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MENTHOL CIGARETTE ADVERTISING AND CIGARETTE DEMAND

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ABSTRACT

The FDA is considering using its regulatory authority over the tobacco industry to promote public health by restricting the advertising of menthol cigarettes. In this paper we contribute new empirical evidence on the effects of magazine advertisements for menthol cigarettes on cigarette demand. Unlike previous research on cigarette advertising and demand, we use individual-level data and a measure of advertising exposure based on each consumer's magazine-reading habits. These data allow us to control for individual heterogeneity that influences both advertising exposure and cigarette demand. We exploit quasi-experimental variation in advertising exposure in the 2000s created by sharply different supply-side variation in menthol and non-menthol advertising. We examine the importance of controlling for heterogeneity by estimating simple models relating advertising exposure to behavior and then adding specifications that take advantage of the richness of our individual-level data. We examine advertising effects on multiple margins of cigarette demand. Our empirical results do not provide any evidence that menthol advertising in magazines affects cigarette demand at various margins: the probability of menthol use; smoking participation; the number of cigarettes smoked per day; the probability of a past-year quit attempt; and anti-smoking attitudes among teens.

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I. Introduction

The 2009 Family Smoking Prevention and Tobacco Control Act (TCA) gave the U.S. Food and Drug Administration new regulatory authority over the tobacco industry. The TCA banned the use of flavors in cigarettes, except for menthol. About 28 percent of current smokers choose menthol cigarettes, with the share ranging from 21 percent among white smokers to 74 percent among African American smokers (DeCicca et al 2014).¹ Although the TCA did not require immediate regulatory actions towards menthol, it required the FDA's Tobacco Products Scientific Advisory Committee (TPSAC) to study the impact of menthol cigarettes on public health. The TPSAC report (2012) and an FDA report (2013) conclude that although menthol *per se* is not harmful, the availability and marketing of menthol cigarettes harms public health by increasing smoking initiation and decreasing smoking cessation. In July 2013 the FDA issued an advance notice of proposed rulemaking of possible restrictions on the sale and distribution of menthol cigarettes. The FDA sought public comments on the proposed regulation of menthol including: "Should FDA consider establishing restrictions on the advertising and promotion of menthol cigarettes?" The final rulemaking is pending.²

FDA regulation of menthol cigarette advertising would be the latest chapter in a long history of US regulation of cigarette advertising. In the 1940s the Federal Trade Commission brought forward advertising deception cases including a case against Brown & Williamson for health-related claims about *Kool* cigarettes, one of the first menthol brands (Stratton et al. 2001, p. 61). Ironically, in these early cases the FTC argued that because there was no evidence that

¹ DeCicca et al. (2014) use data from the 2003, 2006-2007 and 2010-2011 cycles of the Tobacco Use Supplements to the Current Population Survey (TUS-CPS).

² In another legal development, in July 2014 the U.S. District Court for the District of Columbia found that three members of TPSAC had conflicts of interest and prohibited the FDA from using the findings of the TPSAC menthol report.

any cigarettes are harmful, claims that a brand like *Kool* is less harmful than other brands are necessarily false. In the 1950s scientific evidence of the harms of smoking led to the cigarette industry's "Tar Derby" where brands competed based on their tar and nicotine content. In 1960 the FTC negotiated a voluntary ban of tar and nicotine claims, then reversed course and in 1966 allowed the claims and in 1970 required tar and nicotine measures in all advertisements (Calfee 1986). In 1970 cigarettes were banned from advertising on television and radio but advertising in magazines was still allowed and continued. The 1998 Master Settlement Agreement between state attorneys general and the cigarette industry banned the use of cartoon figures and prohibited advertisements that targeted youth. In addition to establishing the FDA's regulatory authority over the tobacco industry, the 2009 TCA includes specific restrictions on marketing and advertising: a ban on brand sponsorships of sports and entertainment events; and a ban of the use of misleading descriptors such as "light."³

The possibility of new FDA regulations of menthol cigarette advertising raises questions with long histories of debate in economics and public health. Different theoretical models suggest that advertisements can influence consumer demand because they are persuasive, informative, or are complements to the advertised good (Bagwell 2007). The different theories have different implications for the impact of advertising on social welfare. The impact of cigarette advertising on public health hinges on difficult empirical questions: Does advertising expand the size of the market? Or does advertising mainly change the market shares of competing brands? Econometric studies provide little evidence that cigarette advertising has a

³ Manufacturers are allowed to make reduced harm claims only if they have an approved application from the FDA to market their product as a "modified risk tobacco product."

strong market-expanding impact.⁴ In contrast, public health research reaches a consensus that cigarette advertising encourages youth initiation (Lovato et al. 2011), which is consistent with a market-expanding impact. However, this consensus has been challenged by advertising researchers and economists.⁵ Heckman et al. (2008) emphasize that studies of the link between advertising and smoking must take into account “the consequences of human choice for the validity of their statistical analysis.”(Heckman et al. 2008, p. 42). In addition to consumer choices, it is crucial that studies of advertising take into account the choices of profit-maximizing manufacturers who target their advertising to reach potential consumers (Avery et al. 2007).

In this paper, we contribute new empirical evidence on the effects of magazine advertisements for menthol cigarettes on cigarette demand. Unlike previous research on cigarette advertising and demand, we use individual-level data and a measure of advertising exposure based on each consumer’s magazine-reading habits. These data allow us to control for individual heterogeneity that influences both advertising exposure and cigarette demand. We use data from the 1998-2009 Simmons National Consumer Survey (NCS). We exploit quasi-experimental variation in advertising exposure in the 2000s created by sharply different supply-side variation in menthol and non-menthol advertising. We examine the importance of controlling for

⁴ In their extensive review Chaloupka and Warner (2000, p. 1586) conclude that “no consensus concerning the effects of advertising on smoking has emerged from this research.” In a meta-analysis of 137 econometric estimates, the median estimates imply that a 10 percent increase in advertising expenditures results in less than one percent increase in cigarette demand (Gallet and List 2003).

⁵ The fundamental challenge is researchers’ inability, for practical and ethical reasons, to assess youth smoking rates in clinical trials where some are randomly exposed to cigarette advertising and others are not. The alternative of relying on correlations between smoking behaviors and advertisement recall and awareness faces the criticism that smoking or favorable attitudes towards smoking “drives heightened attention to advertising, smoking portrayals in movies, and/or ownership of promotional items.” (Taylor and Bonner, 2003, p. 420) Reviews by economists of this body of research raise similar questions about whether the findings support a causal link between ads and youth smoking (Geweke and Martin 2002; Heckman et al. 2008; Nelson 2010).

heterogeneity by estimating simple models relating advertising exposure to behavior and then adding specifications that take advantage of the richness of our individual-level data. We examine advertising effects on multiple margins of cigarette demand: smokers' choices to smoke menthol versus non-menthol brands; smoking participation; the number of cigarettes smoked per day; and attempts to quit smoking. We also use data from the 2000-2005 NCS Teens Studies to examine the effect of menthol advertising on teens' anti-smoking attitudes.

After providing some background information in section II, in section III we describe our empirical approach and data. Sections IV and V present our empirical results and section VI provides a concluding discussion.

II. Background

To set the stage for our empirical analysis, in this section we briefly review some of the recent history of smoking and cigarette advertising in the U.S. The publication of the 1964 Surgeon General's Report on the health consequences of smoking is widely seen as a landmark event that helped launch anti-smoking campaigns in the U.S. and many other countries. The decline in smoking since 1964 has been called "arguably the most successful public health endeavor in developed nations in the past half century" (Warner 2007). Figure 1 shows U.S. adult smoking prevalence from 1965 to 2011 and teen smoking prevalence from 1977 to 2011. Adult and teen smoking has shown a mainly steady decline, with adult smoking prevalence falling from 43 percent in 1965 to 20 percent in 2011. The exception to the mainly steady decline in smoking is the rise in teen smoking from 1992 to 1997. Our data cover 1998 – 2009, a period when both adult and teen smoking rates fell.

Turning to cigarette advertising, Figure 2 shows the trend in the industry's expenditures on magazine advertising from 1965-2012. The data are from the FTC (2013) and are adjusted for

inflation. Cigarette industry magazine advertising expenditures peaked in 1983 at about \$900 million and had fallen to about \$300 million per year by the mid-1990s. Advertising expenditures increased in the late 1990s before dropping to under \$50 million per year from 2005 through 2012. During our study period cigarette advertising expenditures are low by historical standards but include both a brief rise and then a steady drop.

Figure 3 shows that the drop in magazine advertising of non-menthol cigarettes was much steeper than the drop in menthol cigarette advertising. Because the FTC (2013) only provides industry expenditures, Figure 3 uses the data we describe and use below. It shows the trends in the number of magazine cigarette advertisements and in average consumer exposure to these advertisements. The data on the number of advertisements are from Kantar Media Intelligence and cover all cigarette advertisements that appeared in popular magazines. As described in more detail below, we combine this information with information on magazine-reading habits from the NCS to create an individual-level measure of potential advertising exposure. Around 2000, the average consumer exposure to non-menthol advertisements was almost twenty times higher than average exposure to menthol advertisements. Around 2007, menthol advertising overtook non-menthol advertising, both in terms of the number of advertisements and in average consumer exposure.

We have also analyzed the trends broken down by cigarette manufacturer and brand (not shown in Figure 3). In the early 2000s Philip Morris and RJR stopped placing advertisements for their market-leading non-menthol brands (*Marlboro* and *Camel*). Lorillard continued to place advertisements for *Newport*, the leading menthol brand. To oversimplify the supply-side variation somewhat: the different advertising strategies adopted by Philip Morris and RJR on the

one hand, and Lorillard on the other, led to the different trends in magazine advertising for non-menthol and menthol cigarettes.⁶

Our empirical study exploits the trends in menthol and non-menthol advertising to conduct a quasi-experimental analysis of the impact of menthol advertising on cigarette demand. During our study period various anti-smoking policies were enacted, including state and federal cigarette excise tax hikes. The average inflation-adjusted price of cigarettes increased from \$3.09 in 1998 to \$5.87 in 2009. This price increase and other new policies might have contributed to the decline in smoking shown in Figure 1.⁷ One influence moving in the opposite direction is the cigarette industry's expenditures on price promotions, promotional allowances, coupons and retail-value expenditures such as "buy one, get one free." Expenditures in these categories increased from \$6.7 billion in 1998 to \$16.4 billion in 2003, and then decreased to \$7.9 billion in 2009 (inflation-adjusted figures from FTC 2013). On a per pack basis, industry expenditures in these categories increased from \$0.29 per pack in 1998 to \$0.50 per pack in 2009. The \$0.21 per pack increase in price promotions offsets about eight percent of the \$2.78 increase in the average cigarette price over our study period.⁸ Promotional expenditures influence cigarette demand through retailers and other channels which are independent of magazine advertisements, so this trend should not pose a threat to the validity of our quasi-experimental research design.

