**November 2010**

# Menthol Cigarettes and Youth Smoking Uptake

## Final Report

Prepared for

Center for Tobacco Products
Food and Drug Administration
9200 Corporate Blvd.
Rockville, MD 20850

Prepared by

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Legacy for Health

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# 1. PROBLEM AND RELEVANCE

Given the importance of efforts to prevent or reduce youth smoking and evidence suggesting that menthol cigarettes are preferred by a large proportion of youth smokers (Hersey et al. 2006, in press), understanding the role menthol cigarettes may play in the smoking uptake process and the development of nicotine dependence is an important part of efforts to reduce youth smoking. Yet relatively few studies have addressed this issue. Five cross-sectional studies with youth (Collins & Moolchan, 2006; Hersey et al., 2006, in press; Muilenburg & Legge, 2008; Wackowski & Delveno, 2007) have found a significant relationship between youth smoking of menthol cigarettes and indicators of nicotine dependence. However, these findings have not been investigated in a longitudinal cohort study that provides a contemporaneous measure of menthol cigarette use. The one longitudinal study that was conducted asked youth to recall, at the end of the study, whether their first cigarette was menthol or nonmenthol, and nearly half of respondents could not answer this question (DiFranza et al., 2004).

To address this gap, we conducted secondary analyses of a 3-year cohort study of youth to assess the relationship between smoking menthol cigarettes and the progression toward established smoking and the development of nicotine dependence.

# 2. STUDY QUESTIONS AND HYPOTHESES

We analyzed a 3-year longitudinal cohort school-based study of 12- to 18-year-olds to examine the influence of early use of menthol cigarettes (compared with nonmenthol cigarettes) on the development of nicotine dependence and progression toward established smoking. The following hypotheses were tested:

- Youth who begin smoking menthol cigarettes are more likely than youth who smoke nonmenthol cigarettes to progress to established smoking.
- Youth who begin smoking menthol cigarettes exhibit more symptoms of nicotine dependence than youth who begin smoking nonmenthol cigarettes.

# 3. DATA SOURCE

We conducted secondary analyses of the American Legacy Longitudinal Tobacco Use Reduction Study (ALLTURS), a longitudinal school-based survey of 47,237 middle school and high school youth conducted in three waves from 2000 through 2003. The study was conducted in 83 schools in 7 communities and 5 states. For additional details on the ALLTURS sample, see Davis et al. (2009).

# 4. PRIMARY OUTCOMES

We assessed the impact of early use of menthol cigarettes on smoking uptake or progression to established or regular smoking. We used several measures of progression based on wave 3 status:

- smoking 100+ cigarettes lifetime,
- smoking cigarettes on 20 or more of the past 30 days (established smoking), and
- smoking on 30 of the past 30 days (daily smoking).

We also measured progression using indicators for a transition into each of the three smoking levels at wave 3:

- a transition from smoking less than 100 cigarettes to smoking more than 100 cigarettes,
- a transition from smoking on less than 20 days per month to smoking 20 or more days per month, and
- a transition from nondaily smoking to daily smoking.

Our measure of nicotine dependence is a summative scale of four individual items (the scale used here is adapted—based on items available in all three waves of the ALLTURS survey—from a scale developed and reported in Nonnemaker et al. [2004]):

- The first item measures the average score for the response to two survey questions: "How soon after you wake up do you usually smoke your first cigarette on weekdays?," and "How soon after you wake up do you usually smoke your first cigarette during the weekend?"
- The second scale item measures the score for responses to the survey question "If you are sick with bad cold or sore throat, do you smoke cigarettes?"
- The third item measures the score for the response to the survey question "How true is this statement for you? When I go without a smoke for a few hours, I experience cravings."
- The fourth item measures the score for responses to the survey question "How true is this statement for you? I sometimes have strong cravings for cigarettes where it feels like I'm in the grip of a force that I can't control."

The items are coded in such a way that a higher score on the scale means a participant is reporting higher dependence.

Key explanatory variables include

- an indicator for reporting first smoking is of menthol cigarettes, and
- indicators for pattern of menthol use (menthol to menthol, menthol to nonmenthol, nonmenthol to menthol, and nonmenthol to nonmenthol).

