," and "30 days."

Current cigarette smokers were also asked to report the brand of cigarettes they smoked most often and presented with a screen with 25 (26 in 2004 only) of the leading selling brands (e.g., Camel, Kool, Marlboro, Newport, Salem), as well as a category of “A brand not on this list.” If the respondent answered “A brand not on this list” then s/he was presented with another screen showing 32 (34 in 2004 only) less commonly sold brands (e.g., Lucky Strike, Old Gold), as well as the category “A brand not on this list”.

If the respondent once again responded “A brand not on this list,” then s/he was asked to type in the name of the brand of cigarettes smoked most often. Brands that were typed in included 305s, Bronco, Gold Coast, and Seneca. Smokers who provided a brand name during either of the first two brand-related questions (i.e., on the first or second screen), were asked to verify the name of the cigarette brand they smoked most often during the previous 30 days. If the brand initially recorded was not verified, then the respondent was cycled through the brand questions again. In each year of the study period, the percentage of NSDUH smokers who selected and verified a brand from those listed on one of the two screens ranged from 94.6% to 96.4%.

Smokers who usually smoked a brand from either of the first two screens were also asked, “Were the [CIGFILL] cigarettes you smoked during the past 30 days menthol?” (Note: “[CIGFILL]” is replaced by the computer with the name of the brand the respondent previously reported and verified as having smoked most often). Response categories included “Yes” and “No.” If the respondent was one of the <5% of smokers who did not usually smoke one of the 57 brands (60 in 2004) listed on the two screens, then that respondent was asked, “Were the cigarettes you smoked during the past 30 days menthol?”

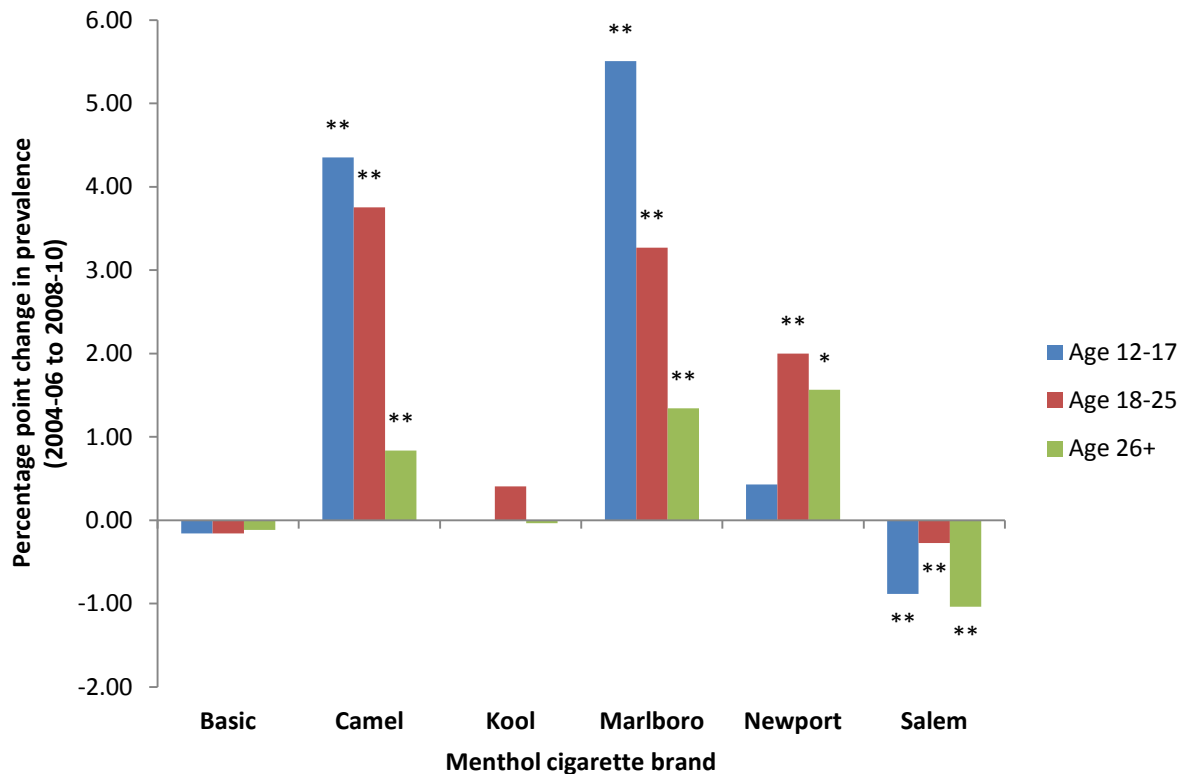
Initially in our analyses and in previous work,² menthol use was classified based exclusively on self-reported responses to the menthol-related questions. However, we observed that some respondents who smoked brands that were sold exclusively (at least 99%, including Newport and Salem) as mentholated varieties in many cases (see Tables S1 and S2) reported smoking non-mentholated varieties. Similarly, some smokers of exclusively non-mentholated brands (e.g., Lucky Strike, Old Gold, Winston) listed their brand as menthol. We used sales data³ to classify brands. Sales data were obtained for 2008 for grocery, drug, and merchandize stores and for 2009 for those types of stores and convenience stores as well.

