Perceived message effectiveness of cigar warning themes among adults in the United States

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ABSTRACT

Most tobacco warnings focus on health harms to the consumer, but other message themes may be promising. We assessed perceived message effectiveness (PME) among adults who smoke cigars for 12 cigar warning statements to discourage smoking, and measured PME across four message themes: *explicit health effects to the consumer*, *secondhand smoke effects*, *chemicals/constituents*, and *toxicity*. Between April 23 and May 7, 2020, we conducted an online study with U.S. adults who used any cigar type in the past 30 days (n = 777). Participants were randomly assigned to view two out of 12 warnings and rate each one on PME. We analyzed PME mean ratings (range 1 [low] to 5 [high]). The warning statements for lung cancer ($M = 3.91$) and heart disease ($M = 3.77$) had the highest PME ratings; secondhand smoke ($M = 3.50$) and formaldehyde ($M = 3.48$) had the lowest PME ratings. Multilevel analyses showed that the *explicit health effects* theme was associated with higher PME ratings compared to other warning themes ($ps < 0.05$ for *chemicals/constituents* and *secondhand smoke effects*) except *toxicity* ($p = .16$). Higher awareness of consequences was associated with higher PME ratings ($p < .001$). Higher nicotine dependence was also associated with higher PME ratings ($p = .004$). Warning statements with information addressing the themes of health harms and toxicity could potentially inform those who smoke cigars about the broader harms of cigar use and should be considered in FDA labeling regulations for cigars.

1. Introduction

Approximately 8.7 million adults in the United States (U.S.) regularly smoke cigars. Cigars encompass a variety of products, including premium cigars (example brands include Macanudo, Cohiba), little cigars (example brands include Swisher Sweets Littles, Cheyenne), and cigarillos (example brands include Black & Mild, Swisher Sweets) (Corey et al., 2018). They vary in terms of shape, size, and manufacturing process, as well as packaging, how they are used, and who uses them (Corey et al., 2018; Teutsch et al., 2022). All cigars cause multiple cancers and other health effects (Chang et al., 2015; Cornelius et al., 2020). In a longitudinal study, adults reporting former or current exclusive cigar use had a higher all-cause mortality rate than those

reporting no tobacco use (Christensen et al., 2018). Cigar use also heightens risks and death from several cancers (e.g., oral, esophageal, bladder), coronary heart disease, stroke, and chronic obstructive pulmonary disease (Chang et al., 2015; Christensen et al., 2018; National Cancer Institute, 2010). Many constituents in cigar smoke also cause health problems and some exist at higher levels than in cigarette smoke, such as tobacco-specific nitrosamines and carbon monoxide (Baker et al., 2000; Hoffmann & Hoffmann, 1998; Koszowski et al., 2015; Koszowski et al., 2017). Furthermore, cigar use is associated with other tobacco product use as well as use of other substances, including marijuana (Cohn et al., 2015; Cornacchione Ross et al., 2020; Schauer et al., 2017; Strong et al., 2018).

Misperceptions exist about the risks of cigar smoking (Cohn et al.,

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2015; Cornacchione et al., 2016; DeSantis, 2002; Jolly, 2008; Sterling et al., 2016; Sterling et al., 2017), which influences beliefs about their health harms and may influence cigar smoking behavior (Cornacchione et al., 2016; Sterling et al., 2016; Sterling et al., 2017). Warning labels can convey accurate information about the health risks of cigar smoking and discourage use. In the U.S., the Food and Drug Administration (FDA) has regulatory authority over cigars. The Deeming Rule requires the display of six rotating text-only warnings on all cigar packaging and advertising (Food and Drug Administration, 2016) but these warnings have not been implemented due to litigation, with the court stating that the FDA had not provided evidence on the effectiveness of cigar warnings (Cigar Association of America et al. v. FDA). Similar challenges have been faced for pictorial cigarette warnings, which resulted in the FDA developing warnings that contained information that were not as well-known by the public to demonstrate that the warnings would result in new knowledge and better understanding of the health consequences of cigarette smoking (Pepper et al., 2020a, 2020b). However, these warnings were also vacated in December 2022 after a ruling by a federal judge who deemed the cigarette warnings violated the First Amendment (R.J. Reynolds Tobacco Company Et Al. V. U.S. Food and Drug Administration et al., 2022). Given the legal challenges faced for tobacco warnings in the U.S., both text and pictorial, additional research is needed to add to the scientific base for demonstrating warning effectiveness to support future warnings development and implementation.

