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Brief Report
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Brief Report

Designing More Effective Cigar Warnings: An Experiment Among Adult Cigar Smokers

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Abstract

Introduction: Little systematic evidence exists about the effectiveness of cigar warnings. This study examined the perceived message effectiveness (PME) of warning statements about different health consequences caused by cigars. PME is a validated self-report scale of how effectively a health message discourages smoking.

Aims and Methods: We conducted an online study from April to May 2020 with adults in the United States who used cigars in the past 30 days ($n = 777$). Participants were randomly assigned to view and rate PME (three items, range 1–5) for seven out of 37 text warning statements about different health consequences from cigar use. Linear mixed effects models evaluated the most effective warning characteristics (eg, type of health consequence), controlling for repeated measures and participant demographics.

Results: Analyses showed that health consequences about the cardiovascular system ($B = 0.38$), mouth ($B = 0.40$), other digestive ($B = 0.45$), respiratory system ($B = 0.36$), and early death ($B = 0.36$) were associated with higher PME scores than reproductive health consequences (all p values <.001). Similar results were found for these health consequences compared with addiction (all p values $p < .001$). We also observed that awareness of the health consequence was associated with higher PME scores ($B = 0.19$, $p < .001$) and length of the warning message (number of characters) was associated with lower PME scores ($B = –0.007$, $p = .03$). No differences were observed between cancer and noncancer health consequences ($p = .27$) or health consequences that used plain language versus medical jargon ($p = .94$).

Conclusions: Our study provides new evidence about the perceived effectiveness of different cigar health warning statements and identifies features that may strengthen statements.

Implications: Our study with cigar smokers from across the United States provides much-needed evidence concerning the perceived effectiveness of different cigar health warning statements and

features that may strengthen such statements. Mandated cigar warnings in the United States could be strengthened by including health consequences that were perceived as more effective in our study (eg, early death), using health consequences that participants were aware of, and using short warning statements.

Introduction

Even though cigars have similar adverse health effects as cigarettes,[1–3] cigars are regulated differently than cigarettes in the United States (eg, fewer regulations, lower taxes, available in any flavor, including menthol, except in select jurisdictions with laws banning the sale of flavored cigars). In 2016, the Food and Drug Administration (FDA) mandated that cigar warning statements include one of six warnings to be implemented in 2018 (eg, cigar smoking can cause lung cancer and heart disease, Supplementary Table A)[4]; however, the US Court of Appeals for the DC Circuit ruled that the FDA cannot require these new cigar warning labels, claiming that the FDA did not provide adequate evidence for their impact on consumption of cigars (Cigar Association of America et al. v. FDA). Nevertheless many cigars carry warnings in compliance with a preexisting Federal Trade Commission agreement that are similar to FDA warnings (Supplementary Table A)[5] and some cigar companies have voluntarily implemented the FDA warnings on cigar product packaging.[6]

Although promising research has been conducted to improve the text used in cigarette warnings, little systematic research has been conducted on how to similarly strengthen cigar warnings. Research on how to improve cigar warnings is needed for three reasons: (1) FDA needs evidence to demonstrate the impact of cigar warnings on consumption before implementing new warnings; (2) extant research indicates that FDA-mandated cigar text warnings could be improved because some of the warning statements are less believable than others[7,8]; (3) FDA-mandated warnings discuss nine health consequences of cigar use but there are a number of other health consequences that could be discussed with no research indicating which consequences are most impactful.

The goal of this study was to evaluate different characteristics of text-only cigar warning statements on perceived message effectiveness (PME). PME refers to the extent to which a person believes that a health message will be effective in changing their smoking-related behavior.[9] Longitudinal research from tobacco education campaigns has shown that PME predicts quit intentions and cessation behavior, making it a useful construct to evaluate cigar warning statements.[10] We hypothesized that warnings with health consequences that were already known to participants,[11] included the word cancer,[12] and used plain language rather than medical jargon[13,14] would be more effective (ie, obtain higher PME ratings) than warnings without those elements. We also hypothesized that (1) reproductive warnings would be rated as less effective than other types of health consequences among the general population, but that they would be most effective among subgroups that they apply to, such as women of reproductive age,[15] and (2) addiction warnings would be less effective than other types of health consequences.[16–18]

Methods

Participants

Qualtrics recruited a final sample of 777 participants for our study from April 23 to May 7, 2020. Qualtrics has existing panels for social science research with a platform for online surveys. To be eligible for participation, adults had to be 18 years or older, speak English, live in the United States, and currently use little cigars, cigarillos, or traditional large cigars (defined as using one of those products in the past 30 days). The University of North Carolina at Chapel Hill Institutional Review Board approved the study.

