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Attitudes Toward FDA Regulation of Newly Deemed Tobacco Products

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Abstract

Objective—To examine how smokers perceive FDA oversight of e-cigarettes, hookah, and cigars.

Methods—Current US smokers (N = 1,520) participating in a randomized clinical trial of pictorial cigarette pack warnings completed a survey that included questions about attitudes toward new FDA regulations covering newly deemed tobacco products (ie, regulation of e-cigarettes, nicotine gels or liquids used in e-cigarettes, hookah, and cigars).

Results—Between 47% and 56% of current smokers viewed these new FDA regulations favorably and between 17% – 24% opposed them. Favorable attitudes toward the regulations were more common among smokers with higher quit intentions (adjusted odds ratio (aOR): 1.17, 95% CI: 1.02, 1.33) and more negative beliefs about smokers (aOR: 1.18, 95% CI: 1.05, 1.33).

Participants with higher education, higher income, and previous exposure to e-cigarette advertisements had higher odds of expressing positive attitudes toward the new FDA regulations (p < .05).

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Human Subjects Statement. The University of North Carolina at Chapel Hill Institutional Review Board approved study procedures, and participants provided their written informed consent.

Conflict of Interest Statement. The authors have no competing interests to declare.

Conclusions—Almost half of current smokers viewed FDA regulation of newly deemed tobacco products favorably. Local and state policy-makers and tobacco control advocates can build on this support to enact and strengthen tobacco control provisions for e-cigarettes, cigars, and hookah.

Keywords

public policy; public opinion; non-cigarette tobacco products

INTRODUCTION

The US Food and Drug Administration (FDA) regulates cigarettes and smokeless tobacco. In 2016, the agency released a new deeming rule extending its regulatory authority to include e-cigarettes, hookah, and cigars.¹ Other regulations already covered many of these newly deemed products to some extent because state and local governments can enact stronger tobacco prevention ordinances than called for in federal regulations.² For instance, some nonfederal regulations restrict access to these products to youth under the age of 18, ban use of these products where cigarette smoking is prohibited, or raise taxes.^{3,4} The recent FDA deeming rule requires that all products derived from tobacco, including e-cigarettes, hookah, and cigars, meet a public health standard set forth in the 2009 Family Smoking Prevention and Tobacco Control Act, include health warnings on product packages and advertisements, and not be sold to youth under the age of 18.¹ Additionally, manufacturers of these newly deemed tobacco products must now report harmful and potentially harmful constituents, not make modified risk claims on tobacco products (unless authorized by the FDA), and obtain authorization before selling new products.¹

Enforcement of some of these new regulations began in August, 2016,¹ but prior to this time several groups filed lawsuits against the FDA.⁵ Many of these lawsuits challenged the classification of e-cigarettes as “tobacco products”; others contested the regulation prohibiting the use of the term “mild” in tobacco products.⁵ These lawsuits may delay enforcement of some of these new regulations.

With impending enforcement, examining how the public perceives regulations of newly deemed tobacco products is timely. Attitudes toward tobacco control policies are associated with implementation, enforcement, and effectiveness.^{6,7} For instance, a review by the Interactional Agency for Research on Cancer concluded that “public attitudes are likely to impact how well such laws are complied with and enforced; hence, how well these laws achieve health protection goals.”^{8, p. 93} Specifically, when laws are enacted without public support, poor compliance can occur (especially for voluntary control measures, such as smoke-free homes).⁸ Compliance has been higher in countries that conducted public education campaigns accompanying the law and where there was increased public support.⁸ Additionally, a cross-sectional study of California youth found associations between favorable attitudes toward anti-tobacco policies and advocacy behaviors, such as asking someone not to smoke.⁹

Moreover, studies assessing policy attitudes can illuminate potential messages for media campaigns designed to increase public support for and compliance with regulation.^{10,11} Before implementation of a new law, media campaigns can inform individuals of the

upcoming law and its rationale; after implementation, media campaigns can also increase support and compliance, typically by emphasizing the law's benefits and thanking individuals for helping with successful implementation.¹² Research suggests that high compliance exists in jurisdictions where media campaigns have been aired.^{13–15} For instance, a study of a social marketing campaign designed to promote Mexico City's 2008 smoke-free law found an increase in support of the law and in increase in its perceived benefits.¹² The FDA also uses media campaigns to encourage voluntary compliance of retailers with Tobacco Control Act regulations.¹⁶

