

Public Knowledge and Credibility Perceptions of the FDA as a Tobacco Regulator

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Abstract

Introduction: Since the U.S. Food and Drug Administration (FDA) was granted regulatory authority over tobacco products in 2009, few studies have examined perceived credibility of the FDA in this role. The current study assessed knowledge and credibility of the FDA as a regulator of tobacco products.

Methods: In a nationally representative survey of U.S. adults (N = 4758), we assessed knowledge that the FDA regulates the manufacture, distribution, and marketing of cigarettes, and credibility of the FDA as a tobacco regulator. We examined demographic differences in knowledge and credibility, and associations of knowledge and trust in government with credibility perceptions.

Results: Less than half of respondents reported knowing the FDA regulates how cigarettes are sold (46.8%) and advertised (49.7%), and only 36.0% knew the FDA regulates how cigarettes are made, with few demographic differences. Respondents reported that the FDA was moderately credible in regulating tobacco. Knowledge of the FDA as a tobacco regulator and trust in government were the strongest predictors of credibility. Being of younger age, being White (compared to African American), and being male were associated with higher credibility ratings of the FDA.

Conclusions: Much of the public still does not know that the FDA regulates tobacco products, and credibility perceptions are moderate. Greater knowledge of the FDA's regulatory role was associated with higher credibility; efforts that increase the public's understanding of the FDA's role as a tobacco regulator may positively impact views of the agency's credibility. This may in turn improve public reception to the FDA's messages and regulations.

Implications: This study is the first to show nationally representative estimates of both knowledge and credibility of the FDA as a tobacco regulator. Our research shows further that knowledge of the FDA's tobacco regulatory roles is likely to be an important factor related to perceived credibility of the FDA. Increasing the public's knowledge of the FDA's roles may enhance the agency's credibility, which can improve public reception to messages and regulations.

Introduction

The U.S. Food and Drug Administration (FDA) was given regulatory authority over cigarettes, roll your own tobacco products, and smokeless tobacco under the 2009 Family Smoking Prevention and Tobacco Control Act (FSPTCA), which mandates that the FDA oversee various aspects of tobacco manufacturing, advertising, and sales.¹ In May 2016, the FDA issued a final “deeming” rule extending their regulatory authority from the limited tobacco products covered by FSPTCA to all tobacco products, including e-cigarettes, little cigars and cigarillos, and hookah.² As a tobacco regulator, the FDA has broad authority to regulate the manufacture, distribution, and marketing of tobacco products, which includes developing and implementing public communication campaigns about the harms of tobacco use, including *The Real Cost*,³ *Fresh Empire*,⁴ and *This Free Life*.⁵

Previous research has indicated that public knowledge of and beliefs about the credibility of an organization can impact the overall effectiveness of communication activities in changing attitudes and behavior^{6–8} and can enhance support for and compliance with recommendations and regulations.^{9–11} Source credibility itself is made up of two main underlying constructs: expertise, or the ability of an organization to know correct information, and trustworthiness, or the extent to which an organization presents what it believes to be correct information.^{6,7,12} Knowing that the FDA regulates the manufacturing, distribution (sales), and advertising of tobacco products, such as cigarettes, may inform views of the agency’s expertise in this role. For a government agency, the extent to which the agency is perceived to act in the public’s best interest is a third construct that is likely also to be a key element of credibility.⁶ One study about the FDA’s role in ensuring medication safety found that beliefs about the agency’s credibility (specifically trustworthiness in this case) can drive behavior change, as parents who trusted the FDA’s recommendations about cold medications were more likely to follow these recommendations for their children.¹⁰ Another study tested the effect of source credibility on warnings for alcohol, cigarettes, and iron supplements, finding that the inclusion of a specific source (including the FDA) increased ratings of the credibility of the warning and compliance intentions.¹¹ Thus the public’s knowledge of the FDA’s roles as a tobacco regulator and beliefs about its credibility may impact the agency’s ability to successfully communicate with the public and implement new tobacco regulations.