If a respondent reported usually smoking Newport and also reported on the menthol question that the usual brand was non-menthol, the respondent’s response to the menthol variable question was recoded as menthol. Similar adjustment was made for exclusively non-mentholated brands Lorillard introduced Newport Regular (i.e., non-menthol) in November 2010.⁴ According to 2010 A.C. Nielsen data from grocery, drug, and merchandize stores and from convenience stores, we estimated that about 1% of Newport sales were for Newport Regular in 2010 (Cristine Delnevo, personal communication, March 17, 2013 and Jidong Huang, personal communication, March 18, 2013). As a result, we continued to re-classify Newport as menthol in 2010.

Brands with fewer than 30 observations were not reclassified. These included menthol brands Alpine, Sampoerna, and Signature and non-menthol brands Cherokee, Du Maurier, Echo and Zig Zag.

SUPPLEMENTARY FIGURES

Figure S1. Percentage point change in prevalence of smoking various mentholated cigarette brands among past 30-day smokers by age -- United States, 2004-2006 to 2008-2010.



* $p < 0.05$, ** $p < 0.001$ for difference in prevalence between 2004-2006 and 2008-2010

Source: National Survey on Drug Use and Health. Self-reported menthol status for Kool, Newport, and Salem was adjusted if necessary using retail checkout scanner data. NOTE: Age 12-17 years are represented by blue bars; age 18-25 years are represented by red bars; age 26+ years are represented by green bars. Sample size = 84,457; 43,616 for 2004-2006 and 40,841 for 2008-2010.

SUPPLEMENTARY TABLES

Table S1. Percentage of respondents reporting that their usual brand was mentholated for brands that were re-classified as 100% menthol based on AC Nielsen data, by brand and age -- United States, 2004-2006 and 2008-2010.

Usual brand/age	2004-2006			2008-2010		
	Unweighted n	% Menthol (Unweighted)	% Menthol (Weighted)	Unweighted n	% Menthol (Unweighted)	% Menthol (Weighted)
Kool	1181	94.75	96.38	1078	96.20	97.88
12-17 yrs	171	88.30	89.89	142	85.92	79.43
18-25 yrs	501	95.01	94.64	514	97.67	97.47
26+ yrs	509	96.66	97.03	422	97.87	98.71
Newport	7022	93.93	95.84	7359	93.56	96.11
12-17 yrs	1425	86.95	86.37	1215	83.79	84.74
18-25 yrs	3941	94.82	94.91	4132	93.97	93.14
26+ yrs	1656	97.83	97.80	2012	98.61	98.68
Salem	486	93.62	95.56	233	95.28	96.40
12-17 yrs	67	89.55	88.11	7	71.43	54.64
18-25 yrs	93	87.10	88.04	48	87.50	91.76
26+ yrs	326	96.32	96.12	178	98.31	96.82

Source: National Survey on Drug Use and Health

Table S2. Percentage of respondents reporting that their usual brand was not mentholated for brands that were reclassified as 100% non-menthol based on AC Nielsen data, by brand and age -- United States, 2004-2006 and 2008-2010.