⁶Even for just the major brands, the patterns in the data are complex. There are no *Marlboro* advertisements after 2002. The number of *Marlboro* magazine advertisements drops substantially from 318 in 2000 to 68 in 2001 to 3 in 2002. RJR continues to advertise *Camel* through 2007. RJR advertises its menthol brand *Salem* somewhat intermittently through 2004. There are advertisements for the menthol brand *Kool* through 2007. *Kool* was made by Brown & Williamson, which was purchased by RJR in 2003. Some manufacturers used different strategies for different brands. For example, RJR continues to advertise *American Spirit* through 2009.

⁷Warner and Mendez (2012) and DeCicca and Kenkel (2015) show that the demographics of the smoking population explain most of the decline.

⁸The average cigarette price and the number of cigarette packs sold are from *The Tax Burden on Tobacco*.

III. Empirical Approach and Data

We use individual-level data from the 1998-2009 NCS Adult Studies and the 2000-2005 NCS Teens Studies to estimate cigarette demand as a function of exposure to cigarette advertising, demographic demand shifters, and control variables. The NCS conducts repeated cross-sectional surveys of consumers with two waves each year (spring and fall). It collects broad and detailed information on consumer choices, brand preferences, usage of major media, and attitudes and opinions. The NCS provides sample sizes of: 198,686 adults age 25 and over; 16,455 young adults age 18-24; and 14,361 teens age 12-17. Table 1 provides descriptive statistics for the key variables we use in our analysis. The Appendix provides more details about the NCS and the definitions of the key variables.

We examine several different margins of adult cigarette demand. To explore whether advertising effects the brand share of menthol cigarettes, we estimate a model of the probability a current smoker chooses a menthol versus a non-menthol brand. To explore possible market-expanding impacts of advertising we estimate the standard two part model of current smoking participation and, conditional upon participation, the number of cigarettes smoked per day. We also estimate a model of the probability a smoker reports a past-year quit attempt.

In our sample of adults over the age of 25 about 27 percent of smokers use menthol, compared to 31 percent in among adults aged 18-25. 18 percent of older adults and 23 percent of younger adults are current smokers. Smokers over 25 smoke more cigarettes per day than smokers aged 18-25 (18 cigarettes per day versus 13) and are less likely to have attempted to quit smoking in the past year (42 percent versus 46 percent). Figure 4 shows the trends in these adult smoking behaviors over our study period. Menthol use is fairly steady. Similar to the trend in

Figure 1, smoking participation and cigarettes smoked per day decline over our study period.⁹ The fraction attempting to quit smoking does not show a strong trend; the drop from 2003 to 2004 appears to be due to a change in survey design.¹⁰

We also estimate a model of teen anti-smoking sentiment. Anti-smoking sentiment is measured by agreement with the statement “People who smoke are stupid.”¹¹ Using measures of smoking attitudes as outcome variables is a well-established approach in public health research. Some previous research suggests that smoking attitudes are predictors of adolescent smoking behavior (e.g., Andrews and Duncan 1998, Flay et al. 1998). However, some recent research raises questions about the direction of causality between smoking attitudes and smoking behaviors (de Leeuw et al. 2008). But even with reverse causality between sentiment and smoking, our measure of anti-smoking sentiment can be viewed as a useful proxy for teen smoking.

In our sample about two-thirds of teens agree with an anti-smoking statement. Figure 5 shows a slight upward trend in anti-smoking sentiment over our study period.

We exploit the NCS data on magazine-reading habits to create a measure of each individual’s potential exposure to cigarette advertisements in magazines. The Kantar Media Intelligence data includes the date and other information about all cigarette magazine advertisements that appeared in popular magazines. We distinguish advertisements for menthol

⁹ The level and trend in smoking participation in Figure 3 do not match the national level and trend in Figure 1 because the NCS intentionally over-samples higher-income consumers. Our econometric models below control for consumer income and other demographics. Based on the discussion of Solon, Haider and Wooldridge (2014), we do not use sample weights in our analysis.

¹⁰ Beginning in 2004 the question about attempting to quit smoking was moved to a section of the survey about smoking cessation products such as nicotine gum.

¹¹ The 2000-2005 NCS Teens waves ask about the “smokers are stupid” question. The 1998 waves instead ask about agreement with the statement “Smoking should be banned in all public places.”

from non-menthol cigarettes when the product label contains “Menthol” or the advertisement is for one of the leading menthol brands (*Kool, Newport, and Salem*). We measure the individual’s potential exposure to the advertisements as the number of advertisements that appeared in magazines a respondent read over the past 12 months weighted by the frequency with which the respondent reads each magazine.

IV. Main Results

We first examine the relationship between exposure to menthol advertisements and demand for menthol versus non-menthol cigarettes, conditional on smoking. Table 2 reports the results for adults over the age of 25 and Table 3 reports the results for young adults age 18 – 25. Each Table reports the results of three specifications: a naïve model that does not include any control variables except indicators for survey wave; a model that includes controls for demographic characteristics; and our preferred specification that includes a set control variables for magazine-readership habits.

The results from the different specifications in Tables 2 and 3 demonstrate the importance of controlling for industry targeting of advertisements. The results are similar for older and younger adults. In the naïve specification, exposure to menthol advertisements is strongly positively associated with menthol use. At the same time, exposure to advertisements for non-menthol cigarettes is almost as strongly negatively associated with menthol use. Smokers in the highest menthol advertising exposure category are estimated to be about 30 percentage points more likely to use menthol cigarettes, i.e. about double the sample average. Smokers in the highest non-menthol exposure category are about 11 to 12 percent less likely to use menthol. The associations mainly disappear in the second specification that includes demographic controls. This pattern suggests that the associations in the naïve specification stem

from targeted advertising, where cigarette companies advertise in magazines with higher readerships of demographic groups who are already more likely to smoke menthol cigarettes.

To further explore the possible targeting of advertising, we estimate models of advertising exposure as functions of the demographic variables. The results (reported in the Appendix) show strong differences across demographic groups. Most notably, African-American smokers are 12 percentage points less likely to be in the zero menthol advertising exposure category and are 15 percentage points more likely to be in the highest menthol advertising exposure category.¹² In the Kantar data we verify that advertisements for menthol cigarettes appear disproportionately in a few magazines with high African-American readership. Over 10 percent of all menthol advertisements appeared in either *Ebony* or *Jet*, magazines read by about 30 percent of African-Americans in our sample but only 0.4 percent of whites. Manufacturers' apparent decisions to target menthol advertising reflect long-standing differences: the market share of menthol has been much higher among African-American smokers since at least the 1970s (DeCicca et al. 2014).

The results from the preferred specifications in Tables 2 and 3 provide no evidence that exposure to menthol advertisements increases the probability that smokers use menthol. The estimated coefficients on the indicators for different levels of exposure are small, fairly precisely estimated, and statistically insignificantly different from zero. Because this specification controls for the specific magazines each individual reads, identification relies on within-magazine variation over time in the number of cigarette advertisements. This variation is plausibly exogenous because it stems from the quasi-experimental supply-side variation created

¹² African-American smokers are not less likely to be in the zero non-menthol advertising exposure category and are only a little over 1 percentage point more likely to be in the highest non-menthol advertising exposure category.

by different cigarette manufacturers' different business strategies over the 2000s. Several recent studies use similar identification strategies to estimate the effects of advertising on health-related consumption choices (Avery et al. 2007, Avery et al. 2012, and Dave and Saffer 2013).

We next turn to explore the relationships between menthol advertising and additional margins of cigarette demand. The impact of advertising on youth smoking is of special concern. In Table 4 we report models that use a measure of whether the respondent agrees with an anti-smoking statement included in the 1998-2005 NCS Teens study. In the naïve specification there is a strong negative relationship between anti-smoking sentiment and exposure to menthol advertisements. While 65 percent of the sample agrees with the anti-smoking statement, teens in the two highest exposure categories are almost 12 percentage points less likely to agree. Similar to the patterns in Tables 2 and 3, the associations are weaker in the specification that includes demographic controls. The associations are essentially non-existent in the preferred specification that controls for magazine-reading.

Tables 5 and 6 present results from our preferred specification for additional margins of cigarette demand for older adults and younger adults, respectively. The smoking outcomes considered are: current smoking participation; the number of cigarettes smoked per day by current smokers; and whether or not a current smoker attempted to quit in the past year. The results provide no evidence that menthol advertising increases smoking or discourages quitting. In general the estimated coefficients on the exposure measures are relatively small and not statistically significantly different from zero. The results show some statistically significant associations between exposure to non-menthol advertisements and less smoking and more quit attempts. These patterns are surprising, but we note that most of the coefficients are relatively small.

The results for the other explanatory variables (not shown in Tables 5 and 6 but available upon request) are generally consistent with previous research on cigarette demand. Statistically significant demographics include sex, age, race/ethnicity, education and income. As in previous research, the associations between education and cigarette demand are particularly strong. Among adults over age 25, higher cigarette prices are associated with lower smoking participation, fewer cigarettes per day conditional on smoking, and a higher probability of making a quit attempt. Although the coefficients are not statistically significant at conventional levels, the implied elasticity of demand is about -0.12. Several recent studies find elasticities in this range or smaller.¹³

V. Additional Results

In empirical microeconomics it is important to explore whether estimates of causal treatment effects are credible and robust to alternative specifications, falsification exercises, and so on. In this section we carry out additional empirical exercises in the same spirit. First, we explore whether the results from our preferred specification might be due to insufficient variation in advertising exposure, i.e. whether our quasi-experiment lacks statistical power. Second, we explore the possibility of omitted variable bias towards zero.

In the preferred specification, the controls for magazine-reading reduce the extent of variation in advertising exposure. To explore the degree of the resulting multi-collinearity, we estimate auxiliary regressions of each advertising exposure measure as a function of the

¹³ The models include state fixed effects and the standard errors are clustered by state. The total elasticity of -0.12 is the sum of the participation elasticity (-0.075) and the conditional demand elasticity (-0.047). Our elasticity estimates are somewhat smaller than the average participation elasticity of -0.126 and the average conditional demand elasticity of -0.072 from Tauras (2006). Callison and Kaestner (2014, p. 158) discuss additional estimates and conclude that: “a relatively small number of studies have examined the association between tobacco taxes (prices) and adult smoking and these studies have not produced a consensus finding.” Callison and Kaestner’s empirical analysis finds very small or nonexistent price effects.

magazine-reading controls and the other explanatory variables. The R^2 s from the auxiliary regressions are around 0.75, implying that about 25 percent of variation remains as a source of identification. A common rule of thumb is that the implied variance inflation factor (VIF) above 10 indicates problematic multi-collinearity; in our models the VIFs are around 4. As a case study of the within-magazine variation in cigarettes over time, we examine *Sports Illustrated*, a major cigarette advertiser. The number of cigarette advertisements per year in the national edition of *Sports Illustrated* ranged from 0 to 149, with a median of 25. There is additional variation over time in cigarette advertising in the regional editions of *Sports Illustrated*. We interpret the multi-collinearity diagnostics and the case study as supportive evidence that the identifying variation in the preferred specification is sufficient to provide meaningful evidence about the impact of advertising on menthol use.