Cigar products currently have warnings that adhere to the 2001 Federal Trade Commission warning requirement (US Federal Trade Commission, 2000), and some cigar manufacturers have voluntarily implemented the FDA cigar warnings (Wackowski et al., 2020). However, there is limited research – especially when compared to cigarettes (Cornacchione Ross et al., 2019; Kong et al., 2019) – on consumer responses to cigar warnings (Cornacchione Ross et al., 2021a; Cornacchione Ross et al., 2021b; Gratale et al., 2022; Jarman et al., 2017; Kowitt et al., 2017; Kowitt et al., 2021; Wackowski et al., 2021). These existing studies have assessed believability of warnings, developing health harms warning statements, and developed and tested pictorial warnings (Cornacchione Ross et al., 2021a; Cornacchione Ross et al., 2021b; Gratale et al., 2022; Jarman et al., 2017; Kowitt et al., 2017; Kowitt et al., 2021; Wackowski et al., 2021).

Tobacco warnings frequently communicate the discrete health effects associated with use (e.g., lung cancer). However, messages about other relevant topics could also be effective and could be used to expand the library of potential cigar warnings to effectively communicate the diverse harms of cigar use to consumers. Previous research has demonstrated the effectiveness of messages about the constituents in tobacco smoke or secondhand smoke effects (Cho, Thrasher, Swayampakala, et al., 2018; Cornacchione et al., 2016; Goldstein et al., 2021; Hall et al., 2014; Lazard et al., 2018; Sutfin et al., 2019; Wiseman et al., 2016). These types of messages could potentially be used in warning statements for cigars. Little research has examined strategies to optimize warnings for cigars, including developing novel warning statements from non-health-related themes that might be effective and could potentially supplement the existing cigar warning themes. Awareness, or knowledge, about the harms of smoking cigars is an important outcome for FDA in assessing warning effectiveness (Family Smoking Prevention and Tobacco Control Act, 2009). Novel statements that include information about which consumers are not already aware of may be effective because they include new information that allows for additional learning, thus promoting greater understanding of the harms associated with cigar smoking (Pepper et al., 2020b). Thus, the goal of this study was to examine the perceived message effectiveness (PME) of different themes for cigar warning statements, filling a gap in the literature for identifying effective warning themes (Thrasher et al., 2019), which could supplement the six existing and FDA-proposed cigar warnings, increasing the library of warnings to implement and include in a rotation plan. This would also address the issue of "wear-out" or message fatigue after repeated exposure to the same warning–new

warnings are more likely to be noticed and perceived as effective (Kim & So, 2018; So, 2022; Woelbert & d'Hombres, 2019). PME is a widely-used construct for identifying promising messages, including warnings, in tobacco control. It predicts attitudes, intentions, and quitting behavior, and has been used as a construct in the regulatory decision-making process for cigarette warnings (Baig et al., 2021; Food and Drug Administration, 2020; Noar et al., 2018, 2020). In this study, we assessed PME for themes of direct health effects to self, health effects to others (secondhand smoke), cigar smoke constituents, and cigar toxicity.

2. Methods

2.1. Study design and procedures

Participants were randomized to one of six panels that each contained two warning statements (see Warning Statement Development). Each panel included a message from a unique theme (i.e., multiple messages from a single theme did not occur). Each participant viewed two warning statements to reduce participant burden. After viewing each statement, we asked participants about their awareness of that consequence and PME rating (see measures).

