



## Short Communication

## Graphic-enhanced information improves perceived risks of cigar smoking

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## ABSTRACT

The internet is a major source of health information and several notable health web sites contain information on the risks associated with cigar smoking. Previous research indicates that internet pages containing health information on cigars have high reading levels and are restricted to text material, which can decrease understanding. We examined the effects of existing text-only (from the United States National Cancer Institute website) versus novel graphic-enhanced information on smokers' perceptions of health risks associated with cigar smoking.

The study was a laboratory-based single session of current cigarette smokers ( $n = 102$ ) who viewed cigar smoking risk information on a computer monitor then completed cigar risk questionnaire items. Participants were randomized to view either text-only or graphic-enhanced cigar information. The graphic version contained additional risk information about cigarillos and little cigars. Text-only participants were more likely to underestimate perceived health risks associated with cigar smoking compared to graphic-enhanced participants (47.1% versus 17.7%,  $p = .001$ ); and, graphic-enhanced participants were more likely to report that they would share the cigar health risk information with friends compared to those viewing text-only, 47.0% versus 27.4%,  $p = .005$ . Employing graphics to convey health risks associated with cigar smoking increases understanding and likeliness to share information. Integrating information about little cigar and cigarillo risk in conjunction with large cigar risk information is an effective public health strategy to provide more comprehensive risk information. Utilizing graphics on health information internet pages can increase knowledge and perceived risks of cigar smoking.

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## 1. Introduction

The internet is a popular source of health information; half of US adults report searching the internet for health information (Cohen & Stussman, 2010). Several websites have health information on cigars, yet they have high reading levels, no graphics, and ignore little cigars and cigarillos (Dollar, Mix, & Kozlowski, 2008). There have been few efforts to correct misperceptions of cigars as a less-hazardous product (Dollar et al., 2008). People often minimize the health risks of cigars (Baker, Dye, Denniston, & Ainsworth, 2001; Nyman, Taylor, & Biener, 2002). Effective means of communicating risk information are needed on the internet to counter common beliefs that cigars are a safer alternative to cigarettes.

In the U.S., cigar sales, especially of little cigars and cigarillos, have risen dramatically in the past two decades, as cigarette sales declined (United States Department of Agriculture (2007); Kozlowski, Dollar, &

Giovino, 2008). This rise was supported by lower tax rates on cigars and by beliefs that cigars are less dangerous than cigarettes (Campaign for Tobacco Free Kids, 2010, Feb.10).

Although cancer risk for cigar smokers depends on frequency of use and depth of inhalation, the risk is clearly far greater than for non-smokers (Shopland, Burns, Hoffman, Cummings, & Amacher, 1998), and approaches level of risk for cigarette smokers for many cancer types (Baker, Ainsworth, Dye et al., 2000; Shanks & Burns, 1998; Shopland et al., 1998). In the case of little cigars and cigarillos, inhalation patterns approximate cigarette smoking behaviors, and lung cancer risk is comparable to that associated with cigarettes (Boffetta, Nyberg, Agudo et al., 1999; Henningfield, Hariharan, & Kozlowski, 1996). Compared to large cigars, for which risk is complex because it depends on smoking history and inhalation, the explicit dangers from little cigar smoking are more easily communicated. Yet, there is an absence of risk information on little cigars available on websites (Dollar et al., 2008).

We conducted a laboratory-based investigation on the effects of graphic-enhanced web-based messages to improve smokers' understanding of cigar smoking risks compared to text-only messages taken from the National Cancer Institute (NCI) website, (see Dollar et al.,

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2008) Research on graphic communications (Hammond et al., 2007) led us to hypothesize that participants viewing the graphic version would have a better understanding of the risks. Additionally, we included little cigar and cigarillo risk information in the graphic version.

## 2. Methods

### 2.1. Participants

Participants were 102 current smokers responding to advertisements for a 90 min study on attitudes and beliefs about tobacco smoking. Eligibility was self-reported smoking a minimum 10 daily cigarettes (non-menthol) for a minimum 5 years; not currently trying to quit or no intent to do so in the next two months; age 21 to 65; English as primary language; no current substance abuse; no visual impairments. The protocol was institutional review board-approved and sessions conducted October 2008–April 2009.