Finally, state and local tobacco control policy-makers can use information garnered from studies examining policy attitudes to engage in local actions, including counter-marketing strategies, enforcement of provisions, and adoption of strengthened local tobacco control provisions. For instance, interviews with 444 state legislators found that perceived constituent support was associated with legislators' intention to vote for a tax increase.⁶ Thus, research on policy attitudes can inform local and state policy-makers as they enact stronger tobacco control provisions. New York City, for example, relied on several strategies to build a spectrum of public support when seeking to raise the minimum age to purchase tobacco.¹⁷ Several other examples exist of state and local organizations using data about policy attitudes to enact stronger tobacco control efforts.^{18–20}

Examining attitudes of smokers is especially important. When individuals perceive policies to be too restrictive, they may respond by ignoring such policies or opposing them.^{21,22} Smokers, who likely place greater importance on tobacco than non-smokers, may therefore react more negatively to potential tobacco control policies.²¹ Indeed, previous research has found that smokers are less supportive of tobacco control policies than non-smokers,^{10,23,24} and while data are limited, smokers may react more negatively to tobacco control efforts, such as cigarette pack warnings.²¹

Previous research has examined attitudes toward e-cigarette regulation, finding a moderate to high proportion of favorable attitudes for different e-cigarette regulations, depending on the type of regulation, participant characteristics, and setting (eg, geographic location).^{25,26} For instance, youth access restrictions are viewed more favorably than other types of regulations and smokers seem to have less favorable attitudes to regulations than non-smokers.^{25,26} However, no studies to our knowledge have examined attitudes for regulation of cigars or hookah, and none has done so exclusively with smokers. Our study examined attitudes toward FDA regulation of newly deemed tobacco products (ie, e-cigarettes, hookah, and cigars) among a large sample of current US smokers.

METHODS

Participants and Procedures

Data for our study came from a randomized clinical trial of pictorial warnings on cigarette packs. Recruitment occurred from September 2014 to August 2015 in North Carolina and California. Participants were age 18 or older and current smokers (ie, had smoked more than 100 lifetime cigarettes and smoked every day or some days). The trial randomized 2,149 smokers to receive text-only warnings or pictorial warnings on their cigarette packs for 4

weeks. Participants completed surveys at the baseline visit and then at each weekly visit. Of the 1,731 participants who attended the third study visit when policy attitudes were assessed, we dropped data for 211 participants (12%) who had missing data on any of the variables examined, creating an analytic sample of 1,520 smokers. The University of North Carolina Institutional Review Board approved study procedures, and participants provided their written informed consent. More details about the study methods are available elsewhere.²⁷

Measures

Policy attitudes—Four survey items assessed attitudes toward FDA regulation of newly deemed tobacco products. During the third week of the study, the survey included 4 items that read, “Do you think the FDA should regulate,” 1) “e-cigarettes and other vaping devices,” 2) “nicotine gels or liquids used in e-cigarettes and other vaping devices,” 3) “cigars,” and 4) “tobacco used for water pipes and hookah.” Response options to each of the items were “yes” (coded as 1), “no” (coded as 0), and “don’t know” (coded as 0). To create an index of attitudes toward FDA regulations of newly deemed tobacco products, we summed the 4 policy support variables (range 0–4, with higher scores indicating more favorable attitudes). Because the resulting index was strongly bimodal, we dichotomized scores for individuals who had favorable attitudes toward most regulations (ie, thought FDA should regulate 3 or all of the 4 products) vs. individuals who did not have favorable attitudes toward most regulations (ie, thought FDA should regulate 0, 1, or 2 products).

Demographics—Demographic characteristics assessed were race (white, Black / African American, or other), ethnicity (Hispanic or non-Hispanic), gender (male, female, or transgender), sexual orientation (straight/heterosexual or gay, lesbian, or bisexual), age, poverty status (classified as above or below 150% of the Federal Poverty Line), and education. The dataset also included site (North Carolina or California) and trial arm (whether participants were assigned to receive pictorial warnings or text-only warnings).

Tobacco-related correlates—Tobacco-related correlates included smoking frequency, quit intentions, tobacco prevention media campaign awareness, e-cigarette advertising exposure, positive/negative smoker prototypes, positive/negative e-cigarette user prototypes, trait reactance, e-cigarette use, cigar use, and hookah use.

The smoking frequency survey item read, “On how many of the last 7 days did you smoke cigarettes?”. We classified participants as daily smokers if they reported smoking on all 7 days and non-daily smokers if they reported smoking on 1–6 days.²⁸ The quit intention item read, “Are you planning to quit smoking...” with response options for “within the next month”, “within the next 6 months”, “sometime in the future beyond 6 months” or “not planning to quit”.²⁹ We reverse coded responses so that item scores ranged from 1–4, with 4 indicating higher intentions.