Past research provides some insights into existing levels of knowledge about the FDA’s tobacco regulatory authority and its credibility, although several limitations remain to be addressed by the current research. With regard to knowledge, one study, conducted shortly after the FDA received authority to regulate tobacco products in 2009, found that most smokers did not know that the FDA had authority to regulate tobacco products.¹³ Another study, conducted a few years later (2012–2013), showed that still less than half of the public knew that the FDA regulated tobacco products.¹⁴ Thus, even several years after the FDA gained regulatory authority over tobacco products, knowledge of this authority was not widespread. In another study, a majority (62.5%) of U.S. adults felt the FDA gave trustworthy information to the public, a related component to credibility.¹⁵ In a scale development study of the FDA’s tobacco-related credibility, participants rated its credibility as moderately high, although this study used a convenience sample and was not nationally representative.¹⁶

The current study builds on this past research and is the first to report estimates of both knowledge and credibility of the FDA among a nationally representative sample of adults in the United

States, specific to its tobacco regulatory role. In this study, we sought to understand the potential factors associated with public knowledge and credibility respectively. Additionally, based on our conceptualization of credibility as a construct made up of trustworthiness, expertise, and public interest, we hypothesized that having greater knowledge about the FDA as a regulator of tobacco products could enhance views of its credibility. We examined associations of demographic characteristics, behaviors, and beliefs with knowledge of the FDA as a regulator of tobacco products and perceived credibility of the FDA in this role.

Methods

A nationally representative telephone survey of adults aged 18 years or older was conducted between September 2014 and May 2015. Random digit dial (RDD) landlines and cell phone numbers that covered approximately 98% of the U.S. population were used. To oversample smokers, the poorest counties with the highest smoking rates were oversampled. Cell phones were oversampled to maximize inclusion of young adults. Sampling weights were based on variables including census region, age, education, gender, ethnicity, phone type (cell or landline), and regional smoking rates. The survey topics included tobacco communication, the FDA’s regulation of tobacco products, and chemicals in tobacco products. All newly developed survey measures were tested using cognitive interviewing, including the knowledge and credibility items used in the current study. The entire sample included 5014 interviews with a weighted response rate of 42%. Further details about the design and methods used in this national survey are provided in a separate paper.¹⁷ The study was approved by UNC Chapel Hill’s Institutional Review Board (#13–2779).

Outcome Measures

Knowledge of FDA Regulation of Tobacco

Survey respondents who answered “yes” to the question, “Have you ever heard of the FDA or the Food and Drug Administration?” received three additional questions in random order to assess their knowledge of the FDA’s regulation of tobacco products, with reference to cigarettes specifically, as cigarettes are the most commonly used and known tobacco product. The three questions were, “Do you think the FDA regulates how cigarettes are... (1) made, (2) sold in stores, (3) advertised?,” and participants were given “yes” and “no” as response options. If respondents did not answer “yes” or “no,” the interviewer coded their responses as “do not know” or “refused” as appropriate. “Yes” responses to each item were treated as separate outcomes in logistic regression models of knowledge. In linear regression models of credibility, “yes” responses to each knowledge item were coded as “1”, and summed to create a measure of knowledge that ranged from 0 to 3.

Credibility of FDA as a Tobacco Regulator

Prior to asking about perceived credibility of the FDA, the interviewer informed all participants, “The FDA now regulates cigarettes and many other tobacco products. The next series of questions is about your opinions towards the FDA in this role.” Credibility was measured using eight items examining beliefs about the trustworthiness, expertise, and public interest of the FDA as a tobacco regulator.⁶ Items included, “Do you trust the FDA to inform the public about the risks of tobacco products?,” “Is the FDA honest about the risks of tobacco products?,” “Do you believe what the FDA says about the risks of tobacco products?,” “Is the FDA an expert on

regulating tobacco products?,” “Is the FDA capable of doing a good job regulating tobacco products?,” “Can the FDA effectively regulate tobacco products?,” “Is the FDA committed to protecting the public from possible risks of tobacco products?,” and “Do you believe that if the FDA knew that certain tobacco products are less harmful than thought, they would tell the public?”. Respondents answered “yes” or “no” to each item. Interviewers coded other responses as “do not know” or “refused” as appropriate. “Yes” responses were summed to create a scale ranging from 0 to 8 with higher numbers indicative of higher perceived credibility. As a whole, this measure showed acceptable internal consistency (Cronbach’s $\alpha = 0.79$).