2.2. Participants

Qualtrics recruited a convenience sample of 777 participants for our study from April 23 to May 7, 2020. Qualtrics is an online survey research platform that has participant panels for research. To be eligible for this study, participants had to be an adult age 18 or older, speak English, live in the U.S., and use little cigars, cigarillos, or traditional large cigars in the past 30 days. The University of North Carolina at Chapel Hill Institutional Review Board approved the study.

2.3. Warning statement development

To create the warning statements, we examined systematic reviews and research studies on known health effects of cigars and constituents found in cigar smoke (Baker et al., 2000; Chang et al., 2015; Iribarren et al., 1999; Katsiki et al., 2013; Shanks and Burns, 1998; US Department of Health and Human Services, 2014). For the statements about *explicit health effects to the consumer ("explicit health effects")*, we selected two health harms (heart disease, lung cancer) that were similar to the existing cigar warnings. For *secondhand smoke effects*, we created two warnings about harm to others and harm to children and included a general statement about secondhand smoke, reflecting similar themes as an existing cigar warning. For the *chemicals/constituents* statements, we selected four chemicals that performed well in previous research (arsenic, lead, formaldehyde, uranium) and another (carbon monoxide) that has appeared in other tobacco warnings (Goldstein et al., 2021). Finally, for the statements about *toxicity*, we created two statements about cigar smoke being poisonous and toxic, similar to warnings used in other countries. In total, twelve statements were assessed, with two focused on *explicit health effects*, three on *secondhand smoke effects*, five on *chemicals/constituents*, and two on *toxicity*. The warning statements are available in the supplemental table.

2.4. Measures

2.4.1. Awareness

To assess participant awareness of the 12 consequences described in the warning statements, they were asked "are you aware or not aware that cigar smoking [can cause/contains] [consequence]?" for each warning statement they viewed (Cho, Thrasher, Swayampakala, et al., 2018). Responses were coded as yes (1) or no/don't know (0).

2.4.2. Perceived message effectiveness

Our primary outcome was PME (Baig et al., 2019), adapted from a

validated scale with three items: how much does this statement 1) make you concerned about the health effects of smoking cigars?; 2) make cigar smoking seem unpleasant?; 3) discourage you from wanting to smoke cigars? Response options are on a 5-point scale ranging from 1 (not at all) to 5 (a great deal), and we averaged responses to the three items (Cronbach's alpha range = 0.89 – 0.94 across warning statements).

2.4.3. Cigar use

Cigar use was assessed with product descriptions and items from PATH and images of example products. We assessed ever use and current (past 30 day) use of cigarillos, little cigars, and large cigars separately (Edwards et al., 2020; PhenX Toolkit).

2.4.4. Nicotine dependence

Nicotine dependence was assessed using measures from Sung et al. (2018) from the National Adult Tobacco Survey, which assesses nicotine dependence for multiple forms of tobacco products (e.g., during the past 30 days, have you had a strong craving to use tobacco products of any kind?) (Sung et al., 2018). Nicotine dependence is scaled from 0 to 5 based on 5 measures, with 0 being low nicotine dependence and 5 being high nicotine dependence.

2.4.5. Correlates

We also assessed demographic characteristics including age, gender, race, ethnicity, and education.

2.5. Analysis

Warning messages were categorized into four themes: *explicit health effects* to the consumer, *secondhand smoke* effects, *chemicals/constituents*, and *toxicity*. Frequencies and means were generated to describe participant demographics, PME, and awareness by individual warning statement and warning theme. To determine which covariates to include in a linear mixed model, we assessed bivariate correlations with PME, using t-tests, ANOVAs, or Pearson's correlation, depending on covariate type. If correlates were significant at $p < 0.10$, they were included in the final linear mixed model, also controlling for participant characteristics and the panel to which participants were assigned. All analyses were conducted in SAS 9.4 with $\alpha = 0.05$.