# 5. ANALYSIS APPROACH

To address the research questions, we used regression methods (logistic regression for the six progression indicator outcomes, and ordinary least squares regression for the nicotine dependence scale outcome). We estimated two models for each outcome. The first includes an indicator that measures youth initiation to menthol cigarettes. The second includes indicators for the youth menthol use patterns across waves: menthol (in waves 1 or 2) to menthol (in wave 3), nonmenthol (in waves 1 or 2) to menthol (in wave 3), menthol (in waves 1 or 2) to nonmenthol (in wave 3), and nonmenthol (in waves 1 or 2) to nonmenthol (in wave 3). The latter group is the reference category.

Analyses were restricted to youth who participated in all three waves of ALLTURS. A total of 35,252 youth were interviewed at baseline, of which 46.5% (N = 16,396) completed all three waves. In addition, we dropped from the analyses youth who initiated smoking before baseline (because we have no information about their menthol status) and youth who were older than age 17 at baseline. Analyses were estimated using weights (pweights in Stata) that account for baseline characteristics as well as attrition (see Davis et al. [2009] for more information on weights).

We first estimated the regression models of the wave 3 outcomes and transition indicators dropping youth who initiate to smoking at wave 3—this focuses the model on the impact of menthol use prior to the transition (because initiation to menthol use would be concurrent with the outcome). We re-estimated each model including those who initiate in wave 3. In this model, those who initiate to menthol at wave 3 are classified as using menthol first. In the models where we include indicators for pattern of menthol use, those who initiate to menthol at wave 3 are included in the menthol to menthol group, whereas those who initiate to nonmenthol in wave 3 are included in the nonmenthol to nonmenthol group. Note that when we exclude wave 3 initiators, never smokers or non-smokers in waves 1 or 2 are excluded from the models (this results from the definition of menthol use being conditional on smoking). However, when we include wave 3 initiators never and non-smokers are included in the models.

# 6. RESULTS

## 6.1 Descriptive Results

Table 1 presents descriptive statistics of the smoking behavior outcomes, menthol initiation, and patterns in preference for menthol and nonmenthol cigarettes for youth who initiated prior to wave 3. More than half (51.3%) of wave 3 smokers reported having smoked at least 100 cigarettes in their lifetime. Only 36.7%, however, reported smoking daily at wave 3. All three smoking status measures were higher for males than females and higher for white and other race respondents than for black or Hispanic respondents. The table also

presents the number of current smokers who transitioned to heavier smoking stages by wave 3. For example, 28.3% of nondaily smokers who initiated before wave 3 became daily smokers by the second follow-up. Transitions were more frequent for white respondents than black and Hispanic respondents for all three smoking measures. The menthol pattern measures show that 22.6% of current smokers smoked menthol cigarettes both at initiation and wave 3, with 41.1% doing the same for nonmenthol cigarettes. Finally, the prevalence of menthol cigarettes as a smokers' first initiation to menthol was higher for black respondents than all other races.

Table 2 presents the same descriptive statistics as Table 1 but includes current smokers who initiated at wave 3. Again, we see higher prevalence of daily smoking, established smoking, and 100 cigarettes smoked for males compared with females and for white and other race youth compared with black and Hispanic youth. Transition or initiation to these smoking stages at wave 3 is also more prevalent among males, white respondents, and other race respondents. Among wave 3 smokers, 43.0% reported menthol use at initiation. A large majority of current smokers at wave 3 maintained a preference for either menthol or nonmenthol cigarettes across survey waves—36.8% began smoking menthols and still smoked menthols at wave 3, whereas 49.3% began smoking nonmenthols and still smoked nonmenthols in wave 3.

Table 3 presents characteristics of wave 3 current smokers based on their menthol use patterns across survey waves, excluding smokers who initiated at wave 3. Notable results include the gender distribution of menthol-to-nonmenthol smokers, who were 57.5% male, and the relatively low prevalence of white menthol-to-menthol smokers. Menthol-to-nonmenthol smokers also showed higher levels of smoking than each of the other three groups, with higher values for each of the four smoking behavior measures, including the nicotine dependence scale.

Table 4 presents the same descriptive analysis of menthol use patterns but includes smokers who initiated at wave 3. The menthol-to-nonmenthol and nonmenthol-to-menthol estimates are the same regardless of the inclusion of wave 3 menthol initiation cases. Again, we see that menthol-to-nonmenthol smokers are predominantly male (57.5%). Menthol-to-nonmenthol and menthol-to-menthol smokers have higher estimates for each of the smoking behavior outcomes, including the nicotine dependence scale.

