Believability of Cigarette Warnings About Addiction: National Experiments of Adolescents and Adults

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Abstract

Introduction: We conducted two experiments to examine the believability of three addiction-focused cigarette warnings and the influence of message source on believability among adolescents and adults in the United States.

Methods: Experimental data were collected using national phone surveys of adolescents (age 13–17; *n* = 1125; response rate, 66%) and adults (age 18+; *n* = 5014; response rate, 42%). We assessed the believability of three cigarette warnings about addiction attributed to four message sources (Food and Drug Administration [FDA], Surgeon General, Centers for Disease Control and Prevention [CDC], no source).

Results: The majority of adolescents and adults reported the three cigarette warnings were very believable (49%–81% for adolescents; 47%–76% for adults). We found four to five times higher odds of adolescents believing a warning that cigarettes are addictive (warning 1) or that nicotine was an addictive chemical (warning 2) compared to a warning that differentiated the addictive risks of menthol versus traditional cigarettes (warning 3), warning 1 adjusted odds ratio (aOR): 4.53, 95% confidence interval (CI): 3.10, 6.63; warning 2 aOR: 3.87, 95% CI: 2.70, 5.50. Similarly, we found three to five times higher odds of adults (including current smokers) believing the same warnings, warning 1 aOR: 3.74, 95% CI: 2.82, 4.95; warning 2 aOR: 3.24, 95% CI: 2.45, 4.28. Message source had no overall impact on the believability of warnings for either population.

Conclusions: Our findings support the implementation of FDA's required warnings that cigarettes are addictive and that nicotine is an addictive chemical. These believable warnings may deter adolescents from initiating smoking and encourage adults to quit smoking.

Implications: This article describes, for the first time, the believability of different cigarette warnings about addiction. We now know that the majority of adolescents and adults believe cigarette warnings that highlight cigarettes as addictive and that nicotine is an addictive chemical in tobacco. However, a warning that highlighted the relative risk of addiction for menthol cigarettes compared to traditional cigarettes was not as believable among either population. Our findings support the implementation of FDA's required warnings that cigarettes are addictive and that nicotine is an addictive chemical that may deter adolescents from initiating smoking and encourage adults to quit smoking.

Introduction

Tobacco use causes 480 000 deaths, $96 billion in direct healthcare expenditures, and $97 billion in productivity losses each year in the United States.[1,2] For many, the addictive nature of cigarettes makes them susceptible to life-long use. Every day, over 3800 youth under 18 smoke their first cigarette, and over 1000 become daily smokers.[3] If smoking continues at this pace, 5.6 million young people in the United States will die prematurely as a result.[2]

Much of the addictiveness of cigarettes is attributed to nicotine, a psychoactive substance with powerful reinforcing effects.[4] Messages that warn potential and current smokers of the addictive nature of cigarettes, and the addictive chemicals within them, may be one way to discourage tobacco use in the United States; warnings on cigarette packaging have the potential to discourage smoking and promote cessation behavior by providing novel information and, perhaps more importantly, reminders of health risks.[5,6] Addiction-oriented warnings may be particularly important for motivating adolescents to reject tobacco use, as addiction threatens adolescents' autonomy.[7,8] However, there is limited research on receptivity to cigarette warnings among adolescents and how their responses to warnings compare with adult populations.

Warnings can increase knowledge of both constituents in cigarette smoke and diseases caused by smoking.[9,10] Design of warnings, including what text is shown, is critical. Existing work suggests current warnings on cigarette packs in the United States do not elicit adequate attention or cognitive processing, although warning variations—of specific text and image combinations—do affect how cigarette warnings are perceived.[11–13] Adding a picture can increase attention to the warning, although images might only do so when shown with effective text about the risks of smoking.[14] Thus, how risks are communicated is important; yet, little is known about how specific-themed warnings should be framed. For addiction, there is little evidence how differently worded warnings that communicate the same risk vary on believability among adolescents and adults in the United States—perceiving the warnings as factual or true is critical for cognitive processing and the potential impact of warning labels.[15,16]

