TABLE 2—Support Among Blacks for Banning Cigarettes With Menthol: United States, 2009

Demographic Variables	Percentage of Sample (Unweighted)	Support Ban on Menthol (Weighted), % (95% CI)	Support Ban on Menthol, AOR (95% CI)
Overall (n = 303)		75.8 (70.9, 80.7)	
Smoking status**			
Never smoker	64.4	83.4 (78.0, 88.8)	3.83 (1.74, 8.45)
Former smoker	17.8	71.4 (57.7, 85.1)	1.95 (0.74, 5.15)
Current smoker (Ref)	17.8	52.8 (39.4, 66.2)	1.00
Age, y			
18–24 (Ref)	12.5	87.5 (78.1, 96.9)	1.00
25–44	31.0	77.6 (70.0, 85.2)	0.58 (0.21, 1.60)
45–64	38.9	67.1 (56.9, 77.3)	0.39 (0.14, 1.11)
≥ 65	17.5	75.9 (60.3, 91.5)	0.54 (0.15; 1.97)
Education			
< High school[a]	12.2	62.5 (43.1, 81.9)	0.61 (0.19, 1.97)
High school diploma/GED	30.0	83.3 (75.3, 91.3)	1.65 (0.71, 3.81)
Some college	30.7	69.4 (59.6, 79.2)	0.66 (0.31, 1.42)
College (Ref)	27.1	78.3 (69.4, 87.2)	1.00
Gender			
Women	69.3	80.9 (74.7, 87.1)	1.74 (0.95, 3.20)
Men (Ref)	30.4	69.1 (60.9, 77.3)	1.00

Note. AOR = adjusted odds ratio; CI = confidence interval; GED = Graduate Educational Development Exam.
[a]n < 30.
**P < .001.

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Modeling the Future Effects of a Menthol Ban on Smoking Prevalence and Smoking-Attributable Deaths in the United States

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We used a validated smoking simulation model and data from the 2003 Tobacco Use Supplement to the Current Population Survey to project the impact that a US menthol ban would have on smoking prevalence and smoking-attributable deaths. In a scenario in which 30% of menthol smokers quit and 30% of those who would have initiated as menthol smokers do not initiate, by 2050 the relative reduction in smoking prevalence would be 9.7% overall and 24.8% for Blacks; deaths averted would be 633 252 overall and 237 317 for Blacks. (*Am J Public Health.* 2011;101:1236–1240. doi:10.2105/AJPH.2011.300179)

The Family Smoking Prevention and Tobacco Control Act[1] authorized the Food and Drug Administration to establish the Center for Tobacco Products to regulate tobacco for the protection of the public health. The Center for

Tobacco Products is charged with considering a ban on the menthol flavoring in cigarettes (menthols). The act specifies that in considering the impact of a ban, a broad public health standard is to be applied rather than a narrow individual standard of whether there is more or less harm to individual users of menthols. Although there is evidence that menthol plays a role in smoking initiation and cessation,[2–6] little is known about the anticipated impact of such a ban on population-level smoking behavior and subsequent deaths that may be averted. Of particular interest is the effect of a ban on the Black population, which has substantially higher rates of menthol use than do other racial/ethnic groups.[7]

In the absence of an experimental or actual ban on menthols, simulation modeling can be a useful tool to understand the potential pathways and predict the anticipated effect of such a policy intervention.[8] In the current study, we used a validated smoking simulation model, SimSmoke,[9–14] in conjunction with plausible ranges of change in patterns of smoking behavior, to examine the potential impact of a menthol ban on future smoking prevalence and smoking-attributable deaths.

METHODS

We extended previous versions of the SimSmoke model to explicitly distinguish menthol and nonmenthol smokers. Separate models were developed for males and females, both for the total population and for Blacks. The model uses self-reported data from the 2003 Tobacco Use Supplement to the Current Population Survey (TUS-CPS) as well as initial population data for the year 2003.

We first distinguished among never, current, and former smokers. Current smokers were those who had smoked at least 100 cigarettes in their lifetime and smoked some or all days. Former smokers were those who had smoked at least 100 cigarettes in their lifetime but did not currently smoke, further distinguished by how many years ago they had quit smoking. Current and former smokers were also differentiated by cigarette type into menthol, nonmenthol, and no usual type, as defined by the TUS-CPS.[15] We averaged data over 3-age-year groups (e.g., people aged 18–20 years) and then smoothed.

