Perceptions and Perceived Impact of Graphic Cigarette Health Warning Labels on Smoking Behavior Among U.S. Young Adults

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ABSTRACT

Introduction: In 2011, the Food and Drug Administration published a final rule requiring cigarette packages and advertisements to include graphic health warning labels (HWLs) with new warning statements. Implementation of this rule has been stalled by legal challenge. This study assessed correlates of smoking-related intentions related to graphic HWLs among current cigarette smokers and nonsmokers in a national sample of U.S. young adults aged 18–34.

Methods: Data were collected from 4,236 participants aged 18–34 using an online panel in January 2012 for the Legacy Young Adult Cohort Study. Analyses were weighted to provide nationally representative estimates. Our main outcome was assessed with a single item: "Do you think that new warning labels with graphic pictures would make you think about not smoking?"

Results: Twenty-two percent of the young adults were current cigarette smokers. Fifty-three percent endorsed that new graphic HWLs would make them think about not smoking (40% among current smokers compared with 56% among nonsmokers). Among nonsmokers, those aged 18–24, females, Hispanics, and those who were aware of graphic cigarette HWLs were more likely to report intention to not smoke related to graphic HWLs. Among current smokers, intending to quit within the next 6 months was correlated with intention resulting from graphic HWLs. Hispanic ethnicity and intention to quit within 30 days were strong correlates of intention in light, nondaily, and self-identified social/occasional smokers.

Conclusions: This study supports previous findings that graphic HWLs play an important role in preventing smoking, in addition to encouraging cessation in young adults.

INTRODUCTION

In 2010, the Food and Drug Administration's Center for Tobacco Products (FDA CTP) proposed regulation requiring large, graphic health warning labels (HWLs) and nine new warning statements, as dictated by the Family Smoking Prevention and Tobacco Control Act, to be included on cigarette packages and in cigarette advertisements. Although published as a final rule in 2011, implementation has been stalled by two lawsuits brought by tobacco companies (Food and Drug Administration, 2012) and a U.S. Court of Appeals decision in one of the cases that the graphic warnings proposed violated First Amendment speech protections (*R.J. Reynolds Tobacco Co. v. Food and Drug Admin*, 2012). In the August 2012 decision, the court affirmed that the FDA did not provide the evidence needed to support that the graphic HWLs would "directly advance" its interest in reducing the number of Americans who smoke (*R.J. Reynolds Tobacco Co. v. Food and Drug Admin*, 2012). In March 2013, the government affirmed that it would not appeal the case and that the FDA would "undertake research to support a new rulemaking consistent with the Tobacco Control Act" (Associated Press, 2013).

Longitudinal data from countries with established graphic HWLs (Australia and Canada) suggest that HWLs reduce smoking prevalence, increase quit attempts, and reduce relapse among ex-smokers (Azagba & Sharaf, 2013; Partos, Borland, Yong, Thrasher, & Hammond, 2013). Both youth and adults are more likely to recall larger warnings, rate larger warnings as having greater impact, and equate the size of the warning with the magnitude of the risk (BRC Marketing & Social Research, 2004; Centre for Behavioral Research in Cancer, 1992; Environics Research Group Ltd., 1999; Les Etudes De Marche Createc, 2008; Linthwaite, 1985; Rootman & Flay, 1995; Shanahan & Elliott, 2009). Graphic HWLs evoke more

thoughts of harm, quitting, and emotionally charged reactions than text-only warning labels (Borland, Wilson et al., 2009). Graphic HWLs also lead some viewers to forego cigarettes, a behavioral reaction that, along with cognitions about quitting, is one of the strongest predictors of subsequent quitting (Borland, Wilson et al., 2009). A recent randomized controlled trial showed that the nine FDA graphic warning labels had a consistently greater impact than text-only labels on message salience, perceived impact, credibility, and intention to quit across diverse populations (Cantrell et al., 2013).