**Table 1. Weighted Estimates among Current Smokers at Wave 3 (Excluding Those Who Initiate at Wave 3)**

| | Overall (N = 479) | | Gender | | | | Race/Ethnicity | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Female (N = 215) | | Male (N = 264) | | White, NH (N = 320) | | Black, NH (N = 39) | | Hispanic (N = 49) | | Other, NH (N = 71) | |
| **Measures at Wave 3** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Smoking status at wave 3 | | | | | | | | | | | | | | |
| Smoke daily | 177 | 36.7% | 59 | 28.1% | 118 | 43.6% | 119 | 40.5% | 11 | 18.5% | 20 | 35.0% | 27 | 34.9% |
| Established smoker | 223 | 44.7% | 81 | 35.7% | 142 | 51.8% | 151 | 49.0% | 13 | 21.5% | 26 | 43.8% | 33 | 43.3% |
| Smoke 100 cigarettes in lifetime | 244 | 51.3% | 100 | 46.1% | 144 | 55.8% | 166 | 55.1% | 12 | 20.9% | 24 | 43.9% | 42 | 61.6% |
| Transition in smoking status at wave 3 | | | | | | | | | | | | | | |
| Smoke daily | 88 | 28.3% | 41 | 26.3% | 47 | 30.7% | 63 | 33.7% | 5 | 8.0% | 6 | 16.6% | 14 | 26.7% |
| Established smoker | 111 | 36.3% | 54 | 33.5% | 57 | 39.7% | 78 | 41.7% | 6 | 11.9% | 9 | 25.3% | 18 | 37.8% |
| Smoke 100 cigarettes in lifetime | 131 | 42.9% | 71 | 40.9% | 60 | 45.6% | 92 | 47.5% | 5 | 9.5% | 11 | 29.4% | 23 | 55.7% |
| First initiation to menthol | 161 | 38.8% | 78 | 40.0% | 83 | 37.8% | 98 | 35.5% | 15 | 51.8% | 24 | 44.2% | 24 | 40.5% |
| Menthol to menthol | 98 | 22.6% | 50 | 24.9% | 48 | 20.5% | 57 | 19.2% | 11 | 39.1% | 13 | 17.4% | 17 | 30.9% |
| Menthol to nonmenthol | 55 | 15.5% | 26 | 13.8% | 29 | 17.0% | 37 | 16.3% | 3 | 10.0% | 9 | 22.0% | 6 | 10.3% |
| Nonmenthol to menthol | 82 | 20.8% | 41 | 21.2% | 41 | 20.4% | 56 | 20.2% | 4 | 13.0% | 5 | 18.2% | 17 | 29.5% |
| Nonmenthol to nonmenthol | 133 | 41.1% | 64 | 40.1% | 69 | 42.1% | 95 | 44.3% | 9 | 37.9% | 13 | 42.4% | 16 | 29.3% |

Note: NH = non-Hispanic

**Table 2. Weighted Estimates among Current Smokers at Wave 3 (Including Those Who Initiate at Wave 3)**

| | Overall (N = 1100) | | Gender | | | | Race/Ethnicity | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Female (N = 501) | | Male (N = 599) | | White, NH (N = 757) | | Black, NH (N = 92) | | Hispanic (N = 100) | | Other, NH (N = 151) | |
| **Measures at Wave 3** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Smoking status at wave 3 | | | | | | | | | | | | | | |
| Smoke daily | 334 | 31.4% | 101 | 21.3% | 233 | 39.7% | 232 | 34.0% | 24 | 18.3% | 28 | 24.8% | 50 | 32.8% |
| Established smoker | 430 | 39.2% | 143 | 29.4% | 287 | 47.2% | 301 | 42.0% | 31 | 24.9% | 35 | 29.8% | 63 | 42.3% |
| Smoke 100 cigarettes in lifetime | 484 | 45.6% | 172 | 35.7% | 312 | 54.2% | 344 | 48.6% | 33 | 29.2% | 35 | 32.5% | 72 | 51.7% |
| Initiation or transition in smoking status at wave 3 | | | | | | | | | | | | | | |
| Smoke daily | 278 | 28.6% | 89 | 20.0% | 189 | 36.3% | 197 | 31.7% | 20 | 14.7% | 19 | 18.6% | 42 | 30.8% |
| Established smoker | 351 | 35.7% | 122 | 27.5% | 229 | 43.2% | 249 | 38.8% | 26 | 21.4% | 23 | 22.8% | 53 | 40.4% |
| Smoke 100 cigarettes in lifetime | 382 | 41.3% | 145 | 32.4% | 237 | 50.1% | 274 | 44.5% | 28 | 26.0% | 23 | 25.7% | 57 | 48.3% |
| First initiation to menthol | 456 | 43.0% | 206 | 42.0% | 250 | 43.8% | 299 | 40.3% | 39 | 50.0% | 47 | 41.9% | 71 | 51.3% |
| Menthol to menthol | 393 | 36.8% | 178 | 36.1% | 215 | 37.5% | 258 | 34.3% | 35 | 45.0% | 36 | 30.6% | 64 | 47.5% |
| Menthol to nonmenthol | 55 | 5.9% | 26 | 5.4% | 29 | 6.4% | 37 | 6.1% | 3 | 3.9% | 9 | 9.2% | 6 | 4.2% |
| Nonmenthol to menthol | 82 | 8.0% | 41 | 8.3% | 41 | 7.6% | 56 | 7.5% | 4 | 5.1% | 5 | 7.6% | 17 | 12.0% |
| Nonmenthol to nonmenthol | 459 | 49.3% | 222 | 50.2% | 237 | 48.5% | 331 | 52.1% | 38 | 45.9% | 41 | 52.6% | 49 | 36.3% |