We consider several possible sources of omitted variable bias. During our study period there was a general trend towards less smoking. There were also various anti-smoking policy initiatives. Because advertising exposure was also trending downward, these influences might create a bias *away* from zero towards finding advertising effects. We explore several influences that might have moved in the opposite direction: coupon use; a proxy for exposure to point-of-sale advertising; and a proxy for exposure to internet advertising. We do not find that our measures are strongly associated with cigarette demand or that their omission tends to bias the advertising effects towards zero (results reported in the Appendix). Although this might be due to measurement error in the proxy variables, we note that our quasi-experimental design relies on identifying variation in advertising exposure that should be expected to be orthogonal to influences like these.

VI. Discussion

Our empirical results do not provide any evidence that menthol advertising in magazines affects cigarette demand at various margins: the probability of menthol use; smoking participation; the number of cigarettes smoked per day; the probability of a past-year quit attempt; and anti-smoking sentiment among teens. We find strong evidence that advertising manufacturers target their menthol advertising at certain demographic groups. We also find that failure to control for targeting yields misleading results: for example, we find that a strong association between teen anti-smoking sentiment and menthol advertising exposure disappears when we control for magazine-reading habits. This pattern suggests that manufacturers target menthol advertisements to appear in the magazines read by teens with more favorable attitudes towards smoking. Studies of advertising and cigarette demand need to use research designs that control for targeting and other sources of heterogeneity.

The 2009 TCA provides the FDA with authority to regulate menthol cigarette advertising if the regulation is “appropriate for public health... determined with respect to the risks and benefits to the population as a whole, including users and nonusers of the tobacco product...” Consistent with previous economic research that mainly fails to find a strong market-expanding impact of cigarette advertising in general, our results provide no evidence that menthol advertising in magazines harms public health through its effects on users or non-users. Although it might face First Amendment challenges, the FDA could issue a rule that bans menthol cigarette advertising in magazines. Because advertising can be expected to have diminishing marginal productivity, previous econometric estimates that advertising has a small or zero effect at the margin do not rule out much a larger effect from such a non-marginal change. However, zero exposure to menthol advertising is well within the range of our data. Our estimates that

menthol advertising has small or zero effects should be relevant for analysis of a range of regulatory approaches up to and including a ban of magazine advertisements.

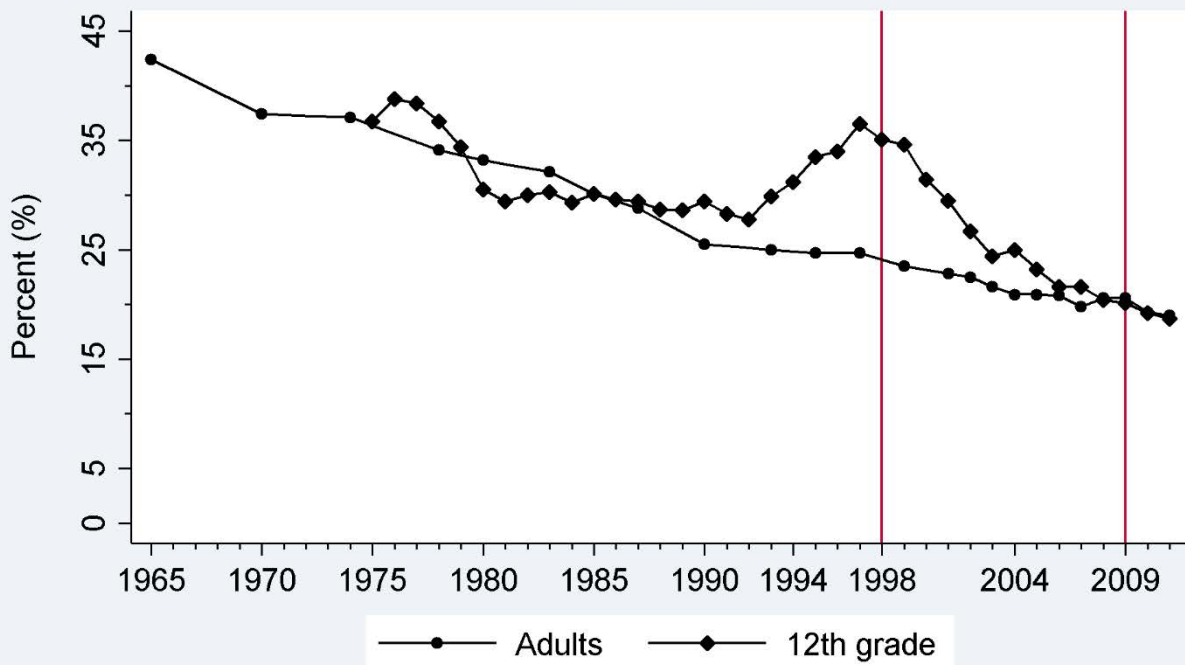
Our study's limitations suggest caveats for the policy implications. We lack data on teen smoking behaviors so we are unable to directly examine advertising effects on this very important group of users and non-users. However, we are able to examine teens' anti-smoking sentiment, which other research shows proxies for current smoking and predicts future smoking. We are also able to examine the effects of menthol advertising on cigarette demand by young adults age 18 – 24. Although the teenage years are a critical period for smoking initiation, both initiation and cessation are also common in early adulthood. In longitudinal data, DeCicca, Kenkel and Mathios (2008) find that about 13 percent of age-18 non-smokers initiated smoking by age 26, while about one-third of age-18 smokers had quit by age 26. Our results do not provide any evidence that menthol advertising affects similar transitions in our sample of younger adults. In addition to lacking data on teen smoking, we note several other limitations to the scope of our analysis. We cannot address the longer-run effects of magazine advertising over many years. We also cannot address the effects of other types of cigarette advertising and promotional efforts.

Beyond the implications for public health and FDA regulatory policy, our results and previous research might seem to pose a puzzle for the economics of cigarette advertising. If advertising does not expand the cigarette market, why do cigarette manufacturers spend millions of dollars to advertise in magazines? One possible explanation is that manufacturers advertise to increase their brand's share of an essentially fixed-size market. If cigarette advertising is the non-cooperative outcome of a Prisoner's Dilemma-type game, regulations do not hurt and could even improve industry profits. Consistent with this possibility, Bulow and Klemperer (1998, p. 368)

observe that when negotiating the 1998 MSA the cigarette manufactures “agreed to give up [the advertising images] Joe Camel and the Marlboro Man after the very first day of meetings.” This possibility might also explain why a few years after the MSA Philip Morris and RJR decided to stop advertising in magazines. Lorillard faced possibly different incentives to continue to advertise because its market share was about eight percent, compared to Philip Morris’ 48 percent share and RJR’s 25 percent share (USDHHS 2000, p. 307). An interesting direction for future work is to develop and test this explanation more formally.

FIGURE 1 Cigarette Smoking Prevalence

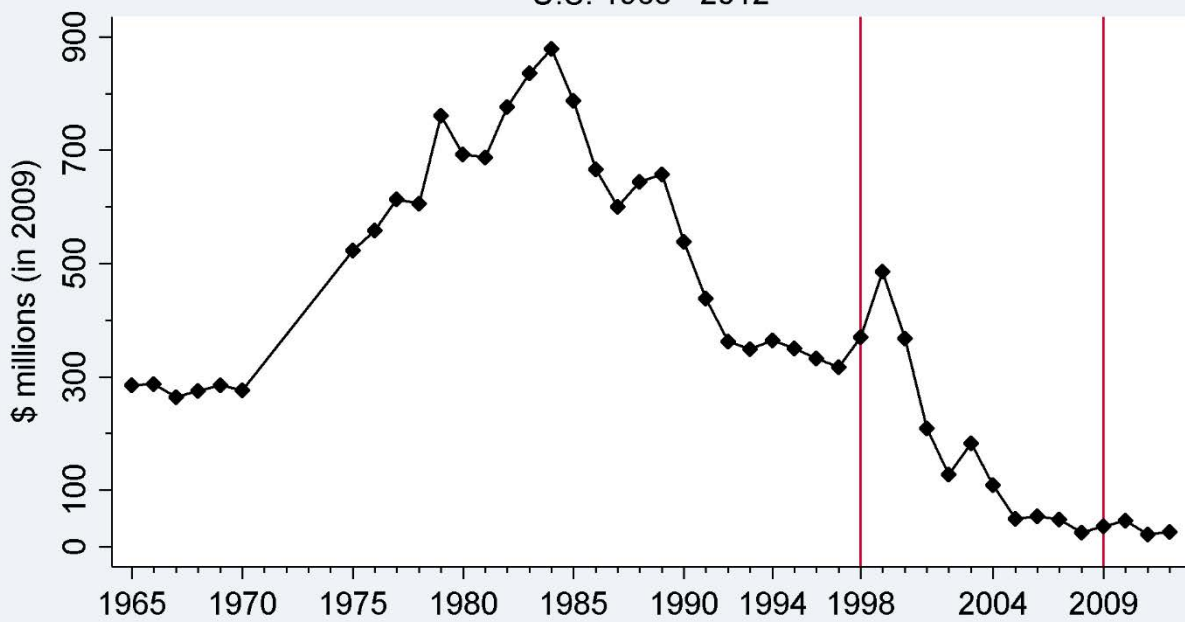
U.S. 1965 - 2011



SOURCE: CDC estimates & MTF data.