Disrupting smoking transitions in young adulthood is key to averting the long-term health consequences of smoking. New graphic cigarette HWLs may provide a means for disrupting transitions, thereby facilitating both prevention and cessation in this age group. Studies of HWLs in young adults show that graphic HWLs are more effective than text-only warnings at garnering attention, communicating risk, and discouraging smoking (O'Hegarty, Pederson, Yenokyan, Nelson, & Wortley, 2007). Youth and young adult nonsmokers report that graphic HWLs would dissuade them from experimentation with cigarettes and perceive that graphic HWLs would be an effective intervention for prevention, cessation, and relapse prevention (O'Hegarty et al., 2006; Vardavas, Connolly, Karamanolis, & Kafatos, 2009).

Although new graphic warning labels have not yet been implemented, FDA unveiled its final graphic cigarette HWLs in June 2011. The purpose of this research was to assess correlates of smoking-related intentions associated with graphic HWLs among current cigarette smokers and nonsmokers in a nationally representative sample of U.S. young adults aged 18–34 surveyed approximately 6 months after the new labels were made public. The potential implications of graphic HWLs for smoking prevention and cessation were also explored in this important age group and in subgroups of current smokers, including social, light, and nondaily smokers. To our knowledge, this is the first study to examine the perceived effectiveness of graphic HWLs in a national sample of U.S. young adults.

METHODS

Participants

The Legacy Young Adult Cohort Study was designed to understand the trajectories of tobacco use in a young adult population using a longitudinal cohort sample. The detailed methods of this study have been described elsewhere (Rath, Villanti, Abrams, & Vallone, 2012). Briefly, the cohort is comprised of a nationally representative sample of young adults aged 18–34 drawn from GfK's KnowledgePanel®. KnowledgePanel® is an online panel of adults aged 18 and older that covers both the online and off-line populations in the United States (http://www.knowledgenetworks.com/knpanel/index.html). The panel was recruited via address-based sampling, a probability-based random sampling method that provides statistically valid representation of the U.S. population, including cell-phone-only households. GfK provided households without Internet access with a free netbook computer and Internet service to reduce response bias in typical online survey samples. African American and Hispanic young adults were oversampled to ensure sufficient sample sizes for subgroup analyses. The current study uses cross-sectional data from the Wave 2 survey,

which was collected in January 2012 ($N = 4,236$). At baseline, the household recruitment rate for this study was 14.8%, and in 65.0% of these households, one member completed a core profile survey in which the key demographic information was collected. For this particular study, only one panel member per household was selected at random to be part of the study sample and no members outside the panel were recruited. The study completion rate was 56.9%, and thus, the cumulative response rate was 5.5%. At Wave 2, 73.0% (3,092 participants) of the baseline sample was retained, with a completion rate of 66.3% among follow-up participants and 50.2% for the 1,144 new participants for a cumulative response rate of 6.6%. Observations were deleted for those respondents where data were missing on the item assessing ever tobacco use ($N = 40$). This study was approved by the Independent Investigational Review Board, Inc., and online consent was collected from participants before survey self-administration.

Measures

Outcome Measure
The outcome of interest was a binary measure of smoking-related intention related to graphic HWLs ("Do you think that new warning labels with graphic pictures would make you think about not smoking?"); participants responding "yes" to an item were coded as 1 and those responding "no" as 0.

Other Warning Label Items
We assessed awareness of new graphic HWLs ("Have you heard about or seen new warning labels which include graphic pictures (i.e., pictures of disease or death caused by smoking)?"). Respondents also provided binary measures of beliefs ("Do warning labels on cigarettes make smokers more likely to quit?") and past behavior ("Have warning labels led you to decide not to have a cigarette?"). All questions on cigarette HWLs were developed for an NCI-funded longitudinal study of adolescents and young adults (2P01CA098262-06A1; PI: Robin Mermelstein). Participants were not exposed to images of current cigarette HWLs or the FDA's nine graphic HWLs as part of this study.

