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Development of the FDA Tobacco Credibility Scale (FDA-TCS)

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Abstract

Objectives—Messages from organizations with high, compared to low, credibility may be more persuasive. Whereas the tobacco industry has long recognized the importance of credibility in promoting its messages and public image, the source credibility of key tobacco control organizations has gone largely unmeasured. To assess credibility of a key tobacco regulator, we developed a scale of the US Food and Drug Administration (FDA) tobacco-related credibility.

Methods—We developed and tested 30 items reflective of the dimensions of source credibility (trust, expertise, and public interest) and FDA's tobacco regulatory roles in a sample of 1353 US adults and assessed reliability and validity.

Results—Factor analysis identified 3 dimensions of the FDA Tobacco Credibility Scale (FDA-TCS): public interest, trust, and expertise. The 3 subscales showed evidence of reliability and convergent validity; all subscales were correlated with general FDA credibility and trust in government. Those who knew that the FDA regulates tobacco scored higher on the trust and expertise subscales. The subscales were also associated with support for potential regulations, suggesting criterion-related validity.

Conclusions—The FDA-TCS allows for an understanding of the impact of credibility on responses to the FDA's tobacco control communications and regulatory efforts.

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Human Subjects Statement

This research was approved by The Institutional Review Board at the University of North Carolina at Chapel Hill (#14-2475).

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

Keywords

source credibility; health communication; public opinion; scale development

Source credibility, encompassing beliefs about the trustworthiness and expertise of a message source, may be a key factor impacting persuasion and agreement with an organization's messages.¹ Tobacco companies have recognized credibility is key to enhancing their corporate image, public support, and receptivity to their messages, and have worked actively to improve their credibility.^{2–6} Despite its potential influence, relatively few studies have measured and tested the effects of source credibility of key tobacco control organizations. One such tobacco control agency is the United States (US) Food and Drug Administration (FDA), which, in addition to its historical responsibilities ensuring the safety of food and drugs, now regulates tobacco, a novel role regulating an inherently harmful class of products.⁷

Since passage in 2009 of the Family Smoking Prevention and Tobacco Control Act, the FDA regulates the manufacture, marketing, and distribution of tobacco products through its Center for Tobacco Products (CTP).⁷ Because the FDA traditionally regulated food and drugs, existing measures of FDA credibility may be inappropriate for understanding public perceptions of FDA credibility around tobacco issues.⁸ A study found that in 2009, less than half of US adults were aware of FDA's authority to regulate tobacco, though many adults were generally supportive of messages about the health risks of tobacco and protective regulations.⁹ With tobacco product regulation being vastly different from approving food products and medication, it is necessary to evaluate public perceptions of the FDA's credibility as a tobacco regulator.

The concept of credibility, whether of an organization or individual source, encompasses 2 underlying dimensions: trust and expertise.⁸ In an organizational context, expertise reflects the extent to which an organization knows correct information, and trustworthiness is the extent to which an organization is believed to present what it considers correct information.¹ Several studies have identified other dimensions of credibility, such as familiarity with an organization, congruence of its values with one's personal values,^{8,10,11} and social concern.¹² For a government agency or non-profit organization, public interest is likely to be a particularly important component of credibility.⁸ Relating to tobacco control communication, the credibility of the source may affect the success of tobacco education messages to prevent tobacco use and increase quit attempts by tobacco users, as well as public responses to regulatory communications.¹³

Existing measures of source credibility have been developed for use with private for-profit companies, which have distinct interests from, and for which the public may judge credibility differently than, government or nonprofit agencies, that are often the source of anti-tobacco messages.^{8,14} Specifically, for health information, non-profits (compared to for-profit institutions)¹⁴ and government entities (compared to local news or industry sources)¹⁵ are perceived as more highly credible sources. Extrapolating from this evidence, perceptions of the FDA's credibility may differ based on whether the agency is communicating about

food, drugs, or tobacco products, as the match of an organization with a topic about which it is expected to be an expert likely matters.