Specific to risks of addiction, a variety of warning statements have been suggested for cigarette packaging to discourage use or encourage smoking cessation. The Food and Drug Administration (FDA) is required to include statements about addiction among their set of nine cigarette packs warnings (ie, Cigarettes are addictive) according to the Family Smoking Prevention and Tobacco Control Act. Additionally, included with the FDA's recent expanded regulatory authority is a requirement that all cigarette tobacco, roll-your-own tobacco, and newly deemed products other than cigars display an addiction warning about nicotine. The warning (ie, This product contains nicotine. Nicotine is an addictive chemical) may deter use of tobacco products by increasing risk perceptions about nicotine (currently low in the United States) to mirror high levels of *awareness* that nicotine is in cigarettes.[17,18]

Addiction-oriented warnings that address specific tobacco products, such as menthol cigarettes, may also be particularly important, given the fact that among youth smokers, over 1 million use menthol cigarettes, and among adult smokers, over 18 million use menthol cigarettes.[19] The perceived smoothness of the menthol additive reinforces use, and menthol is the only advertised tobacco additive.[20,21] When burned, menthol creates a complex matrix of substances that make it difficult to understand the effects and dangers.[20] Yet, it is clear that the positive sensory effects of menthol cigarettes—the smooth, cool taste—is linked to increased smoking intake, quickened rates of nicotine dependency, and lower quit rates.[22–25] The recent FDA report on health effects of menthol cigarettes concluded that "… the weight of evidence supports the conclusion that menthol in cigarettes is likely associated with increased dependence."[24] Given the addictive nature of menthol cigarettes,[26–28] coupled with the fact that some youth think menthol cigarettes are *less* harmful and addictive than regular cigarettes,[29] an addiction warning for menthol cigarette could be another potentially important warning (ie, Menthol cigarettes are more addictive than regular cigarettes). Warnings that address the specific risks of addiction with menthol cigarettes could be important to prevent initiation and reduce use among youth and adults.

The source of warnings may also influence how the information is received, and most importantly, if it is believed by adolescents and adults.[30,31] The credibility of a source can influence whether individuals believe the individual or organization is *worth* listening to and whether one *should* be listening to them.[32] The source can function as a cue or indicator of message quality and influence viewers' attitudes, according to the Elaboration Likelihood Model, with high source credibility particularly influential for messages processed on the periphery of one's consciousness.[33–35] Thus, source attribution (eg, Surgeon General, FDA) may affect receptivity to cigarette warnings,[30,31] although research in this area is limited. Current warnings on cigarette packs in the United States use the Surgeon General as source, whereas cigarette warnings required by the Tobacco Control Act propose no source (only the word "warning"). Whether a particular source would increase warning believability is an important, yet understudied area of research.

To advance an understanding of addiction warning content and source, we sought to (1) determine the believability of three addiction-focused cigarette warnings and (2) examine the influence of message source on believability of the addiction warnings with two national samples of adolescents and adults in the United States.

Methods

Participants

Adolescent Sample

Experimental data were collected using a phone survey. From November 2014 to June 2015, the Carolina Survey Research Laboratory (CSRL) conducted phone surveys for a recruited probability sample of 1125 adolescents living in the United States, using random-digit-dial and list-assisted sampling frames. The survey included questions on tobacco regulatory constructs, including tobacco product use, tobacco constituent perceptions, and tobacco regulatory agency credibility. CSRL oversampled counties with higher prevalence of smokers and low-income respondents. To be eligible for study participation, adolescents had to be ages 13–17 and speak English or Spanish. Interviewers obtained verbal consent from adolescents' parents or guardians and verbal assent from the adolescents. The response rate among adolescents was 66%, calculated using the American Association for Public Opinion Research formula 4. The weighted sample is nationally representative of 13–17 year olds living in the United States, with cell or landline access, who could expect to obtain consent from a guardian for a tobacco use phone survey.