Because media campaign awareness may be associated with policy attitudes,³⁰ we assessed tobacco prevention media campaign exposure by asking whether participants had seen 4 Real Cost campaign advertisements or 1 Tips from Former Smokers campaign advertisement in the past 4 weeks. We dichotomized exposure as “yes” (if participants recalled seeing at least 1 advertisement, coded as 1) or “no” (if participants did not recall

seeing any advertisements, coded as 0). Likewise, since previous research has found associations between exposure to information and advertising about e-cigarettes and public support for e-cigarette regulations,^{26,31} we assessed e-cigarette advertising exposure. The survey asked, “In the last 30 days, have you seen or heard any advertisements for e-cigarettes?” and dichotomized exposure as “yes” (coded as 1) or “no” (coded as 0). We adapted this item from the Wave 2 survey of the Population Assessment of Tobacco and Health (PATH) study.³²

Previous research has found smoker prototypes to be associated with willingness/interest in trying tobacco products and relapse after quitting.^{33–35} However, no studies to our knowledge, have looked at it as a correlate of policy attitudes. The survey assessed positive (4 items) and negative smoker prototypes (4 items) by asking participants to consider “... how much the following characteristics describe a typical cigarette smoker your age.”^{33,36} The 5-point scale ranged from “not at all” (coded as 1) to “very much” (coded as 5). We created a mean score for positive smoker prototypes (cool, smart, sexy, healthy; $\alpha = .79$) and for negative smoker prototypes (disgusting, unattractive, immature, inconsiderate; $\alpha = .82$). The survey used the same items to assess positive ($\alpha = .86$) and negative ($\alpha = .86$) e-cigarette user prototypes, replacing “cigarette smoker” with “e-cigarette user.”

To assess e-cigarette, cigar, and hookah use, the survey assessed ever use (even one or 2 times) and use during the previous week. Cigar use included premium cigars, little cigars, and cigarillos. We classified participants as “never used”, “ever used”, or “used in past week”.

Since some research suggests that reactance is associated with lower support for tobacco control policies,²¹ we included a measure of trait reactance as a correlate of attitudes toward FDA regulations. The survey used 11 items from the Hong Psychological Reactance Scale that measures trait psychological reactance in response to different scenarios (eg, “I become angry when my freedom of choice is restricted”).³⁷ The response scale ranged from strongly disagree (coded as 1) to strongly agree (coded as 5); we created a scale by averaging the responses ($\alpha = .86$).³⁸

Data Analysis

We first examined correlates of positive attitudes toward FDA regulations of newly deemed tobacco products using bivariate logistic regressions. We then conducted a multivariable logistic regression, including correlates from the bivariate analyses that were statistically significant with $p < .10$. Results included odds ratios (ORs), adjusted odds ratios (aOR) and confidence intervals (CI). Analyses used SAS version 9.4 survey procedures (SAS Inc., Cary, NC, USA). We set critical $\alpha = .05$ and used 2-tailed statistical tests.

RESULTS

Participant Characteristics

Most participants were ages 25 to 54 (68.2%) (Table 1). The sample was diverse, with a substantial number of African American (44.9%), low income (52.8%), low education (28.4% reported a high school degree or less), and sexual minority (17.1% identified as gay,

lesbian or bisexual) participants. More than three-quarters of the sample were daily smokers (81.1%), and many participants were ever users of hookah (30.5%), cigars (39.3%), or e-cigarettes (47.4%).

Attitudes toward FDA regulations of newly deemed tobacco products

About half of respondents reported that FDA should regulate each newly deemed tobacco product (Figure 1). Smokers favored regulation of e-cigarette liquids and nicotine gels (56.2%) most, followed by regulation of e-cigarettes (51.8%), cigars (47.8%), and hookah (47.0%). Nearly one-third of smokers (26% to 29%) reported that they did not know whether they supported the regulations, and smaller percentages of smokers (17% to 24%) opposed these regulations. Slightly less than half (45.8%) of the participants had favorable attitudes toward 3 or 4 of the 4 regulations assessed (Figure 2).