Note: NH = non-Hispanic

**Table 3. Estimates among Menthol Switching Patterns (Excluding Those Who Initiate at Wave 3)**

| Explanatory Variables | Menthol to Menthol % | Menthol to Nonmenthol % | Nonmenthol to Menthol % | Nonmenthol to Nonmenthol % |
|---|---|---|---|---|
| Gender | | | | |
| Female | 52.6% | 42.5% | 48.7% | 46.5% |
| Male | 47.4% | 57.5% | 51.3% | 53.5% |
| Race/Ethnicity | | | | |
| White (NH) | 54.0% | 66.9% | 61.6% | 68.4% |
| Black (NH) | 15.3% | 5.7% | 5.5% | 8.2% |
| Hispanic | 9.1% | 16.8% | 10.3% | 12.2% |
| Other race (NH) | 21.6% | 10.6% | 22.5% | 11.3% |
| Smoke daily | 31.0% | 46.0% | 26.2% | 24.5% |
| Established smoker | 38.1% | 60.4% | 40.1% | 29.9% |
| Smoke 100 cigarettes in lifetime | 49.2% | 74.3% | 41.3% | 35.7% |
| Nicotine dependence measure (mean) | 6.8 | 7.9 | 6.1 | 5.8 |

Note: NH = non-Hispanic

**Table 4. Estimates among Menthol Switching Patterns (Including Those Who Initiate at Wave 3)**

| Explanatory Variables | Menthol to Menthol % | Menthol to Nonmenthol % | Nonmenthol to Menthol % | Nonmenthol to Nonmenthol % |
|---|---|---|---|---|
| Gender | | | | |
| Female | 45.6% | 42.5% | 48.7% | 47.4% |
| Male | 54.4% | 57.5% | 51.3% | 52.6% |
| Race/Ethnicity | | | | |
| White (NH) | 61.1% | 66.9% | 61.6% | 69.3% |
| Black (NH) | 10.5% | 5.7% | 5.5% | 8.0% |
| Hispanic | 9.0% | 16.8% | 10.3% | 11.6% |
| Other race (NH) | 19.4% | 10.6% | 22.5% | 11.1% |
| Smoke daily | 35.0% | 46.0% | 26.2% | 21.1% |
| Established smoker | 43.7% | 60.4% | 40.1% | 27.2% |
| Smoke 100 cigarettes in lifetime | 51.0% | 74.3% | 41.3% | 32.1% |
| Nicotine dependence measure (mean) | 6.5 | 7.9 | 6.1 | 5.6 |

Note: NH = non-Hispanic

## 6.2 Regression Results

The regression results for the wave 3 smoking status measures as outcomes and initiation to menthol as the key explanatory variable are presented in Table 5. Initiation to menthol is positively and significantly associated with each outcome in the models that include wave 3 initiators. Initiation to menthol is also positively associated with smoking daily at wave 3 when excluding wave 3 initiators. Black respondents showed significantly lower prevalence than white respondents for each of the three smoking outcomes in all models. Similarly, Hispanic respondents were significantly less likely than white respondents to be established smokers at wave 3 or to have smoked 100 cigarettes in their lifetime at wave 3. Finally, males had a positive and significant association with each wave 3 outcome status compared with females.