Adult Sample

From September 2014 to May 2015, CSRL also recruited a separate probability sample of 5014 adults age 18+ in the United States.[36] Two independent and nonoverlapping random digit-dialing frames (cell and

landline) were used for sampling, ensuring coverage to approximately 98% of US households. In order to ensure adequate representation among smokers, high-smoking/low-income areas were oversampled. Cell phones were also oversampled to ensure adequate representation among young adults. To be eligible for participation, a telephone number needed to reach a household with an English- or Spanish-speaking resident 18 years of age or older. The sample had a weighted response rate of 42%, which is comparable to other national tobacco surveys.[37,38] Participation was voluntary and anonymous; informed oral consent was obtained by all participants before enrollment in the study. More details on the sampling and data collection procedures can be found elsewhere.[36] The UNC Chapel Hill Institutional Review Board approved all study procedures for both samples.

Procedure and Experimental Measures

Following consent, participants were told "Imagine seeing this cigarette warning …" and then randomly assigned to 1 of 12 conditions. These included three cigarette warnings: *Cigarettes are addictive*, *This product contains nicotine derived from tobacco. Nicotine is an addictive chemical*, or *Menthol cigarettes are more addictive than regular cigarettes*. Warnings began with one of four randomly assigned sources: Surgeon General warning, FDA warning, Centers for Disease Control and Prevention [CDC] warning, or warning (no source). An example of a warning execution is, "FDA warning: Cigarettes are addictive." Believability of the warnings was assessed with the question "how believable is this warning?" with response options of not at all (1), somewhat (2), or very (3). Demographics and susceptibility to smoking cigarettes were then asked.

Covariate Measures

Survey questions included demographic characteristics: age (13–17 for adolescents; 18+ for adults), sex (male, female), race (white, black or African American, American Indian or Alaska Native, Asian or Asian American, Pacific Islander, other races), ethnicity (Hispanic, non-Hispanic), education or parental education for adolescent samples (less than high school, high school graduate, some college, associate's degree, bachelor's degree, graduate or professional degree). Additional covariates used in our study were smoking status (including susceptibility to cigarette use for adolescents), menthol cigarette use (adults only), and quit intentions (adults only).

Cigarette Smoking Status (Adolescents)

Since susceptibility to cigarette use has been shown to predict adolescents at risk for future smoking,[39] we included it as a covariate in this study. Two susceptibility questions were asked of all adolescents who had not used cigarettes in the past 30 days.[39] The questions were: "Do you think you will smoke a cigarette in the next year?" and "If one of your best friends were to offer you a cigarette, would you smoke it?" For both items, response options included "definitely yes," "probably yes," "definitely not," and "probably not." If a participant chose "definitely yes, probably yes, or probably not" in response to either of the two questions, then he or she was classified as susceptible to cigarette smoking. If not, the respondent was classified as not susceptible. Adolescents who reported using cigarettes in the past 30 days were classified as current cigarette smokers.

Cigarette Smoking Status (Adults)

Current cigarette use was measured with two items, asking adults "have you smoked at least 100 cigarettes in your entire life?" and "do you now smoke cigarettes every day, some days, or not at all?" Adults who reported smoking at least 100 lifetime cigarettes and reported current smoking every day or some days were classified as smokers. Otherwise, participants were classified as nonsmokers.

Menthol Cigarette Use

Menthol cigarette use was measured with the item "in the past 30 days, how many of the cigarettes you smoked were menthols?" with response options for "all," "some," or "none." This item was only asked of adults who reported smoking every day or some days.

Quit Intentions

Quit intentions were measured with the item "are you planning to quit smoking …" with response options for "within the next month" (coded as 4), "within the next 6 months" (coded as 3), "sometime in the future beyond 6 months" (coded as 2), or "are you not planning to quit" (coded as 1). This item was only asked of adult who reported smoking every day or some days. The response scale for quit intentions ranged from 1 to 4, with 4 indicating higher intentions.