Independent Variables

Demographic Characteristics

Demographic variables included age (grand mean centered), gender (male = 0, female = 1), race (Black/African American = 0, other race = 1, White = 2), ethnicity (Latino = 0, not Latino = 1), poverty status (income above = 0 or below = 1 the poverty line), sexual orientation (gay, lesbian, or bisexual [GLB] = 0 or not GLB = 1), education (less than high school = 5, high school diploma or general equivalency diploma = 4, some college = 3, associate’s degree = 2, college degree = 1, or graduate degree = 0) and current smoking status (current smokers were defined as having smoked at least 100 cigarettes in their lifetime and currently smoke some days or every day; current smoker = 0, not a current smoker = 1). We were most interested in current smoking status (rather than lifetime smoking status), as current smokers would likely be the most directly impacted by the FDA’s regulation of tobacco products. Levels of each categorical variable with the highest numerical code were set as the reference groups.

Beliefs

Trust in the federal government was measured using the item “How much trust do you have in the Federal government?” Responses were coded as 0 = none at all, 1 = not very much, 2 = no opinion, 3 = a fair amount, 4 = a great deal; participants who reported “don’t know” or who refused to answer this question were coded as missing.

Analyses

Sample characteristics are given for the entire survey sample ($N = 5014$). Descriptive analyses of knowledge and credibility perceptions, as well as regression analyses included respondents who reported that they had heard of the FDA ($N = 4758$, 94.9% of total sample). Cases with missing data on any covariates were dropped from their respective regression models. All analyses were performed in SAS 9.4 using the survey design features of the study. Weighted sample means and proportions with 95% confidence intervals were produced and surveylogistic and surveyregression procedures were used. In models with knowledge and credibility as the outcome, we tested factors that predicted “yes” responses to these items, or, in other words, greater knowledge and higher perceptions of credibility. We first conducted three logistic regression models to assess the relationships between demographic and belief variables and knowledge that the FDA regulates how tobacco products are made, sold, and advertised, respectively. Second, we used linear regression to assess the associations between demographic and belief variables and credibility of the FDA. We conducted two linear regression models, the first containing only the demographic variables and the second which added the belief and knowledge variables.

Results

Sample Characteristics and Descriptive Analyses

Weighted sample characteristics are provided in [Table 1](#) and are similar to U.S. population characteristics with regard to gender (48.5% male), race (67.9% White), Hispanic ethnicity (14.2%), education (42.6% with a high school diploma or less), poverty status (17.5% living below the poverty line), sexual orientation (96.8% heterosexual), and current smoking (17.5% current smokers). Unweighted sample characteristics are also shown in this table for reference. Weighted data was used for all analyses.

Just over one-third of respondents knew that the FDA regulates how cigarettes are made (36.0%), while just less than half knew that the FDA regulates how cigarettes are advertised (49.7%), and sold in stores (46.8%). When evaluating the “yes” responses across all three domains, 26.3% of participants did not know the FDA regulated any of these three domains. Of the 73.7% that did know the FDA regulated at least one domain, 25.6% knew that the FDA regulated only one of these domains, 28.5% knew that the FDA regulated two of these domains, and 19.7% knew that the FDA regulated all three of these domains. The public viewed the FDA to be moderately credible on tobacco issues, shown by a mean response of 4.6 on a scale of 0 to 8. Weighted frequencies of responses to each of the credibility items are shown in [Table 2](#). Several items showed similar degrees of endorsement; most were supported by over half to three-quarters of participants. The two items were supported by less than half of participants were, “Is the FDA an expert on regulating tobacco products?” and “Do you believe that if the FDA knew that certain tobacco products are less harmful than thought, they would tell the public?”

Knowledge of FDA as a Tobacco Regulator

Being male (compared to female) was associated with 1.28 higher odds of knowing the FDA regulates how cigarettes are *made* (see [Table 3](#)). There were no significant predictors of knowledge that the FDA regulates how cigarettes are *sold*. In the model of knowledge that the FDA regulates how cigarettes are *advertised*, those with a bachelor’s degree, compared to those with less than a high school education, had 1.70 higher odds of knowing that the FDA regulates how cigarettes are advertised, and current smokers, compared to nonsmokers, had 1.53 higher odds of knowing that the FDA regulates how cigarettes are advertised.