### 2.2. Procedures

Participants smoked one of their own brands to standardize time since last cigarette, and completed demographic and smoking-related questionnaires administered using computer-based software (MediaLab v2004.3.14, Empirisoft) presented on 19-inch monitors. Participants

viewed cigarette and potential reduced exposure product (PREP) materials (not reported) prior to the cigar module.

Participants were randomized, balanced for sex, to text or graphic conditions presented in Gazetracker (Eye Response Technologies), completed a 7-item Cigar Questionnaire, provided open-ended comments, and received \$50.00.

### 2.3. Risk information

Risk information was either text-only or graphic-enhanced with minimal text (see Fig. 1A and B), presented as two successive screens (i.e., 1A-1 then 1A-2; or 1B-1 then 1B-2), congruent for occupied monitor space. Text-only was an unedited excerpt (243 of 1525 words) from a NCI webpage (<http://www.cancer.gov/cancertopics/factsheet/Tobacco/cigars>) entitled “Questions and Answers about Cigar Smoking and Cancer” and was the answer to the question, “How are the health risks associated with cigar smoking different from those associated with smoking cigarettes?” (see Fig. 1A). It was selected based on ratings of risk message, harm reduction theme and complexity level (Dollar et al., 2008).

The graphic version was similar to the text version and employed simple warning or traffic light graphics, derived from a traffic light information campaign in the United Kingdom on healthy eating (<http://www.eatwell.gov.uk/foodlabels/trafficlights/>). Additionally, graphics to convey risks related to inhalation and the number of

## A

How are the health risks associated with cigar smoking different from those associated with smoking cigarettes?

Health risks associated with both cigars and cigarettes are strongly linked to the degree of smoke exposure. Since smoke from cigars and cigarettes are composed of many of the same toxic and carcinogenic (cancer causing) compounds, the differences in health risks appear to be related to differences in daily use and level of inhalation.

Most cigarette smokers smoke every day and inhale. In contrast, as many as three-quarters of cigar smokers smoke only occasionally, and the majority do not inhale.

All cigar and cigarette smokers, whether or not they inhale, directly expose the lips, mouth, tongue, throat, and larynx to smoke and its carcinogens. Holding an unlit cigar between the lips also exposes these areas to carcinogens.

In addition, when saliva containing smoke constituents is swallowed, the esophagus is exposed to carcinogens. These exposures probably account for the fact that oral and esophageal cancer risks are similar among cigar smokers and cigarette smokers.

Cancer of the larynx occurs at lower rates among cigar smokers who do not inhale than among cigarette smokers. Lung cancer risk among daily cigar smokers who do not inhale is double that of nonsmokers, but significantly less than the risk for cigarette smokers. However, the lung cancer risk from moderately inhaling smoke from five cigars a day is comparable to the risk from smoking up to one pack of cigarettes a day.

## B

### Comparing Health Risks from Cigarettes and Cigars

**Health Risk Summary**

• High-tar cigarettes		Huge Risks- Not safe!
• Lower-tar cigarettes		Huge Risks- Not safe!
• Lowest-tar cigarettes		Huge Risks- Not safe!
• Cigars If previous cigarette smoker If inhale Frequent use		Huge Risks- Not safer than cigarettes!
• Cigars If never cigarette smoker No inhalation Rare use		Moderate Risks- A little safer than cigarettes
• Nicotine Replacement Therapy (Patch, Gum)		Low Risks- Much safer than any tobacco product

Cigars Can be Just as Deadly as Cigarettes

Health Risks come from..

1. If smoke is inhaled (taken into the lungs)
2. Number smoked
3. Type of cigar smoked
4. If you are or ever have been a cigarette smoker

1. If smoke is inhaled (taken into the lungs)  
Inhaling is dangerous for lung health, even if you inhale only a little. Inhaled cigar smoke is as dangerous as inhaled cigarette smoke.



#### 2. Number smoked

- Smoking a cigar once a week or less is less dangerous than daily smoking of cigars.
- Smoking several cigars a day can be the same as smoking many cigarettes each day.

