




BMJ Open Identifying attributes of effective cigar warnings: a choice-based conjoint experiment in an online survey of US adults who smoke cigars

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ABSTRACT

Objective Little evidence exists on which cigar warning statement attributes may impact cigar warning effectiveness; research is needed to identify the most effective cigar warning topics and text. This study was designed to inform the development of improved cigar warnings.

Design We conducted a choice-based conjoint experiment. The experiment systematically manipulated cigar warning statement attributes, including cancer health effect (mention of colon cancer and/or oral cancer), non-cancer health effect (mention of heart disease and/or blood clots), causal language, warning marker word, verb use and tobacco type. Participants evaluated eight choice sets, each containing three cigar warnings with contrasting attributes, and chose the warnings that most and least encouraged them to quit smoking cigars. Using a Bayesian mixed logit model, we estimated the relative importance of each attribute and the attribute part-worth utility.

Setting An online survey of adults in the USA.

Participants We enrolled 959 US adults who used little cigars, cigarillos, or large cigars in the past 30 days using an online survey from October to December 2020.

Primary outcome measures The primary outcomes for the experiment are relative attribute importance and attribute part-worth utility.

Results The most important attributes to participant selection of warnings were the non-cancer and the cancer health effects (29.3%; 95%CI 28.6% to 30.0% and 29.0%; 95% CI 28.4% to 29.6%, respectively), followed by causal language (16.3%; 95% CI 15.7% to 16.8%), marker word (10.3%; 95% CI 9.9% to 10.7%), verb use (8.8%; 95% CI 8.5% to 9.2%) and tobacco type (6.3%, 95% CI 5.9% to 6.6%).

Conclusions Our findings indicate that health effects are the most important attributes when designing cigar warning statements, but other attributes, like causal terminology, also influence perceived warning effectiveness. Based on our findings, 'DANGER: Tobacco causes heart disease and blood clots' is an example of a highly effective warning statement for cigars.

INTRODUCTION

Over 9 million adults in the USA smoke cigars,^{1 2} which cause cancer, heart disease

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We used a large convenience sample of adults who use cigar products in the USA; evidence suggests that experiments with convenience samples in tobacco control may demonstrate the same pattern of statistical significance and effect direction as experiments with representative samples.
- ⇒ Although the choice-based conjoint experimental design allows us to quantify the relative importance of each attribute and level, it only examines choice behaviour and not actual quitting.
- ⇒ Study attributes are based on previously identified important warning characteristics, but the addition of other attributes may change the attributes' importance.

and early death.^{3 4} Tobacco products in the USA are regulated by the US Food and Drug Administration (FDA),⁵ and the FDA and current legal precedents require evidence specific to cigars to enact more effective cigar warnings.⁶ Currently the only communication to US consumers about the risks of cigars on packages are small, text-only warning labels, even though larger, graphic warnings are an evidence-based tobacco control strategy.⁷⁻⁹

Although there is strong evidence that large cigarette warnings with graphic imagery deter use,⁸ evidence is limited about how different attributes of cigar warning statements impact effectiveness. Tobacco health warnings are most effective when they are large, on a prominent area of tobacco packaging, and include an image.⁸ Previous work indicates that some health effects generate more effective messages than others,^{7 10} and that including multiple risks¹¹ or health effects and information on toxic products¹² in the same warning may be more motivating than including only one health effect. However, we were unable to locate work that examines

whether including multiple health effects improves tobacco warnings. Describing multiple health effects may also increase the perceived severity of the consequences of cigar use, and perceived severity can be a key factor in behaviour change.¹³ The causal language linking cigars to health effects in the warning statement may also be associated with the perceived effectiveness of warning statements, with the verb 'causes' being more effective than a less definitive language like 'contributes to' or 'can contribute to,'¹⁴ based on a recent study of cigarette, sugar-sweetened beverage, and alcohol warnings.

Other attributes potentially associated with effective tobacco warning statements include a marker word at the beginning of a warning (ie, WARNING, DANGER), the specificity of the tobacco product mentioned (eg, tobacco vs cigars), and the types of verbs used in the statement. Including a marker word may help draw attention to the rest of the warning message and has been recommended for warnings in Canada and is used in a majority of warnings included in a recent review.¹⁵ Previous warning research has found that marker words increased perceived message effectiveness¹¹ and warning text recall.¹⁶ To the best of our knowledge, no research has examined the impact of tobacco product description in warning statements (eg, tobacco vs cigar) or the verb used to indicate product use in warning effectiveness. These attributes may be important because this language could change how specific the warnings feel to the audience and give less opportunity for people who use the product to exempt their own use from the risk the warning is describing. Cigar warnings in the USA include both 'tobacco' and 'cigar' as the tobacco product description.^{9 17} In most previous warning statement work, warning attributes have been examined in isolation from one another, limiting the ability to assess the importance of these attributes relative to one another and identify the strongest message across multiple attributes.