Warning Statement Development

To create the list of health consequences caused by cigar smoking, we surveyed systematic reviews and research studies on known health consequences of cigars,[1–3] reviewed cigar-specific information in the FDA Deeming Regulations (a list of rules regarding the regulation of all tobacco products in the United States), and verified possible health consequences with a medical expert. From this information, we selected 36 health consequences that can be caused by cigars and added a fake health consequence as a control. We generated different versions of messages for particular health consequences to ensure that lay-language was used. For instance, to describe negative outcomes in the heart, we used both coronary heart disease and heart disease as two warnings variations. Two researchers coded each health consequence for whether they referred to medical jargon or plain language.

Procedures

We randomized participants to one of six panels. Each panel contained six health consequences that can be caused by cigars and one question about a fake health consequence that is not caused by cigars (syphilis). For each health consequence, we presented a statement to participants: "Cigar smoking can cause [health consequence]." in a white box with black text and then asked participants about their awareness of the health consequence and their PME rating.

Measures

Primary Outcome

Our primary outcome was PME, which we assessed with three items, adapted from a previously validated and reliable scale.[9] We asked participants: "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?"

The five-point response scale ranged from not at all (coded as 1) to a great deal (coded as 5). We averaged responses to the three items (Cronbach's alpha ranged from 0.84 to 0.95 across the warning statements).

Correlates

We assessed warning label characteristics, including the *type of health consequence* described in the warning (ie, cardiovascular, mouth, other digestive, reproductive, respiratory, early death, and addiction), whether *cancer* was mentioned (eg, liver cancer), whether *plain language* (rather than medical jargon) was used, the *length* of the warning message (# of characters), and participant *awareness* of the health

consequence. To assess awareness of each health consequence and the "fake" consequence (ie, syphilis), we asked: "Are you aware or not aware that cigar smoking can cause [health consequence]?" We coded responses of yes as 1 and other responses (no and don't know) as 0.

Control Variables

We controlled for several participant characteristics including age, gender identity, sexual orientation, race, Hispanic ethnicity, education, income, nicotine dependence,[19] and type of cigar product used in the past 30 days.

Data Analysis

In bivariate models using *t* tests, ANOVAs, or Pearson's correlations, we examined correlates of PME. If correlates were significant at $p < .10$, we included them in a linear mixed model, also controlling for participant characteristics and the panel to which participants were assigned. We also examined in separate linear mixed effects models whether *male-specific reproductive health consequences* (lower sperm count, impotence, erectile dysfunction) and *general reproductive health consequences* (infertility, fertility problems, low birth weight, stillbirth) were more or less effective among: (1) women of reproductive age (18–40 years old), (2) men of reproductive age (18–40 years old), (3) women not of reproductive age (41 years+), and (4) men not of reproductive age (41 years+). We used an age cutoff of 40 years old based on previously published research.[15]

Results

Participant Characteristics

Participant characteristics and tobacco use variables are presented in Supplementary Table B. The mean age of participants was 39.9 (SD: 13.4), and the majority of the sample identified as White (66.2%), non-Hispanic or Latino (84.9%), and straight or heterosexual (87.4%).

Perceived Message Effectiveness

The three health consequences with the highest PME ratings were colon cancer (mean: 3.79, SD: 1.08), oral cancer (mean: 3.78, SD: 1.12), and esophageal cancer (mean: 3.77, SD: 1.08) (Table 1). The three health consequences with the lowest PME ratings were lower sperm count (mean: 2.79, SD: 1.36), impotence (mean: 3.21, SD: 1.34), and erectile dysfunction (mean: 3.24, SD: 1.45).