Credibility of FDA

In the model assessing the relationships between demographic predictors and the credibility of the FDA (Model 1, [Table 4](#)), being of older age and a current smoker were associated with lower perceptions of the FDA’s credibility. Gender and education were also significantly related to the FDA’s credibility; males and those with a graduate-level education (compared to a less than high school education) had higher perceptions of the FDA’s credibility. The R^2 was very low at 0.04, indicating that demographic characteristics explained little variance in perceptions of credibility.

In the next model, which included the above demographics and two belief variables, age, gender, race, knowledge of the FDA’s tobacco regulatory role, and trust in the federal government were all significantly associated with credibility perceptions (Model 2, [Table 4](#)). Being male (compared to female) was associated with higher perceptions of the FDA’s credibility, and each additional year

Table 1. Weighted Sample Characteristics

Demographic characteristics	Unweighted % or mean	Weighted % or mean	95% CI
Gender			
Male	47.3	48.5	46.0–51.0
Female	52.7	51.5	49.0–54.0
Age, years	45.9	46.7	45.8–47.7
Race			
White	69.6	67.9	65.6–70.4
Black or African American	19.6	18.3	16.3–20.3
Other race	10.8	13.7	12.0–15.5
Ethnicity			
Latino/Hispanic	8.6	14.2	12.4–16.0
Non-Latino/Hispanic	91.4	85.8	84.0–87.6
Education			
<High School (HS)	10.5	11.2	9.2–13.2
G12 or GED, HS Diploma	24.7	31.4	28.8–34.0
Some college	20.7	20.7	18.8–22.6
Associate's degree	9.9	10.5	9.0–12.0
Bachelor's degree	21.2	15.7	14.3–17.1
Graduate or professional degree	13.0	10.5	9.4–11.6
Poverty status			
Below poverty line	18.7	17.5	15.3–19.6
Above poverty line	81.3	82.5	80.4–84.7
Sexual Orientation			
Straight or heterosexual	96.1	96.8	96.1–97.4
Gay, lesbian, or bisexual	3.9	3.2	2.6–3.9
Current Cigarette Smoking			
Current smoker	23.0	17.8	16.0–19.6
Nonsmoker	77.0	82.2	80.4–84.0
Trust in the federal government (range: 0–4)	2.9	2.0	1.9–2.0
Knowledge that FDA regulates how cigarettes are...			
Made? (% yes)	38.1	36.0	33.5–38.5
Sold in stores (% yes)	49.9	46.8	44.2–49.4
Advertised (% yes)	53.6	49.7	47.1–52.3
Credibility (range: 0 to 8; higher numbers indicative of higher credibility)	4.6	4.6	4.5–5.7

CI = confidence interval; FDA = Food and Drug Administration; GED = general equivalency diploma; GLB = gay, lesbian, or bisexual.

Table 2. Weighted Frequencies of Responses to FDA Credibility Questions

Credibility items	% Yes (95% CI)
Do you trust the FDA to inform the public about the risks of tobacco products?	67.2 (64.8–69.6)
Is the FDA honest about the risks of tobacco products?	61.5 (59.0–64.1)
Do you believe what the FDA says about the risks of tobacco products?	74.6 (72.3–76.9)
Is the FDA an expert on regulating tobacco products?	33.4 (31.0–35.8)
Is the FDA capable of doing a good job regulating tobacco products?	61.1 (58.6–63.5)
Can the FDA effectively regulate tobacco products?	54.2 (51.7–56.8)
Is the FDA committed to protecting the public from possible risks of tobacco products?	55.7 (53.2–58.3)
Do you believe that if the FDA knew that certain tobacco products are less harmful than thought, they would tell the public?	43.7 (41.2–46.3)

CI = confidence interval; FDA = Food and Drug Administration.

of age and being African American (compared to White) were associated with lower perceptions of the FDA's credibility. Greater knowledge of the FDA's roles and trust in the federal government showed the largest positive association with higher credibility ratings. The R^2 of this model, though still low, was more than four times that of the previous model at 0.19, with the added contributions of knowledge of the FDA's roles and trust in the Federal government.