Correlates of favorable attitudes toward FDA regulation

Stronger quit intentions (aOR: 1.17, 95% CI: 1.02, 1.33) and more negative beliefs about smokers (aOR: 1.18, 95% CI: 1.05, 1.33) were associated with having favorable attitudes towards new FDA regulations in multivariable analysis (Table 2). Additionally, smokers who reported exposure to e-cigarette advertisements had higher odds of favorable attitudes than smokers who did not report exposure (aOR: 1.43, 95% CI: 1.14, 1.78). Smokers categorized as low income had lower odds of favorable attitudes than their higher-income counterparts (aOR: 0.73, 95% CI: 0.58, 0.91). Smokers who reported some college (aOR: 1.48, 95% CI: 1.14, 1.93), a college degree (aOR: 2.07, 95% CI: 1.45, 2.96), or a graduate degree (aOR: 2.94, 95% CI: 1.75, 4.93) had higher odds of favorable attitudes than smokers with a high school degree or less. In bivariate analyses, but not in multivariable analyses, having favorable attitudes toward new FDA regulations was less common among black respondents; respondents with positive smoker prototypes; respondents with positive e-cigarette user prototypes; and respondents who used cigars in the past week, whereas favorable attitudes were more common among respondents who had ever used e-cigarettes or ever used hookah.

DISCUSSION

Almost half of adult smokers in our study had favorable attitudes toward FDA regulations of newly deemed tobacco products. Support for FDA regulation of newly deemed products outweighed opposition. About half of smokers favored each of the 4 regulations, whereas only about 1 in 5 smokers opposed them. The remaining smokers were undecided. It is possible that since many smokers want to quit cigarettes,³⁹ they would support regulations to prevent others from using other tobacco products. It is also possible that many smokers assumed that the FDA would regulate other tobacco products, such as cigars, e-cigarettes, and hookah, and therefore viewed regulations more favorably.

Research from public policy and agenda setting theory suggests that attitudes are an important factor in policy adoption, implementation, and effectiveness.^{6,7} For instance, in a review of the 1998 failed US Senate tobacco legislation, Blendon and Young concluded that lack of broad public support contributed to the legislation's failure.⁴⁰ Moreover, the tobacco industry can use public opposition to regulations to further delay implementation and

marshal support among legislators concerned with limiting ‘individual freedom’.^{41,42} For these reasons, examining attitudes toward proposed or newly adopted regulations is important. While few studies have prospectively examined the relationship between attitudes and *compliance* with public health laws, some data suggest that how the public views laws or regulations may be associated with the extent to which they comply with regulations, taxes, and other legal requirements.⁴³ Moreover, research from the US and UK suggests that there is a strong correlation between policy acceptability and perceived policy effectiveness.⁴⁴ To increase the level of public support for new policies, tobacco control advocates could therefore use media campaigns as a population-level intervention. By emphasizing the need for regulation, the FDA’s role in regulating tobacco products, and the effectiveness of regulations, campaigns could attempt to make attitudes toward new FDA regulations more positive.¹² Moreover, given that we found more than a quarter of smokers reported uncertainty regarding new FDA regulations, campaigns could focus on smokers who have not yet made up their minds as a way to increase favorable attitudes.

We also found that smokers with higher quit intentions and more negative beliefs about smokers had more favorable attitudes toward FDA regulations, a finding that is consistent with previous research.¹⁰ It is possible that smokers who would like to quit smoking cigarettes support regulations of other tobacco products as an additional measure to aid quit attempts. We cannot, however, determine the temporality of this association. At the very least, our findings suggest that media campaigns designed to increase public awareness or support about regulations could focus on smokers with low quit intentions. Notably, we found no difference in the proportion of favorable attitudes among users of e-cigarettes, hookah, and cigars compared to non-users of these products, which further suggests consistent support across products for these new regulations, independent of product use.

Smokers with income below the poverty line had *less* favorable attitudes toward FDA regulations and individuals with higher educational attainment had *more* favorable attitudes toward FDA regulations, suggesting the importance of including income and education as distinct control variables (rather than some combined “SES” variable) in future analyses.⁴⁵ Finally, we found that exposure to e-cigarette advertising was associated with having more favorable attitudes toward most regulations. This finding stands in contrast with previous research in which higher exposure to advertising, media, and interpersonal discussion about e-cigarettes was associated with lower support for vaping regulations.³¹ It is possible that discrepancies occurred because other studies have looked at specific regulations (eg, policies to regulate vaping in certain venues) in the general public and our study looked at general regulations among smokers only. Future research could further explore the association between exposure to advertising and attitudes toward regulation.