3. Results

Participants (N = 777) self-reported as 48.9% female, 66.2% White, 23% Black or African American, 15.1% Hispanic, with an average age of 39.9 (SD = 13.4). Among the sample, 65.9% reported past 30-day use of little cigars, 90.9% cigarillos, and 54.7% traditional large cigars (not mutually exclusive). Most of the sample (n = 573, 73.8%) reported using at least two different types of cigars and reported a mean dependence rating of 3.2 (SD = 1.5). Additional demographic variables are in Table 1.

3.1. Warning statements

The individual warning statements for lung cancer (M = 3.91, SD = 1.01), heart disease (M = 3.77, SD = 1.06), and harm to children (M = 3.71, SD = 1.13) had the highest PME ratings. The statements with the lowest PME ratings were about carbon monoxide (*M* = 3.52, SD = 1.05), secondhand smoke (*M* = 3.50, SD = 1.15), and formaldehyde (*M* = 3.48, SD = 1.07). Descriptive statistics for each warning statement and warning themes are in Table 2.

3.2. Multilevel analyses

Mixed modeling analyses showed that increasing awareness of consequences in the warnings was associated with higher PME ratings (B = 0.3, *p* <.001). When looking at warning themes, warnings about

Table 1
Participant characteristics and tobacco use variables among adults who smoke cigars in the U.S. in 2020, n = 777.

Variable	N (%) or Mean (SD)
Age	39.9 (13.4)
Gender	
Male	389 (50.1%)
Female	380 (48.9%)
Transgender or other	8 (1.0%)
Sexual orientation	
Heterosexual or straight	679 (87.4%)
Gay, lesbian, bisexual, something else	98 (12.6%)
Ethnicity	
Not Hispanic or Latino	659 (84.9%)
Hispanic or Latino	117 (15.1%)
Race	
White	514 (66.2%)
Black or African American	179 (23.0%)
Any Other Race	84 (10.8%)
Education	
High school degree or less	218 (28.1%)
Some college or higher	559 (71.9%)
Income	
Below $49,999 per year	384 (49.4%)
Greater than $50,000 per year	393 (50.6%)
Past 30 day little cigar use[a]	512 (65.9%)
Past 30 day cigarillo use[a]	706 (90.9%)
Past 30 day traditional large cigar use[a]	425 (54.7%)
Nicotine dependence[b]	3.2 (1.5)

[a] Not mutually exclusive
[b] Response range from 0 to 5, higher values indicate more nicotine dependence

Table 2
Mean perceived message effectiveness and awareness ratings for cigar warning themes and statements among adults who smoke cigars in the U.S. in 2020, n = 777.

Consequence	PME Mean	PME SD	Awareness %
Explicit health effects to consumer	3.84	1.04	87.3%
Lung cancer	3.91	1.01	94.6%
Heart disease	3.77	1.06	80.0%
Secondhand smoke effects	3.60	1.16	88.1%
Harm children	3.71	1.13	84.6%
Harm others	3.57	1.19	87.7%
Secondhand smoke	3.50	1.15	92.1%
Chemicals/constituents	3.54	1.04	49.6%
Arsenic	3.63	1.16	56.2%
Uranium	3.53	1.28	26.9%
Lead	3.53	1.18	38.5%
Carbon Monoxide	3.52	1.05	74.8%
Formaldehyde	3.48	1.07	52.3%
Toxicity	3.64	1.10	75.4%
Toxic	3.66	1.05	80.0%
Poisonous	3.61	1.14	70.8%

Note: PME ranged from 1 to 5, with higher ratings indicating greater PME. Individual warnings are categorized by warning theme.

chemicals/constituents (B = -0.13, *p* =.017) and *secondhand smoke* effects (B = -0.15, *p* = 0.045) were associated with lower PME ratings compared to warnings about *health harms* (Table 3). There were no significant differences between *health harms* and *toxicity* warning statement themes (B = - 0.11, *p* =.16). Increasing nicotine dependence was associated with higher PME ratings (B = 0.07, *p* = 0.004). An interaction between theme and nicotine dependence was not significant when included in the model so it was removed.