A choice-based conjoint (CBC) experimental task involves asking participants to choose from a set of options with attributes that are systematically varied rather than asking participants to rate one option at a time. CBC experiments allow researchers to estimate the independent and relative effects of multiple attributes on consumer perceptions and intentions, including perceived message effectiveness. This method has been used to study a variety of cigarette warning label attributes, such as the inclusion of pictorial elements (vs not), types of imagery used (eg, graphic portrayals of diseased body parts, personal suffering, symbolic representations of risk), warning size (eg, larger vs smaller), the inclusion of cessation resource information (vs not) and formatting (eg, lettering and background colours), as well as purchasing preferences depending on warnings and other tobacco packaging and policy characteristics.^{18–25} Because cigar warnings can contain multiple attributes, a CBC analysis is a robust way of understanding each attribute's independent influence on choice compared with the other attributes.^{26 27} The goal of this study was to

identify combinations of warning statement characteristics that produced the most effective cigar warnings.

METHODS

Study design

We conducted a one-time cross-sectional web-based study that included a CBC experiment from October to December 2020. We designed and fielded survey measures and the experiment based on the literature and pretesting feedback. We used a survey panel company, Qualtrics, to recruit a convenience sample and administer incentives to participants. Potential participants were invited to participate in the survey, and if they were eligible, they were asked to provide informed consent and proceed to the full survey. To orient participants to the choice task format, they were shown a sample task with instructions about how to complete it correctly (online supplemental file 1). Participants then completed the choice tasks on cigar warning attributes. After completing the choice tasks, participants answered questions about their tobacco use and demographic characteristics.

Participants

Qualtrics recruited a convenience sample of 989 participants; 30 participants were removed for answering all choice tasks the same way, for a final sample size of 959. Qualtrics provides survey software to field online surveys and also works with existing panels for social science research. The enrolment goal for this survey was 750 participants who completed the study with good data, as determined by Qualtrics. To recruit participants for the study, Qualtrics partnered with existing panels to enroll their members in the study. To be eligible for the study, potential participants had to be at least 18 years old, live in the USA and speak English. Participants also must have reported current (past 30 days) use of little cigars, cigarillos, or large cigars. To prevent the same person from completing the survey more than once, participants with the same Qualtrics ID were prevented from participating more than once, and survey programming was used to prevent the same device from completing the survey more than once. Participants who completed the study and provided good data (eg, completed the survey in a reasonable amount of time and did not answer the same way for each question) received an incentive based on the length of the survey, their agreement with the panel provider, and their incentive type preference (rewards vary and may include cash, airline miles, gift cards, redeemable points, sweepstakes entrance and vouchers). A soft launch of the study was conducted first with the initial 51 participants, the data were checked to ensure accuracy of survey programming and logic, and once data quality was confirmed recruitment for the full study proceeded. Participants in the soft launch were included in the final sample. The study team received no identifiable data from participants, and research data were stored securely on University servers. This study was approved by

Table 1 Choice-based conjoint study attributes and levels

Attribute	Levels	Exclusions
Non-cancer health effect	Four levels: ► Heart disease ► Blood clots ► Heart disease and blood clots ► None	Cannot combine no cancer health effect with no non-cancer health effect. That is, all warnings will have to include at least one health effect. Also cannot combine levels to result in more than two health effects in a warning.
Cancer health effect	Four levels: ► Colon cancer ► Oral cancer ► Oral cancer and colon cancer ► None	
Causal language	Up to four levels that describe the association and level of scientific certainty between use of cigars and disease/health effect ► Causes ► Can cause ► Is associated with ► Increases the risk	
Marker word	Three levels: ► WARNING ► DANGER ► None	
Verb	Three levels ► Use ('cigar <i>use</i> causes...', tobacco <i>use</i> causes...') ► Smoking ('cigar <i>smoking</i> causes...', tobacco <i>smoking</i> causes...') ► No verb ('cigars cause', 'tobacco causes')	
Tobacco type	Two levels: ► Cigar ► Tobacco	

the Institutional Review Board at the University of North Carolina at Chapel Hill (IRB # 20–0871).