Given the likely importance of source credibility in tobacco control and the lack of adequate source credibility measures for public health organizations, we developed a scale of the FDA's credibility as a tobacco regulator, the FDA Tobacco Credibility Scale (FDA-TCS). This FDA-specific credibility scale was developed as a foundation for a new body of research to monitor the credibility of a key tobacco control organization as it implements and promotes its regulatory missions. In this manuscript, we present our scale development process, including item generation, factor analyses, reliability and initial validity analyses, and the final scale for use in future research.

METHODS

Item Development

Based on the method outlined in DeVellis,¹⁶ we first developed a thorough description of the concept of source credibility after reviewing the theoretical and empirical literature on the subject to understand its definition, scope, and underlying constructs.⁸ In a literature review on source credibility, we found that trust and expertise were widely recognized as the 2 key underlying constructs, with public interest likely an additional construct on which the credibility of a government agency would be judged.⁸ We generated scale items for each of these dimensions of source credibility: trust, expertise, and public interest, and these roles of the FDA as regulator of tobacco products: communicating risks of tobacco use, and regulating the manufacture, marketing, and distribution of tobacco products. To guide item development, we developed a matrix to organize these domains (Table 1). After generating items to reflect balanced content coverage of the domains, the research team reviewed and edited items for face validity, clarity, and readability. To assess face validity, we relied on prior literature and team members' expertise in tobacco regulatory science and health communication to ensure we had properly covered the domains. Using an iterative process, team members read and edited items so that they were as simply worded and as clearly written as possible. Items that were too complex or wordy were re-written for improved clarity or deleted from the item pool.

Data Collection

We tested our items using Amazon's Mechanical Turk online marketplace, where "workers" can accept virtual tasks, such as completing a survey, for a set payment amount. This service is increasingly being used by behavioral researchers and demonstrates good response quality and respondent diversity, relative to other survey recruitment methods.^{17,18} Our participants, all at least 18 years of age and based in the US, were offered \$2 to take a 20-minute survey. For the purposes of obtaining meaningful data, we screened for people that had heard of the FDA. To reach a key target audience and maximize variability in item responses, we oversampled tobacco users by including the following in our task description: "We ask that you only take part in this survey if you have ever heard of the US Food and Drug Administration, or FDA. We are especially hoping for tobacco users to take our survey, although this is not required." The survey consisted of 5 parts: (1) 3 knowledge questions

about the FDA and its general regulatory roles, (2) the credibility scale items, (3) validity measures, (4) attention check items, and (5) demographic questions.

Measures

FDA Tobacco Credibility Scale items—The FDA credibility as a tobacco regulator was initially measured by 30 positively-worded items (eg, “The FDA knows about the risks of tobacco use.”) with responses on a 5-point Likert scale ranging from “agree strongly” to “disagree strongly.” To break up the scale and ease reading effort by participants of specific scale items, items were presented on 3 virtual “pages” of the survey, with public interest, trust, and expertise items each grouped together on a page to facilitate interpretation.

General FDA credibility (convergent validity)—General FDA credibility was measured by the degree to which respondents agreed, on a 7-point scale from “agree strongly” to “disagree strongly,” with 6 positively-worded items (3 about trust, 3 about expertise) adapted from Newell and Goldsmith’s corporate credibility scale.¹⁹ Example items include, “I trust the FDA,” and “The FDA is skilled in what it does.”

Trust in government (convergent validity)—Trust in government was measured by responses to the question: “How much of the time do you think you can trust the federal government in Washington DC to do what is right?” on a scale of 1 to 4 with response options “never,” “some of the time,” “most of the time,” and “always.”

Knowledge of FDA regulatory roles (convergent validity)—We asked participants in 3 separate questions whether they thought the FDA regulated food, drugs, and tobacco. The tobacco knowledge question was used to assess convergent validity.

Support for tobacco control regulatory policies (criterion-related validity)—Support for potential FDA regulatory policies was measured by dichotomous yes/no responses to supporting banning menthol from cigarettes, reducing the nicotine level in cigarettes, and having larger health warnings on cigarette packs.