**Table 5. Relationship between Outcomes and Initiation to Menthol Use (Wave 3 Status or Level of Use Outcomes)**

| | Smoke Daily at Wave 3 | | | | Established Smoking at Wave 3 | | | | Lifetime Cigarette Smoker at Wave 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | |
| Explanatory Variables | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) |
| Male | 1.81* | (1.07 – 3.06) | 2.36** | (1.67 – 3.35) | 1.86* | (1.12 – 3.09) | 2.11** | (1.53 – 2.91) | 1.53 | (0.91 – 2.57) | 2.16** | (1.57 – 2.98) |
| Age | 1.13 | (0.94 – 1.37) | 1.12 | (1.00 – 1.25) | 1.12 | (0.93 – 1.34) | 1.07 | (0.96 – 1.20) | 1.19 | (0.99 – 1.43) | 1.12 | (1.00 – 1.24) |
| Black (NH) | 0.26* | (0.08 – 0.81) | 0.34** | (0.17 – 0.69) | 0.23** | (0.08 – 0.63) | 0.39** | (0.21 – 0.71) | 0.15** | (0.05 – 0.44) | 0.35** | (0.19 – 0.64) |
| Hispanic | 0.69 | (0.30 – 1.59) | 0.57 | (0.32 – 1.04) | 0.68 | (0.31 – 1.49) | 0.52* | (0.30 – 0.89) | 0.61 | (0.27 – 1.39) | 0.49** | (0.28 – 0.84) |
| Other (NH) | 0.74 | (0.33 – 1.64) | 0.87 | (0.52 – 1.44) | 0.77 | (0.36 – 1.64) | 0.95 | (0.59 – 1.53) | 1.24 | (0.55 – 2.77) | 1.00 | (0.61 – 1.65) |
| First initiation to menthol | 1.71* | (1.01 – 2.92) | 1.99** | (1.42 – 2.80) | 1.68 | (1.00 – 2.82) | 1.94** | (1.41 – 2.66) | 1.61 | (0.93 – 2.76) | 1.94** | (1.40 – 2.68) |

Note: CI = confidence interval; NH = non-Hispanic; OR = odds ratio

*Significant at 5%; **Significant at 1%; confidence intervals are 95% confidence intervals.

Table 6 presents the regression results for the wave 3 smoking status measures with menthol use patterns as the key explanatory variable while controlling for gender, age, and race/ethnicity. The results show that respondents who switched from menthol cigarettes to nonmenthol cigarettes were significantly more likely to qualify for each status outcome compared with the nonmenthol reference group in models that included wave 3 initiators. Furthermore, menthol-to-nonmenthol smokers were significantly more likely to be daily and established smokers compared with the nonmenthol reference group for models that excluded those cases. Inclusion in each wave 3 smoking status was more likely for menthol-to-menthol respondents than for the nonmenthol reference group in models that included wave 3 initiators. Menthol-to-menthol smokers were also more likely to be established smokers in the model that excluded those cases. For demographics, we again see that black respondents have significantly lower prevalence than white respondents for each status outcome, whether wave 3 initiators are included or not. Similarly, in the models that included wave 3 initiators, Hispanic youth were significantly less likely than white youth to be established smokers or to have smoked 100 cigarettes in their lifetime at wave 3. Finally, males were more likely than females to experience each outcome in all models except for the lifetime cigarette count model that excluded wave 3 initiators.

Table 7 shows the logit regression results for each of the three smoking behavior transition indicators, with the first initiation to menthol indicator as the key explanatory variable and controlling for gender, age, and race/ethnicity. For all three outcomes, the models that include wave 3 initiators reveal a positive and statistically significant association between menthol at initiation and transitions to high levels of smoking. This relationship is also positive and significant for the lifetime cigarette count model that excludes wave 3 menthol initiation cases. Looking at the demographic controls, we see black respondents were significantly less likely than white respondents to transition to high levels of smoking at wave 3. Furthermore, Hispanic respondents were less likely than white respondents to transition to established smoking or 100 lifetime cigarettes by wave 3 in the models that include those who initiate at wave 3. Finally, males were more likely than females to make each transition in the models with wave 3 initiators.