Finally, in addition to federal regulation, states and localities can use favorable attitudes to enact and strengthen local tobacco control provisions. As of 2016, more than a dozen states and 500 localities have regulated e-cigarette use in existing smoke-free venues,⁴⁶ more than a dozen states and 300 localities have regulated e-cigarette use in other venues,⁴⁶ and several large cities—including Chicago and New York City—have regulated or prohibited the sale of flavored tobacco products, including e-cigarettes, cigars, and hookah.⁴⁷ Our findings may

suggest groups of individuals that local and state agencies may want to focus on to increase favorable attitudes toward regulations.

Limitations

Strengths of our study include our diverse sample of adult smokers. However, limitations include that we cannot determine the temporality of associations; our measures of FDA regulations did not include specific examples of regulations (eg, banning use, regulating sale) or what regulation means; and we did not assess awareness of current FDA regulations. Additionally, we collected data using a convenience sample of smokers for a randomized clinical trial, which may limit the generalizability of findings to smokers more broadly. Moreover, attitudes toward the deeming rule among non-smokers and after the implementation of the rule remain unknown. Despite these limitations, our study provides new data about attitudes toward FDA regulations of newly deemed tobacco products among US smokers. Future research could be used to explore more in-depth perceptions of specific regulations, policy support among non-smokers and former smokers, and what “regulation” may mean to different people.

IMPLICATIONS FOR TOBACCO REGULATION

Implementation of FDA regulations of newly deemed tobacco products is ongoing. Our findings suggest several areas of particular interest for tobacco regulatory science. First, about half of smokers supported FDA regulation of e-cigarettes, cigars, and hookah. Support is likely to be even higher among non-smokers.^{10,23,31} This high level of public support may facilitate compliance with and enforcement of the FDA’s new regulatory measures,^{12–16} such as reporting adverse experiences or product violations,⁴⁸ and effectiveness of the FDA’s new regulatory measures, such as noticing health warnings on newly deemed tobacco products.⁴⁹ Continued surveillance of public attitudes will allow FDA to tailor messaging about new policies.

However, some smokers were undecided about or opposed stronger regulations. As implementation and enforcement of FDA regulations continues, stronger educational campaigns that encourage compliance with existing and new regulations may be necessary. Such campaigns could emphasize the rationale and potential benefits of regulation and define FDA’s role in regulation.¹² These campaigns could focus on smokers who have not made up their minds about regulations (~28% in our study) or smokers who opposed regulation (~22%). Such campaigns would have the potential to increase favorable attitudes toward regulation, and they could also help normalize policy change and regulation of tobacco products to counter marketing and arguments from the tobacco industry.

Finally, tobacco control regulations continue to occur locally and in states, outside of federal regulations. Community organizations and tobacco control advocates in states can build on the high level of support we found in our study to enact and strengthen tobacco control provisions for e-cigarettes, cigars, and hookah. Historically, grassroots community efforts have succeeded in encouraging adoption of some of the strongest and most innovative tobacco control policies, which can then pave the way for state and federal adoption.⁵⁰ By using well-known strategies, such as allowing constituents to engage with policymakers or

capitalizing on relationships with retailers,¹⁷ local communities can adopt innovative regulations of new tobacco products, such as flavor or advertising restrictions to prevent youth initiation. Moreover, community organizations and tobacco control advocates can even seek support from smokers who favor regulation to influence legislators' perceptions of constituent support.⁶ In the meantime, while implementation of FDA regulation of newly deemed tobacco products continues, further research is needed on what types of regulations smokers and non-smokers favor, how they define regulation, and the role of the FDA in regulation.