Survey design

To assess which cigar warning statement characteristics produced the most effective cigar warning statements among adult cigar users, we used a CBC experimental design. The CBC experiment was designed to vary elements of a cigar warning statement that showed three warning messages at a time and asked participants to select which was 'best' and 'worst' from each set of warnings. Table 1 shows all attributes and levels included in the experiment, as well as exclusions where certain combinations of levels were not used. The cancer and non-cancer health effect attributes could be combined or stand alone in a warning so that each warning could have up to two health effects in total. For example, the levels for two cancer health effects and two non-cancer health effects could not be combined, but one non-cancer health effect could be combined with one cancer health effect at a time and vice versa. Once attributes and levels were determined, they were entered into Light-house Studio Software 9.11 (Provo, Utah), which was used to create a balanced overlap design.²⁸ A balanced overlap design is an efficient way to create many versions

of the questionnaire to be administered to participants, reduces the risk of order effects and balances the number of times a level is shown.^{29 30} Participants completed the eight choice tasks that were randomly assigned to them. In each choice task, participants selected the warning that most encouraged them to quit smoking cigars and the warning that least encouraged them to quit.

Cigar warning statement development

To develop the warning attributes, we chose to include two non-cancer health effects (heart disease and blood clots) and two cancer health effects (colon cancer and oral cancer) that performed well in a previous study and were developed based on existing scientific evidence about cigar health effects.⁷ Although previous work has highlighted the need for warnings across a variety of themes,³¹ evidence from our warning development work found health warnings to be the most effective theme, compared with warnings about secondhand smoke, toxicity and chemicals.³² Other warning attributes that we chose to examine were causal language (causes, can cause, is associated with, increases the risk), warning marker word (WARNING, DANGER, none), verb (smoking, use, none) and tobacco type (cigar, tobacco). Levels from each warning attribute were randomly combined into a text

warning with up to two health effects: (Marker Word): (Tobacco Type) (Verb) (Causal Language) (Cancer Health Effects and/or Non-Cancer Health Effects). Two example warnings were (1) Cigar use can cause heart disease and (2) DANGER: Tobacco smoking causes oral cancer and heart disease. The maximum number of health effects included in a warning in this experiment was two, either two non-cancer health effects, two cancer health effects or one cancer health effect and/or one non-cancer health effect. Warnings always included at least one health effect.

Measures

Tobacco use and demographic measures

Participant characteristics, such as current use of tobacco and demographic characteristics, were measured before or after the choice tasks. Participants first answered questions about ever and current (past 30-day) use of cigarillos, little cigars, and large cigars, using items from the Population Assessment of Tobacco and Health study.^{33–36} For example, to measure ever cigarillo use, cigarillo products were described and then participants were asked, ‘Have you ever used cigarillos, even just one time?’ with response options ‘Yes’ or ‘No’. Anyone who answered ‘Yes’ was asked, ‘On how many of the past 30 days did you smoke a cigarillo?’ Participants who answered one or more days to the current use question were classified as current cigarillo users. The procedure was repeated for little cigars and large cigars.

After completing the choice tasks, participants were asked about their past 30-day use of other tobacco products, their nicotine dependence³⁷ and their ever and current use of cigars to smoke cannabis (blunts).^{35 36} At the end of the survey, participants were also asked about their gender identity,³⁸ sexual orientation,³⁹ whether they identify as Hispanic or Latino and what group best represents their race.⁴⁰ Participants then answered questions about their educational attainment, age and income.

CBC outcome measures

To explain how to complete the choice tasks, participants were shown an example of a choice task with instructions on how to complete it (online supplemental file 1). After the instructions, participants completed eight choice tasks with three warning statements each. They were asked, ‘Which statement encourages you to quit smoking cigars the most? Which statement encourages you to quit smoking cigars the least? There is no right answer and no wrong answer. Please choose the ones that are the most and least encouraging’. This measure was adapted for a choice task from a perceived message effectiveness item.⁴¹ Because warning labels are required for cigars, we did not measure a ‘none of these’ option; this option is more fitting in consumer experiments where participants may choose to buy none of the options.