Correlates of PME

Results from bivariate models are in Supplementary Table C; there was no effect of plain language on PME ($p = .94$) so we did not include it in multivariable models. In multivariable models controlling for participant characteristics and the panel to which participants were assigned, awareness of the health consequence was associated with higher PME scores ($B = 0.19$, $p < .001$) and length of the warning message was associated with lower PME scores ($B = -0.007$, $p = .03$) (Table 2). Health consequences about the cardiovascular system ($B = 0.38$), mouth ($B = 0.40$), other digestive ($B = 0.45$), respiratory system ($B = 0.36$), and early death ($B = 0.36$) were all associated with higher PME scores than reproductive health consequences (all p values <.001). Similar results were found for these health consequences compared with addiction (all p values <.001) (Supplementary Table D). We observed no difference between health consequences about cancer versus noncancer ($B = -0.05$, $p = .27$).

Table 1. Mean PME and Awareness Ratings, $n = 777$

Health consequence, by type	PME, mean[e]	PME, SD	Awareness, %
Cardiovascular			
Blood clot[a]	3.72	1.06	53.9
Coronary heart disease	3.71	1.14	76.2
Heart attacks[a]	3.65	0.98	80.3
Heart disease[a]	3.64	1.08	88.5
Stroke[a]	3.60	1.02	73.9
Mouth			
Oral cancer[b]	3.78	1.12	86.9
Mouth cancer[a,b]	3.63	1.06	89.2
Tongue cancer[a,b]	3.61	1.14	67.4
Lip cancer[a,b]	3.49	1.04	65.4
Other digestive			
Colon cancer[b]	3.79	1.08	55.4
Esophageal cancer[b]	3.77	1.08	80.8
Esophagus cancer[b]	3.72	1.02	81.5
Bladder cancer[b]	3.72	1.18	42.3
Pharyngeal cancer[b]	3.70	1.05	63.9
Blood in urine[a]	3.67	1.15	39.2
Throat cancer[a,b]	3.60	1.06	89.2
Laryngeal cancer[b]	3.57	1.07	68.5
Liver cancer[a,b]	3.57	1.07	54.3
Stomach cancer[a,b]	3.52	1.05	65.4
Pancreatic cancer[b]	3.49	1.07	54.6
Reproductive			
Low birth weight[a,c]	3.37	1.22	76.9
Stillbirth[a,c]	3.51	1.28	63.9
Infertility[c]	3.27	1.44	51.2
Fertility problems[a,c]	3.26	1.31	61.5
Erectile dysfunction[d]	3.24	1.45	37.7
Impotence[d]	3.21	1.34	43.9
Lower sperm count[a,d]	2.79	1.36	37.8
Respiratory			
Lung disease[a]	3.72	1	92.9
Lung cancer[a,b]	3.66	1.13	90.0
COPD	3.65	1.08	70.8
Fatal lung disease[a]	3.60	1.05	90.0
Emphysema	3.59	1.03	82.3
Death			
Early death[a]	3.69	0.98	89.8
Premature mortality	3.43	1.19	74.6
Addiction			
Addiction[a]	3.51	1.17	89.2
Nicotine addiction	3.27	1.23	97.7
Syphilis	3.49	1.33	29.9

COPD = chronic obstructive pulmonary disease; PME = perceived message effectiveness.

[a]Health consequences were coded as belonging to the plain language category.

[b]Health consequences were coded as belonging to the cancer category.

[c]Health consequences were coded as general reproductive health consequences.

[d]Health consequences were coded as male-specific reproductive health consequences.

[e]PME scores ranged from 1 to 5, with higher scores indicating greater PME.

Correlates of PME for Reproductive Warnings

When examining only the reproductive health cigar warnings, we found that men regardless of reproductive age, reported the male reproductive warnings as more effective than women of reproductive age ($B = 0.66$, $p < .001$ and $B = 0.71$, $p < .001$, respectively) (Supplementary Table E). For the general reproductive warnings, we found that women of reproductive age ($B = 0.52$, $p = .002$) and men of reproductive age ($B = 0.34$, $p = .04$) found the warnings more effective than men not of reproductive age.