Table 8 presents the regression results for the three smoking behavior transition indicators, with the menthol use pattern indicators as the key explanatory variables and controlling for gender, age, and race/ethnicity. Most notably, we see that respondents who switched from menthol cigarettes to nonmenthol cigarettes were significantly more likely to transition to increased smoking for each transition outcome compared with the nonmenthol reference group, whether wave 3 initiators are included or not. Transitions for each outcome were also more likely for menthol-to-menthol respondents than for the nonmenthol reference group. For demographics, we again see that black respondents had significantly fewer transitions than white respondents for each outcome, whether wave 3

**Table 6. Relationship between Outcomes at Wave 3 and Pattern of Menthol Use (Wave 3 Status or Level of Use Outcomes)**

| | Smoke Daily at Wave 3 | | | | Established Smoking at Wave 3 | | | | Lifetime Cigarette Smoker at Wave 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | |
| Explanatory Variables | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) |
| Male | 1.76* | (1.03 – 3.02) | 2.35** | (1.65 – 3.34) | 1.88* | (1.12 – 3.17) | 2.11** | (1.52 – 2.93) | 1.44 | (0.85 – 2.45) | 2.13** | (1.54 – 2.95) |
| Age | 1.15 | (0.96 – 1.39) | 1.12* | (1.00 – 1.26) | 1.14 | (0.95 – 1.37) | 1.08 | (0.97 – 1.20) | 1.19 | (0.99 – 1.43) | 1.11 | (1.00 – 1.24) |
| Black (NH) | 0.28* | (0.09 – 0.89) | 0.36** | (0.18 – 0.73) | 0.23** | (0.08 – 0.66) | 0.40** | (0.22 – 0.75) | 0.16** | (0.05 – 0.48) | 0.37** | (0.20 – 0.68) |
| Hispanic | 0.86 | (0.37 – 1.98) | 0.62 | (0.35 – 1.10) | 0.87 | (0.39 – 1.91) | 0.56* | (0.33 – 0.94) | 0.67 | (0.29 – 1.52) | 0.49** | (0.29 – 0.84) |
| Other (NH) | 0.77 | (0.34 – 1.74) | 0.87 | (0.52 – 1.45) | 0.77 | (0.35 – 1.70) | 0.94 | (0.58 – 1.53) | 1.16 | (0.51 – 2.65) | 0.96 | (0.58 – 1.58) |
| Menthol to menthol | 1.80 | (0.91 – 3.59) | 2.09** | (1.45 – 3.03) | 1.96* | (1.00 – 3.82) | 2.07** | (1.47 – 2.93) | 1.75 | (0.87 – 3.52) | 2.08** | (1.47 – 2.94) |
| Menthol to nonmenthol | 2.24* | (1.03 – 4.86) | 3.30** | (1.59 – 6.87) | 2.14 | (0.99 – 4.58) | 3.25** | (1.58 – 6.66) | 2.18 | (0.97 – 4.92) | 3.41** | (1.59 – 7.31) |
| Nonmenthol to menthol | 1.30 | (0.63 – 2.68) | 1.85 | (0.95 – 3.59) | 1.44 | (0.71 – 2.90) | 2.05* | (1.08 – 3.87) | 1.25 | (0.61 – 2.57) | 1.98* | (1.03 – 3.78) |

Note: CI = confidence interval; NH = non-Hispanic; OR = odds ratio

*Significant at 5%; **Significant at 1%; confidence intervals are 95% confidence intervals.

**Table 7. Relationship between Outcomes at Wave 3 and Initiation to Menthol Use (Transition Outcomes)**

| | Smoke Daily at Wave 3 | | | | Established Smoking at Wave 3 | | | | Lifetime Cigarette Smoker at Wave 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | |
| Explanatory Variables | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) |
| Male | 1.33 | (0.72 – 2.47) | 2.22** | (1.53 – 3.22) | 1.39 | (0.76 – 2.54) | 1.96** | (1.39 – 2.78) | 1.35 | (0.71 – 2.57) | 2.16** | (1.53 – 3.07) |
| Age | 1.07 | (0.85 – 1.35) | 1.09 | (0.97 – 1.23) | 1.01 | (0.80 – 1.26) | 1.03 | (0.92 – 1.16) | 1.20 | (0.96 – 1.50) | 1.10 | (0.98 – 1.24) |
| Black (NH) | 0.14** | (0.04 – 0.46) | 0.30** | (0.14 – 0.63) | 0.17** | (0.05 – 0.50) | 0.39** | (0.21 – 0.73) | 0.08** | (0.02 – 0.26) | 0.35** | (0.19 – 0.65) |
| Hispanic | 0.39 | (0.13 – 1.15) | 0.43* | (0.22 – 0.85) | 0.45 | (0.17 – 1.20) | 0.40** | (0.22 – 0.75) | 0.47 | (0.17 – 1.30) | 0.42** | (0.23 – 0.78) |
| Other (NH) | 0.76 | (0.31 – 1.86) | 0.89 | (0.52 – 1.51) | 0.89 | (0.38 – 2.09) | 1.01 | (0.61 – 1.67) | 1.32 | (0.54 – 3.19) | 0.98 | (0.58 – 1.64) |
| First initiation to menthol | 1.76 | (0.94 – 3.30) | 2.11** | (1.47 – 3.03) | 1.66 | (0.89 – 3.09) | 2.02** | (1.44 – 2.84) | 2.39** | (1.25 – 4.58) | 2.32** | (1.64 – 3.28) |