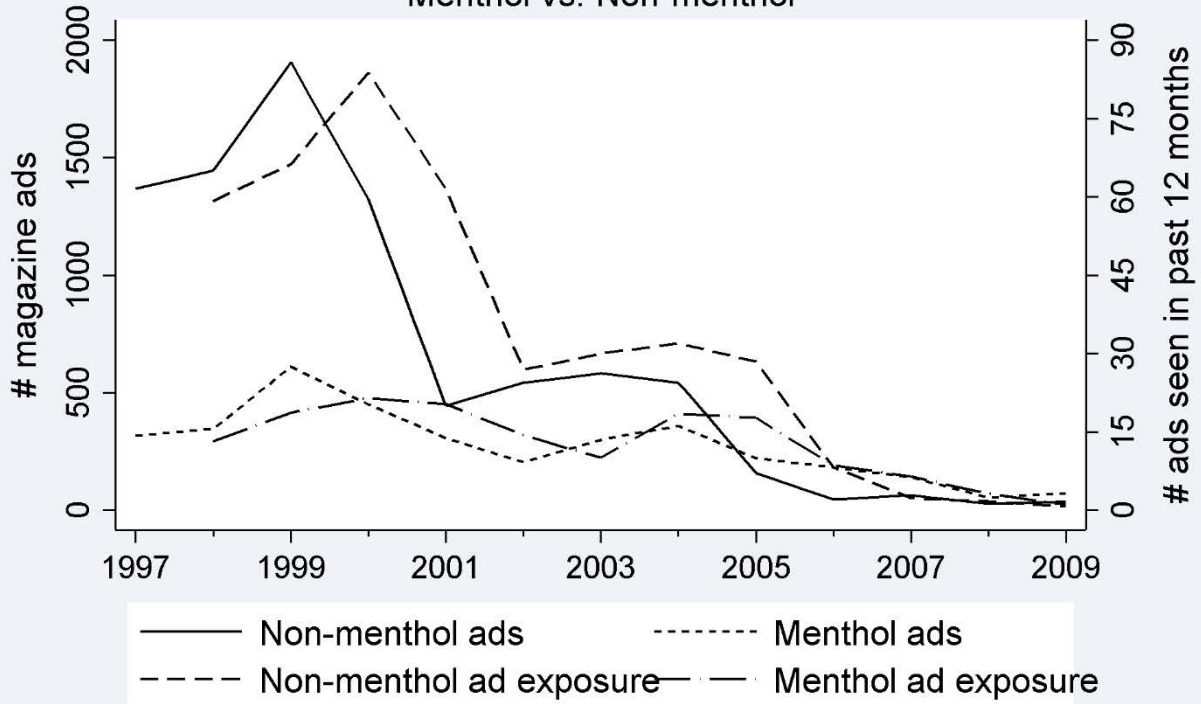
NOTE: Vertical lines indicate the study period (1998-2009).

FIGURE 2 Magazine Cigarette Advertising Expenditures
U.S. 1965 - 2012



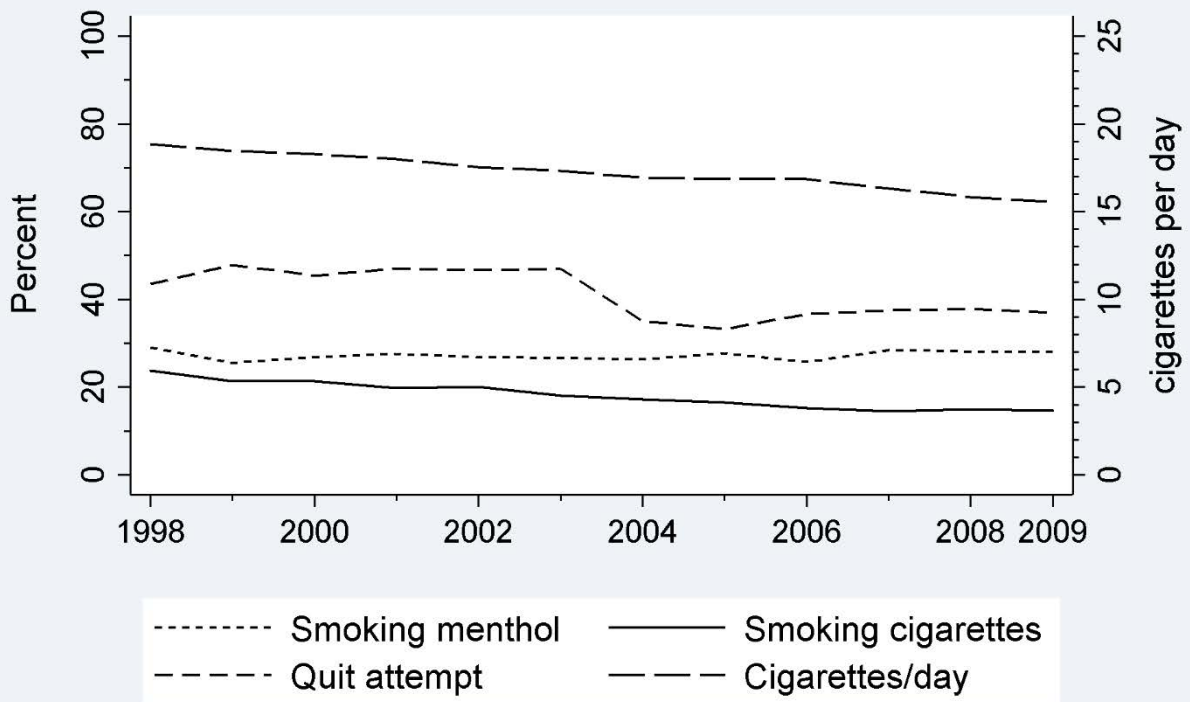
SOURCE: FTC Cigarette report for 2012 (2015).
NOTES: Vertical lines indicate the study period (1998-2009);
expenditures before 1970 include newspaper advertising.

FIGURE 3 Cigarette Ads & Ad Exposure
Menthol vs. Non-menthol



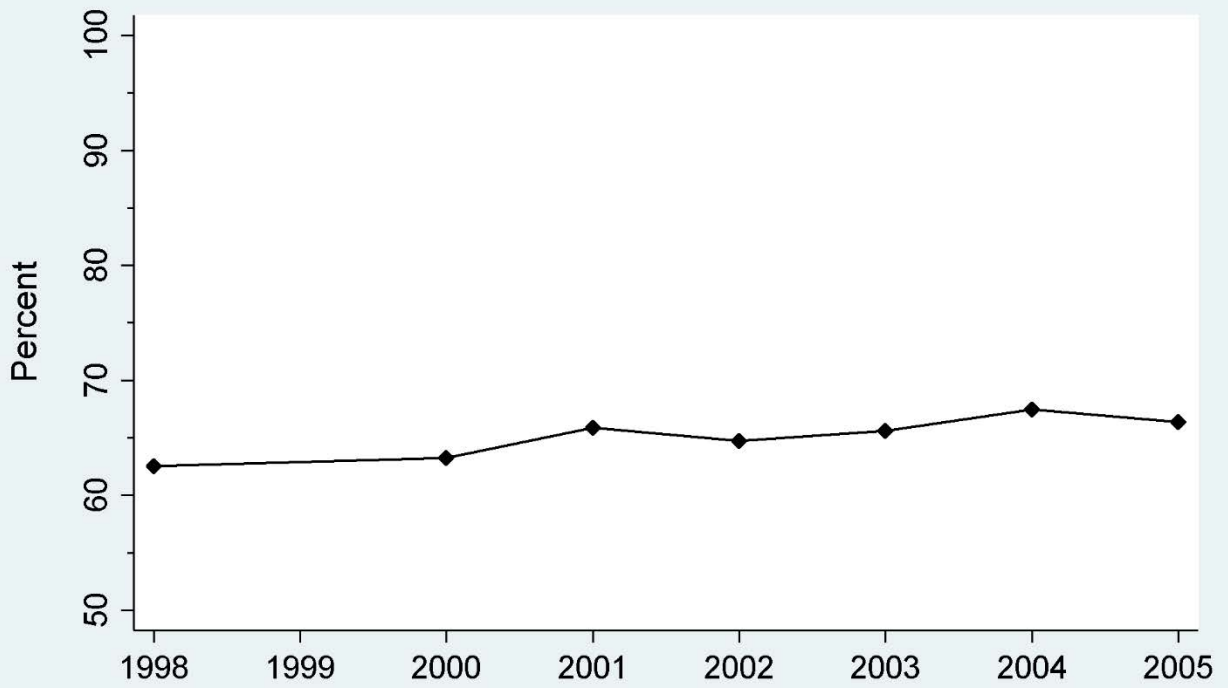
SOURCE: Data from Kantar Media & NCS Adults Studies.

FIGURE 4 Smoking Behaviors



SOURCE: Data from NCS Adults Studies.

FIGURE 5 Teens with Anti-smoking Attitude



SOURCE: Data from NCS Teens Studies.

Table 1. Descriptive Statistics for Key Variables Used in Analysis

	Teens	Age 18-24	Age >=25
Agree with anti-smoking sentiment	0.65		
Smoke menthol cigs most often		0.31	0.27
Smoke cigarettes		0.23	0.18
Cigarettes smoked per day		13.2	17.9
Attempted to quit in past 12m		0.46	0.42
<i>Menthol ads seen in past 12m:</i>			
0 to less than 1	0.29	0.24	0.34
1 to less than 16	0.37	0.38	0.39
16 to less than 31	0.15	0.18	0.15
31 to less than 46	0.082	0.088	0.062
46 to less than 61	0.042	0.047	0.025
61 or more	0.063	0.066	0.028
<i>Non-menthol ads seen in past 12m:</i>			
0 to less than 1	0.23	0.22	0.30
1 to less than 16	0.19	0.25	0.24
16 to less than 31	0.14	0.12	0.11
31 to less than 46	0.099	0.085	0.082
46 to less than 61	0.064	0.067	0.068
61 or more	0.28	0.26	0.19
Observations	14,361	16,455	198,686

Table 2. Advertising and the Probability of Menthol Use (ages 25+)

	1	2	3
<u>Menthol ads seen in past</u>			
<u>12m:</u>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	0.07025*** (0.00853)	0.01826* (0.00830)	0.01520 (0.00852)
16 to less than 31	0.11843*** (0.01111)	0.02534* (0.01089)	0.01271 (0.01200)
31 to less than 46	0.15735*** (0.01385)	0.02699* (0.01366)	0.00746 (0.01556)
46 to less than 61	0.19181*** (0.01742)	0.02652 (0.01719)	-0.00574 (0.01985)
61 to less than 2000	0.30387*** (0.01619)	0.04675** (0.01661)	-0.02062 (0.02338)
<u>Non-menthol ads seen in past</u>			
<u>12m:</u>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	-0.03464*** (0.00893)	-0.00346 (0.00864)	-0.01114 (0.00882)
16 to less than 31	-0.05614*** (0.01167)	-0.00854 (0.01132)	-0.01809 (0.01164)
31 to less than 46	-0.06969*** (0.01263)	-0.01664 (0.01226)	-0.02562* (0.01274)
46 to less than 61	-0.06988*** (0.01366)	-0.00141 (0.01328)	-0.01311 (0.01389)
61 to less than 2000	-0.10953*** (0.01300)	-0.00740 (0.01280)	-0.01433 (0.01431)
Control for:			
Survey waves	Yes	Yes	Yes
Individual demographics		Yes	Yes
Magazine readership			Yes
Obs	35,447	35,447	35,447
Adj R-squared	0.012	0.083	0.086
Dep Var Mean	0.27	0.27	0.27

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

The demographics in the models in columns 2 and 3 include age, sex, race/ethnicity, education, marital status, employment status, household income, region, county size, and Designated Market Area size.