4. Discussion

The goal of this study was to assess PME for different warning themes to support the development of effective cigar warnings. Three key findings of our study are: 1) specific warning themes elicited higher PME

Table 3

Correlates of perceived message effectiveness for cigar warning themes and statements among adults who smoke cigars in the U.S. in 2020, multivariable model, n = 773.

Correlate	B (SE)	p-value
Respondent aware that health consequence is caused by cigar smoking		
No	REF	
Yes	**0.30 (0.05)**	**<0.001**
Theme of Warning		
Explicit health effects to consumer	REF	
Secondhand smoke effects	**−0.15 (0.07)**	**0.045**
Constituents/chemicals	**−0.13 (0.06)**	**0.017**
Toxicity	−0.11 (0.08)	0.16
Nicotine Dependence	**0.07 (0.02)**	**0.004**

Note: Model controls for panel which participants were assigned, age, gender, sexual orientation, ethnicity, race, education, income, and nicotine dependence. Boldface denotes statistical significance p < 0.05.

ratings than others, providing evidence about developing additional cigar messaging; 2) participants' self-reported levels of nicotine dependence were positively associated with PME ratings; and 3) participants' awareness of the warning statement was associated with higher PME ratings.

The *explicit health effects* theme was rated as significantly higher on PME than both the *secondhand smoke* and *constituents* themes but was not significantly different than the *toxicity* theme. Most existing tobacco warnings include content about the health harms to the user, and when the FDA developed new warnings for cigarettes, additional statements about health effects were developed. Our study demonstrates that this theme is an effective strategy for increasing perceptions of effectiveness. Previous research in tobacco communication has identified that communicating about specific *constituents* is promising (Cho, Thrasher, Swayampakala, et al., 2018; Cornacchione et al., 2016; Goldstein et al., 2021; Hall et al., 2014; Lazard et al., 2018; Sutfin et al., 2019; Wiseman et al., 2016), but little is known about communicating about toxicity more broadly. It is possible that warnings that communicate about toxicity more broadly, rather than about a specific constituent, might be more effective because the language is universally understood, as opposed to individual constituents, which likely require a higher level of understanding. Future research could assess how these different warning themes impact important outcomes for warnings (Noar, Hall, et al., 2016), such as increased understanding about the harms of smoking, as well as changes in beliefs and behaviors.

Although the themes provide useful information about overall effectiveness, it is important to not discount any individual statement within a theme that might be uniquely effective. Although the *explicit health effects* theme elicited significantly higher ratings of PME compared to *secondhand smoke* and *constituents* themes, variation occurred within a theme across individual warning statements. For example, there was variation within the *secondhand smoke* theme in terms of PME. The warning statement about harm to children had a higher PME mean rating than secondhand smoke in general. This finding aligns with other research that identified that tobacco warnings about secondhand smoke harms to children are effective, even among younger adults (Healey & Hoek, 2016; Islam et al., 2016).

In our mixed models, we found that increased nicotine dependence was associated with higher PME ratings. This is a promising finding given that the purpose of tobacco warnings is to educate consumers about the health harms of tobacco and ultimately decrease use. Warnings that are perceived as more effective among those who are more nicotine dependent might lead them to quit smoking cigars. However, the role of nicotine dependence on how people respond to warnings is

mixed. For example, warnings have deterred purchasing among those with lower nicotine dependence but not high nicotine dependence, indicating that people with greater dependence are more likely to satisfy their nicotine cravings (Shadel et al., 2019; Stone et al., 2021). However, other studies have found the effect of warnings on quitting to be independent of nicotine dependence, suggesting that warnings may result in quit attempts regardless of nicotine dependence (Cho, Thrasher, Yong, et al., 2018; Schneider et al., 2012). Research should continue to look at how nicotine dependence can impact warning effectiveness, particularly in the context of cigar warnings.