The smoking model simulates groups of individuals as they transition into and out of smoking through initiation, cessation, and relapse rates, following a discrete first-order Markov process. We measured initiation for each cigarette type through age 24 years as the change in smoking prevalence between successive age-year groups; this figure thus represents initiation net of cessation and switching between types for each age. We applied cessation rates after age 24 years in the model, measured as smokers who had quit in the past year but not in the past 3 months as a percentage of smokers 1 year ago.[16] We constructed separate cessation rates by gender and type for 3-age-year groups and then smoothed. We applied the same relapse rates to former smokers by type, distinguished by age and gender on the basis of various sources.[17–20]

The influence of tobacco-control policies on initiation and cessation through the year 2010 were incorporated into the model by using measures of price, smoke-free air, and expenditure policies obtained from the Impacteen Web site (http://www.impacteen.org). We calibrated the model by comparing smoking rates from the model predicted for 2006 to smoking rates from the 2006 TUS-CPS.

We used the calibrated model to estimate the effect of banning menthol cigarettes as of the year 2011. A ban on menthol cigarettes may have 3 types of effects. First, some former menthol smokers may simply switch to smoking nonmenthol cigarettes (switching effect). However, in a recent preliminary analysis of 2010 TUS-CPS data, only 36.2% of all menthol smokers and 25.7% of Black menthol smokers predicted that they would switch to a nonmenthol brand if menthol cigarettes were no longer available.[21] A second effect is that some menthol smokers may quit soon after the ban as a response to the unavailability of their preferred cigarette, that is, the cigarette viewed as more safe or less harsh (cessation effect). Tauras et al.[22] did not find close substitutability of the 2 products; in fact, they found that nonmenthol cigarettes were less of a substitute for menthol cigarettes than was the reverse. Indeed, in 2010 TUS-CPS data, 39.0% of all menthol smokers and 46.8% of Black menthol smokers reported that they would quit if menthol cigarettes were not available.[21] Although intentions do not always translate into actual behavior, this suggests that menthol smokers are dedicated to menthol flavoring and do not see nonmenthol cigarettes as a suitable substitute.

Finally, some individuals who would have initiated smoking menthol cigarettes may not initiate (initiation effect). Studies have not directly considered the effects of a menthol ban on smoking initiation, but the proportion of menthol smokers is inversely related to age, suggesting that menthol cigarettes are the preferred starter cigarette and that they facilitate initiation.[7]

Former menthol smokers who remain smokers in the switching effect are assumed to take on the cessation rate of nonmenthol smokers. This rate is directly estimated from the TUS-CPS and has been found to be relatively stable for the years 2003 and 2006.[15] Direct estimates were not available for the cessation and initiation effects. On the basis of the studies cited above, we considered 3 conservative, plausible scenarios: (1) 10% of the menthol smokers permanently quit, and 10% of those who would have initiated as menthol smokers do not initiate; (2) 20% quit, and 20% do not initiate; and (3) 30% quit, and 30% do not initiate.

For each scenario, we projected the effect on smoking prevalence, the absolute number of smokers, and the number of smoking-attributable deaths 40 years forward, to the year 2050. We calculated the percentage change in smoking prevalence relative to the baseline case (status quo scenario, i.e., no ban is enacted) and the deaths averted because of a menthol ban as the difference between smoking-attributable deaths in the baseline case and those under a ban. Previous studies do not clearly distinguish mortality risks of menthol and nonmenthol smokers, so we applied the same relative risks to menthol and nonmenthol that have been applied to all smokers in previous SimSmoke models.[10,11,23,24]

In the baseline scenario, the model incorporates switching between menthols and nonmenthols up through age 24 years through our measure of net initiation by type, but the model does not consider switching after age 24 years. The few studies that examine switching yield mixed results.[4,25,26] In the model, those smokers maintaining no preference for either menthol or nonmenthol—who are probably most likely to switch—are conservatively assumed to continue as nonmenthol smokers after the ban.