Table 3. Advertising and the Probability of Menthol Use (ages 18-24)

	1	2	3
<u>Menthol ads seen in past 12m:</u>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	0.06145 (0.03414)	0.03218 (0.03338)	0.01206 (0.03423)
16 to less than 31	0.10639** (0.04067)	0.04236 (0.04000)	0.01211 (0.04308)
31 to less than 46	0.16304*** (0.04665)	0.07443 (0.04603)	0.04203 (0.05196)
46 to less than 61	0.18710*** (0.05304)	0.09413 (0.05228)	0.06646 (0.06133)
61 or more	0.29156*** (0.05012)	0.15515** (0.05015)	0.10551 (0.06890)
<u>Non-menthol ads seen in past 12m:</u>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	-0.03236 (0.03546)	-0.01315 (0.03462)	0.00035 (0.03553)
16 to less than 31	-0.05757 (0.04350)	-0.02219 (0.04256)	0.00725 (0.04454)
31 to less than 46	0.00082 (0.04652)	0.03326 (0.04546)	0.06824 (0.04767)
46 to less than 61	-0.10957* (0.04869)	-0.05951 (0.04767)	-0.02839 (0.05039)
61 or more	-0.12604** (0.04807)	-0.04800 (0.04733)	0.00731 (0.05192)
Control for:			
Survey waves	Yes	Yes	Yes
Individual demographics		Yes	Yes
Magazine readership			Yes
Obs	3,708	3,708	3,708
Adj R-squared	0.030	0.087	0.112
Dep Var Mean	0.31	0.31	0.31

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

The demographics in the models in columns 2 and 3 include age, sex, race/ethnicity, education, marital status, employment status, household income, region, county size, and Designated Market Area size.

Table 4. Advertising Exposure and Teens' Agreement with Anti-smoking Sentiment

	1	2	3
<i>Menthol ads seen in past 12m:</i>			
<i>0 to less than 1(omitted)</i>			
1 to less than 16	-0.02186 (0.01641)	-0.00780 (0.01642)	-0.00415 (0.01688)
16 to less than 31	-0.04834* (0.02047)	-0.01380 (0.02082)	0.00941 (0.02253)
31 to less than 46	-0.07283** (0.02337)	-0.02981 (0.02393)	0.00254 (0.02680)
46 to less than 61	-0.11763*** (0.02772)	-0.07200* (0.02841)	-0.03315 (0.03251)
61 and more	-0.11526*** (0.02553)	-0.04912 (0.02712)	0.00256 (0.03793)
<i>Non-menthol ads seen in past 12m:</i>			
<i>0 to less than 1(omitted)</i>			
1 to less than 16	0.00750 (0.01642)	0.01271 (0.01635)	0.00906 (0.01679)
16 to less than 31	0.03991 (0.02064)	0.03362 (0.02064)	0.01661 (0.02180)
31 to less than 46	0.02304 (0.02211)	0.01386 (0.02216)	-0.00880 (0.02396)
46 to less than 61	0.03760 (0.02454)	0.02817 (0.02466)	-0.00154 (0.02691)
61 and more	0.01928 (0.02358)	0.00142 (0.02414)	-0.04031 (0.02818)
Control for:			
Survey waves	Yes	Yes	Yes
Individual demographics		Yes	Yes
Magazine readership			Yes
Obs	14,361	14,361	14,361
Adj R-squared	0.005	0.025	0.034
Dep Var Mean	0.65	0.65	0.65

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

The demographics in the models in columns 2 and 3 include age, sex, race/ethnicity, household income, region, county size, and Designated Market Area size.

Table 5. Advertising Exposure and Smoking Participation, Cigarettes per Day, and Quit Attempts (ages 25+)

	Smoking participation	Cigarettes per day	Quit attempt
<i>Menthol ads seen in past 12m:</i>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	0.00471 (0.00290)	-0.30074 (0.19281)	0.00264 (0.00930)
16 to less than 31	0.00762 (0.00427)	-0.41766 (0.27157)	-0.00153 (0.01315)
31 to less than 46	0.00145 (0.00565)	-0.75891* (0.35210)	0.00779 (0.01705)
46 to less than 61	0.00181 (0.00745)	-0.36259 (0.44925)	0.00007 (0.02174)
61 or more	0.00105 (0.00893)	-0.44391 (0.52901)	-0.02961 (0.02573)
<i>Non-menthol ads seen in past 12m:</i>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	-0.01449*** (0.00307)	-0.46284* (0.19949)	0.04281*** (0.00963)
16 to less than 31	-0.01855*** (0.00413)	-0.52056* (0.26335)	0.04710*** (0.01272)
31 to less than 46	-0.01095* (0.00459)	-0.42768 (0.28831)	0.03554* (0.01394)
46 to less than 61	-0.02070*** (0.00499)	-0.33321 (0.31424)	0.03041* (0.01519)
61 or more	-0.01879*** (0.00517)	-0.69240* (0.32387)	0.04788** (0.01566)
Obs	198,686	35,447	39,115
Adj R-squared	0.099	0.104	0.027
Dep Var Mean	0.18	17.86	0.42

Notes: Regressions control for survey waves, individual demographics (age, sex, race/ethnicity, education, marital status, employment status, household income, region, county size, and Designated Market Area size), cigarette price, and magazine-readership indicators.

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 6. Advertising Exposure and Smoking Participation, Cigarettes per Day, and Quit Attempts (ages 18 – 24)

	Smoking participation	Cigarettes per day	Quit attempt
<i>Menthol ads seen in past 12m:</i>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	0.00298 (0.01289)	0.30220 (0.65504)	-0.00291 (0.03644)
16 to less than 31	0.00589 (0.01704)	-0.14371 (0.82434)	-0.01347 (0.04606)
31 to less than 46	-0.00915 (0.02092)	-0.21814 (0.99423)	0.00753 (0.05561)
46 to less than 61	-0.03494 (0.02494)	-0.78252 (1.17343)	0.00663 (0.06499)
61 or more	-0.04224 (0.02837)	-0.49812 (1.31827)	-0.00136 (0.07341)
<i>Non-menthol ads seen in past 12m:</i>			
<i>0 to less than 1 (omitted)</i>			
1 to less than 16	0.00100 (0.01330)	-0.24140 (0.67987)	0.07202 (0.03773)
16 to less than 31	-0.00602 (0.01714)	-0.01144 (0.85231)	0.00210 (0.04751)
31 to less than 46	0.01186 (0.01883)	0.66335 (0.91214)	0.09607 (0.05074)
46 to less than 61	0.02358 (0.02036)	0.21856 (0.96409)	0.05644 (0.05374)
61 or more	0.01584 (0.02074)	0.23924 (0.99347)	0.06866 (0.05516)
Obs	16,455	3,708	3,982
Adj R-squared	0.119	0.088	0.054
Dep Var Mean	0.23	13.25	0.46

Notes: Regressions control for survey waves, individual demographics (age, sex, race/ethnicity, education, marital status, employment status, household income, region, county size, and Designated Market Area size), cigarette price, and magazine-readership indicators.

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

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Appendix

NCS Data and Definitions of Key Variables

The NCS sample, drawn independently each wave, is a multistage stratified probability sample representative of all adults 18 years of age or older living in households in the 48 contiguous states in the United States (excluding Hawaii and Alaska). In the course of recruiting NCS respondents, all teenagers age 12-17 in the household were identified and invited to participate in the NCS Teens Study. Because the NCS is a marketing survey, higher-income households are intentionally over-sampled. We restrict the sample to non-Hispanics as the NCS began to over-sample Hispanics in 2004, about the middle of our study period.

We use four measures of smoking behavior as dependent variables in our analysis. We measure smoking participation based on the question: “Do you currently smoke cigarettes?” We measure menthol use based on answers to a question about types of cigarettes smokers smoke most often. Menthol use indicates if a smoker reports any type of menthol cigarettes including “menthol”, “lights 100s menthol”, “lights, menthol”, “king size menthol”, and “100s menthol.” The NCS survey asks smokers the average number of cigarettes they smoke each day in six groups: 40 or more, 30-39, 20-29, 10-19, 5-9 and less than 5. We take the mid-point of each group (40 for the highest group): 40, 35, 25, 15, 7.5, or 2.5 as the value for the amount of cigarettes smoked daily. The quit attempt variable is based on answers to the question: “Have you tried to stop smoking in the last 12 months?”

Our key explanatory variables indicate the individual’s potential exposure to menthol and non-menthol advertisements in magazines. We measure exposure as the number of advertisements that appeared in magazines a respondent reports having read over the past 12 months, weighted by the frequency with which the respondent reads each magazine. The weights are based on respondent’s reports for each magazine of the average number of issues read or looked into out of the last four issues.

All of our models include the following demographics: age, sex, race/ethnicity, education, marital status, employment status, household income, region, county size, and the size of the respondent’s Designated Market Area (media market, roughly comparable to a Metropolitan Statistical Area). We also include a measure of the average price of cigarettes (from the *Tax Burden on Tobacco*) in the respondent’s state of residence.

Our preferred specification includes controls for the frequency with which the respondent reads each of 98 consumer magazines.

Additional Results

To explore the targeting of advertisements, Appendix Table 1 presents models of advertising exposure as functions of the demographic variables.

Appendix Tables 2 and 3 present models of cigarette demand that include additional explanatory variables: a measure of cigarette coupon use; the number of times shopped at convenience stores in the last four weeks (as a proxy for exposure to point-of-sale cigarette advertising); and indicators of the level of internet use (as a proxy for exposure to internet cigarette advertising). These variables are only available for 2003-2009. Our main analysis uses data from 1998-2009 to preserve sample size and exploit as much variation in magazine advertising as possible.