	2004-2006			2008-2010		
Usual brand/age	Unweighted n	% Non-Menthol (Unweighted)	% Non-Menthol (Weighted)	Unweighted n	% Non-Menthol (Unweighted)	% Non-Menthol (Weighted)
Kent	30	80.00	82.22	26	84.62	92.04
12-17 yrs	2	50.00	56.26	0	0.00	0.00
18-25 yrs	5	100.00	100.00	4	75.00	80.23
26+ yrs	23	78.26	81.71	22	86.36	92.36
Lucky Strike	41	95.12	95.53	26	96.15	95.13
12-17 yrs	8	87.50	96.88	1	100.00	100.00
18-25 yrs	25	100.00	100.00	13	100.00	100.00
26+ yrs	8	87.50	92.62	12	91.67	94.16
Old Gold	72	95.83	98.79	59	89.83	94.41
12-17 yrs	8	87.50	72.80	2	100.00	100.00
18-25 yrs	19	89.47	94.59	29	79.31	62.19
26+ yrs	45	100.00	100.00	28	100.00	100.00
Viceroy	50	100.00	100.00	6	83.33	92.07
12-17 yrs	3	100.00	100.00	1	0.00	0.00
18-25 yrs	6	100.00	100.00	0	0.00	0.00
26+ yrs	41	100.00	100.00	5	100.00	100.00
Winston	542	95.57	95.62	371	94.88	97.53
12-17 yrs	30	70.00	68.34	22	72.73	79.40
18-25 yrs	103	96.12	97.25	56	91.07	89.46
26+ yrs	409	97.31	95.78	293	97.27	97.94

Source: National Survey on Drug Use and Health

Table S3. Prevalence of cigarette smoking (%) by type of cigarette smoked, age, gender, and race/ethnicity -- United States, 2004-2010.

		Type of cigarette smoked		2004		2005		2006		2007		2008		2009		2010	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
12-17 years																	
<i>Overall</i>	Menthol	5.3	4.82,5.75	4.8	4.25,5.32	4.8	4.43,5.19	4.9	4.45,5.4	4.6	4.14,5.00	5.0	4.51,5.42	4.5	4.13,4.96		
	Non-menthol	6.0	5.52,6.49	5.5	4.96,5.95	5.3	4.81,5.71	4.5	4.20,4.89	3.9	3.53,4.23	3.5	3.10,3.80	3.4	3.01,3.81		
<i>Gender</i>																	
Male	Menthol	4.6	4.09,5.18	4.3	3.71,4.92	4.3	3.69,4.96	4.8	4.24,5.42	4.4	3.80,4.94	4.8	4.19,5.40	4.4	3.92,4.92		
	Non-menthol	6.2	5.48,6.85	5.7	4.98,6.47	5.4	4.63,6.10	4.9	4.33,5.42	4.0	3.47,4.44	3.9	3.38,4.44	3.8	3.23,4.38		
Female	Menthol	6.0	5.32,6.62	5.3	4.50,6.06	5.3	4.85,5.78	5.0	4.45,5.60	4.8	4.25,5.30	5.1	4.43,5.86	4.7	3.97,5.38		
	Non-menthol	5.8	5.26,6.41	5.2	4.53,5.80	5.1	4.58,5.72	4.2	3.76,4.66	3.8	3.24,4.37	3.0	2.61,3.36	3.0	2.53,3.46		
<i>Race/Ethnicity</i>																	
Non Hispanic Caucasian	Menthol	5.8	5.20,6.44	4.8	4.23,5.28	4.9	4.36,5.38	5.5	4.93,6.09	4.8	4.19,5.36	5.2	4.68,5.69	5.1	4.60,5.70		
	Non-menthol	8.1	7.29,8.88	7.5	6.86,8.24	7.2	6.58,7.84	6.3	5.79,6.90	5.2	4.65,5.65	5.0	4.41,5.51	4.2	3.64,4.78		
Non Hispanic Black	Menthol	5.3	4.20,6.34	6.1	4.69,7.53	5.7	4.39,6.97	5.8	4.44,7.11	4.9	3.80,5.92	4.8	3.67,5.95	4.2	3.12,5.18		
	Non-menthol	0.5	0.14,0.79	0.5	0.05,0.93	0.1	0.00,0.13	0.3	0.03,0.65	0.2	0.02,0.48	0.2	0.03,0.34	0.3	0.05,0.58		
Hispanic	Menthol	3.7	2.77,4.65	4.3	3.27,5.37	4.2	3.55,4.77	3.1	2.34,3.89	3.8	2.91,4.75	4.6	3.40,5.77	3.8	2.92,4.63		
	Non-menthol	4.4	3.07,5.64	3.4	2.56,4.21	3.5	2.78,4.32	2.8	1.95,3.73	3.1	1.99,4.23	2.2	1.47,2.95	3.4	2.56,4.31		
18-25 years																	
<i>Overall</i>	Menthol	14.0	13.18,14.76	13.7	12.97,14.36	14.1	13.43,14.76	14.2	13.45,14.97	14.6	13.79,15.48	15.9	15.10,16.65	16.3	15.62,17.01		
	Non-menthol	25.7	24.70,26.73	25.3	24.54,26.02	24.2	23.30,25.14	21.6	20.81,22.48	20.4	19.52,21.25	19.6	18.74,20.50	17.3	16.55,18.05		
<i>Gender</i>																	
Male	Menthol	14.4	13.17,15.57	14.0	13.09,14.92	14.4	13.37,15.47	14.9	13.76,15.99	15.4	14.34,16.42	16.3	15.13,17.37	17.0	16.03,18.03		
	Non-menthol	29.5	27.98,31.11	28.9	27.60,30.18	27.3	26.07,28.51	25.2	23.85,26.59	23.7	22.34,25.01	23.6	22.16,24.98	20.2	19.15,21.33		