Table 2. Correlates of PME, Multivariable Model, $n = 777$

Correlate	*B* (SE)	*p*
Respondent aware that health consequence is caused by cigar smoking		
No	REF	
Yes	**0.19 (0.03)**	**<.001**
Type of health consequence		
Reproductive	REF	
Cardiovascular	**0.38 (0.04)**	**<.001**
Mouth	**0.40 (0.06)**	**<.001**
Other digestive	**0.45 (0.05)**	**<.001**
Respiratory	**0.36 (0.04)**	**<.001**
Death	**0.36 (0.05)**	**<.001**
Addiction	0.07 (0.05)	.20
Cancer health consequence		
No	REF	
Yes	−0.05 (0.05)	.27
Length of warning message	**−0.007 (0.003)**	**.03**

Model controls for which panel participants were assigned to, age, gender, sexual orientation, ethnicity, race, education, income, nicotine dependence, and type of cigar product used in the past 30 days. Boldface denotes statistical significance $p < .05$. PME = perceived message effectiveness.

Discussion

The FDA's deeming rule in 2016 mandated that all cigar packaging and advertisements display one of six new text-only warnings beginning in 2018[4]; however, due to recent litigation, this mandate was vacated. While we did not specifically evaluate the FDA-mandated warnings, we did find that health consequences mentioned in three of the warnings (mouth cancer, throat cancer, lung cancer, and heart disease) were perceived as highly effective in our study and that additional health consequences not mentioned in warnings (eg, early death) also showed potential to be effective.

Warnings about addiction and reproductive health were rated less effective than other types of health consequences. A number of studies have found that warnings about nicotine addiction on cigarette, e-cigarette, and waterpipe tobacco packages are less effective than other types of warnings on the hazards and harms of tobacco products.[16–18] Our findings extend this body of research to cigars. Further, while one of the FDA-mandated warnings discusses reproductive health, findings from the current study suggest that reproductive cigar warnings may not perform as well in a general population of cigar smokers, but that reproductive cigar warnings highlighting the negative consequences on men (as opposed to more general consequences) may be effective for men even though they may be less effective than warnings focused on other outcomes.

Whereas previous research on cigarette smoke constituents found that cancer health consequences were more discouraging than noncancer health consequences among cigarette smokers,[12] our models showed no statistically significant differences between cancer health consequences and noncancer health consequences. It is important to note, however, that these findings do not suggest that cancer health consequences are ineffective. Indeed, of the top 10 most highly rated health consequences, seven were about cancers that are not currently mentioned in FDA-mandated cigar warnings: colon cancer, oral cancer, esophageal/esophagus cancer, bladder cancer, and pharyngeal cancer. Contrary to our hypothesis and existing research,[13,14] we also found no effect of plain language on PME scores.

Our study found participants who were aware of the health consequence described in the warning rated it as more effective than participants who were not aware of that health consequence and that shorter warnings may be more effective than longer ones. Warning labels on lesser-known health consequences could increase public understanding of the health risks of tobacco use, which is an FDA mandate.[4] However, our research and other studies show that these lesser-known health consequences may also be less effective,[11] perhaps due to reduced message credibility. There is clearly a fine line between using well-known versus lesser-known health consequences, and if the goal of warnings is to promote cessation and impede uptake, awareness should not be the only factor in determining whether or not a health consequence should be used. Overall, our findings suggest that a mix of well-known and lesser-known health consequences could be used as text statement in cigar warnings. If lesser-known health consequences are used, campaigns with more resources could to be implemented to inform the public about these lesser-known health consequences.

Limitations

There are several limitations to this study, including that (1) we only examined one self-reported outcome (PME); (2) this was a one-time cross-sectional study; (3) we used an age cutoff of less than 40 years old to categorize men and women of reproductive age based on previously published research,[15] and actual reproductive age for men and women can be higher than 40 years old; (4) although two researchers coded each health consequence for whether it referred to "plain language" versus "medical jargon," some subjectivity was used to make these determinations; (5) there was likely overestimation of awareness of health consequences caused by cigar smoking since 29.9% of the sample reported that cigar smoking caused syphilis (fake health effect); and (6) all participants were recruited online and are not representative of the US population or of cigar smokers. However, research suggests that for experiments, results from convenience-based online samples are similar to probability-based samples.[11,20]

Conclusions

Even though cigars have similar adverse health effects as cigarettes, cigars are regulated differently than cigarettes in the United States. Our study provides needed evidence on the perceived effectiveness of different cigar health warnings and features that may strengthen the text statements of such warnings.

Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at https://academic.oup.com/ntr.

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Declaration of Interests

None declared.

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- Formal analysis (lead)
- Investigation (equal)
- Methodology (equal)
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Data Availability

Data are available upon request to Dr Adam O. Goldstein (adam_goldstein@med.unc.edu).