Data Analysis

Analyses for this study were conducted with SAS version 9.4. Cigarette warning, source, and control variables were simultaneously entered in a multivariable weighted logistic regression model. Since there were three ordered response options to the outcome variable (ie, very, somewhat, not at all believable), we initially conducted an ordinal logistic regression analysis to assess predictors associated with warning believability. However, since the proportional odds assumption was violated for both adolescent and adult samples ($\chi^2 = 29.28$, $df = 17$, $p = .03$ and $\chi^2 = 62.63$, $df = 16$, $p < .001$),[40] we conducted analyses utilizing a multivariable logistic regression model, comparing participants who reported the warnings to be very believable with those who reported the warnings to be somewhat or not at all believable.

We conducted three logistic regression models for (1) all adolescents, (2) all adults, and (3) adult current smokers. We also examined interactions between warning source and statement among adolescents, adults, and adult current smokers, and an interaction between warning statement and menthol cigarette use among adult current smokers. Only individuals with complete data across all relevant variables were included; 9 observations (0.8%) were deleted from the adolescent sample and 96 observations (1.9%) from the adult sample were deleted because of missing variables. Results include weighted percentages, adjusted odds ratios (aOR), and confidence intervals (CI). For all analyses, statistical significance was set at $p < .05$.

Results

Table 1 provides weighted sample percentages for the adolescents ($n = 1125$) and adults ($n = 5014$). The adolescent sample was approximately half female (48.7%); on average age 15; and majority non-Hispanic white (68.9%). Parents of adolescents were well educated, with 62.5% having a college degree or higher. A large proportion of adolescents reported not being a current smoker (97%) and among them 13.9% reported being susceptible to cigarette smoking. The adult sample (aged 18–95) was also approximately half female (51.5%) and majority non-Hispanic white (62.1%). More than one-third of adults reported having a college degree or higher (36.7%). Current smokers comprised 17.8% of the adult sample. Among adults who reported smoking every day or some days, over

Table 1. Participant Characteristics for Adolescents, $N = 1125$ and adults, $N = 5014$

Variable	Adolescents		Adults	
	Unweighted *n*	Weighted % or mean (SE)	Unweighted *n*	Weighted % or mean (SE)
Gender				
Female	564	48.7	2640	51.5
Male	561	51.3	2372	48.5
Age, mean (SE)	1124	15.0 (0.0)	4995	46.7 (0.5)
Race/ethnicity				
Non-Hispanic white	857	68.9	3280	62.1
Non-Hispanic black	114	12.5	948	17.7
Non-Hispanic other	68	8.7	328	5.9
Hispanic	84	9.8	432	14.2
Education or parent education[a]				
Less than high school	75	6.9	524	11.2
High school graduate	169	13.2	1232	31.4
Some college	193	17.5	1034	20.7
Associate's degree	115	10.3	496	10.5
Bachelor's degree	338	30.0	1060	15.7
Graduate or professional degree	233	22.2	651	10.5
Cigarette smoking status (adolescents)				
Not susceptible	924	83.1	—	—
Susceptible	159	13.9	—	—
Current cigarette smoker	40	3.0	—	—
Cigarette smoking status (adults)				
Not a current smoker	—	—	3856	82.2
Current smoker	—	—	1151	17.8
Menthol cigarette use[b]				
Nonmenthol cigarette use	—	—	628	46.2
Menthol cigarette use	—	—	565	53.8
Quit intentions,[b,c] mean (SE)	—	—	1137	2.5 (0.1)

SE = standard error.

[a]Parents of adolescents reported education.

[b]These variables were only asked of adults who reported smoking every day or some days.

[c]Response scale for quit intentions ranged from 1 to 4, with 4 indicating higher intentions.

half reported currently using menthol cigarettes (53.8%) and average quit intentions were 2.5 (standard error: 0.1), on a scale of 1–4, where 4 indicates higher quit intentions.

Table 2 shows the weighted logistic regression results for adolescents. Overall, 69.4% of adolescents reported the warnings were very believable with the remainder reporting the warnings were somewhat ($n = 299$, 27.1%) or not at all believable ($n = 37$, 3.6%). These warnings were universally reported to be very believable among individuals of different demographic characteristics, such as age and race/ethnicity.