Smoking Status
Given young adults' great variability in cigarette smoking behaviors and identification, smoking status was assessed based on both reports of smoking behavior and self-identified smoking status. Unlike adult surveys of tobacco use, participants did not have to meet a 100-cigarette threshold to be considered a current user. Cigarette smoking was defined from past 30-day cigarette use: current smokers were those who smoked cigarettes on 1–30 days of the past 30 days, and nonsmokers were defined as those who smoked on 0 days or had never smoked a cigarette. Among cigarette smokers, different groups of smokers were classified based on frequency of smoking and cigarettes smoked per day. Daily smokers were defined as smoking on all 30 of the past 30 days, and nondaily smokers were classified as smoking on 1–29 of the past 30 days. Due to a programming error in the survey, the upper bound for mean number of cigarettes smoked per day on days smoked was 30 cigarettes. Light smokers were defined as smoking 1–10 cigarettes per day and heavier smokers smoking 11–30 cigarettes per day on days smoked. Current cigarette smokers also provided information on time to first tobacco product after waking, intention to quit

smoking cigarettes, and history of quit attempts. Response choices for the intention to quit item followed the stages of change theory (Prochaska & DiClemente, 1983) and included "Within the next 30 days" (preparation), "Within the next six months" (contemplation), "Longer than six months" (precontemplation), "I don't plan on quitting" (precontemplation), and "I don't smoke now." Models of current smoking utilized the first four response choices.

Among current smokers, subgroups of smokers based on self-identified smoking status were further identified using the following item: "Which of the following best describes how you think of yourself?" with response choices of "smoker," "social smoker," "occasional smoker," "ex-smoker," "someone who tried smoking" and "nonsmoker." "Social" and "occasional" smokers were collapsed into a single category and the following categories were used in the analyses, "smoker" and "social/occasional smoker".

Susceptibility to smoking among nonsmoking young adults was assessed in line with previous studies of adolescent susceptibility (Evans, Farkas, Gilpin, Berry, & Pierce, 1995; Mowery, Farrelly, Haviland, Gable, & Wells, 2004). Those defined as "open to smoking" were either never smokers or had ever smoked (but not in the past 30 days) and answered "definitely yes," "probably yes," or "probably no" to either of the following two questions: (a) "Will you smoke a cigarette any time in the next year?" and (b) "If one of your friends or somebody close to you offered you a cigarette or other tobacco product, would you smoke/use it?" Those defined as "closed to smoking" were young adults who reported never using tobacco and responded "definitely no" to both questions.

Other Control Variables
Sociodemographic items assessed included age (grouped as 18–24 and 25–34), gender, race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Other, non-Hispanic; and Hispanic) and educational attainment (less than high school, high school, and some college or greater).

Data Analysis

All analyses were performed using Stata IC 11.0 and post-stratification weights were used to offset any non-response or non-coverage bias and produce nationally representative estimates. Missing data were handled with listwise deletion per Stata's survey procedures. Univariate analyses were conducted to provide descriptive characteristics of the sample and endorsement of the four cigarette HWL items in the full sample. Covariates for multivariable logistic regression were chosen based on a priori assumptions and the results of bivariate analyses. In bivariate analyses, two variables (education and time to first cigarette) were not significantly correlated with the intention outcome; education was retained in the full model as a control variable, and time to first cigarette was excluded. Because the outcome related to new graphic HWLs, the item relating to awareness of new graphic HWLs was included as a control variable in the multivariable models for nonsmokers and current smokers. Sensitivity analyses were conducted to examine correlates of intention related to graphic HWLs in nonsmokers and current smokers who reported being aware of new graphic HWLs and to test for interactions between age and other covariates in these models. Multivariable models were also developed to examine intention related to graphic

HWLs in subgroups of current smokers using the sociodemographic and intention to quit variables, excluding the awareness of graphic HWLs indicator which was not associated with self-identified smoking status ("social/occasional smoker" and "smoker"), light and heavier smoking, or daily and nondaily smoking in bivariate analysis.