Female	Menthol	13.6	12.80,14.36	13.3	12.36,14.29	13.8	13.00,14.51	13.5	12.51,14.57	13.9	12.92,14.87	15.5	14.49,16.50	15.6	14.62,16.56
	Non-menthol	21.9	20.90,22.81	21.6	20.47,22.79	21.1	19.76,22.46	18.0	17.04,19.02	17.1	16.08,18.05	15.6	14.59,16.65	14.3	13.51,15.05
<i>Race/Ethnicity</i>															
Non Hispanic Caucasian	Menthol	12.3	11.50,13.06	11.8	10.88,12.71	12.7	11.79,13.62	12.5	11.76,13.34	13.1	12.21,13.97	14.5	13.71,15.39	15.6	14.82,16.42
	Non-menthol	33.0	31.96,34.10	32.5	31.43,33.55	31.5	30.41,32.52	28.1	27.07,29.09	26.8	25.58,28.06	26.0	24.72,27.35	22.8	21.78,23.75
Non Hispanic Black	Menthol	27.5	25.08,29.90	26.0	23.45,28.53	25.0	23.02,26.97	24.0	21.63,26.29	24.5	22.08,26.86	24.2	21.89,26.53	24.6	22.22,27.02
	Non-menthol	2.0	1.24,2.77	2.3	1.37,3.31	1.7	1.08,2.41	1.8	1.02,2.64	1.2	0.76,1.69	1.9	1.22,2.65	1.5	0.91,2.15
Hispanic	Menthol	11.2	9.05,13.35	11.4	10.16,12.68	11.4	9.55,13.31	12.9	11.18,14.56	13.1	11.62,14.67	14.1	12.36,15.75	12.7	11.13,14.23
	Non-menthol	20.6	17.92,23.19	20.5	18.39,22.62	17.5	15.76,19.30	15.9	13.69,18.19	16.0	14.23,17.76	14.6	12.69,16.55	13.9	12.48,15.23
26+ years															
Overall	Menthol	7.0	6.65,7.42	7.2	6.73,7.71	7.6	7.03,8.08	7.4	6.87,7.92	7.6	7.04,8.20	7.0	6.49,7.48	7.4	6.95,7.91
	Non-menthol	16.9	16.31,17.59	17.2	16.46,18.04	16.8	16.20,17.50	16.4	15.74,17.12	15.9	15.06,16.83	16.1	15.37,16.86	15.3	14.65,16.03
<i>Gender</i>															
Male	Menthol	6.8	6.11,7.42	6.7	5.91,7.43	7.5	6.77,8.21	7.4	6.71,8.19	7.4	6.53,8.27	6.5	5.83,7.25	7.1	6.47,7.82
	Non-menthol	20.3	19.35,21.30	20.7	19.37,22.10	19.9	18.87,21.00	19.4	18.42,20.48	18.8	17.61,19.98	18.5	17.42,19.65	18.2	17.22,19.27
Female	Menthol	7.3	6.68,7.88	7.7	7.18,8.26	7.6	6.94,8.29	7.4	6.74,7.96	7.8	7.14,8.51	7.4	6.79,7.99	7.7	6.99,8.40
	Non-menthol	13.9	13.00,14.74	14.1	13.08,15.04	14.0	13.19,14.86	13.7	12.93,14.41	13.3	12.34,14.34	13.9	12.97,14.82	12.7	11.78,13.54
<i>Race/Ethnicity</i>															
Non Hispanic Caucasian	Menthol	5.3	4.84,5.80	5.2	4.70,5.62	5.5	4.98,6.01	5.4	4.81,6.03	5.5	5.00,6.10	4.8	4.43,5.21	5.3	4.79,5.73
	Non-menthol	19.7	18.81,20.6	19.8	18.72,20.86	19.0	18.24,19.82	19.1	18.20,19.95	18.6	17.66,19.64	18.9	17.97,19.87	18.1	17.19,19.09
Non Hispanic Black	Menthol	21.7	19.10,24.22	21.9	19.55,24.20	21.7	18.83,24.49	21.4	19.44,23.36	24.0	21.49,26.47	21.1	18.80,23.37	22.0	19.66,24.36
	Non-menthol	3.6	2.43,4.76	4.7	3.21,6.26	5.2	3.76,6.68	4.5	2.81,6.15	3.3	2.32,4.20	3.7	2.21,5.24	3.0	1.66,4.36
Hispanic	Menthol	5.3	4.06,6.54	6.6	5.28,7.96	7.0	5.46,8.54	6.9	5.51,8.27	6.0	4.76,7.19	7.3	5.90,8.74	7.7	6.28,9.03
	Non-menthol	15.2	13.29,17.17	15.7	13.91,17.54	16.6	14.22,18.97	13.7	11.52,15.9	13.3	11.60,15.03	14.4	12.76,16.10	13.6	10.97,16.14