Discussion

This is the first national study to examine both knowledge and credibility of the FDA as a tobacco regulator, as well as variables associated with both of these constructs. In the first six years since the passage of the 2009 FSPTCA, overall levels of knowledge about the FDA's new regulatory role remain relatively low, although may show

Table 3. Factors Associated with the Odds of Knowing that the FDA Regulates How Cigarettes are Made, Sold, and Advertised

	Made	Sold	Advertised
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Male	1.28 (1.01, 1.61)*	1.16 (0.93, 1.45)	1.19 (0.96, 1.48)
Age	0.99 (0.98, 1.00)	0.99 (0.98, 1.00)	1.00 (0.99, 1.01)
Latino	0.87 (0.60, 1.28)	0.84 (0.58, 1.20)	0.75 (0.52, 1.08)
Race			
Black or African American	0.96 (0.71, 1.32)	0.96 (0.71, 1.30)	0.80 (0.60, 1.06)
Other Race	0.80 (0.55, 1.16)	1.02 (0.72, 1.45)	1.07 (0.75, 1.51)
Education			
Graduate or professional degree	1.20 (0.69, 2.08)	1.67 (0.98, 2.85)	1.38 (0.81, 2.37)
Bachelor's degree	1.10 (0.65, 1.86)	1.48 (0.89, 2.47)	1.70 (1.01, 2.85)*
Associate's degree	0.91 (0.51, 1.63)	1.24 (0.71, 2.16)	1.24 (0.70, 2.17)
Some college, no degree	1.06 (0.63, 1.78)	1.32 (0.80, 2.18)	1.65 (1.00, 2.73)
HS diploma or GED	0.98 (0.57, 1.68)	1.24 (0.74, 2.08)	1.35 (0.81, 2.27)
Poverty status	1.24 (0.86, 1.80)	1.27 (0.96, 1.67)	0.90 (0.64, 1.27)
GLB	0.76 (0.47, 1.21)	1.09 (0.69, 1.72)	1.19 (0.73, 1.93)
Current smoker	1.14 (0.85, 1.52)	1.27 (0.96, 1.67)	1.53 (1.16, 2.03)*

Referent groups are Female, not Latino, White, less than high school education, income above poverty line, not GLB, not a current smoker.

CI = confidence interval; FDA = Food and Drug Administration; GED = general equivalency diploma; GLB = gay, lesbian, or bisexual; OR = odds ratio.

*95% CI does not include 1.

Table 4. Factors Associated With FDA Credibility

	Model 1: Demographics		Model 2: Demographics and beliefs	
	β (SE)	<i>p</i>	β (SE)	<i>p</i>
Intercept	0.00 (0.32)**	<.0001	0.00 (0.32)**	<.0001
Age	-0.13 (0.00)**	<.0001	-0.11 (0.00)**	<.0001
Male	0.07 (0.12)*	.01	0.05 (0.11)*	.04
Latino	-0.03 (0.20)	.35	-0.04 (0.20)	.18
Race				
African American/Black	-0.03 (0.16)	.30	-0.06 (0.14)*	.01
Other race	-0.02 (0.18)	.55	-0.04 (0.17)	.11
Below poverty line	0.02 (0.21)	.54	0.00 (0.17)	.88
Smoker	-0.06 (0.16)*	.03	-0.04 (0.14)	.10
GLB	0.01 (0.23)	.54	0.00 (0.21)	.80
Education				
Graduate degree	0.10* (0.33)	.03	0.05 (0.30)	.25
Bachelor's degree	0.02 (0.31)	.67	-0.01 (0.29)	.83
Associate's degree	-0.01 (0.33)	.83	-0.02 (0.30)	.64
Some college	-0.04 (0.31)	.50	-0.05 (0.28)	.29
HS diploma or GED	-0.04 (0.31)	.54	-0.06 (0.28)	.33
FDA knowledge (range: 0 to 3)			0.24 (0.06)**	<.0001
Trust in federal government			0.30 (0.05)**	<.0001
Variance explained: R^2	0.04		0.19	

Referent groups are Female, not Latino, White, less than high school education, income above poverty line, not GLB, not a current smoker.