RESULTS

The study sample was comprised of 4,196 young adults with 41% aged 18–24 and 59% aged 25–34 and an even balance of males and females (Table 1). Nearly 60% of the sample was White, with 13% Black, 20% Hispanic, and 7% reporting "other race." Thirteen percent had less than a high school education, 28% had a high school education, and 59% had some college or greater. Twenty-two percent of the sample reported having smoked a cigarette in the past 30 days.

Endorsement of Warning Label Items

Overall, slightly more than half of young adults reported awareness of new warning labels that include graphic pictures (54%) and endorsed that warning labels with graphic pictures would make them think about not smoking (53%). Fifteen percent of the full young adult sample reported believing that warning labels on cigarettes, in general, make smokers more likely to quit, and this was significantly higher in nonsmokers (16%) compared with current smokers (11%; $p = .02$). Among nonsmokers, 23% reported that warning labels had led them to decide not to have a cigarette (past behavior) as a result of HWLs compared with 12% of current cigarette smokers ($p < .001$), and 56% reported intention related to graphic HWLs compared with 40% of current smokers ($p < .001$). There was no association between awareness of the new graphic warning labels and past 30-day cigarette use.

Multivariable Models of Intention: Nonsmokers and Current Cigarette Smokers

Table 2 presents the multivariable models of intention related to graphic HWLs in nonsmokers and current cigarette smokers as defined by recent smoking behavior. Among nonsmokers, awareness of new graphic HWLs was correlated with significantly higher smoking-related intention (odds ratio [OR] = 2.47; 95% confidence interval [95% CI] = 2.01–3.03). Thinking about not smoking based on graphic HWLs was 55% higher (95% CI = 1.25–1.92) among those of younger age (18–24 vs. 25–34), 37% higher (95% CI = 1.12–1.68) in females compared with males, and 38% higher (95% CI = 1.06–1.79) in Hispanics compared with Whites. Results of the sensitivity analysis looking only at nonsmokers aware of graphic HWLs produced consistent findings.

Among current cigarette smokers, intention to quit within the next 30 days ($OR = 3.22$; 95% CI = 1.48–6.98) and within the next 6 months ($OR = 2.66$; 95% CI = 1.40–5.09) were the strongest correlates of intention to not smoke as a result of graphic HWLs. Intention was marginally higher in Hispanic compared with White current smokers ($OR = 1.78$; 95% CI = 0.92–3.43). In the sensitivity analysis of current smokers aware of the graphic HWLs, intention to quit within the next 30 days or 6 months remained significant correlates of intention to not

Table 1. Characteristics of Legacy Young Adult Cohort Sample (Wave 2), Weighted

	Full sample (unweighted n = 4,196), %	Among nonsmokers (unweighted n = 3,382), %	Among current cigarette smokers (unweighted n = 812), %	p value*
Overall	–	78.0	22.0	–
Age				.5849
18–24	40.9	41.2	39.7	
25–34	59.1	58.8	60.3	
Gender				.0547
Male	49.9	48.8	54.0	
Female	50.1	51.3	46.0	
Race/ethnicity				.1244
White, non-Hispanic	59.7	58.6	63.5	
Black, non-Hispanic	13.1	12.8	14.1	
Other, non-Hispanic	7.3	7.8	5.9	
Hispanic	19.9	20.9	16.6	
Education				**<.001**
Less than high school	12.8	11.5	17.6	
High school	27.8	25.5	35.7	
Some college or greater	59.4	63.0	46.7	
Open to smoking		39.3		–
Self-identified smoking status				–
Smoker			58.6	
Social or occasional smoker			41.5	
Smoking intensity on days smoked, past 30 days				–
Light (1–10 cigarettes per day)			64.9	
Heavier (11–30 cigarettes per day)			35.1	
Smoking frequency, past 30 days				–
Nondaily (1–29 days)			47.5	
Daily (all 30 days)			52.6	
Time to first tobacco product after waking				–
Within 5 min			14.8	
5–30 min			36.7	
31–60 min			20.1	
Greater than 60 min			28.4	
Quit attempt in past 12 months			42.6	–
Intention to quit smoking				–
I don't plan to quit			37.6	
Longer than 6 months			24.5	
Within 6 months			25.5	
Within 30 days			12.5	
Cigarette warning label items				
Do warning labels on cigarettes make smokers more likely to quit?	14.6	15.7	10.6	**.0157**
Have warning labels led you to decide not to have a cigarette?	20.7	23.1	12.5	**<.001**
Have you heard about or seen new warning labels which include graphic pictures?	54.0	53.0	57.6	.0931
Do you think that new warning labels with graphic pictures would make you think about not smoking?	52.7	56.4	39.9	**<.001**