Source: National Survey on Drug Use and Health, 2004-2010. Respondents aged 12 years and older. Self-reported menthol status was adjusted if necessary using retail checkout scanner data. Sample size = 389,698

Table S4. Prevalence of smoking various mentholated cigarette brands among past 30-day smokers by age -- United States, 2004-2006 and 2008-2010.

		2004-2006			2008-2010			
		Number of smokers (1,000s)	%	95% CI	Number of smokers (1,000s)	%	95% CI	p-value
Age 12+	Basic-menthol	646	1.07	0.88,1.27	561	0.96	0.73,1.20	0.47
	Camel-menthol	412	0.69	0.59,0.78	1,278	2.19	1.99,2.39	<0.001
	Kool	1,701	2.83	2.54,3.12	1,687	2.90	2.59,3.20	0.75
	Marlboro-menthol	3,727	6.20	5.82,6.57	4,613	7.91	7.45,8.38	<0.001
	Newport	7,107	11.82	11.34,12.29	7,687	13.19	12.53,13.85	<0.001
	Salem	1,246	2.07	1.78,2.36	715	1.23	0.91,1.55	<0.001
Age 12-17	Basic-menthol	20	0.76	0.45,1.07	12	0.60	0.31,0.90	0.47
	Camel-menthol	60	2.28	1.75,2.81	134	6.63	5.74,7.52	<0.001
	Kool	71	2.66	2.21,3.11	54	2.67	2.06,3.27	0.99
	Marlboro-menthol	349	13.18	12.00,14.36	379	18.69	17.23,20.16	<0.001
	Newport	658	24.85	23.30,26.40	512	25.28	23.66,26.89	0.70
	Salem	29	1.11	0.80,1.42	5	0.23	0.03,0.42	<0.001
Age 18-25	Basic-menthol	50	0.40	0.22,0.58	28	0.24	0.16,0.32	0.11
	Camel-menthol	187	1.49	1.30,1.67	605	5.24	4.81,5.67	<0.001
	Kool	261	2.08	1.81,2.35	287	2.48	2.12,2.85	0.07
	Marlboro-menthol	1,379	10.96	10.45,11.49	1,645	14.24	13.45,15.03	<0.001
	Newport	2,274	18.09	17.30,18.87	2,320	20.09	19.27,20.90	<0.001
	Salem	58	0.46	0.34,0.58	21	0.19	0.13,0.24	<0.001
Age 26+	Basic-menthol	575	1.28	1.02,1.54	521	1.16	0.86,1.47	0.56
	Camel-menthol	165	0.37	0.26,0.48	538	1.20	0.97,1.44	<0.001
	Kool	1,369	3.05	2.67,3.42	1,347	3.01	2.60,3.43	0.90
	Marlboro-menthol	1,998	4.45	4.00,4.90	2,589	5.79	5.31,6.27	<0.001
	Newport	4,174	9.29	8.70,9.89	4,854	10.86	10.06,11.66	0.002
	Salem	1,158	2.58	2.20,2.96	689	1.54	1.13,1.96	<0.001

Source: National Survey on Drug Use and Health. Self-reported menthol status for Kool, Newport, and Salem was adjusted if necessary using retail checkout scanner data. Sample size = 84,457; 43,616 for 2004-2006 and 40,841 for 2008-2010

Table S5. Prevalence (%) of smoking various mentholated cigarette brands among past 30-day smokers aged 12+, by age and race/ethnicity -- United States, 2004-2006 and 2008-2010.