β reflects standardized estimates.

FDA = Food and Drug Administration; GED = general equivalency diploma; GLB = gay, lesbian, or bisexual; HS = high school.

* $p < .05$.

** $p < .0001$.

some signs of improvement.¹⁴ Specifically, while most of the sample did not know that the FDA regulates how cigarettes are made, sold, or advertised, when considered as separate outcomes, the majority of the sample did know that the FDA regulated at least one of those areas (74%). Despite these gaps in knowledge, U.S. adults believe that the FDA is moderately credible when it comes to regulating tobacco products. These results have implications for policy makers and organizations interested in strengthening the FDA's tobacco-related efforts.

In our knowledge models, many demographic and smoking status variables were not significantly associated with knowing that the FDA regulates tobacco products. This result is promising because we did not observe large disparities in knowledge across people of different genders, races, ethnicities, poverty statuses, smoking statuses, sexual orientations, or levels of education. These results stand somewhat in contrast to an earlier study that found knowledge of the FDA's tobacco regulatory role differed by some demographic groups, such that males, older participants, and those with lower

education were more likely to believe that their current brand of cigarette had been evaluated by the government.¹³ It may be that as time since the passage of the FSPTCA elapses, disparities in knowledge across demographic factors are closing, perhaps due to visibility of the FDA's media campaigns (such as the *The Real Cost*),³ news media coverage of the FDA's actions (such as of challenges to graphic warning label regulations¹⁸ and new regulations on e-cigarettes¹⁹), or policy enforcement. To fully understand these results, future research should examine overall levels of knowledge of the FDA's regulation of tobacco products and differences in knowledge by demographic groups that arise over time; understanding such disparities in knowledge may be important to closing disparities in tobacco use as a whole.^{20,21}

Our models of credibility showed that regardless of ethnicity, smoking status, sexual orientation, and poverty status (above or below the poverty line), ratings of credibility of the FDA were largely similar. In our study, overall levels of credibility were moderate, which demonstrated that the public perceives the FDA as generally competent in its tobacco regulatory role. In an age of historic lows in trust of the federal government,²² these results are encouraging. More importantly perhaps, factors with the greatest associations with credibility were level of knowledge about the FDA's tobacco regulatory role and general trust in the Federal government. These knowledge and belief variables showed effects after controlling for demographic characteristics, and, when added to the model, even removed the effect of smoking status on credibility. As the number of tobacco regulatory roles that a participant knew about increased, their ratings of the credibility of the FDA also increased, suggesting that increasing the public's awareness of the FDA's regulatory roles over tobacco marketing, sales, and advertising may positively impact perceptions of the FDA's credibility. The more that the public learns that the FDA regulates tobacco, the more they may trust the FDA and view the FDA to be expert in this role.

Although overall assessment of the FDA's credibility was moderate, two of the eight items in this credibility scale, which pertained to expertise and public interest, received affirmative responses from less than half of the sample, suggesting specific areas where the FDA's credibility can be increased. These items included whether the FDA is an expert at regulating tobacco, and whether the agency would tell the public if it knew that certain tobacco products were *less* harmful than originally thought. The first of these two items may result from a lack of knowledge of the FDA's regulatory roles, shown by responses to our knowledge items as well; if less than half of respondents knew that the FDA regulated each domain of tobacco product manufacturing, advertising, and sales, many may not perceive the FDA to be an expert in this role. By educating the public about its regulatory role and evidence-based process of policymaking, the FDA may be able to increase views about its expertise in this area. Such impact may come about as the FDA takes more actions that reach large proportions of the public, such as nationwide implementation of pictorial warnings on cigarette packs, which has been stalled due to industry litigation.²³ Additionally, increasing transparency of regulatory action, and highlighting ways that the public can provide feedback about tobacco regulation may further enhance views that the agency is working in the public interest, and also increase ratings of credibility.