Note. Missing data in full sample: current cigarette use (2); "Do warning labels on cigarettes make smokers more likely to quit?" (42); "Have warning labels led you to decide to not have a cigarette?" (53); "Have you heard about or seen new warning labels which include graphic pictures?" (38); "Do you think that new warning labels with graphic pictures would make you think about not smoking" (44). Missing data in nonusers: open to smoking (198); "Do warning labels on cigarettes make smokers more likely to quit?" (39); "Have warning labels led you to decide to not have a cigarette?" (50); "Have you heard about or seen new warning labels which include graphic pictures?" (35); "Do you think that new warning labels with graphic pictures would make you think about not smoking" (39). Missing data in current cigarette smokers: self-identified smoking status (92); smoking frequency (0); smoking intensity (47); time to first tobacco product after waking (92); quit attempt in past 12 months (15); intention to quit (13); "Do warning labels on cigarettes make smokers more likely to quit?" (3); "Have warning labels led you to decide to not have a cigarette?" (3); "Have you heard about or seen new warning labels which include graphic pictures?" (3); "Do you think that new warning labels with graphic pictures would make you think about not smoking" (4).
*p value for difference between current cigarette smokers and nonsmokers. Bold typeface indicates p < .05.
Source. Legacy Young Adult Cohort Study, Wave 2 (January 2012).

Table 2. Multivariable Analysis of Intention to Not Smoke Based on New, Graphic Warning Labels in Current Cigarette Smokers and Nonsmokers, Weighted

	Among nonsmokers (unweighted n = 3,149)		Among current cigarette smokers (unweighted n = 680)	
	Adjusted *OR*	95% CI	Adjusted *OR*	95% CI
Age				
18–24	**1.55**	**(1.25–1.92)**	0.88	(0.54–1.42)
25–34	Ref.		Ref.	
Gender				
Male	Ref.		Ref.	
Female	**1.37**	**(1.12–1.68)**	1.34	(0.85–2.12)
Race/ethnicity				
White, non-Hispanic	Ref.		Ref.	
Black, non-Hispanic	1.29	(0.89–1.87)	0.83	(0.36–1.89)
Other, non-Hispanic	1.04	(0.70–1.56)	1.10	(0.43–2.81)
Hispanic	**1.38**	**(1.06–1.79)**	1.78	(0.92–3.43)
Education				
Less than high school	1.13	(0.77–1.65)	1.54	(0.78–3.02)
High school	1.07	(0.82–1.38)	0.99	(0.59–1.66)
Some college or greater	Ref.		Ref.	
Open to smoking	0.92	(0.75–1.14)		
Self-identified smoking status				
Smoker			Ref.	
Social or occasional smoker			1.02	(0.57–1.84)
Smoking frequency, past 30 days				
Nondaily (1–29 days)			1.59	(0.88–2.86)
Daily (all 30 days)			Ref.	
Smoking intensity on days smoked, past 30 days				
Light (1–10 cigarettes per day)			0.69	(0.40–1.21)
Heavier (11–30 cigarettes per day)			Ref.	
Quit attempt in past 12 months			1.42	(0.89–2.26)
Intention to quit				
I don't plan to quit			Ref.	
Longer than 6 months			1.60	(0.85–3.03)
Within 6 months			**2.66**	**(1.40–5.09)**
Within 30 days			**3.22**	**(1.48–6.98)**
Have you heard about or seen new warning labels which include graphic pictures? (Awareness)	**2.47**	**(2.01–3.03)**	1.15	(0.70–1.88)