Furthermore, we found that awareness of consequences (measured after warning exposure and before PME) was associated with greater PME ratings in our mixed models. However, some warning statements that had high awareness had lower PME ratings (e.g., the secondhand smoke statement had one of the highest awareness but lowest PME ratings). Thus, awareness is not the only factor driving effects. For example, some messaging research has identified that messages focused on novel themes can be effective because they introduce new information to the consumer and promote increased understanding of the diverse negative outcomes associated with cigar smoking (Kim et al., 2013; Pepper et al., 2020b). It is important for additional consumer education efforts to communicate the risks of cigar smoking, such as campaigns, which have the ability to communicate through multiple messages to ensure messages are noticed and that the health harms in the messages become salient and understood. In particular, repeated exposure to a message can increase knowledge and effectiveness, whereas this study entailed a single exposure. In fact, novel messages, both in terms of content and design, are more likely to result in talking to others about the message (Kim et al., 2013), which can result in knowledge and behavior change (Thrasher et al., 2016). In this study, less than half of the sample knew the constituents that are present in cigar smoke, warranting communication campaigns to educate consumers about these harms. Furthermore, strengthening warnings, such as including an image to go along with the warning statement, can also increase warning effectiveness, resulting in quitting or preventing initiation (Noar, Francis, et al., 2016).

5. Limitations

A limitation of this study is that this was a single cross-sectional experiment of different warning statements with forced exposure. However, it is promising that we found effects after a single exposure, which could potentially indicate effects in natural exposure conditions where repeated exposure occurs. Indeed, similar pre-market cigarette warning experiments have produced results that are similar to those after smokers are repeatedly exposed to warnings (Huang et al., 2016). Furthermore, each participant was randomized to view only two of the 12 statements due to concerns about fatigue and exposure to other messages in the study, but we ensured that participants saw messages from two different themes. This strategy also allowed us to not introduce a broad comparative frame by asking participants to rate multiple messages. Participants may have also been more likely to falsely claim that they were aware of a cigar smoking consequence due to social desirability. However, there was variability in level of knowledge across the 12 warning statements, so even if awareness was inflated, we are still able to see differences across the different statements. This study also assessed only text-only warning elements. Adding other warnings features that are known to increase warning effectiveness (e.g., imagery, size) could change the effectiveness of any individual statement or theme in this study. There was also variability in the number of messages within each theme. This study used an online convenience sample, although research has demonstrated that convenience samples can produce similar results to probability-based samples in message testing experiments (Jeong et al., 2019). Furthermore, because this is a convenience sample, the sample characteristics do not necessarily reflect those who smoke cigars, particularly little cigar and cigarillos, because

this sample is mostly White and with relatively higher incomes and education levels, limiting generalizability.

6. Conclusion

This study fills a gap in the literature regarding warning labels for cigars by identifying optimal message themes for effective warnings. Although the FDA-mandated cigar warnings were recently struck down, this study adds to the scientific evidence for developing effective warning statements, for both cigars and other tobacco products, that could withstand legal scrutiny.

CRediT authorship contribution statement

Jennifer Cornacchione Ross: Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Supervision. **Sarah D. Kowitt:** Conceptualization, Investigation, Validation, Writing – review & editing. **Kristen L. Jarman:** Conceptualization, Investigation, Validation, Formal analysis, Data curation, Writing – review & editing, Supervision, Project administration. **Leah M. Ranney:** Investigation, Writing – review & editing. **Allison J. Lazard:** Investigation, Writing – review & editing. **James F. Thrasher:** Investigation, Writing – review & editing. **Paschal Sheeran:** Investigation, Writing – review & editing. **Adam O. Goldstein:** Investigation, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2023.102236.

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