Some warnings were more believable than others. *Cigarettes are addictive* (aOR: 4.53, 95% CI: 3.10, 6.63) and *This product contains nicotine derived from tobacco. Nicotine is an addictive chemical* (aOR: 3.87, 95% CI: 2.70, 5.50) had higher odds of being reported as very believable compared to *Menthol cigarettes are more addictive than regular cigarettes* (reference group). The differences for source (ie, Surgeon General, FDA, CDC, no source) among adolescents were statistically nonsignificant. The interaction between warning statement and source was not significant ($p = .19$). Lastly, current adolescent smokers had lower odds of finding the statements to be very believable (aOR: 0.47, 95% CI: 0.22, 0.99) than nonsmokers.

Table 3 shows the weighted logistic regression results for adults. Overall, 65.6% of adults reported the warnings were very believable with the remainder reporting the warnings were somewhat ($n = 1239$, 25.9%) or not at all believable ($n = 487$, 8.5%). Similar to results observed among adolescents, *Cigarettes are addictive* (aOR: 3.74, 95% CI: 2.82, 4.95) and *This product contains nicotine derived from tobacco. Nicotine is an addictive chemical* (aOR: 3.24, 95% CI: 2.45, 4.28) had higher odds of being reported as very believable compared to *Menthol cigarettes are more addictive than regular cigarettes* (reference group). No effect of source on warning believability was observed and the interaction between warning statement and source was not significant ($p = .64$). Lastly, current smokers had lower odds of finding the statements to be very believable (aOR: 0.68, 95% CI: 0.51, 0.89), compared to nonsmokers.

Table 4 shows the weighted logistic regression results for current adult smokers. Among adult smokers only, 60.8% reported the warnings were very believable, with the remainder reporting the warnings were somewhat ($n = 287$, 25.4%) or not at all believable ($n = 189$, 13.8%). Similar to adolescent and adult samples, *Cigarettes are addictive* (aOR: 5.00, 95% CI: 2.83, 8.84) and *This product contains nicotine derived from tobacco. Nicotine is an addictive chemical* (aOR: 4.28, 95% CI: 2.42, 7.56) had higher odds of being reported as very believable compared to *Menthol cigarettes are more addictive than regular cigarettes* (reference group). Additionally, among current adult smokers, males had lower odds of reporting the statements as very believable (aOR: 0.58, 95% CI: 0.35, 0.95), as did adults with an associate's degree (aOR: 0.47, 95% CI 0.22, 0.99), a bachelors' degree (aOR: 0.46, 95% CI: 0.22, 0.94), or a graduate/professional degree (aOR: 0.30, 95% CI: 0.09, 0.97), compared to adults with less than a high school degree. Lastly, adult smokers with

Table 2. Weighted Logistic Regression Results for Adolescents, *N* = 1116

Variable	Reported very believable, *n* (%)	aOR (95% CI)
Message		
"Menthol cigarettes are more addictive than regular cigarettes."	183 (48.6)	Ref
"Cigarettes are addictive."	300 (80.5)	4.53 (3.10, 6.63)***
"This product contains nicotine derived from tobacco. Nicotine is an addictive chemical."	304 (78.1)	3.87 (2.70, 5.50)***
Source		
No warning	173 (65.6)	Ref
Surgeon general warning	187 (67.2)	1.20 (0.77, 1.85)
FDA warning	210 (72.9)	1.38 (0.89, 2.12)
CDC warning	217 (71.7)	1.32 (0.86, 2.03)
Gender		
Female	382 (66.9)	Ref
Male	405 (71.7)	1.38 (1.01, 1.88)
Age	NA (continuous)	0.98 (0.87, 1.10)
Race/ethnicity		
Non-Hispanic white	608 (70.6)	Ref
Non-Hispanic black	81 (70.3)	1.07 (0.63, 1.80)
Non-Hispanic other	40 (60.8)	0.66 (0.37, 1.20)
Hispanic	57 (68.0)	0.78 (0.46, 1.33)
Parent education		
Less than high school	56 (76.5)	Ref
High school graduate	121 (73.7)	0.69 (0.30, 1.54)
Some college	134 (68.2)	0.51 (0.22, 1.15)
Associate's degree	88 (74.5)	0.88 (0.36, 2.15)
Bachelor's degree	227 (68.1)	0.55 (0.25, 1.21)
Graduate or professional degree	160 (65.1)	0.49 (0.22, 1.10)
Cigarette smoking status		
Not susceptible	657 (70.5)	Ref
Susceptible	108 (66.7)	0.78 (0.50, 1.21)
Current cigarette smoker	22 (53.2)	0.47 (0.22, 0.99)*