Note. OR = odds ratio; CI = confidence interval.
The multivariable model in nonsmokers adjusted for age, gender, race/ethnicity, education, being open to smoking, and awareness of new graphic HWLs on cigarettes. The multivariable model in current smokers controlled for all of these variables, as well as self-identified smoking status, smoking frequency, smoking intensity, quit attempt in the past 12 months, and intention to quit. 233 of 3,382 observations (7%) were missing data on one or more variables in the multivariable model of nonsmokers and 132 of 812 observations (16%) had missing data in the model of current smokers. Bold typeface indicates $p < .05$.
Source. Legacy Young Adult Cohort Study, Wave 2 (January 2012).

smoke as a result of graphic HWLs. Variables that became significant in this model were having less than a high school education (*OR* = 2.70), having made a quit attempt in the past 12 months (*OR* = 2.18) and being a light smoker (*OR* = 0.42).

Interactions between age and the other covariates in both models in Table 2 were not statistically significant.

Multivariable Models of Intention Among Subgroups of Current Cigarette Smokers

When different subgroups of current cigarette smokers were examined as defined by recent smoking behavior or self-identified smoking status (Table 3), new patterns emerged. Hispanic ethnicity (compared with White) and intention to quit smoking within 30 days were consistently correlated with higher intention related to graphic HWLs among self-identified "social/occasional smokers," light smokers, and nondaily smokers.

DISCUSSION

In a nationally representative sample of U.S. young adult cigarette smokers and nonsmokers aged 18–34, over half reported that graphic HWLs would be likely to make them think about not smoking; this is more than twice the number that endorsed forgoing a cigarette in the past as a result of cigarette HWLs. Among nonsmokers, younger adults (aged 18–24), females, Hispanics, and those who were aware of graphic HWLs on cigarettes were more likely to report that the labels would

Table 3. Multivariable Analysis of Intention to Not Smoke Based on New, Graphic Warning Labels Related to New, Graphic Warning Labels in Subgroups of Current Smokers, Weighted

	Among self-identified "social smokers" (unweighted n = 302)		Among self-identified "smokers" (unweighted n = 406)		Among light smokers (1–10 cig/day) (unweighted n = 522)		Among heavier smokers (11–30 cig/day) (unweighted n = 232)		Among nondaily smokers (unweighted n = 384)		Among daily smokers (unweighted n = 412)	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Age												
18–24	1.51	(0.77–2.95)	0.74	(0.39–1.40)	1.04	(0.63–1.72)	0.90	(0.39–2.09)	1.20	(0.69–2.09)	0.78	(0.41–1.48)
25–34	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Gender												
Male	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Female	1.36	(0.73–2.55)	1.21	(0.65–2.24)	**1.62**	**(1.01–2.62)**	1.40	(0.65–3.02)	1.24	(0.72–2.12)	1.19	(0.65–2.20)
Race/ethnicity												
White, non-Hispanic	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Black, non-Hispanic	0.71	(0.28–1.83)	1.09	(0.34–3.52)	1.19	(0.55–2.59)	0.73	(0.16–3.32)	0.73	(0.30–1.79)	1.04	(0.33–3.28)
Other, non-Hispanic	0.60	(0.18–2.01)	1.23	(0.32–4.68)	1.05	(0.40–2.80)	0.83	(0.11–6.17)	0.55	(0.19–1.61)	1.21	(0.33–4.34)
Hispanic	**3.13**	**(1.29–7.61)**	1.29	(0.50–3.34)	**2.53**	**(1.32–4.84)**	1.07	(0.24–4.89)	**2.03**	**(1.02–4.06)**	1.43	(0.53–3.89)
Education												
Less than high school	0.35	(0.11–1.12)	**2.65**	**(1.16–6.05)**	0.76	(0.34–1.69)	2.20	(0.81–6.00)	1.22	(0.49–3.05)	1.69	(0.73–3.93)
High school	0.72	(0.33–1.56)	1.29	(0.65–2.56)	0.68	(0.39–1.19)	1.48	(0.61–3.61)	0.75	(0.39–1.45)	1.34	(0.68–2.65)
Some college or greater	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Intention to quit												
I don't plan to quit	Ref.		Ref.		Ref.		Ref.		Ref.		Ref.	
Longer than 6 months	1.11	(0.47–2.65)	2.03	(0.82–5.05)	1.25	(0.67–2.35)	1.72	(0.60–4.96)	1.13	(0.54–2.37)	1.80	(0.74–4.39)
Within 6 months	1.55	(0.67–3.60)	**3.86**	**(1.59–9.41)**	**1.92**	**(1.02–3.61)**	**3.42**	**(1.23–9.56)**	1.24	(0.59–2.59)	**4.14**	**(1.75–9.80)**
Within 30 days	**2.91**	**(1.13–7.48)**	3.36	(0.96–11.72)	**3.40**	**(1.59–7.25)**	1.86	(0.44–7.86)	**3.38**	**(1.52–7.52)**	2.30	(0.73–7.23)
Probability > *F* (overall model)		.04		.02		<.001		.41		.05		.09