Appendix Table 1A Menthol Ads Seen in Past 12 Months among Younger Adults (age 18-24)

	0 to less than 1	1 to less than 16	16 to less than 31	31 to less than 46	46 to less than 61	61 or more
Age=19	0.00201 (0.01131)	0.00917 (0.01348)	-0.01716 (0.01069)	-0.00771 (0.00794)	0.00720 (0.00597)	0.00649 (0.00676)
Age=20	0.00465 (0.01153)	0.01447 (0.01374)	-0.01249 (0.01089)	-0.01127 (0.00809)	-0.00616 (0.00608)	0.01080 (0.00689)
Age=21	-0.01848 (0.01155)	0.02518 (0.01377)	-0.00760 (0.01091)	-0.01309 (0.00811)	0.00385 (0.00609)	0.01013 (0.00691)
Age=23	-0.00380 (0.00997)	0.01341 (0.01189)	-0.00895 (0.00942)	-0.00807 (0.00700)	-0.00265 (0.00526)	0.01006 (0.00596)
Female	-0.12138*** (0.00635)	0.02572*** (0.00757)	0.04147*** (0.00600)	0.02431*** (0.00446)	0.01433*** (0.00335)	0.01555*** (0.00380)
Black	-0.06842*** (0.01064)	-0.12963*** (0.01268)	-0.00313 (0.01005)	0.01873* (0.00747)	0.03524*** (0.00561)	0.14721*** (0.00636)
Asian	0.06718*** (0.01490)	0.01766 (0.01777)	-0.04650*** (0.01408)	-0.02847** (0.01046)	-0.00899 (0.00786)	-0.00087 (0.00891)
Other race	0.01417 (0.01705)	-0.03047 (0.02032)	-0.00482 (0.01611)	-0.01492 (0.01197)	0.00840 (0.00899)	0.02764** (0.01019)
Divorce/separate/widow	-0.02336 (0.02447)	-0.02429 (0.02916)	0.00236 (0.02312)	0.00213 (0.01717)	0.02885* (0.01290)	0.01430 (0.01463)
Never married	-0.06345*** (0.01022)	-0.04070** (0.01218)	0.02142* (0.00966)	0.02828*** (0.00717)	0.02328*** (0.00539)	0.03118*** (0.00611)
High school	-0.02993** (0.01076)	0.01046 (0.01282)	0.00279 (0.01017)	0.01307 (0.00755)	0.00260 (0.00567)	0.00101 (0.00643)
Some college	-0.06876*** (0.01086)	0.01852 (0.01295)	0.01489 (0.01026)	0.02742*** (0.00762)	0.00596 (0.00573)	0.00197 (0.00649)
College	-0.06910*** (0.01348)	0.04592** (0.01607)	0.01057 (0.01274)	0.02273* (0.00946)	0.00381 (0.00711)	-0.01394 (0.00806)
Unemployed	-0.00881 (0.01100)	0.01519 (0.01312)	0.00240 (0.01040)	-0.00202 (0.00772)	-0.00590 (0.00580)	-0.00086 (0.00658)
Not in labor force	0.03491*** (0.00813)	0.00353 (0.00969)	-0.01322 (0.00768)	-0.00704 (0.00571)	-0.00672 (0.00429)	-0.01145* (0.00486)
HH income: 20-35k	-0.03155 (0.01699)	0.02115 (0.02025)	0.00799 (0.01606)	-0.00900 (0.01193)	0.00750 (0.00896)	0.00392 (0.01016)
HH income: 35-50k	-0.04600** (0.01657)	0.02911 (0.01975)	0.02265 (0.01566)	-0.01886 (0.01163)	0.00896 (0.00874)	0.00414 (0.00991)
HH income: 50-75k	-0.04075** (0.01522)	0.01762 (0.01815)	0.02086 (0.01439)	-0.00742 (0.01069)	0.00893 (0.00803)	0.00075 (0.00910)
HH income: 75k+	-0.04284** (0.01392)	0.02193 (0.01659)	0.00839 (0.01315)	-0.00654 (0.00977)	0.01374 (0.00734)	0.00533 (0.00832)
Midwest	-0.02091* (0.00976)	0.00563 (0.01164)	0.00234 (0.00922)	0.01042 (0.00685)	0.00562 (0.00515)	-0.00310 (0.00584)
South	0.01763 (0.00997)	0.01594 (0.01188)	-0.01221 (0.00942)	-0.01596* (0.00700)	0.00294 (0.00526)	-0.00834 (0.00596)
West	0.02457* (0.01034)	-0.00124 (0.01233)	-0.00866 (0.00978)	-0.00027 (0.00726)	-0.00236 (0.00546)	-0.01203 (0.00619)
County size B	-0.00873 (0.01198)	0.00008 (0.01428)	0.00961 (0.01132)	-0.00501 (0.00841)	0.00779 (0.00632)	-0.00373 (0.00716)
County size C	-0.01140 (0.01376)	0.00470 (0.01641)	0.01875 (0.01301)	-0.00634 (0.00966)	0.01010 (0.00726)	-0.01580 (0.00823)
County size D	0.00130 (0.01468)	0.00139 (0.01750)	0.00503 (0.01388)	0.00218 (0.01031)	0.01533* (0.00774)	-0.02524** (0.00878)
Top DMA: 26-50	0.01378 (0.01066)	-0.00740 (0.01270)	-0.00777 (0.01007)	0.00602 (0.00748)	-0.00590 (0.00562)	0.00126 (0.00637)
Top DMA: 1-5	0.01803 (0.01089)	-0.00455 (0.01298)	-0.00021 (0.01029)	0.00054 (0.00765)	-0.00572 (0.00575)	-0.00808 (0.00651)
Top DMA: 6-10	0.02757 (0.01522)	0.00293 (0.01814)	0.00374 (0.01438)	-0.00237 (0.01068)	-0.02233** (0.00803)	-0.00954 (0.00910)
Top DMA: 11-25	0.04840** (0.01672)	0.01254 (0.01994)	-0.01733 (0.01580)	-0.01933 (0.01174)	-0.01055 (0.00882)	-0.01374 (0.01000)

Top DMA: unknown	0.04064*	0.02671	-0.01587	-0.01985	-0.02746**	-0.00417
	(0.01592)	(0.01897)	(0.01504)	(0.01117)	(0.00839)	(0.00952)
Constant	0.37334***	0.41196***	0.17208***	0.05564**	-0.01126	-0.00177
	(0.02600)	(0.03099)	(0.02457)	(0.01825)	(0.01371)	(0.01555)
Obs	16,455	16,455	16,455	16,455	16,455	16,455
Adj R-squared	0.139	0.041	0.030	0.029	0.023	0.084
Dep Var Mean	0.24	0.38	0.18	0.09	0.05	0.07

NOTE: Models control for survey wave indicators. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 1B Menthol Ads Seen in Past 12 Months among Older Adults (age >= 25)

	0 to less than 1	1 to less than 16	16 to less than 31	31 to less than 46	46 to less than 61	61 or more
Age25-34	-0.03658*** (0.00397)	0.01503*** (0.00436)	-0.00226 (0.00321)	0.00641** (0.00216)	0.00636*** (0.00141)	0.01103*** (0.00144)
Age35-44	-0.03094*** (0.00352)	0.01679*** (0.00386)	-0.00338 (0.00284)	0.00578** (0.00191)	0.00422*** (0.00125)	0.00753*** (0.00128)
Age45-54	-0.01811*** (0.00341)	0.01107** (0.00374)	-0.00523 (0.00276)	0.00370* (0.00185)	0.00299* (0.00121)	0.00558*** (0.00124)
Age55-64	-0.00611 (0.00326)	0.00582 (0.00358)	-0.00244 (0.00264)	0.00127 (0.00177)	-0.00009 (0.00116)	0.00155 (0.00118)
Age65-77	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)
Female	-0.07679*** (0.00202)	0.02791*** (0.00222)	0.02633*** (0.00163)	0.00984*** (0.00110)	0.00667*** (0.00072)	0.00604*** (0.00073)
Black	-0.12374*** (0.00394)	-0.10953*** (0.00432)	0.00367 (0.00319)	0.03694*** (0.00214)	0.04570*** (0.00140)	0.14695*** (0.00143)
Asian	0.08643*** (0.00593)	-0.01187 (0.00651)	-0.04358*** (0.00480)	-0.02439*** (0.00322)	-0.00660** (0.00211)	0.00002 (0.00215)
Other race	0.02043** (0.00768)	-0.04057*** (0.00842)	-0.01761** (0.00621)	0.00537 (0.00417)	0.00457 (0.00273)	0.02780*** (0.00279)
Divorce/separate/widow	-0.02126*** (0.00274)	-0.00246 (0.00300)	0.00475* (0.00221)	0.00645*** (0.00149)	0.00492*** (0.00097)	0.00760*** (0.00099)
Never married	-0.03799*** (0.00352)	-0.01416*** (0.00386)	0.01399*** (0.00285)	0.01203*** (0.00191)	0.01017*** (0.00125)	0.01597*** (0.00128)
High school	-0.07461*** (0.00381)	0.02663*** (0.00418)	0.02491*** (0.00308)	0.01266*** (0.00207)	0.00537*** (0.00135)	0.00504*** (0.00138)
Some college	-0.12120*** (0.00395)	0.05338*** (0.00433)	0.03395*** (0.00319)	0.01804*** (0.00215)	0.00840*** (0.00140)	0.00743*** (0.00143)
College	-0.13236*** (0.00393)	0.08620*** (0.00431)	0.02514*** (0.00318)	0.01366*** (0.00214)	0.00485*** (0.00140)	0.00250 (0.00143)
Unemployed	-0.01668** (0.00581)	0.00532 (0.00637)	0.00385 (0.00469)	0.00220 (0.00316)	0.00192 (0.00206)	0.00339 (0.00211)
Not in labor force	0.00190 (0.00261)	0.00339 (0.00286)	0.00079 (0.00211)	-0.00176 (0.00142)	-0.00128 (0.00093)	-0.00305** (0.00095)
HH income: 20-35k	-0.02775*** (0.00508)	0.00802 (0.00557)	0.00931* (0.00411)	0.00399 (0.00276)	0.00106 (0.00180)	0.00537* (0.00184)
HH income: 35-50k	-0.03424*** (0.00505)	0.00955 (0.00554)	0.00930* (0.00409)	0.00514 (0.00275)	0.00347 (0.00179)	0.00679*** (0.00184)
HH income: 50-75k	-0.04833*** (0.00478)	0.01259* (0.00524)	0.01439*** (0.00386)	0.00891*** (0.00260)	0.00452** (0.00170)	0.00792*** (0.00174)
HH income: 75k+	-0.06518*** (0.00468)	0.01595** (0.00514)	0.02351*** (0.00379)	0.01121*** (0.00255)	0.00649*** (0.00166)	0.00803*** (0.00170)
Midwest	-0.02501*** (0.00307)	-0.00347 (0.00337)	0.01636*** (0.00248)	0.00697*** (0.00167)	0.00270* (0.00109)	0.00245* (0.00112)
South	0.01672*** (0.00310)	0.00354 (0.00340)	-0.01112*** (0.00250)	-0.00562*** (0.00168)	-0.00213 (0.00110)	-0.00139 (0.00112)
West	0.00679* (0.00326)	0.00549 (0.00358)	-0.00044 (0.00264)	-0.00472** (0.00177)	-0.00328** (0.00116)	-0.00385** (0.00119)
County size B	-0.01417*** (0.00376)	-0.01058* (0.00413)	0.01418*** (0.00304)	0.00833*** (0.00204)	0.00205 (0.00134)	0.00019 (0.00137)
County size C	-0.01655*** (0.00436)	-0.00145 (0.00478)	0.01704*** (0.00352)	0.00316 (0.00237)	0.00121 (0.00155)	-0.00340* (0.00158)
County size D	0.04687*** (0.00450)	-0.02045*** (0.00493)	-0.01148** (0.00364)	-0.00762** (0.00245)	-0.00262 (0.00160)	-0.00469** (0.00163)
Top DMA: 26-50	0.03046*** (0.00333)	0.00134 (0.00365)	-0.01145*** (0.00269)	-0.00520** (0.00181)	-0.00647*** (0.00118)	- (0.00121)
Top DMA: 1-5	0.03208*** (0.00341)	0.00991** (0.00374)	-0.01047*** (0.00276)	-0.01221*** (0.00186)	-0.00774*** (0.00121)	- (0.00124)
						0.00868*** (0.001158)***