RESULTS

In the absence of a menthol ban, the model predicts a slow downward trend in overall smoking prevalence from 18.1% (20.3% for males and 16.1% for females) in 2003 to 8.2% in 2050. Smoking rates decline, but the percentage of those smoking menthols is projected to increase. From 2003 to 2050, menthol use increases from about 23% to 27% among all males and from 65% to 77% among Black males. For females, the menthol rate stays flat for all smokers, but it increases from 76% in 2003 to 83% in 2050 among Blacks (results not shown).

Figure 1 presents the projected smoking prevalence of all smokers under the status quo and the projected changes in population prevalence under a scenario of 10% change (10% reduction in initiation and 10% increase in cessation), a scenario of 20% change, and a scenario of 30% change. At 10 years following the hypothetical ban on menthol in cigarettes, the model projects a 4% relative reduction in smoking prevalence compared with the status quo under the 10% scenario, increasing to 4.6% at 20 years and 4.8% at 40 years. At 40 years, the model projects a 7.2% decrease under the 20% scenario and a 9.7% decrease under the 30% scenario. For Blacks in 2050, the projected relative reduction is a 9.1% decrease under the 10% scenario, a 17.0% decrease under the 20% scenario, and a 24.8% decrease under the 30% scenario.

Table 1 presents the projected number of smoking-attributable deaths at 10-year intervals through 2050 for each scenario and computes deaths averted at 2050 relative to status quo estimates. In 2020, the menthol ban results in 1.06 million fewer smokers under the most conservative scenario, increasing slightly through 2030 and then declining (results not shown). In 2020 alone, there are 4764 smoking-attributable deaths averted, increasing to 11 355 in 2040. From 2011 to 2050, a total of 323 107 deaths are averted under the 10% scenario, 478 154 under the 20% scenario, and 633 252 under the 30% scenario. Almost one third of the deaths averted are among Blacks, for whom 91 744 deaths are averted under the 10% scenario, 164 465 under the 20% scenario, and 237 317 under the 30% scenario.

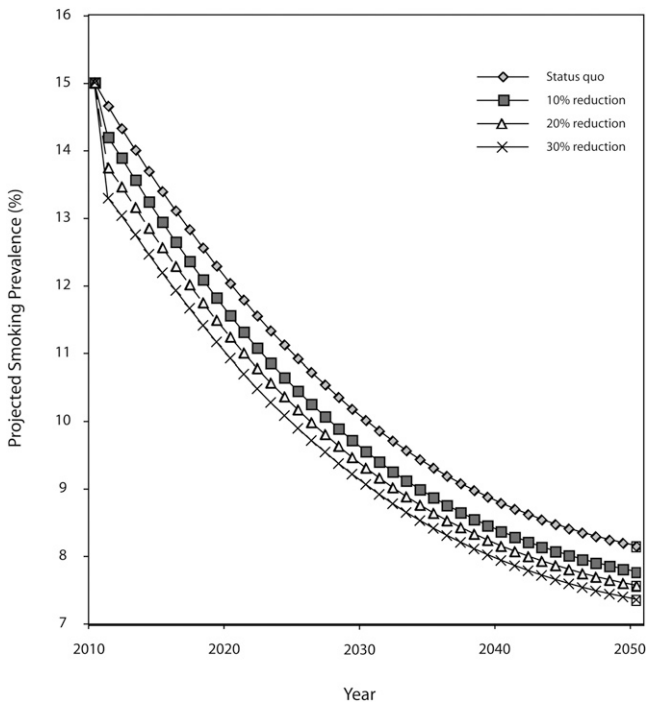

FIGURE 1—Smoking prevalence if menthol is banned under 3 scenarios (10%, 20%, and 30% change in initiation and cessation), projected from 2010 to 2050: United States.