#### 3. Type of cigar smoked

- Little cigars or cigarillos have health risks similar to cigarettes.
- Lifelong smokers of cigarillos have the same lung cancer risk as lifelong smokers of cigarettes.
- One large cigar can give as much smoke as 6 little cigars or 6 cigarettes.
- Think of little cigars as if they were brown cigarettes- and just as dangerous as cigarettes!

Many little cigars = Many cigarettes = One large cigar



#### 4. IF you are or ever have been a cigarette smoker

- Cigarette smokers (former or current) are especially at risk with cigars.
- Cigarette smokers tend to inhale cigars.
- Little cigars and cigarillos can be just as dangerous as cigarettes.

Fig. 1. Text-only and graphic versions of cigar risk information internet pages.

cigars smoked, as well as the risks of little cigar and cigarillo use were included. (Fig. 1B).

## 2.4. Measures

### 2.4.1. Descriptive measures and covariates

Age, sex, education, race, ethnicity, preferred cigarette brand, number of years smoking, nicotine dependence [Fagerstrom Test of Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991)], history of cigar use, and need for cognition (preference for thinking about complex issues; Cacioppo, Petty, Feinstein, & Jarvis, 1996) were assessed prior to viewing cigar risk information.

### 2.5. Cigar questionnaire

A 7-item Cigar Questionnaire test was used to assess participants' perceived risks of cigar smoking and attitude toward the information presented. Cigar items focused upon risk knowledge and the content of the information provided. Participants were instructed to select the response option that best reflects their answer to the following statements: *how do cigars and cigarettes compare in risks to the users?*; *little cigars are less dangerous than cigarettes*; *inhalation of cigar smoke increases risks to health*; *how likely would you be to tell a cigar smoking friend or family member about what you learned from reading the webpage?*; and *acceptability: was the web page on cigars interesting?*; *was the web page on cigars annoying?*; *did you like or dislike the webpage on cigars?* The first item was scored on a 5-point response format (1 = cigars are much less dangerous than cigarettes; 2 = ...a little less dangerous...; 3 = ...about as dangerous...; 4 = ... a little more dangerous...; 5 = ...much more dangerous...). Items 2–5 were scored on a 5-point response format (1 = not at all; 2 = a little; 3 = moderately; 4 = very much; 5 = extremely); and the last item on a 4-point response format (1 = dislike it greatly; 2 = dislike it a little; 3 = like it a little; 4 = like it greatly).

### 2.6. Statistical analysis

Analysis of Variance (ANOVA) assessed condition effects on cigar risk perception and attitude toward messages, with covariates  $p < .20$  retained in models. Fisher's Exact tests were performed post-hoc to explore dichotomous differences [*less versus more* (item 1); *not at all versus any level* (items 2–6); *dislike versus like* (item 7)].

## 3. Results

### 3.1. Descriptive statistics

Participants were 67% male, and 90% White, 5% Asian American, 3% African American; 2% Hispanic irrespective of race; mean age, 30.5 years ( $SD = 8.1$ ). All participants completed high school; 42% college graduates; 74% never married; 37% currently had full-time work, 34% part-time work, and 28% not working. Average number of daily cigarettes was 16.5 ( $SD = 5.6$ ; range 10–40); participants started smoking at age 16.5 ( $SD = 2.7$ ) and had been daily smokers for 12.8 years ( $SD = 6.9$ ). Mean nicotine dependence score (FTND) was 4.1 ( $SD = 2.1$ ; range 0–9).