aOR = adjusted odds ratio; CI = confidence interval; NA, not applicable; Ref = reference group.
*Statistically significant, $p < .05$.
**Statistically significant, $p < .01$.
***Statistically significant, $p < .001$.

increasing intent to quit had higher odds of reporting the statements as very believable (aOR: 1.30, 95% CI: 1.04, 1.64). The differences for the effect of source on warning believability among adults were statistically nonsignificant and the interaction between menthol use and warning statement was not significant ($p = .20$).

Among adult current smokers, there was a significant interaction between warning source and warning statement ($p = .02$). Specifically, the overall more believable statements that *Cigarettes are addictive* or *This product contains nicotine derived from tobacco. Nicotine is an addictive chemical* remained so when FDA was the source or when there was no source. However, only one of these statements was significantly more believable than the menthol statement when the source was the CDC (cigarettes are addictive; aOR: 3.79, 95% CI: 1.26, 11.38) or the Surgeon General (nicotine statement; aOR: 3.60, 95% CI: 1.32, 9.88) primarily due to higher believability ratings of the menthol statement with these sources.

Discussion

Across the two national samples—including over 6000 adolescents and adults in the United States—we found more than 70% of people thought cigarette warnings about the addictiveness of cigarettes, in general, or nicotine specifically, were very believable. Warnings about the addictiveness of menthol cigarettes compared to traditional cigarettes, however, were believed by less than half of the adolescents and adults. When compared, individuals were three to five times more likely to believe cigarette warnings stating the addictive nature of cigarettes or that nicotine in tobacco was an addictive chemical than they were to believe warnings about the addictive nature of menthol cigarettes. Specifically, adolescents hearing the addiction warnings focused on cigarettes or nicotine had four to five times higher odds of reporting the warnings to be very believable compared to those who received the menthol addiction warning—the one warning not currently required by the FDA. Similarly, we found three to five times higher odds of adults (including current smokers) believing the same warnings. Notably, adult smokers found all the warnings less believable than nonsmokers and although source has been found to influence the believability of cigarette warnings previously with adults,[30] no main effect of source attribution was detected in either of our national samples.

These results have several implications for tobacco regulatory science. First, our study is the first to investigate the believability of warnings about tobacco addiction across the developmental spectrum. If addiction warnings are not believable, it is unlikely they will have an impact on decreasing initiation and increasing cessation. Since first use of cigarettes occurs during adolescence for a majority of smokers, it is of great importance to understand how adolescents perceive and respond to addiction cigarette warnings,[11] especially those required by FDA for national implementation. In fact, since all smokers and potential smokers see the same warnings, it is important