		Basic		Camel		Kool		Marlboro		Newport		Salem					
		%	95% CI	%	95% CI		%	95% CI	%	95% CI	%	95% CI					
Age 12 - 17																	
Non Hispanic Caucasian																	
2004-2006		0.96	0.55,1.37	2.35	1.75,2.95		2.12	1.59,2.64	13.59	12.18,15		17.72	16.11,19.34	1.30	0.9,1.7		
2008-2010		0.80	0.38,1.22	7.15	6.18,8.12	**	1.85	1.37,2.34	20.21	18.48,21.94	**	18.29	16.75,19.82	0.31	0.03,0.59	**	
Non Hispanic black																	
2004-2006		0.35	0,1.03	0.26	0,0.76		5.58	2.89,8.27	2.36	0.9,3.83		83.82	79.09,88.56	1.11	0.04,2.18		
2008-2010		-	-	4.29	0.24,8.34	*	6.03	2.56,9.49	4.09	1.01,7.18		77.73	72.03,83.44	-	-	*	
Hispanic																	
2004-2006		0.15	0,0.37	3.72	1.4,6.05		2.87	1.15,4.58	15.68	12.91,18.46		26.63	22.26,31	0.41	0,0.91		
2008-2010		0.31	0,0.67	6.38	3.85,8.92		3.21	1.01,5.41	17.86	13.97,21.76		28.04	22.52,33.55	0.09	0,0.27		
Age 18-25																	
Non Hispanic Caucasian																	
2004-2006		0.45	0.21,0.68	1.76	1.51,2.01		1.26	1.02,1.51	11.49	10.88,12.1		9.95	9.28,10.61	0.50	0.35,0.64		
2008-2010		0.28	0.17,0.39	5.63	5.13,6.13	**	1.74	1.38,2.11	*	15.10	14.08,16.12	**	10.80	10.11,11.49	0.17	0.1,0.25	**
Non Hispanic black																	
2004-2006		0.44	0.04,0.83	0.39	0.06,0.72		8.18	6.61,9.74	2.63	1.69,3.58		79.15	76.94,81.37	0.47	0.07,0.88		
2008-2010		0.11	0,0.25	0.96	0.33,1.59		5.38	3.86,6.9	*	4.20	2.92,5.48	*	81.25	79.24,83.26	0.49	0.18,0.8	
Hispanic																	
2004-2006		0.24	0.01,0.47	1.24	0.81,1.67		1.29	0.84,1.73	12.14	10.51,13.77		18.46	15.96,20.96	0.39	0.07,0.71		
2008-2010		0.17	0,0.37	6.07	4.78,7.36	**	2.99	2.07,3.91	**	15.94	13.75,18.13	*	19.80	17.73,21.87	0.10	0,0.25	
Age 26+																	
Non Hispanic Caucasian																	
2004-2006		1.27	0.97,1.57	0.44	0.3,0.59		1.83	1.5,2.16	3.91	3.38,4.43		3.52	3.07,3.97	2.17	1.75,2.58		
2008-2010		0.95	0.67,1.24	1.26	0.98,1.55	**	1.84	1.51,2.18	5.70	5.17,6.23	**	3.65	3.21,4.09	1.26	0.83,1.68	*	
Non Hispanic black																	
2004-2006		2.36	1.42,3.31	0.03	0,0.08		12.06	9.94,14.18	2.34	1.33,3.34		44.37	41.15,47.58	6.96	5.21,8.71		
2008-2010		3.07	1.85,4.3	0.26	0,0.52		11.32	8.68,13.97	1.86	1.17,2.56		52.61	49.07,56.14	**	3.74	2.19,5.28	*
Hispanic																	
2004-2006		0.55	0.03,1.06	0.18	0,0.48		1.35	0.64,2.05	8.12	6.25,9.99		11.79	9.68,13.9	0.89	0.29,1.49		
2008-2010		0.78	0.27,1.28	1.69	0.81,2.56	*	1.79	0.81,2.78	9.00	7.27,10.72		13.07	10.58,15.57	1.11	0.32,1.91		

* p < 0.05, **p<0.001 for difference in prevalence between 2004-2006 and 2008-2010. Source: National Survey on Drug Use and Health. Self-reported menthol status for Kool, Newport, and Salem was adjusted if necessary using retail checkout scanner data. Sample size = 84,457; 43,616 for 2004-2006 and 40,841 for 2008-2010.

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