Demographic variables—Participants were asked their age, sex, race (5 categories), ethnicity (Hispanic or not), education (6 categories), and income (5 categories). They also were asked their smoking status with the questions: “Have you smoked at least 100 cigarettes in your life?” to assess ever smoking, and, among ever smokers, “Do you now smoke cigarettes every day, some days, or not at all?” to assess current smoking.

Sample Characteristics

Out of the total initial respondent sample size, $N = 1353$, 10 respondents were deleted from final analyses because they failed 2 or more of the survey attention checks. Table 2 shows demographic characteristics of the final analytic sample ($N = 1343$). Almost half (49%) of our sample was comprised of ever smokers, and one-fourth (25%) of the sample consisted of current smokers, suggesting our request for smokers was successful.

Data Analysis

Factor analysis—We conducted exploratory factor analysis using promax rotation to examine the underlying dimensions of FDA tobacco credibility. To determine the optimal number of factors, we examined the scree plot and eigenvalues (keeping those greater than or extremely close to one). To decide which items to retain, we used a combination of empirical indicators (ie, factor loadings) and theoretical consideration of the constructs expected to make up source credibility, as defined by the existing literature. Items were considered acceptable if they had a factor loading of at least 0.40, and did not cross load (>0.30) onto more than one factor. Using these criteria, we used an iterative process to factor analyze one-half of our sample first (randomly selected) and compare it to the other half to confirm consistency of the factor structure across our sample. Last, we factor analyzed the scale in the sample as a whole and deleted any additional items that did not load strongly on a single factor.

Reliability assessment—To conduct reliability analyses, we tested consistency of the scale as a whole and subscales of each underlying dimension using Cronbach's alpha.

Validity assessments—To measure convergent validity, we identified 3 measures with which our scale should be theoretically related.¹⁶ General FDA credibility (not specific to tobacco regulatory duties), trust in the federal government, and knowledge of the FDA's tobacco regulatory role were determined to be related conceptually to the construct of FDA credibility as a tobacco regulator. Specifically, we felt that those who felt the FDA as a whole was a credible agency, those who had higher trust in the federal government, and those who knew the FDA regulated tobacco products, and thus, could better be an expert in this role, would all be likely to have higher ratings of FDA tobacco credibility. Convergent validity was assessed by testing the correlation of our final scale with general FDA credibility and trust in government, and whether there were mean differences by knowledge (measured dichotomously) of whether the FDA regulates tobacco products.

Additionally, we felt that believing the agency to be of higher credibility would be predictive of support for potential FDA regulations, our measure of criterion-related validity.¹⁶ We assessed the criterion-related validity of our new scale by examining whether it predicted support for 3 potential policies using logistic regression. We included demographic and smoking variables (ie, age, sex, race, ethnicity, education, income, and ever smoking) as control variables in regression analyses.

RESULTS

Factor Analysis

Exploratory factor analyses identified 3 dimensions of FDA tobacco credibility: the degree to which the FDA acts in the public's interest (public interest, 6 items), can be trusted to protect the public (trust, 6 items), and has the expertise to be an effective tobacco regulator (expertise, 5 items). The final FDA-TCS, consisted of 17 items. Table 3 shows the items and their factor loadings.

Reliability

The FDA-TCS showed evidence of reliability (public interest: Cronbach's $\alpha = 0.95$, trust: Cronbach's $\alpha = 0.89$, expertise: Cronbach's $\alpha = 0.88$) (Table 4). As a single scale, it was also found to be reliable (Cronbach's $\alpha = 0.95$).

Validity

Overall, our sample had generally positive views of the FDA's credibility (Mean = 5.30 on a 1 (low) to 7 (high) scale, SD = 1.28), but did not have a great deal of trust in the federal government (Mean = 2.14 on a 1 (low) to 7 (high) scale, SD = 0.59). The majority of our sample (71%) knew the FDA regulated tobacco products (N = 951). In terms of support for potential FDA policies, 29.19% (N = 395) of our sample supported banning menthol, 66.08% (N = 894) supported reducing nicotine, and 66.81% (N = 904) supported warning labels that covered 50% of a cigarette pack.