Note: CI = confidence interval; NH = non-Hispanic; OR = odds ratio

*Significant at 5%; **Significant at 1%; confidence intervals are 95% confidence intervals.

**Table 8. Relationship between Outcomes at Wave 3 and Pattern of Menthol Use Indicators (Transition Outcomes)**

| Explanatory Variables | Smoke Daily at Wave 3 | | | | Established Smoking at Wave 3 | | | | Lifetime Cigarette Smoker at Wave 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | | Exclude Wave 3 Initiators | | Include Wave 3 Initiators | |
| | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) | OR | (CI) |
| Male | 1.29 | (0.68 – 2.42) | 2.22** | (1.52 – 3.22) | 1.37 | (0.74 – 2.53) | 1.98** | (1.40 – 2.81) | 1.24 | (0.65 – 2.39) | 2.17** | (1.53 – 3.09) |
| Age | 1.10 | (0.88 – 1.38) | 1.10 | (0.97 – 1.25) | 1.06 | (0.85 – 1.32) | 1.04 | (0.93 – 1.17) | 1.21 | (0.97 – 1.50) | 1.10 | (0.98 – 1.24) |
| Black (NH) | 0.16** | (0.05 – 0.55) | 0.31** | (0.15 – 0.66) | 0.19** | (0.06 – 0.58) | 0.40** | (0.21 – 0.77) | 0.10** | (0.03 – 0.32) | 0.38** | (0.20 – 0.71) |
| Hispanic | 0.48 | (0.16 – 1.44) | 0.47* | (0.24 – 0.92) | 0.57 | (0.22 – 1.51) | 0.43** | (0.24 – 0.79) | 0.50 | (0.17 – 1.49) | 0.43** | (0.23 – 0.80) |
| Other (NH) | 0.88 | (0.36 – 2.17) | 0.92 | (0.54 – 1.57) | 1.01 | (0.43 – 2.40) | 1.03 | (0.62 – 1.71) | 1.40 | (0.56 – 3.52) | 0.98 | (0.58 – 1.66) |
| Menthol to menthol | 1.51 | (0.67 – 3.42) | 2.12** | (1.44 – 3.12) | 1.52 | (0.68 – 3.39) | 2.09** | (1.45 – 3.00) | 1.84 | (0.81 – 4.18) | 2.27** | (1.57 – 3.28) |
| Menthol to nonmenthol | 2.68* | (1.01 – 7.06) | 3.65** | (1.46 – 9.16) | 3.67* | (1.36 – 9.91) | 4.72** | (1.86 – 11.99) | 5.91** | (1.91 – 18.30) | 7.42** | (2.73 – 20.22) |
| Nonmenthol to menthol | 1.09 | (0.49 – 2.44) | 1.38 | (0.66 – 2.88) | 1.50 | (0.69 – 3.28) | 1.79 | (0.90 – 3.59) | 1.23 | (0.54 – 2.79) | 1.55 | (0.76 – 3.17) |

Note: CI = confidence interval; NH = non-Hispanic; OR = odds ratio

*Significant at 5%; **Significant at 1%; confidence intervals are 95% confidence intervals.

initiators are included or not. Similarly, Hispanic youth were significantly less likely than white youth to transition to established smokers or 100-cigarette in lifetime smokers at wave 3. Finally, males were more likely than females to make each transition in the models with wave 3 initiators included.

The results of the OLS regressions for the nicotine dependence scale are shown in Table 9. The results reveal that menthol use at initiation is positively and significantly associated with nicotine dependence, regardless of whether wave 3 initiators are included in the models. Menthol-to-nonmenthol smokers were also significantly more likely to have higher dependence scale scores than nonmenthol-to-nonmenthol smokers in the models both with and without wave 3 initiators. When wave 3 initiators are included, we also see that menthol-to-menthol smokers have significantly lower scale scores than the nonmenthol reference group, while males score significantly higher than females.