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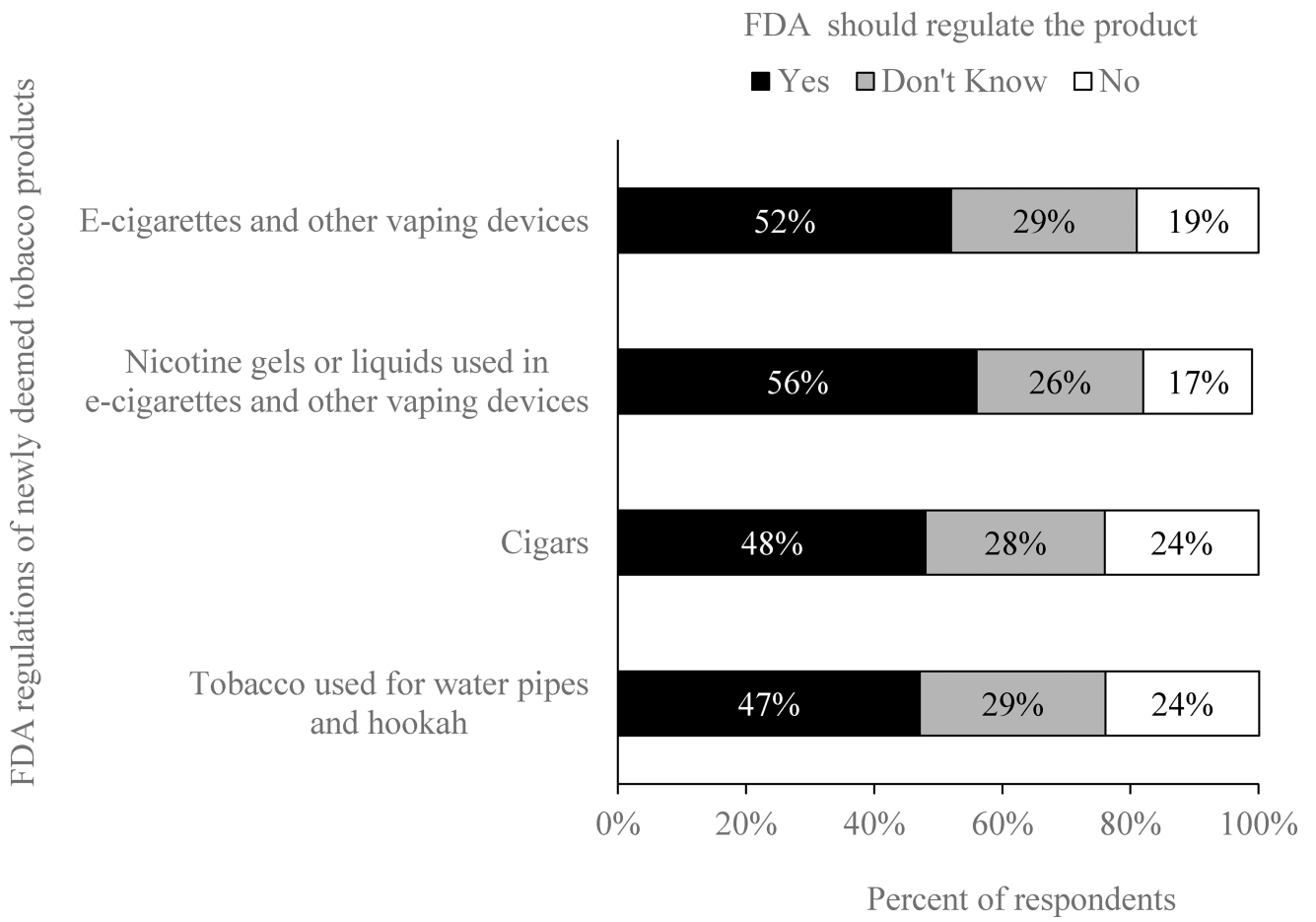