With respect to convergent validity, the FDA-TCS showed significant positive correlations with general FDA credibility (public interest: $r = 0.64$, trust: $r = 0.46$, expertise: $r = 0.62$, all $p < .0001$) and trust in government (public interest: $r = 0.42$, trust: $r = 0.33$, expertise: $r = 0.30$, all $p < .0001$). Additionally, significant mean differences were found between those who did and did not know that the FDA regulated tobacco products. Those who did know the FDA regulated tobacco reported higher credibility of the agency than those that did not know the FDA regulated tobacco, on both trust (Means = 3.56 vs 3.36, $t = -3.44$, $p < .001$) and expertise (Means = 4.13 vs 3.97, $t = -3.47$, $p < .001$), but not public interest (Means = 3.71 vs 3.63, $t = -1.30$, $p = .19$). As a single scale, correlations with general FDA credibility ($r = 0.65$, $p < .0001$) and trust in government ($r = 0.41$, $p < .0001$) were found, as were statistically significant mean differences by knowledge that the FDA regulates tobacco (Means = 3.78 vs 3.64, $t = -3.10$, $p < .01$) (Table 4).

With respect to criterion-related validity, higher ratings on the FDA-TCS subscales were associated with significantly higher odds of support for reducing nicotine in cigarettes and requiring warning labels, shown by logistic regression with demographic variables and ever smoking included as controls. However, responses to the FDA-TCS were not associated with support for banning menthol (Table 4). Higher credibility ratings on the FDA-TCS as a whole also showed a similar pattern of predicting support for potential regulatory policies (Table 4).

DISCUSSION

We developed the FDA-TCS, a new scale that demonstrated reliability and initial validity in our sample, and outlined a method for measuring credibility for other key tobacco control organizations worldwide. Being able to measure source credibility of the FDA as a tobacco regulator is a key step toward monitoring perceptions of the organization as it implements its regulatory efforts.

Factor analyses showed our credibility scale to have 3 underlying dimensions: public interest, trust, and expertise. The last 2 are the most often identified dimensions of credibility in prior research.¹ Public interest was also found to be an important component of

source credibility for the FDA, an institution charged with protecting the US public. Whereas relatively little research on source credibility has been conducted with organizations whose purpose is to promote the public's wellbeing, some existing research has identified public interest as a factor of credibility. One study, for example, found a dimension of newspaper and television credibility (sources meant to inform the public) that they called "social concern."¹² Overall, the dimensions of our FDA-TCS are consistent with prior literature on source credibility, and expand this field of research by this application to a key regulatory agency charged with protecting the public's health.

In terms of content, the items written to reflect public interest and expertise made up 2 subscales as expected; however, the items that were kept in the trust subscale after factor analysis were more narrowly focused, with protection, or specifically, trusting the FDA to protect the public, being a core component of the trust dimension. Out of a pool of trust items on several regulatory topics, the trust subscale encompassed trust in the FDA particularly to protect minors from tobacco sales and marketing. Policies and interventions that protect young people from the harms of tobacco are some of the most highly publicly supported strategies in tobacco control.^{20,21} In this context, it is meaningful that trust in the FDA to protect minors from tobacco is a key component of the agency's credibility. Because many of the FDA's current large investments in communication campaigns focus on young people (eg, The Real Cost), this may actually be enhancing its credibility with the public by increasing feelings of trust that the agency will protect youth from tobacco, provided the public is aware that the FDA launched the campaign, a question that could be investigated by future research. Overall, our study suggests that beliefs about the FDA's concern for the public's interest, trust in the FDA to protect youth from the harms of tobacco, and the expertise of the FDA to regulate tobacco make up perceptions of its credibility.