Table 3. Weighted Logistic Regression Results for Adults, $N = 4918$

Variable	Reported very believable, *n* (%)	aOR (95% CI)
Message		
"Menthol cigarettes are more addictive than regular cigarettes."	778 (46.9)	Ref
"Cigarettes are addictive."	1285 (76.0)	3.74 (2.82, 4.95)***
"This product contains nicotine derived from tobacco. Nicotine is an addictive chemical."	1192 (73.7)	3.24 (2.45, 4.28)***
Source		
No warning	791 (64.2)	Ref
Surgeon general warning	820 (64.0)	0.98 (0.73, 1.34)
FDA warning	822 (66.9)	1.10 (0.80, 1.54)
CDC warning	822 (67.1)	1.11 (0.80, 1.54)
Gender		
Female	1738 (66.9)	Ref
Male	1516 (64.2)	0.88 (0.70, 1.11)
Age	NA (continuous)	1.00 (0.99, 1.00)
Race/ethnicity		
Non-Hispanic white	2200 (66.0)	Ref
Non-Hispanic black	658 (69.4)	1.10 (0.76, 1.59)
Non-Hispanic other	209 (61.4)	0.83 (0.56, 1.24)
Hispanic	271 (60.2)	0.73 (0.52, 1.04)
Education		
Less than high school	355 (64.0)	Ref
High school graduate	802 (66.7)	1.01 (0.60, 1.71)
Some college	658 (67.6)	1.07 (0.64, 1.78)
Associate's degree	314 (60.2)	0.72 (0.39, 1.32)
Bachelor's degree	683 (65.4)	0.87 (0.52, 1.46)
Graduate or professional degree	432 (65.6)	0.91 (0.53, 1.60)
Cigarette smoking status		
Not a current smoker	2582 (66.7)	Ref
Current smoker	672 (60.8)	0.68 (0.51, 0.89)**

aOR = adjusted odds ratio; CI = confidence interval; NA, not applicable; Ref = reference group.
*Statistically significant, $p < .05$.
**Statistically significant, $p < .01$.
***Statistically significant, $p < .001$.

to examine warning reception across the developmental spectrum. Despite this fact, little research on warning reception among adolescents has been conducted.[5,6] That the required FDA addiction warning are very believable for the majority of adolescents and adults across multiple demographic categories, including those susceptible to using as well as those using cigarettes, is reassuring. This finding also provides insights for warnings on noncigarette tobacco products (eg, e-cigarettes, hookah), which are commonly perceived as less addictive and less harmful among vulnerable populations.[41,42]

Second, while two addiction warnings were rated highly, the warning that framed the relative risks of menthol cigarettes was not perceived as believable as other addiction warnings. There are several reasons why this may be the case. Despite evidence that menthol cigarettes are associated with increased initiation and dependence,[26] many are misinformed or uninformed on this issue. Menthol cigarettes are perceived as less harmful than traditional cigarettes among some adolescents,[29] and 41% of adults are not sure if menthol cigarettes are more or less harmful than nonmenthol cigarettes.[43] Menthol advertisements are often designed to convey youthfulness and fun—two concepts commonly linked to health.[44,45] Additionally, menthol cigarettes are often differentiated from traditional cigarettes with green packaging—a color associated with nature and health.[46,47] Given the overall marketing environment that positively portrays menthol cigarettes, a single warning statement might not be enough to overcome erroneous beliefs of reduced risk. Counter-marketing campaigns to educate individuals about menthol cigarette risks would likely increase the believability of the potential addictive risks.[48]

Third, we did not find any consistent impact of source attributions on the believability of the addiction warnings. The lack of impact overall may be because the source was heard rather than read; seeing the source may be necessary to have a measurable impact on the believability of warnings. Our current data support the requirement in the Tobacco Control Act to print warnings without a source (eg, "Surgeon general's warning" or "FDA warning"), as our data suggest that the presence of a credible source does not increase the impact of message with high believability. In the absence of data indicating a positive impact, source should perhaps not be included given limited space on the cigarette pack itself.