Future research should explore any potential unintended consequences of enhancing knowledge of and beliefs about the credibility of the FDA as a tobacco regulator, particularly if those who know the FDA regulates tobacco and believe the agency to be credible in

this role inadvertently believe that tobacco products are safer now that they are regulated. In a study on dietary supplements, informing participants that the FDA did not approve a supplement lowered ratings of safety, suggesting such an effect.²⁴ Traditionally, the FDA's role with regard to food and medications has been to ensure safety, making the role of regulating tobacco unusual because tobacco inherently causes harm. Products such as e-cigarettes may also be perceived differently now that the FDA has gained regulatory authority over them.² In a study of smokers conducted in 2001, those who believed the FDA did not evaluate cigarettes for safety showed greater understanding of the health risks of smoking and were more likely to report quit intentions, suggesting that beliefs about the FDA's regulatory authority could be tied to beliefs about tobacco product risks and quit intentions.²⁵ On the other hand, one national study indicates 43% of smokers report that they would perceive tobacco to be *more* harmful if tobacco products were regulated by the government.¹³ Therefore, knowing tobacco is regulated by the FDA, a government agency, may actually have the opposite effect (ie, lead to perceptions that tobacco products are more harmful), although this should be examined in future research. The FDA's communication campaigns about the harms of tobacco should help guard against perceptions that tobacco products are safe,³⁻⁵ and make known that the FDA is committed to protecting the public from these risks.

Another area for future research is to understand more about individuals who report uncertainty in knowledge and perceived credibility of the FDA. In studies asking participants to assess their health risks, "don't know" responses have been linked to variables associated with vulnerable populations, such as low education.²⁶ Understanding the characteristics and beliefs of individuals who report uncertainty may have important implications for behavior. In past research on regulation by the FDA, not knowing whether the FDA regulated tobacco products was associated with uncertainty about the harms of different types of tobacco products.¹⁴ While the aim of the current paper was to test factors associated with higher knowledge and credibility perceptions (ie, affirmative "yes" responses to our survey items), knowing more about those who express uncertainty about these constructs may be useful for planning communication and regulatory efforts.

Limitations

There are some limitations of this work. We asked specifically about cigarettes (rather than tobacco products in general) in the regulatory knowledge questions, as it is the most familiar of all tobacco products. It may be that even fewer people than reported in this study knew that the FDA regulates other forms of tobacco products. One element of the FDA's role as a tobacco regulator that was not included in our credibility measure is the FDA's enforcement role;²⁷ credibility items about the agency's expertise and trustworthiness as a law enforcement body should be explored in future research.

Conclusions

This study is the first to show national estimates of both knowledge and credibility of the FDA as a tobacco regulator and factors associated with each. Tangible methods exist to increase the public's understanding of the FDA's roles, and knowledge is likely to be an important factor related to the credibility of the FDA. Demonstrating the FDA's expertise in tobacco regulation and promoting transparency in its regulatory processes are likely to further enhance its

credibility, and potentially public responsiveness to the FDA's communication campaigns and regulatory actions.

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Declaration of Interests

None declared.