Reliability analyses showed high consistency of items in the scale as a whole and among each sub-scale individually. Although the alpha of the overall scale is high, this is not necessarily indicative of the scale being a unidimensional construct (and is affected by the size of the scale, such that high alpha values are not uncommon for longer scales).^{22,23} The alphas of each subscale are fairly high as well, especially public interest. Thus, this scale shows consistency in responses across each identified dimension of source credibility.

Evidence of convergent validity was found, shown by associations of the FDA-TCS with general FDA credibility, trust in the federal government, and knowledge that the FDA regulates tobacco. Although there has not been specific past research to demonstrate the links between FDA tobacco credibility and these constructs, beliefs about the FDA as a tobacco regulator would logically be related to these items. Correlations of the FDA-TCS with trust in the overall federal government were lower than those with FDA general credibility, consistent with what we would expect of an FDA-specific scale.

Mean differences by knowledge that the FDA regulates tobacco products were found for the trust and expertise subscales, but not for the public interest subscale. This suggests that views about the FDA acting in the public's best interest on tobacco issues are not currently related to knowing whether the agency regulates tobacco. Future research can investigate factors that do influence perceptions of FDA as acting in the public interest on tobacco

issues. Another area for future research is exploring the relationships among the subscales. For example, if perceptions of the FDA acting in the public interest on tobacco regulation increase, beliefs about the trustworthiness and expertise of the FDA as a regulator of tobacco also may increase.

The FDA-TCS further showed evidence of criterion-related validity, as responses on this scale were associated with higher odds of supporting potential FDA regulatory policies. However, there were relatively modest associations with supporting potential policy changes. It is plausible that some participants believe the FDA is credible on tobacco issues, but disagree with some specific policy options to regulate the manufacturing, marketing, or sales of tobacco products further. In particular, banning menthol had relatively low endorsement in the sample as a whole and was not predicted by responses to the FDA-TCS. This finding is consistent with other research that shows policies to ban menthol have less support than other potential regulatory policies.²⁴ Thus, the FDA-TCS scale seems to predict support for some potential tobacco control policies, but is not as predictive of support for policies that are less popular, perhaps due to less variation in support for these policies.

This research had several limitations. First, our sample composition was not representative of the US public on several demographic variables. Relative to the US population, our analytic sample included higher proportions of white individuals, as well as those with higher education and income. In the current research, only participants who had ever heard of the FDA were invited to take the survey. Of these, however, over two-thirds knew that the FDA regulated tobacco, which is a higher proportion than has been found in past research.²⁵ Additionally, because we displayed the trust, expertise, and public interest items together on a page for ease of participant comprehension and lower respondent burden, this presentation of items may have influenced their inter-correlations and factor analytic results.

Additionally, our items collectively measured at about a 9th grade reading level using the Flesch-Kincaid grade level metric, which is fairly high. While this was likely not a large issue in our particular sample, given the generally high levels of education, future research may suggest that some of our items should be rewritten to be understood more easily by a more diverse population.

As with all scale development studies, future work should test the scale's reliability and validity with other samples, as these are not fixed properties of a scale, but rather assessments made from data in a particular sample.²³ Thus, this new scale should be tested in more diverse samples of the US population to improve understanding of the perceptions of the FDA's credibility as a tobacco regulator.

IMPLICATIONS FOR TOBACCO REGULATION

Overall, the FDA-TCS will be useful for future research to understand how FDA media campaigns and regulations have impact on and are impacted by its tobacco-related credibility. Specifically, the FDA-TCS can be used to measure how perceptions of FDA credibility change with increased public exposure to FDA regulation and messaging, and measure associations of changing perceptions of FDA credibility and tobacco use behavior over time.⁸ In addition, this article details a process by which source credibility measures

could be developed or adapted for other key tobacco control organizations. Internationally, research on how to enhance credibility for organizations like the FDA is warranted; tobacco companies have strategically sought to enhance their public image for decades.^{2,6} The current research also contributes a specific, foundational measure that helps make achievable the broader goal of monitoring and understanding the credibility of a key national tobacco control organization, and how the credibility of that organization changes over time as it increases its regulatory actions and communication campaigns.