Note. AOR = adjusted odds ratio; CI = confidence interval.
Observations with missing data: social smokers (5 of 307), smokers (7 of 413), light (11 of 533), heavier (0 of 232), nondaily (10 of 394), daily (6 of 418). All multivariable models adjusted for age, gender, race/ethnicity, education, and intention to quit. Bold typeface indicates *p* < .05.
Source. Legacy Young Adult Cohort Study, Wave 2 (January 2012).

make them think about not smoking. Among current cigarette smokers, those intending to quit within the next 30 days or next 6 months were more likely to endorse intention related to the graphic HWLs, in line with the preparation and contemplation stages in the stages of change model (Prochaska & DiClemente, 1983). Hispanic ethnicity and intention to quit within 30 days were strong correlates of intention related to graphic HWLs in self-identified social smokers, light smokers, and nondaily smokers. Our data support a potential cessation effect of the graphic HWLs in subgroups of current smokers and a preventive effect among nonsmokers.

Although the current study did not expose participants to the HWLs as part of the study design, the findings among young adult nonsmokers are consistent with quantitative and qualitative evidence from U.S. and Canadian young adults that noted stronger reactions to graphic warning labels among women in terms of considering health effects (O'Hegarty et al., 2007), motivating smokers to quit (Koval, Aubut, Pederson, O'Hegarty, & Chan, 2005), and maintaining abstinence among former smokers (O'Hegarty et al., 2006), particularly for sex-specific messages. They also speak to the importance of increasing awareness of graphic HWLs among nonsmokers to ensure a greater preventive impact among young adults when graphic labels are implemented. Awareness of a message and judgments about its merits are essential first steps in effective consumer information processing, and both are critical for message acceptance, as well as attitudinal and behavior change (Argo & Main, 2004; McGuire, 1999).

Results indicated a greater level of perceived graphic HWL impact on smoking-related intentions (53%) compared with those reporting past changes to smoking behavior as a result of cigarette HWLs (20%). Although our findings do not suggest that exposure to the graphic labels will necessarily alter behavior, they do provide insight into young adults' perceived behavioral reactions given the well-documented relationship between behavioral intention and behavior in the psychological literature (Ajzen, 1991), and findings from other warning label research showing that quit-related cognitions in response to warning labels are predictive of quitting behavior (Borland, Yong, et al., 2009). In one young adult sample, O'Hegarty et al. (2007) found that 53%–58% of current smokers reported that text plus graphic labels would motivate them to quit smoking, compared with less than 30% for text-only labels. Our results are similar given the 40% of current smokers reporting future intentions related to graphic warning labels compared with the 12% of current smokers who reported forgoing a cigarette as a result of the current HWLs. Even so, these estimates may be somewhat conservative given evidence suggesting that individuals believe they are less likely to be persuaded by a message to change their behavior than other people (Perloff, 1999).