**Table 9. Relationship between Measure of Nicotine Dependence at Wave 3 and Menthol Use (Overall)**

| | Exclude Wave 3 Initiators | | | | Include Wave 3 Initiators | | | |
|---|---|---|---|---|---|---|---|---|
| | First Initiation to Menthol is in the Model | | Pattern of Menthol Use across Waves in the Model | | First Initiation to Menthol is in the Model | | Pattern of Menthol Use across Waves in the Model | |
| **Explanatory Variables** | **B** | **(CI)** | **B** | **(CI)** | **B** | **(CI)** | **B** | **(CI)** |
| Male | 1.02 | (−0.12 – 2.16) | 0.97 | (−0.17 – 2.12) | 1.56** | (0.77 – 2.36) | 1.58** | (0.79 – 2.37) |
| Age | −0.02 | (−0.46 – 0.42) | −0.02 | (−0.45 – 0.42) | −0.04 | (−0.32 – 0.25) | −0.05 | (−0.33 – 0.24) |
| Black (NH) | −0.39 | (−3.27 – 2.50) | −0.26 | (−3.19 – 2.68) | −0.39 | (−1.91 – 1.13) | −0.32 | (−1.85 – 1.21) |
| Hispanic | 0.69 | (−1.34 – 2.73) | 0.71 | (−1.40 – 2.82) | −0.18 | (−1.66 – 1.29) | −0.32 | (−1.81 – 1.18) |
| Other(NH) | −0.14 | (−1.53 – 1.25) | −0.1 | (−1.49 – 1.30) | −0.51 | (−1.66 – 0.63) | −0.51 | (−1.66 – 0.64) |
| First initiation to menthol | 1.26* | (0.11 – 2.42) | — | — | 1.04** | (0.26 – 1.82) | — | — |
| Menthol to menthol | | | 1.03 | (−0.50 – 2.56) | | | 0.96* | (0.08 – 1.83) |
| Menthol to nonmenthol | | | 2.03** | (0.53 – 3.53) | | | 2.33** | (1.08 – 3.59) |
| Nonmenthol to menthol | | | 0.36 | (−1.20 – 1.92) | | | 0.69 | (−0.62 – 2.01) |

Note: CI = confidence interval; NH = non-Hispanic; OR = odds ratio

*Significant at 5%; **Significant at 1%; confidence intervals are 95% confidence intervals.

# 7. DISCUSSION

The results presented in this report suggest that starting smoking with menthol (initiating first to menthol) is associated with indicators of progression to established smoking and higher levels of nicotine dependence. This is evident from our models using the indicator for starting with menthol as well as the indicators for menthol pattern.

The results are also consistent across the different outcome indicators measuring progression. It does matter to some extent whether we include those who initiate at wave 3. When wave 3 initiators are not included, although the odds ratios (ORs) are greater than 1, the results are not as consistently statistically significant. However, when the wave 3 initiators are included, the ORs are larger and the results are more consistently statistically significant across the outcomes. When we examine the menthol pattern indicators, the results are strongest and most consistently statistically significant for those who switch from menthol to nonmenthol use. This result holds when we include those who initiate at wave 3. These results suggests the potential importance of menthol as a starter product (i.e., we are observing an effect of starting with menthol, or prior menthol use, and not just current menthol use).

When we include wave 3 initiators, we see statistically significant results for those who start and stay with menthol. This could possibly be related to the fact that including wave 3 initiators includes more minorities. This is due at least in part because African Americans initiate later than whites. When we include wave 3 initiators, we find a significant relationship for minorities, similar to what we see overall and for the white sample.

Several limitations should be noted. First, the analytic sample for these analyses is largely non-Hispanic white. In the results reported in the main body of the report, we control for race/ethnicity. Although we estimated the models presented in the report stratified by race/ethnicity, the estimates are imprecise due to small cell sizes (few minorities experience the outcomes and thus we do not present these results). Second, we restrict the analyses to those who completed all three waves. This decision significantly reduces the sample size, which exacerbates the problem of small cell sizes for results stratified by race/ethnicity. However, this decision was made to simplify analyses given the study time frame and also allows us to use the weights that account for baseline characteristics and attrition. Third, although population-based, ALLTURS is not nationally representative. Finally, ALLTURS does not provide information on menthol use prior to the baseline survey (for those who initiate prior to baseline), and no data are available on smoking patterns during the interim period between survey waves.

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