References

1. Chang CM, Corey CG, Rostron BL, Apelberg BJ. Systematic review of cigar smoking and all cause and smoking related mortality. *BMC Public Health*. 2015;15:1–20.
2. Shanks TG, Burns DM. Disease consequences of cigar smoking. In: *Smoking and Tobacco Control, Monograph 9: Cigars—Health Effects and Trends*. National Cancer Institute; 1998:4105–4160. https://www.researchgate.net/profile/David-Burns-11/publication/265537122_Disease_Consequences_of_Cigar_Smoking/links/56df050608ae9b93f79a87e9/Disease-Consequences-of-Cigar-Smoking.pdf.
3. Baker F, Ainsworth SR, Dye JT, et al. Health risks associated with cigar smoking. *JAMA*. 2000;284(6):735–740.
4. 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):28973–29106.
5. US Federal Trade Commission. *Agreement Containing Consent Order (File No. 002-3202), in the Matter of General Cigar Holdings, Inc*. 2000. https://www.ftc.gov/sites/default/files/documents/cases/2000/06/ftc.gov-generalcigarconsent_.htm. Accessed July 15, 2021.
6. Wackowski OA, Kurti M, Schroth KRJ, Delnevo CD. Examination of voluntary compliance with new FDA cigar warning label requirements. *Tob Regul Sci*. 2020;6(6):379–383.
7. Jarman KL, Kowitt SD, Cornacchione Ross J, Goldstein AO. Are some of the cigar warnings mandated in the U.S. More believable than others? *Int J Environ Res Public Health*. 2017;14(11):1–9.
8. Kowitt SD, Jarman K, Ranney LM, Goldstein AO. Believability of cigar warning labels among adolescents. *J Adolesc Health*. 2017;60(3):299–305.
9. Baig SA, Gottfredson NC, Noar SM, Boynton MH, Ribisl KM, Brewer NT. UNC perceived message effectiveness: validation of a brief scale. *Ann Behav Med*. 2018;52:732–742.
10. Noar SM, Barker J, Bell T, Yzer M. Does perceived message effectiveness predict the actual effectiveness of tobacco education messages? A systematic review and meta-analysis. *Health Commun*. 2020;35(2):148–157.
11. Brewer NT, Morgan JC, Baig SA, et al. Public understanding of cigarette smoke constituents: three US surveys. *Tob Control*. 2016;26(5):592–599.
12. Kelley DE, Boynton MH, Noar SM, et al. Effective message elements for disclosures about chemicals in cigarette smoke. *Nicotine Tob Res*. 2018;20(9):1047–1054.
13. Sutton JA, Yang S, Cappella JN. Perceived effectiveness of objective features of pictorial warning messages. *Tob Control*. 2019;28(e1):e24–e30.
14. Gendall P, Eckert C, Hoek J, Louviere J. Estimating the effects of novel on-pack warnings on young adult smokers and susceptible non-smokers. *Tob Control*. 2018;27(5):519–525.
15. Kollath-Cattano C, Osman A, Thrasher JF. Evaluating the perceived effectiveness of pregnancy-related cigarette package health warning labels among different gender/age groups. *Addict Behav*. 2017;66:33–40.
16. Brewer NT, Jeong M, Hall MG, et al. Impact of e-cigarette health warnings on motivation to vape and smoke. *Tob Control*. 2019;28(e1):e64–e70.
17. Mays D, Tercyak KP, Lipkus IM. The effects of brief waterpipe tobacco use harm and addiction education messages among young adult waterpipe tobacco users. *Nicotine Tob Res*. 2016;18(5):777–784.
18. Thrasher JF, Arillo-Santillán E, Villalobos V, et al. Can pictorial warning labels on cigarette packages address smoking-related health disparities? Field experiments in Mexico to assess pictorial warning label content. *Cancer Causes Control*. 2012;23(suppl 1):69–80.

19. Sung H-Y, Wang Y, Yao T, Lightwood J, Max W. Polytobacco use and nicotine dependence symptoms among US adults, 2012–2014. *Nicotine Tob Res*. 2018;20(suppl 1):S88–S98.

20. Jeong M, Zhang D, Morgan JC, et al. Similarities and differences in tobacco control research findings from convenience and probability samples. *Ann Behav Med*. 2019;53(5):476–485.