### 3.2. Cigar use

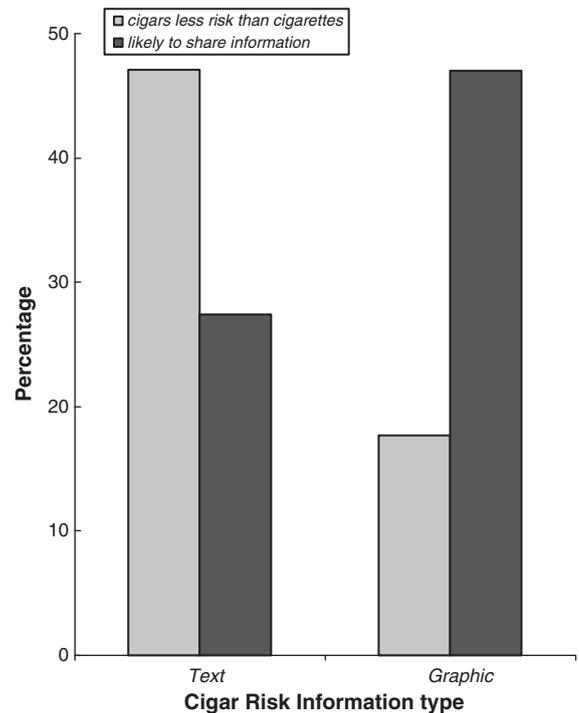
Eleven participants reported smoking a cigar at least 50 times in their entire life and 6 currently smoked cigars, similar to that observed in the US population (5.8%; Centers for Disease Control and Prevention, 2006). Thirteen participants reported ever smoking little cigars, 9 reported cigarillo use, and 23 reported large cigar use; 72 reported having never tried any type of cigar.

### 3.3. The effect of cigar risk information condition on cigar questionnaire items

Text-based and graphic-based groups did not differ with respect to gender, education level, number of ever or current cigar smokers, age, FTND or need for cognition, but did smoke more daily cigarettes [18.0 ( $SD = 6.2$ ) versus 15.0 ( $SD = 4.6$ ),  $p < .01$ ].

Text participants scored lower [2.55 ( $SD = 0.8$ )] than graphic participants [3.18 ( $SD = 0.9$ )] on, *How do cigars and cigarettes compare in risks to the users*, ( $F = 4.897$ ,  $p = .001$ ), controlling for age, daily cigarette count and need for cognition score. Among text participants, 47.1% underestimated the health risks of cigars by responding that cigars are much less or a little less dangerous than cigarettes. Only 17.7% of graphic participants underestimated the health risks of cigars (Fig. 2). A similar trend was found for perceived health risk associated with smoking little cigars/cigarillos compared to cigarettes ( $F = 2.4$ ,  $p = .12$ ). Fisher's Exact test for item 2, *Little cigars are less dangerous than cigarettes?*, indicates a significant difference between text and graphic versions when comparing 'not at all' versus 'any'; 82% of those in the graphic group reported little cigars were not less dangerous than cigarettes compared to 57% of the graphic group (Fisher's  $p$ -value = 0.009).

Graphic participants reported being more likely to tell a friend or family member about what they had learned from the webpage [3.26 ( $SD = 1.2$ )] than were text participants [(2.57  $SD = 1.2$ ),  $F = 2.44$ ,  $p = .005$ ], controlling for age, daily cigarette count and need for cognition. Half of the text participants (49%) were not at all or a little likely to share what they had learned; 27.4% of text participants were very or extremely likely to share the cigar risk information. Alternately, 25.4% of graphic participants were not at all or a little likely to share the information they had learned; 47% were very or extremely likely to share the cigar risk information (Fig. 2).



**Fig. 2.** The percentage of participants who responded that smoking cigars poses less health risk than smoking cigarettes (gray bars). Those viewing the text version were significantly more likely to rate cigars as less risky than those viewing the graphic versions (47.1% versus 17.7% for graphic versions ( $p = .001$ )). And, the percentage of participants who responded they were very or extremely likely to share the cigar risk information with a friend or family member (black bars). Those viewing the graphic versions were significantly more likely to share information on cigar risk than those viewing the text version (47.0% versus 27.4% for text version ( $p = .005$ )).

There were no other significant differences between graphic and text participants ( $p > 0.2$ ); they equally understood that inhalation of cigar smoke increases risks to health [4.43 (SD=0.7) versus 4.45 (SD=0.88)]; found the web pages moderately interesting [2.94 (SD=0.84) versus 3.07 (SD=1.00)]; found the web pages not to be annoying [1.45 (SD=0.76) versus 1.51 (SD=0.83)]; and had mild liking toward the web pages [2.78 (SD=0.58) versus 2.90 (SD=0.58)].