Figure 1.
Attitude Toward FDA Regulation of Newly Deemed Tobacco Products

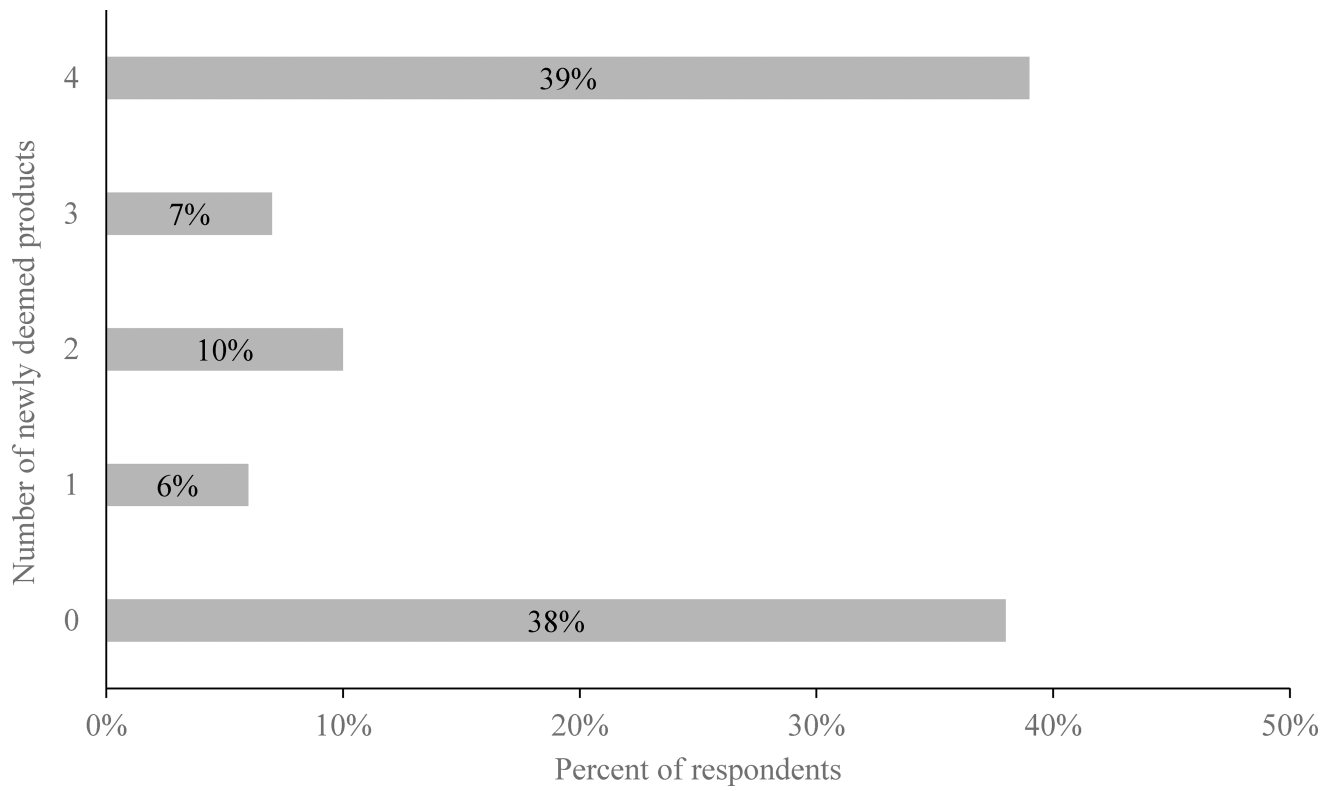


Figure 2.
Number of Newly Deemed Tobacco Products that FDA Should Regulate

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Table 1

Participant Characteristics, N = 1,520

Characteristic	N (%) or mean (SD)
Trial arm	
Text-only warnings	768 (50.5)
Pictorial warnings	752 (49.5)
Study site	
California	822 (54.1)
North Carolina	698 (45.9)
Age, years	
18–24	215 (14.1)
25–39	573 (37.7)
40–54	464 (30.5)
55	268 (17.6)
Gender	
Male	721 (47.4)
Female	773 (50.9)
Transgender	26 (1.7)
Sexual orientation	
Straight or heterosexual	1260 (82.9)
Gay, lesbian, or bisexual	260 (17.1)
Hispanic ethnicity	
No	1413 (93.0)
Yes	107 (7.0)
Race	
White	578 (38.0)
Black or African American	683 (44.9)
Other	259 (17.0)
Education	
High school degree or less	432 (28.4)
Some college	747 (49.1)
College graduate	248 (16.3)
Graduate degree	93 (6.1)
Low income <150% of federal poverty level	
No	717 (47.2)
Yes	803 (52.8)
Smoking frequency	
Daily	1232 (81.1)
Non-daily	288 (19.0)
Quit intentions, mean (SD)	2.4 (0.8)
Tobacco prevention media campaign exposure	
Not exposed	488 (32.1)

Characteristic	N (%) or mean (SD)
Exposed	1032 (67.9)
E-cigarette advertising exposure in the past 30 days	
Not exposed	580 (38.2)
Exposed	940 (61.8)
Positive e-cigarette user prototype, mean (SD)	2.0 (1.0)
Negative e-cigarette user prototype, mean (SD)	1.7 (0.9)
Positive smoker prototype, mean (SD)	1.9 (0.9)
Negative smoker prototype, mean (SD)	2.0 (0.9)
E-cigarette use	
Never used	579 (38.1)
Ever used	721 (47.4)
Used in past week	220 (14.5)
Cigar use	
Never used	608 (40.0)
Ever used	597 (39.3)
Used in past week	315 (20.7)
Hookah use	
Never used	971 (63.9)
Ever used	464 (30.5)
Used in past week	85 (5.6)
Trait reactance, mean (SD)	2.9 (0.7)

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Table 2

Correlates of Favorable Attitudes Toward FDA Regulation of Newly Deemed Tobacco Products, N = 1,520