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Table 1

Item Development Matrix and Example Items

Tobacco Regulatory Roles of FDA	Underlying Constructs of Source Credibility		
	Trust	Expertise	Public Interest
Regulating Manufacturing	I trust the FDA to make good rules about how tobacco products are made.		
Regulating Marketing	The FDA knows how to keep tobacco companies from showing misleading advertisements.		
Regulating Distribution	The FDA is watching out for the public by limiting how cigarettes can be sold.		
Communicating Risks of Tobacco Use	The FDA is honest about the risks of using tobacco products.		

Table 2

Sample Characteristics (N = 1343)

	N or Mean	% or SD
Age (range: 18 to 75 years)	35	11
Sex		
Male	740	55%
Female	603	45%
Hispanic	97	7%
Race		
White	1137	85%
Black or African-American	110	8%
American Indian or Alaska Native	25	2%
Asian	110	8%
Native Hawaiian or other Pacific Islander	8	1%
Ever smokers	655	49%
Current smokers (some days or every day)	336	25%
Education		
Less than High School	8	1%
Graduated High School	170	13%
Some College	358	27%
Associate's, Bachelor's, or Graduate Degree	807	60%
Income		
Below \$50,000	776	58%
Between \$50,000 and \$100,000	455	34%
Above \$100,000	112	8%
Knew that FDA regulates food safety	1334	99%
Knew that FDA regulates drug safety	1318	97%
Knew that FDA regulates tobacco	951	71%

Table 3

FDA-TCS: Final Scale Items and Factor Loadings

Scale Items	Factor Loadings		
	Public Interest	Trust	Expertise
The FDA is interested in the public's well-being when it makes rules about tobacco product advertising.	0.91		
The FDA cares about the public when it limits how tobacco companies can market tobacco products.	0.90		
The FDA has my interest in mind when it makes rules about the manufacturing of tobacco products.	0.82		
The FDA is watching out for the public by limiting how cigarettes can be sold.	0.81		
The FDA treats the public with respect when it makes rules about tobacco products	0.68		
Information from the FDA about tobacco products is fair and balanced.	0.64		
I trust the FDA to protect minors from tobacco advertising.		0.85	
I trust the FDA to prevent sales of cigarettes to minors.		0.78	
The FDA is capable of limiting tobacco product marketing to youth.		0.73	
The FDA has the skills to ban the sale of cigarettes to young people.		0.69	
I trust the FDA to make sure its rules about advertising tobacco products are followed.		0.61	
The FDA knows how to keep tobacco companies from showing misleading advertisements.		0.59	
The FDA knows about the risks of tobacco use.			0.71
Information from the FDA about tobacco use is written by experts.			0.68
The FDA has the expertise to communicate about the risks of tobacco products to the public.			0.65
The FDA is an expert at making rules about the harms of tobacco use.			0.63
The FDA has experience making sure rules about tobacco products are followed.			0.58

Table 4

Means, Reliability, and Validity Analyses of The FDA-TCS and Subscales

	Mean (SD)	Reliability		Convergent Validity		Means with, without knowledge (t-tests)	Criterion-related Validity			
		Cronbach's alpha		Correlation with general FDA credibility (Pearson's r)	Correlation with trust in government (Pearson's r)		Odds of support for banning menthol	Odds of support for lower nicotine	Odds of support for warning labels	
Public Interest	3.69 (1.04)	0.95		0.64 *	0.42 *	3.71, 3.63, t=-1.30	1.10	1.52 *	1.56 *	
Trust	3.50 (0.95)	0.89		0.46 *	0.33 *	3.56, 3.36, t=-3.44 *	1.01	1.27 *	1.24 *	
Expertise	4.09 (0.77)	0.88		0.62 *	0.30 *	4.13, 3.97, t=-3.47 *	1.00	1.46 *	1.43 *	
FDA-TCS	3.74 (0.81)	0.95		0.65 *	0.41 *	3.78, 3.64, t=3.10 *	1.06	1.58 *	1.58 *	

* p < .0001 or 95% CI does not include 1