References

1. Congress. *Family Smoking Prevention and Tobacco Control Act*. PUBLIC LAW 111-31 [H.R. 1256]. 2009.
2. Food and Drug Administration. Deeming tobacco products to be subject to the federal food, drug, and cosmetic Act, as amended by the family smoking prevention and tobacco control Act; Restrictions on the sale and distribution of tobacco products and required warning statements for tobacco products. Final rule. *Fed Regist*. 2016;81(90):28973.
3. Food and Drug Administration. The Real Cost. 2016; <https://therealcost.betobaccofree.hhs.gov/?g=t>. Accessed October 27, 2016.
4. Food and Drug Administration. Fresh Empire. 2016; <https://freshempire.betobaccofree.hhs.gov>. Accessed October 27, 2016.
5. Food and Drug Administration. This Free Life. 2016; <https://thisfreelife.betobaccofree.hhs.gov>. Accessed October 27, 2016.
6. Schmidt AM, Ranney LM, Pepper JK, Goldstein AO. Source credibility in tobacco control messaging. *Tob Regul Sci*. 2016;2(1):31-37.
7. Pornpitakpan C. The persuasiveness of source credibility: a critical review of five decades' evidence. *J Appl Soc Psychol*. 2004;34(2):243-281.
8. Lirtzman SI, Shuv-Ami A. Credibility of sources of communication on products' safety hazards. *Psychol Rep*. 1986;58(3):707-718.
9. President's Task Force on 21st Century Policing. *Final Report of the President's Task Force on 21st Century Policing*. Washington, DC: Office of Community Oriented Policing Services; 2015.
10. Hanoch Y, Gummerum M, Miron-Shatz T, Himmelstein M. Parents' decision following the Food and Drug Administration recommendation: the case of over-the-counter cough and cold medication. *Child Care Health Dev*. 2010;36(6):795-804.
11. Wogalter MS, Kalsher MJ, Rashid R. Effect of signal word and source attribution on judgments of warning credibility and compliance likelihood. *Int J Ind Ergon*. 1999;24(2):185-192.
12. Wiener JL, Mowen JC. Source credibility: on the independent effects of trust and expertise. *NA-Advances in Consumer Research*. 1986;13(1):306-310.
13. Fix BV, O'Connor RJ, Fong GT, Borland R, Cummings K, Hyland A. Smokers' reactions to FDA regulation of tobacco products: findings from the 2009 ITC United States survey. *BMC Public Health*. 2011;11(1):1.
14. Kaufman AR, Finney Rutten LJ, Parascandola M, Blake KD, Augustson EM. Food and Drug Administration tobacco regulation and product judgments. *Am J Prev Med*. 2015;48(4):445-451.
15. Kowitz SD, Schmidt AM, Hannan A, Goldstein AO. Awareness and trust of the FDA and CDC: results from a national sample of US adults and adolescents. *PLoS One*. 2017;12(5):e0177546.
16. Schmidt AM, Ranney LM, Noar SM, Goldstein AO. Development of the FDA Tobacco Credibility Scale (FDA-TCS). *Tob Regul Sci*. 2017;3(1):47-55.
17. Boynton MH, Agans RP, Bowling JM, et al. Understanding how perceptions of tobacco constituents and the FDA relate to effective and credible tobacco risk messaging: a national phone survey of US adults, 2014-2015. *BMC Public Health*. 2016;16(1):516.
18. CBS News. FDA Sued Over Delay on Graphic Cigarette Warning Labels. 2016; <http://www.cbsnews.com/news/fda-sued-over-delay-on-graphic-cigarette-warning-labels/>. Accessed June 23, 2017.
19. The New York Times. FDA Imposes Rules for E-cigarettes in a Landmark Move. 2016; <https://www.nytimes.com/2016/05/06/science/fda-rules-electronic-cigarettes.html>. Accessed June 24, 2017.
20. Garrett BE, Dube SR, Trosclair A, et al. Cigarette smoking—United States, 1965-2008. *MMWR Surveill Summ*. 2011;60(1):109-113.
21. US Department of Health and Human Services. *Surgeon General's Report: The Health Consequences of Smoking—50 Years of Progress*. Rockville: Public Health Service, Office of the Surgeon General; 2014.
22. Pew Research Center. Beyond Distrust: How Americans View Their Government. 2015; <http://www.people-press.org/files/2015/11/11-23-2015-Governance-release.pdf>. Accessed October 27, 2016.
23. Kraemer JD, Baig SA. Analysis of legal and scientific issues in court challenges to graphic tobacco warnings. *Am J Prev Med*. 2013;45(3):334-342.
24. Dodge T, Kaufman A. What makes consumers think dietary supplements are safe and effective? The role of disclaimers and FDA approval. *Health Psychol*. 2007;26(4):513-517.
25. Kaufman AR, Waters EA, Parascandola M, et al. Food and Drug Administration evaluation and cigarette smoking risk perceptions. *Am J Health Behav*. 2011;35(6):766-776.
26. Waters EA, Hay JL, Orom H, Kiviniemi MT, Drake BF. "Don't know" responses to risk perception measures: implications for underserved populations. *Med Decis Making*. 2013;33(2):271-281.
27. US Food and Drug Administration. Compliance, Enforcement & Training. 2016; <http://www.fda.gov/TobaccoProducts/GuidanceComplianceRegulatoryInformation/default.htm>. Accessed January 31, 2017.