Characteristic	Number supporting FDA regulations/total number in each category (%)	Unadjusted models OR (95% CI)	Adjusted model aOR (95% CI)
Trial arm			
Text-only warnings	352/768 (45.8)	REF	
Pictorial warnings	344/752 (45.7)	1.00 (0.81, 1.22)	
Study site			
California	391/822 (47.6)	REF	
North Carolina	305/698 (43.7)	0.86 (0.70, 1.05)	
Age, years			
18–24	98/215 (45.6)	REF	
25–39	263/573 (45.9)	1.01 (0.74, 1.39)	
40–54	213/464 (45.9)	1.01 (0.73, 1.40)	
55	122/268 (45.5)	1.00 (0.70, 1.43)	
Gender			
Male	328/721 (45.5)	REF	
Female	355/773 (45.9)	1.02 (0.83, 1.25)	
Transgender	13/26 (50.0)	1.20 (0.55, 2.62)	
Sexual orientation			
Straight or heterosexual	564/1260 (44.8)	REF	REF
Gay, lesbian, or bisexual	132/260 (50.8)	1.27 (0.97, 1.66)	1.17 (0.88, 1.55)
Hispanic ethnicity			
No	646/1413 (45.7)	REF	
Yes	50/107 (46.7)	1.04 (0.70, 1.54)	
Race			
White	299/578 (51.7)	REF	REF
Black or African American	266/683 (39.0)	0.60 (0.48, 0.75)*	0.89 (0.68, 1.16)
Other	131/259 (50.6)	1.00 (0.71, 1.28)	1.15 (0.85, 1.58)
Education			
High school degree or less	142/432 (32.9)	REF	REF
Some college	347/747 (46.5)	1.77 (1.38, 2.27)*	1.48 (1.14, 1.93)*
College graduate	144/248 (58.1)	2.83 (2.05, 3.90)*	2.07 (1.45, 2.96)*
Graduate degree	63/93 (67.7)	4.29 (2.66, 6.92)*	2.94 (1.75, 4.93)*
Low income, <150% of federal poverty level			
No	386/717 (53.8)	REF	REF
Yes	310/803 (38.6)	0.54 (0.44, 0.66)*	0.73 (0.58, 0.91)*
Smoking frequency			
Daily	122/288 (42.4)	REF	
Non-daily	574/1232 (46.6)	1.19 (0.92, 1.54)	

Characteristic	Number supporting FDA regulations/total number in each category (%)	Unadjusted models OR (95% CI)	Adjusted model aOR (95% CI)
Quit intentions		1.26 (1.12, 1.43) *	1.17 (1.02, 1.33) *
Tobacco prevention media campaign exposure			
Not exposed	239/488 (49.0)	REF	REF
Exposed	457/1032 (44.3)	0.83 (0.67, 1.03)	0.93 (0.73, 1.17)
E-cigarette advertising exposure in the past 30 days			
Not exposed	233/580 (40.2)	REF	REF
Exposed	463/940 (49.3)	1.45 (1.17, 1.78) *	1.43 (1.14, 1.78) *
Positive e-cigarette user prototype		0.83 (0.74, 0.92) *	0.89 (0.78, 1.01)
Negative e-cigarette user prototype		1.02 (0.91, 1.15)	
Positive smoker prototype		0.87 (0.77, 0.97) *	0.94 (0.82, 1.09)
Negative smoker prototype		1.14 (1.02, 1.27) *	1.18 (1.05, 1.33) *
E-cigarette use			
Never used	244/579 (41.1)	REF	REF
Ever used	350/721 (48.5)	1.30 (1.04, 1.62) *	1.08 (0.84, 1.39)
Used in past week	102/220 (46.4)	1.19 (0.87, 1.62)	1.13 (0.77, 1.60)
Cigar use			
Never used	282/608 (46.4)	REF	REF
Ever used	294/597 (49.3)	1.12 (0.90, 1.41)	0.96 (0.74, 1.24)
Used in past week	120/315 (38.1)	0.71 (0.54, 0.94) *	0.83 (0.61, 1.13)
Hookah use			
Never used	425/971 (43.8)	REF	REF
Ever used	239/464 (51.5)	1.37 (1.09, 1.70) *	1.08 (0.82, 1.42)
Used in past week	32/85 (37.7)	0.78 (0.49, 1.23)	0.91 (0.54, 1.53)
Trait reactance		0.89 (0.77, 1.03)	

Note. The multivariable regression model included variables with *p* values <.10 in bivariate analyses.

CI = confidence interval; OR = odds ratio; aOR = adjusted odds ratio; REF= reference category.

* *p* .05