DISCUSSION

This application of SimSmoke modeling suggests that a menthol ban would have large population-level benefits in reducing smoking prevalence, the number of smokers, and the number of smoking-attributable deaths in the United States over a 40-year period. We have provided 3 plausible scenarios to address the lack of data on the proportion of menthol smokers who would quit or never start smoking in the case of a ban on menthol, and our results suggest that somewhere between 323 000 and 633 000 deaths could be avoided under a ban, almost one third of which would be among Blacks. Even under the most conservative scenario, the model predicts a substantial public health benefit of a ban on menthols consistent with the broad public health standard specified by the Family Smoking Prevention and Tobacco Control Act of 2009.[1]

As is typically the case with simulated projections, the models are limited by current evidence regarding switching and initiation behaviors, assumptions inherent in the model, and the reliability of the data. The model uses data from the 2003 TUS-CPS, which yields smoking prevalence rates below those from the National Health Interview Survey (NHIS). We used TUS-CPS data to calibrate our model to predict well between 2003 and 2006. The 2009 TUS-CPS data were not yet available, but the model overpredicts the percentage change in smoking rates from 2006 to 2009 implied by NHIS data. Still, the lower initial smoking level seen in TUS-CPS data relative to NHIS data and the greater projected change in smoking prevalence than is observed in the NHIS data between 2006 and 2009 can both be expected to reduce the estimated number of smoking-attributable deaths and consequently increase the number of deaths averted as a result of the ban. Therefore, the estimate of deaths averted is likely to be conservative.

The immediate effects of a ban are simulated as occurring through cessation in the first year of the ban. The results of a gradual change, either because the ban is implemented in steps or because reactions to the ban occur over

TABLE 1—Smoking-Attributable Deaths (SADs) and Deaths Averted if Menthol is Banned Under 3 Scenarios (10%, 20%, and 30% Change in Initiation and Cessation), Projected From 2010 to 2050: Total Population and Black Population, United States

Menthol Ban Scenarios	SADs, 2010	SADs, 2020	SADs, 2030	SADs, 2040	SADs, 2050	Total SADs	Total SADs Averted Compared With Status Quo
Total population							
Status quo	386 732	410 809	399 028	342 472	272 424	17 923 889	–
10% change	386 732	406 046	388 347	331 117	262 574	17 600 782	323 107
20% change	386 732	402 568	382 621	326 799	259 002	17 445 735	478 154
30% change	386 732	399 091	376 893	322 478	255 424	17 290 637	633 252
Black population							
Status quo	53 836	57 056	53 382	45 022	37 475	2 433 536	–
10% change	53 836	55 234	50 086	42 175	35 320	2 341 792	91 744
20% change	53 836	53 706	47 562	40 044	33 340	2 269 071	164 465
30% change	53 836	52 177	45 036	37 908	31 347	2 196 219	237 317

Note. Total SADs averted include all years from 2010 through 2050 and therefore include years not represented in the table.

a longer period than 1 year, would yield slightly different results in the earlier years but almost identical results by 2020 and certainly identical results by 2050.

SimSmoke incorporates the effect of tobacco-control policies through 2010, assuming that policies have the same percentage effects on menthol and nonmenthol smokers. Evidence on these effects is limited, but some evidence suggests that price and clean-air policies may be less effective among menthol smokers. In the absence of a ban, the percentage of menthol smokers might be expected to increase with stricter tobacco-control policies.[22] We have assumed that relative mortality risks are equal for menthol and nonmenthol smokers, and for Black smokers relative to other racial/ethnic groups. Although the higher lung cancer risk among Black smokers suggests a link to menthol use,[27,28] studies fail to find a clear association between menthol smoking and increased risk for lung cancer or other disease.[29–31] If a menthol ban increases smoking cessation and reduces initiation, Blacks would experience even greater health benefits, which could serve to reduce health disparities.

Given the tremendous harms associated with smoking,[32] public health efforts are needed to positively influence population-level smoking behavior and reinvigorate the stalled decline in adult smoking prevalence in the United States.[33] Such efforts are especially important for populations at increased risk, such as Blacks, who disproportionately smoke menthols. If a menthol ban were accompanied by effective mass-media campaigns and increased access to evidence-based cessation services, additional reductions in smoking prevalence would be likely, further contributing to the public health impact of this policy intervention.

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Contributors

D. T. Levy developed the model and wrote the article. K. Blackman conducted the data analysis. J. L. Pearson, A. C. Villanti, R. S. Niaura, D. M. Vallone, and D. B. Abrams suggested the original idea and contributed to the writing of the article.

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Human Participant Protection

No protocol approval was necessary because the study used secondary data from a public-use data set.

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