Top DMA: 6-10	0.05260 ^{***}	0.02305 ^{***}	-0.02482 ^{***}	-0.02315 ^{***}	-0.01395 ^{***}	-
	(0.00478)	(0.00525)	(0.00387)	(0.00260)	(0.00170)	0.01373 ^{***}
Top DMA: 11-25	0.05090 ^{**}	-0.00023	-0.01817 ^{***}	-0.01328 ^{**}	-0.00913 ^{***}	-
	(0.00520)	(0.00570)	(0.00420)	(0.00283)	(0.00185)	0.01009 ^{***}
Top DMA: unknown	0.04022 ^{***}	0.00531	-0.01240 [*]	-0.01180 ^{**}	-0.00896 ^{***}	-
	(0.00500)	(0.00548)	(0.00404)	(0.00272)	(0.00178)	0.01237 ^{***}
Constant	0.44736 ^{***}	0.38094 ^{**}	0.11541 ^{***}	0.03453 ^{***}	0.01259 ^{***}	(0.00182)
	(0.00799)	(0.00876)	(0.00646)	(0.00434)	(0.00284)	0.00917 ^{**}
Obs	198,686	198,686	198,686	198,686	198,686	198,686
Adj R-squared	0.157	0.048	0.050	0.038	0.024	0.079
Dep Var Mean	0.34	0.39	0.15	0.06	0.03	0.03

NOTE: Models control for survey wave indicators. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 1C Non-menthol Ads Seen in Past 12 Months among Younger Adults (age 18-24)

	0 to less than 1	1 to less than 16	16 to less than 31	31 to less than 46	46 to less than 61	61 or more
Age=19	0.01261 (0.01053)	-0.00033 (0.01142)	-0.00099 (0.00893)	-0.00309 (0.00778)	-0.01043 (0.00701)	0.00222 (0.01078)
Age=20	0.01280 (0.01073)	-0.00317 (0.01163)	0.00123 (0.00910)	0.00546 (0.00793)	-0.00332 (0.00714)	-0.01300 (0.01098)
Age=21	-0.00817 (0.01076)	-0.00162 (0.01166)	0.00905 (0.00911)	0.00949 (0.00795)	-0.00574 (0.00716)	-0.00302 (0.01100)
Age=23	0.00604 (0.00929)	-0.01139 (0.01007)	0.00817 (0.00787)	0.00173 (0.00686)	-0.00404 (0.00618)	-0.00052 (0.00950)
Female	-0.08209*** (0.00591)	0.02518*** (0.00641)	0.00398 (0.00501)	0.00634 (0.00437)	0.00412 (0.00394)	0.04247*** (0.00605)
Black	0.01392 (0.00991)	0.00226 (0.01074)	0.00977 (0.00840)	-0.00531 (0.00732)	-0.01055 (0.00659)	-0.01009 (0.01014)
Asian	0.07283*** (0.01388)	0.00335 (0.01504)	-0.01155 (0.01176)	-0.00292 (0.01026)	-0.01878* (0.00924)	-0.04293** (0.01420)
Other race	0.00090 (0.01588)	0.00554 (0.01721)	0.00371 (0.01345)	-0.01358 (0.01173)	-0.00187 (0.01057)	0.00530 (0.01624)
Divorce/separate/widow	-0.00299 (0.02278)	-0.01290 (0.02470)	0.00349 (0.01931)	-0.02925 (0.01683)	-0.00376 (0.01517)	0.04543 (0.02331)
Never married	-0.04777*** (0.00952)	-0.02471* (0.01032)	0.00607 (0.00807)	-0.00689 (0.00703)	0.01043 (0.00633)	0.06287*** (0.00974)
High school	-0.02909** (0.01002)	0.02112 (0.01086)	0.00739 (0.00849)	-0.01172 (0.00740)	-0.01437* (0.00667)	0.02667** (0.01025)
Some college	-0.06404*** (0.01012)	0.01677 (0.01096)	0.00787 (0.00857)	-0.00387 (0.00747)	-0.00546 (0.00673)	0.04872*** (0.01035)
College	-0.07019*** (0.01256)	0.02903* (0.01361)	0.01039 (0.01064)	0.00980 (0.00928)	-0.00836 (0.00836)	0.02933* (0.01285)
Unemployed	-0.01610 (0.01025)	0.00447 (0.01111)	0.01495 (0.00868)	-0.00540 (0.00757)	0.00597 (0.00682)	-0.00389 (0.01048)
Not in labor force	0.03135*** (0.00757)	-0.00131 (0.00821)	0.00114 (0.00642)	0.00046 (0.00559)	-0.01152* (0.00504)	-0.02013** (0.00775)
HH income: 20-35k	-0.04936* (0.01582)	0.02967 (0.01715)	0.00499 (0.01341)	0.00124 (0.01169)	0.00599 (0.01053)	0.00746 (0.01619)
HH income: 35-50k	-0.06077*** (0.01543)	0.03514* (0.01672)	0.01360 (0.01308)	0.00135 (0.01140)	-0.01238 (0.01027)	0.02305 (0.01579)
HH income: 50-75k	-0.05271*** (0.01418)	0.02565 (0.01537)	0.00435 (0.01201)	0.00035 (0.01047)	-0.00564 (0.00944)	0.02799 (0.01450)
HH income: 75k+	-0.05579*** (0.01296)	0.02471 (0.01405)	0.00674 (0.01098)	-0.00245 (0.00957)	-0.00258 (0.00863)	0.02937* (0.01326)
Midwest	-0.01927* (0.00909)	-0.00566 (0.00985)	0.01248 (0.00770)	0.00525 (0.00672)	0.00281 (0.00605)	0.00440 (0.00930)
South	0.01465 (0.00928)	0.00825 (0.01006)	-0.00126 (0.00787)	-0.00006 (0.00686)	-0.00208 (0.00618)	-0.01950* (0.00950)
West	0.01740 (0.00963)	-0.01010 (0.01044)	0.00376 (0.00816)	0.00219 (0.00712)	-0.00672 (0.00641)	-0.00654 (0.00986)
County size B	-0.01183 (0.01116)	0.01268 (0.01209)	-0.00800 (0.00946)	-0.00699 (0.00824)	0.01702* (0.00743)	-0.00288 (0.01142)
County size C	-0.01985 (0.01282)	-0.00175 (0.01389)	0.00057 (0.01086)	0.00204 (0.00947)	0.01008 (0.00853)	0.00892 (0.01311)
County size D	-0.01635 (0.01367)	0.01567 (0.01482)	-0.00539 (0.01159)	0.00195 (0.01010)	0.00921 (0.00910)	-0.00509 (0.01399)
Top DMA: 26-50	0.01592 (0.00993)	-0.00451 (0.01076)	0.00123 (0.00841)	-0.00310 (0.00733)	-0.01206 (0.00661)	0.00251 (0.01015)
Top DMA: 1-5	0.01645 (0.01014)	0.00385 (0.01100)	0.00031 (0.00860)	0.00322 (0.00750)	-0.01461* (0.00675)	-0.00922 (0.01038)
Top DMA: 6-10	0.03060* (0.01418)	-0.00425 (0.01536)	0.00850 (0.01201)	-0.01246 (0.01047)	-0.02186* (0.00943)	-0.00052 (0.01450)
Top DMA: 11-25	0.04838** (0.01557)	-0.00339 (0.01688)	0.01350 (0.01320)	-0.00497 (0.01151)	-0.01911 (0.01037)	-0.03441* (0.01593)
Top DMA: unknown	0.04914*** (0.01482)	0.01673 (0.01607)	0.01282 (0.01256)	-0.01930 (0.01095)	-0.02379* (0.00987)	-0.03560* (0.01516)

Constant	0.31053*** (0.02421)	0.06069* (0.02624)	0.09625*** (0.02052)	0.07371*** (0.01789)	0.10988*** (0.01611)	0.34893*** (0.02477)
Obs	16,455	16,455	16,455	16,455	16,455	16,455
Adj R-squared	0.209	0.141	0.040	0.035	0.026	0.246
Dep Var Mean	0.22	0.25	0.12	0.08	0.07	0.26

NOTE: Models control for survey wave indicators. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 1D Non-menthol Ads Seen in Past 12 Months among Older Adults (age >= 25)