#### 4. Conclusions

Participants who viewed the graphic version of the cigar risk message were more likely to perceive cigar smoking risks at a level consistent with the scientific literature. Fewer graphic participants underestimated the health risks of smoking cigars relative to text participants (17.7% versus 47.1%). The graphic condition emphasized the relative health risk posed by cigar smoking compared to cigarette smoking: specifically, that cigars carry risks equivalent to cigarettes if you have previously smoked cigarettes, inhale or use frequently. The text version included information on the relative risk of cigars to cigarettes that is no less accurate, but as previously reported, the text has a high reading level and is more open to interpretation (Dollar et al., 2008).

Those viewing the graphic version were also more likely to report that they would share the information with others. The pattern of results indicates that three-quarters of the graphic participants were at least moderately likely to share cigar risk information, compared to half of those the text participants. A 50% increase in intention to share cigar smoking risk information could have meaningful public health implications. Interpersonal health communication, especially from non-health professionals (e.g., family and friends), is linked to smoking cessation attempts (Korhonen et al., 1998). Future research should identify factors that increase sharing risk information, possibly including believability, trust or perceived truth of graphic information (Lipkus & Hollands, 1999; Lipkus, Klein, & Rimer, 2001; Schapira, Nattinger, & McAuliffe, 2006).

Internet sites can reach many individuals with effective health information at a low cost (Strecher, 2007). However, it is critical that the information is accurate and understandable. If main web pages presented understandable graphic-based information then even those giving a cursory inspection might accurately obtain important health information. More detailed information on hyperlinked pages could also be available. Seeking and scanning for health information can lead to increased health knowledge and improved health behaviors (Shim, Kelly, & Hornik, 2006). Knowledge acquired from accurate, succinct statements of smoking risk have been retained up to 9 months later (Kozlowski, Palmer, Stine, Strasser, & Yost, 2001). Counter marketing the risks of tobacco products marketed as harm-reducing has been effective in tobacco control, notably with light cigarette labeling (Kozlowski et al., 2001), and filter ventilation risks (Kozlowski, Yost, Stine, & Celebucki, 2000). Possibly an efficiently and effectively conveyed warning about cigars, that addresses little cigars and cigarillos, could improve risk understanding and reduce the severity of this emerging health threat (Symm, Morgan, Blackshear, & Tinsley, 2005).

This study has limitations. Cigar perceptions were assessed only after viewing the web pages, to avoid priming participants with the items we would be assessing. However, our groups may have differed in cigar knowledge prior to our study. Also, the cigar protocol was part of a larger study in which participants also viewed advertisement materials for potential reduced exposure products and cigarettes prior to completing the cigar module; however none was different than what might be encountered daily. There were very few cigar smokers in the study. However, all participants were current cigarette smokers, and therefore at risk to erroneously consider switching to cigar smoking to reduce harm. Further, 70% of the sample reported ever

smoking a cigar and those who inhale intensely on a cigar, as one does on cigarettes, are at increased risk from cigars (Baker et al., 2000).

The study explored if perceived risks of cigar smoking might be improved by employing a graphic format, in comparison to existing text-based information from an a major website. Results indicate that those viewing graphic versions of the message were significantly more likely to understand the health risks of cigar smoking, and were more likely to intend to share this information with friends and family compared to those viewing a text-only message. Presenting messages about the health risks of cigars in a graphic format might lead to more accurate perceived risk and increased sharing of risk information.

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#### Contributors

AA Strasser and LT Kozlowski designed the study, conducted analyses, and contributed to preparing the manuscript. H Orom contributed to preparing the manuscript. KZ Tang and RL Dumont oversaw data collection, assisted in analyses and assisted with manuscript preparation. JN Cappella contributed to protocol design, analyses and manuscript preparation.

#### Conflict of interest

AA Strasser has received funding from Pfizer as part of its peer-reviewed, GRAND awards program. LT Kozlowski has accepted honoraria and/or hospitalities from manufacturers of tobacco-dependence treatments. He has worked as a paid expert witness in litigation for plaintiffs against the tobacco industry. All other authors declare they have no conflicts of interest.

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