Investigating how addiction warnings ultimately impact behavior—among smokers and nonsmokers—is an important next step. As a first step, we explored the impact of warning statement and source on believability—a theory-based antecedent to changing thoughts and actions. Future studies should explore how these addiction warnings influence perceptions and behavior (eg, knowledge, adolescent initiation, motivation to quit) and their impact when paired with images.[49] This is a large challenge, given that there are not obvious photographs or images to use to depict addiction. This is made all the more challenging by legal challenges to the FDA by the industry,[50] which are likely to have the effect of limiting the types of images that can be used to depict health effects of smoking. Combining graphic images, which

Table 4. Weighted Logistic Regression Results for Current Smokers, $N = 1130$

Variable	Reported very believable, *n* (%)	aOR (95% CI)
Message		
"Menthol cigarettes are more addictive than regular cigarettes."	129 (36.9)	Ref
"Cigarettes are addictive."	286 (73.2)	5.00 (2.83, 8.84)***
"This product contains nicotine derived from tobacco. Nicotine is an addictive chemical."	257 (68.9)	4.28 (2.42, 7.56)**
Source		
No warning	170 (57.3)	Ref
Surgeon general warning	158 (59.0)	1.05 (0.52, 2.13)
FDA warning	173 (61.8)	1.27 (0.67, 2.39)
CDC warning	171 (64.4)	1.32 (0.64, 2.70)
Gender		
Female	338 (66.5)	Ref
Male	334 (55.4)	0.58 (0.35, 0.95)*
Age	NA (continuous)	1.00 (0.98, 1.01)
Race/ethnicity		
Non-Hispanic white	436 (61.1)	Ref
Non-Hispanic black	142 (63.6)	0.92 (0.44, 1.89)
Non-Hispanic other	51 (56.3)	0.92 (0.41, 2.08)
Hispanic	42 (55.7)	0.87 (0.42, 1.81)
Education		
Less than high school	124 (71.1)	Ref
High school graduate	234 (59.3)	0.63 (0.32, 1.23)
Some college	150 (64.7)	0.84 (0.40, 1.74)
Associate's degree	67 (48.1)	0.47 (0.22, 0.99)*
Bachelor's degree	77 (56.2)	0.46 (0.22, 0.94)*
Graduate or professional degree	20 (45.3)	0.30 (0.09, 0.97)*
Menthol cigarette use		
Nonmenthol cigarette use	346 (57.1)	Ref
Menthol cigarette use	325 (63.9)	0.98 (0.57, 1.68)
Quit intentions	NA (continuous)	1.30 (1.04, 1.64)*

aOR = adjusted odds ratio; CI = confidence interval; NA, not applicable; Ref = reference group.
*Statistically significant, $p < .05$.
**Statistically significant, $p < .01$.
***Statistically significant, $p < .001$.

increases attention, with believable text may create warnings with the greatest ability to elicit affective and cognitive reactions, and ultimately, potential impact on smoking beliefs and behavior. Observational studies demonstrate that stronger cigarette pack warnings—which are typically larger in size, on the front and back of packs, and use graphic images, are associated with increased knowledge and reduced smoking behaviors,[10] and a recent randomized trial demonstrated that pictorial cigarette pack warnings increase quit attempts.[49] A challenging next step is to determine what images best represent addiction, given its abstract nature, to ensure the warnings provide credible and relevant information when taken together. Addiction warnings that employ graphic demonstration of addiction may augment message believability among at risk adolescents and adults. Future studies should also explore other design variations—size, placement, and layout features—that may increase adolescents' and adults' attention and message processing of addiction-focused warnings.

Limitations

This study has some limitations. While the phone survey allowed for national samples of adolescents and adults, the warnings were heard, not seen, as would normally occur on cigarette packs. There were few smokers in our adolescent sample; therefore, we were unable to compare the believability of the different warnings among adolescent smokers. Additionally, prior exposure to some of the warnings may also have influenced our results. Still, the robustness of the experimental findings, across the development spectrum in two national samples, lends strength to the findings.

Conclusions

In conclusion, this research highlights important differences in the types of warning statements that adolescents and adults in the United States find believable. Adolescents and adults largely believe warnings that highlight cigarettes as addictive and that nicotine is an addictive chemical in tobacco. Warnings that communicate these important risks of tobacco use may help prevent smoking initiation among adolescents and cessation among adults. Our findings support the use of FDA's addiction warnings for use on tobacco products, including potentially novel tobacco products that contain nicotine, which adolescents and adults may erroneously believe to be less addictive.

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Declaration of Interests

None declared.

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