	0 to less than 1	1 to less than 16	16 to less than 31	31 to less than 46	46 to less than 61	61 or more
Age25-34	-0.02011*** (0.00356)	0.04502*** (0.00366)	-0.00341 (0.00284)	-0.00530* (0.00245)	-0.01083*** (0.00226)	-0.00537 (0.00324)
Age35-44	-0.01624*** (0.00315)	0.03438*** (0.00324)	-0.00292 (0.00251)	-0.00455* (0.00217)	-0.00980*** (0.00200)	-0.00087 (0.00287)
Age45-54	-0.01071*** (0.00306)	0.02459*** (0.00315)	-0.00376 (0.00244)	-0.00050 (0.00211)	-0.00909*** (0.00194)	-0.00054 (0.00278)
Age55-64	-0.00388 (0.00293)	0.01552*** (0.00301)	-0.00218 (0.00233)	0.00026 (0.00202)	-0.00563** (0.00186)	-0.00409 (0.00266)
Age65-77	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)	0.00000 (.)
Female	-0.04175*** (0.00181)	-0.02329*** (0.00186)	-0.00146 (0.00144)	0.00826*** (0.00125)	0.00676*** (0.00115)	0.05150*** (0.00165)
Black	0.00651 (0.00354)	0.00154 (0.00363)	-0.00668* (0.00282)	-0.00766** (0.00244)	-0.00656** (0.00224)	0.01284*** (0.00322)
Asian	0.08753*** (0.00532)	-0.01099* (0.00547)	-0.00391 (0.00424)	-0.00793* (0.00367)	-0.01097** (0.00338)	-0.05373*** (0.00484)
Other race	0.04033*** (0.00689)	-0.01957** (0.00708)	-0.00639 (0.00548)	-0.01332** (0.00474)	-0.00526 (0.00437)	0.00421 (0.00626)
Divorce/separate/widow	-0.00906*** (0.00246)	-0.00079 (0.00252)	-0.00283 (0.00196)	-0.00003 (0.00169)	-0.00139 (0.00156)	0.01410*** (0.00223)
Never married	-0.02370*** (0.00316)	-0.00072 (0.00325)	-0.00309 (0.00252)	0.00105 (0.00218)	-0.00245 (0.00200)	0.02892*** (0.00287)
High school	-0.07280*** (0.00342)	0.00261 (0.00351)	0.01147*** (0.00272)	0.00679** (0.00236)	0.00900*** (0.00217)	0.04293*** (0.00311)
Some college	-0.11868*** (0.00354)	0.01370*** (0.00364)	0.01400*** (0.00282)	0.01196*** (0.00244)	0.01423*** (0.00225)	0.06479*** (0.00322)
College	-0.13152*** (0.00353)	0.02597*** (0.00363)	0.02582*** (0.00281)	0.01340*** (0.00243)	0.01730*** (0.00224)	0.04904*** (0.00321)
Unemployed	-0.01521** (0.00521)	0.00448 (0.00535)	0.00315 (0.00415)	-0.00177 (0.00359)	0.00346 (0.00330)	0.00589 (0.00474)
Not in labor force	0.00244 (0.00234)	-0.00382 (0.00240)	0.00144 (0.00186)	-0.00021 (0.00161)	-0.00113 (0.00148)	0.00127 (0.00213)
HH income: 20-35k	-0.02752*** (0.00456)	0.00944* (0.00468)	0.00438 (0.00363)	0.00098 (0.00314)	0.00575* (0.00289)	0.00697 (0.00414)
HH income: 35-50k	-0.04080*** (0.00453)	0.01327** (0.00466)	0.00573 (0.00361)	0.00418 (0.00312)	0.00420 (0.00288)	0.01342** (0.00412)
HH income: 50-75k	-0.04788*** (0.00429)	0.00514 (0.00440)	0.00438 (0.00341)	0.00718* (0.00295)	0.00719** (0.00272)	0.02398*** (0.00390)
HH income: 75k+	-0.06428*** (0.00420)	0.00666 (0.00432)	0.00636 (0.00335)	0.00784** (0.00289)	0.00617* (0.00267)	0.03724*** (0.00382)
Midwest	-0.01369*** (0.00276)	-0.01135*** (0.00283)	0.00417 (0.00219)	0.00479* (0.00190)	0.00542** (0.00175)	0.01066 (0.00251)
South	0.01905*** (0.00278)	0.00288 (0.00285)	0.00252 (0.00221)	0.00033 (0.00191)	-0.00450* (0.00176)	-0.02027*** (0.00253)
West	0.00599* (0.00293)	0.00294 (0.00301)	0.00111 (0.00233)	0.00217 (0.00202)	-0.00299 (0.00186)	-0.00921*** (0.00266)
County size B	-0.00481 (0.00337)	-0.02045*** (0.00347)	0.00300 (0.00269)	0.00046 (0.00232)	0.00529* (0.00214)	0.01650*** (0.00307)
County size C	-0.00976* (0.00391)	-0.01737*** (0.00401)	-0.00065 (0.00311)	0.00199 (0.00269)	0.01361*** (0.00248)	0.01217*** (0.00355)
County size D	0.03143*** (0.00404)	-0.01918*** (0.00415)	-0.00195 (0.00321)	-0.00217 (0.00278)	0.00063 (0.00256)	-0.00876* (0.00367)
Top DMA: 26-50	0.02154*** (0.00299)	-0.00273 (0.00307)	-0.00413 (0.00238)	-0.00228 (0.00206)	-0.00411* (0.00189)	-0.00830** (0.00271)
Top DMA: 1-5	0.01650*** (0.00306)	0.00986** (0.00315)	-0.00118 (0.00244)	0.00108 (0.00211)	-0.00516** (0.00194)	-0.02110*** (0.00278)
Top DMA: 6-10	0.02425*** (0.00429)	0.02027*** (0.00441)	-0.00389 (0.00342)	-0.00162 (0.00296)	-0.00541* (0.00272)	-0.03360*** (0.00390)
Top DMA: 11-25	0.02971*** (0.00466)	0.00150 (0.00479)	-0.00609 (0.00371)	-0.00019 (0.00321)	-0.00235 (0.00296)	-0.02258*** (0.00424)

Top DMA: unknown	0.02066 ^{***} (0.00448)	0.01183 [*] (0.00461)	-0.00677 (0.00357)	0.00102 (0.00309)	-0.00713 [*] (0.00285)	-0.01961 ^{***} (0.00408)
Constant	0.35859 ^{***} (0.00717)	0.11792 ^{***} (0.00736)	0.11829 ^{***} (0.00571)	0.07950 ^{***} (0.00494)	0.07325 ^{***} (0.00455)	0.25246 ^{***} (0.00651)
Obs	198,686	198,686	198,686	198,686	198,686	198,686
Adj R-squared	0.280	0.119	0.050	0.045	0.038	0.196
Dep Var Mean	0.30	0.24	0.11	0.08	0.07	0.19

NOTE: Models control for survey wave indicators. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 2. Advertising Exposure and Menthol Use, Smoking Participation, Cigarettes per Day, and Quit Attempts (ages 25+); with extra controls; 2003-2009

	smoking menthol b/se	smoking participation b/se	cigarettes day b/se	per quit attempt b/se
menthol ads seen in past 12m: 1 to less than 16	0.00421 (0.01117)	0.00112 (0.00326)	-0.09104 (0.24750)	0.00537 (0.01207)
menthol ads seen in past 12m: 16 to less than 31	-0.02361 (0.01806)	0.00268 (0.00545)	0.48316 (0.40033)	-0.00317 (0.01955)
menthol ads seen in past 12m: 31 to less than 46	-0.03596 (0.02561)	-0.00084 (0.00774)	0.34139 (0.56744)	-0.01447 (0.02770)
menthol ads seen in past 12m: 46 to less than 61	-0.04877 (0.03434)	-0.00575 (0.01067)	0.97763 (0.76108)	-0.03093 (0.03693)
menthol ads seen in past 12m: 61 to less than 2000	-0.10688** (0.04147)	0.02208 (0.01337)	1.41871 (0.91903)	-0.05369 (0.04525)
nonmenthol ads seen in past 12m: 1 to less than 16	-0.01903 (0.01154)	-0.00650 (0.00344)	-0.58607* (0.25583)	0.02935* (0.01247)
nonmenthol ads seen in past 12m: 16 to less than 31	-0.01683 (0.01721)	-0.00667 (0.00520)	-0.50990 (0.38142)	0.03755* (0.01851)
nonmenthol ads seen in past 12m: 31 to less than 46	-0.01743 (0.01982)	-0.00439 (0.00605)	-0.66961 (0.43915)	0.01800 (0.02140)
nonmenthol ads seen in past 12m: 46 to less than 61	0.01990 (0.02393)	-0.01483* (0.00711)	-1.21727* (0.53027)	0.04363 (0.02576)
nonmenthol ads seen in past 12m: 61 to less than 2000	0.01749 (0.02618)	-0.00689 (0.00782)	-1.14326* (0.58020)	0.04621 (0.02810)
cou_type_tobacco_products	0.00957 (0.00748)	0.45263*** (0.00412)	2.47940*** (0.16571)	-0.08369*** (0.00829)
times shopped convenience stores last 4 wks	0.00042 (0.00054)	0.00875*** (0.00021)	0.12513*** (0.01196)	0.00085 (0.00059)
Internet active (home/work): highest	0.01113 (0.01083)	-0.01594*** (0.00337)	1.00414*** (0.24011)	0.08257*** (0.01170)
Internet active (home/work): 2nd_highest	0.00686 (0.01069)	-0.01861*** (0.00324)	-0.07015 (0.23696)	0.06413*** (0.01153)
Internet active (home/work): middle	0.00286 (0.01069)	-0.02238*** (0.00324)	-0.66345** (0.23696)	0.06263*** (0.01153)

	(0.01087)	(0.00320)	(0.24090)	(0.01174)
Internet active (home/work):	0.00904	-0.02054 ^{***}	-0.27373	0.06179 ^{***}
2nd_lowest	(0.01077)	(0.00315)	(0.23857)	(0.01159)
Obs	17,069	109,021	17,069	18,811
Adj R-squared	0.097	0.202	0.121	0.037
Dep Var Mean	0.26	0.16	16.95	0.38

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 3. Advertising Exposure and Menthol Use, Smoking Participation, Cigarettes per Day, and Quit Attempts (ages 18-24); with extra controls ;2003-2009

	smoking menthol b/se	smoking participation b/se	cigarettes day b/se	per quit attempt b/se
menthol ads seen in past 12m: 1 to less than 16	0.01133 (0.05080)	-0.00991 (0.01501)	1.29228 (0.87181)	0.01065 (0.04987)
menthol ads seen in past 12m: 16 to less than 31	0.00919 (0.07011)	0.00109 (0.02227)	0.05814 (1.20323)	0.07688 (0.06913)
menthol ads seen in past 12m: 31 to less than 46	0.13881 (0.09830)	0.00782 (0.03159)	-0.60963 (1.68699)	0.00666 (0.09725)
menthol ads seen in past 12m: 46 to less than 61	0.16477 (0.13993)	-0.05517 (0.04111)	-3.03044 (2.40151)	0.01032 (0.13763)
menthol ads seen in past 12m: 61 to less than 2000	0.17819 (0.15648)	0.00184 (0.05015)	0.78304 (2.68559)	-0.08224 (0.15452)
nonmenthol ads seen in past 12m: 1 to less than 16	0.00834 (0.05172)	-0.00184 (0.01531)	-0.19791 (0.88770)	0.07693 (0.05067)
nonmenthol ads seen in past 12m: 16 to less than 31	-0.03367 (0.07250)	-0.01356 (0.02185)	0.36598 (1.24436)	0.01756 (0.07082)
nonmenthol ads seen in past 12m: 31 to less than 46	0.02476 (0.08237)	0.01438 (0.02564)	0.20189 (1.41368)	0.03196 (0.08034)
nonmenthol ads seen in past 12m: 46 to less than 61	-0.17977 (0.09723)	0.01333 (0.03084)	1.82589 (1.66873)	0.07106 (0.09605)
nonmenthol ads seen in past 12m: 61 to less than 2000	-0.21984 (0.11252)	-0.00647 (0.03525)	2.16675 (1.93104)	0.14402 (0.11053)
cou_type_tobacco_products	-0.00571 (0.03215)	0.24051*** (0.01556)	2.70683*** (0.55178)	-0.09248** (0.03212)
times shopped convenience stores last 4 wks	0.00045 (0.00157)	0.00751*** (0.00056)	0.10547*** (0.02692)	-0.00012 (0.00154)
Internet active (home/work): highest	0.05122 (0.04063)	-0.07208*** (0.01220)	-0.29654 (0.69725)	0.07949* (0.03941)
Internet active (home/work): 2nd_highest	-0.02237 (0.03989)	-0.04893*** (0.01257)	-0.51809 (0.68467)	0.06476 (0.03927)
Internet active (home/work): middle	0.06964 (0.03989)	-0.05342*** (0.01257)	-0.40411 (0.68467)	-0.01396 (0.03927)

Internet active (home/work):	(0.04237)	(0.01305)	(0.72716)	(0.04192)
2nd_lowest	-0.04967	-0.03154*	-0.51862	0.14491***
	(0.04028)	(0.01347)	(0.69127)	(0.03955)
Obs	1,489	7,937	1,489	1,595
Adj R-squared	0.130	0.168	0.113	0.092
Dep Var Mean	0.36	0.19	12.06	0.36

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001