Intervening early with young adults is critical to disrupting the transition from experimental to established smoking. Given the current delays in implementation of graphic warning labels due to industry lawsuits, antismoking media campaigns may consider using graphic messaging as one means to discourage initiation in this population, complemented by several other message strategies to ensure effective communication across the target audience (Richardson & Vallone, 2011). Despite differences in the potential preventive effects of graphic labels among women, Hispanics, and younger nonsmokers, there were no differences by gender, age, or race/ethnicity in the perceived impact of warning labels on smoking behavior

among current cigarette smokers. Hispanic ethnicity, however, remained an important predictor of anticipated behavior among specific subgroups of young adult cigarette smokers. Cantrell et al. (2013) found that graphic HWLs were similarly effective across racial/ethnic subgroups among an adult population of smokers. Our findings suggest that graphic labels may be more effective among 18- to 34-year-old Hispanic lighter, nondaily, and "social" smokers, suggesting there may be subgroups within the smoking population among whom graphic warning labels will have greater impact.

This study harnesses the strengths of an existing online panel using probability-based sampling to recruit a large, nationally representative cohort of young adults, a group typically identified as hard to reach. Our analyses in this study focus on a single wave of data collection and are correlational. There are several limitations in this study: first, all tobacco product use is self-reported and may be subject to recall bias. The online nature of this panel study does not allow for biochemical validation of smoking status. Second, the survey was administered in English and Spanish, and individuals who are not literate in English or Spanish were unable to participate in this study. Third, participants were exposed neither to the current text-only cigarette HWLs nor to the graphic cigarette HWLs proposed by FDA. The questions related to beliefs and past behavior did not ask specifically about the "existing text-only" labels, and the items related to awareness and intention did not specify that the new, graphic warning labels would be on cigarette packaging. Due to the sequencing of the questions, with "warning labels on cigarettes" described in the first of the four questions, we do not anticipate that these omissions would result in sufficient bias to alter the results of our study. We acknowledge that some participants aware of the larger, text-only HWLs on smokeless tobacco packaging implemented in 2010 may have responded to some of these items in relation to new graphic HWLs on smokeless rather than cigarette products. We do not anticipate that this would result in sufficient misclassification to change our findings. Finally, response rates for this survey were 5%–6%, which are much lower than the nearly 50% rate achieved by the CDC's Behavioral Risk Factor Surveillance System in 2011 conducted using Random Digit Dialing on landlines and cell phones (Centers for Disease Control and Prevention, 2013), but evidence indicates that probability-based Internet samples such as the KnowledgePanel do not suffer from notable declines in sample representativeness with declines in response rates (Chang & Krosnick, 2009).

Criticisms of the current evidence highlight the lack of data on the potential impact of new graphic HWLs on population health (*R.J. Reynolds Tobacco Co. v. Food and Drug Admin*., 2012), although studies in other countries have demonstrated that graphic HWLs are more effective than text-only labels in reducing smoking prevalence and promoting quit attempts (Azagba & Sharaf, 2013). Further, cognitive responses to graphic labels, such as intentions not to smoke or thinking about smoking harms, are strongly predictive of cessation behavior (Borland, Yong et al., 2009). Although there is little research on warning label effectiveness among young adults, our results are consistent with the available literature and also provide new information on the potential impact of graphic labels by age and within subgroups of current smokers. Our study supports previous findings in youth and young adults that graphic HWLs play an important role in preventing smoking, in addition to encouraging cessation in young

adults (O'Hegarty et al., 2006, 2007; Vardavas et al., 2009). Findings from this study also provide some evidence for potentially effective messaging among subgroups of smokers for whom there is currently little information. The population-level impact of deterring smoking in young adults is of great importance given the long-term health consequences of smoking and graphic HWLs may serve as a catalyst to reinvigorate smoking reductions in this age group.

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DECLARATION OF INTERESTS

None declared.

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