Analyses

Frequencies for demographic and tobacco use survey measures were analysed in SAS 9.4 (Cary, North Carolina). Primary data analysis was completed in Lighthouse Studio Software. A Bayesian mixed logit model was used to estimate individual part-worth utilities for each participant, as well as mean zero-centred part-worth utilities and average importance overall. These models account for the repeated choice tasks completed by each participant and are considered best practices for analysing CBC data.²⁸ Part-worth utilities are a metric of the magnitude and direction of participants’ preference for or against an attribute level. Positive part-worth utilities indicate a preference for an attribute level, whereas negative part-worth utilities indicate a preference against an attribute level. Participants who answered the same response option for the best or worst for all tasks (straight liners) were removed (n=30) for a final sample size of 959. An unadjusted model with attribute and level predictors was estimated as the primary model, and a model adjusted for demographic variables, including race, ethnicity, gender, education, age, sexual orientation and income, was estimated as a sensitivity test. Both attributes and attribute levels were examined. A level was considered more encouraging to quit cigars if the level’s part-worth utility was higher than 0 and the 95% CI did not include 0. A level was considered less encouraging if the utility was lower than 0 and the 95% CI did not include 0 (both negative numbers). If a level had a 95% CI that included zero, it was considered neither more or less encouraging. Attribute importance was also calculated as part of the Bayesian mixed logit model and estimates the per cent of choice that is due to each attribute in the experiment. The importance of all attributes in the experiment summed to 100.

Patient and public involvement

None.

RESULTS

Sample

Participant characteristics and tobacco use variables are presented in [table 2](#). Just under half (48.4 %) of the 959 participants identified as male, and the mean age was 42 years old. A majority of the sample was white (70.4%), followed by Black or African American (19.7%), or another race (9.9%), and 15.6% reported being Hispanic or Latino. Half (50.3%) of the sample had a household income lower than US\$50 000 per year, and a quarter of the sample had a high school degree or less education (25.6%). There was a substantial overlap in the types of cigars used in the sample; 90% of participants reported current use of cigarillos, 63% reported current use of little cigars and 58% reported current use of large cigars.

Table 2 Participant characteristics and tobacco use variables (n=959)

Variable	N (%) or mean (SD)
Age	42.3 (14.7)
Gender	
Male	464 (48.4%)
Female	488 (50.9%)
Transgender or other	7 (0.7%)
Sexual orientation	
Heterosexual or straight	838 (87.4%)
Gay, lesbian, bisexual other	121 (12.6%)
Ethnicity	
Not Hispanic or Latino	809 (84.4%)
Hispanic or Latino	150 (15.6%)
Race	
White	675 (70.4%)
Black or African American	189 (19.7%)
Other	95 (9.9%)
Education	
High school degree or less	245 (25.6%)
Some college or higher	714 (74.4%)
Income	
<US\$49 999 per year	482 (50.3%)
>US\$50 000 per year	476 (49.6%)
Unknown	1 (0.1%)
Past 30 days cigarillo use	868 (90.5%)
Past 30 days little cigar use	608 (63.4%)
Past 30 days large cigar use	551 (57.5%)

Experimental outcomes

There were no differences in terms of order of effect or magnitude of effect between the unadjusted model that included only experimental attributes and levels and the model that also included demographic covariates, so the results presented are from the unadjusted model.

Relative attribute importance

Attribute importance is estimated as a reflection of the relative importance of each attribute to the others included in the experiment. The most important attributes for participant selection of warnings were the health effects: non-cancer (29.3%; 95% CI 28.6% to 30.0%) and cancer health effects (29.0%; 95% CI 28.4% to 29.6%). The next most important attributes were the causal language used (16.3%; 95% CI 15.7% to 16.8%) and the marker word (10.3%; 95% CI 9.9% to 10.7%). The least important attributes were the verb (8.8%; 95% CI 8.5% to 9.2%) and tobacco type (6.3%, 95% CI 5.9% to 6.6%) (figure 1).

Attribute part-worth utilities

For non-cancer health effects, the level that was most encouraging to quit was heart disease and blood clots together, (46.6; 95% CI 42.0 to 51.1) (table 3). Heart disease on its own was encouraging but of less magnitude (17.4; 95% CI 14.5 to 20.4). For the cancer health effect attribute, warnings were selected as most encouraging when two cancer health effects (oral cancer and colon cancer) were present (44.1; 95% CI 39.4 to 48.8). The next most important attribute, causal language, was most encouraging when the warning included the word 'causes' (11.8; 95% CI 8.7 to 14.8). The phrase 'is associated with' was the least encouraging of the levels tested

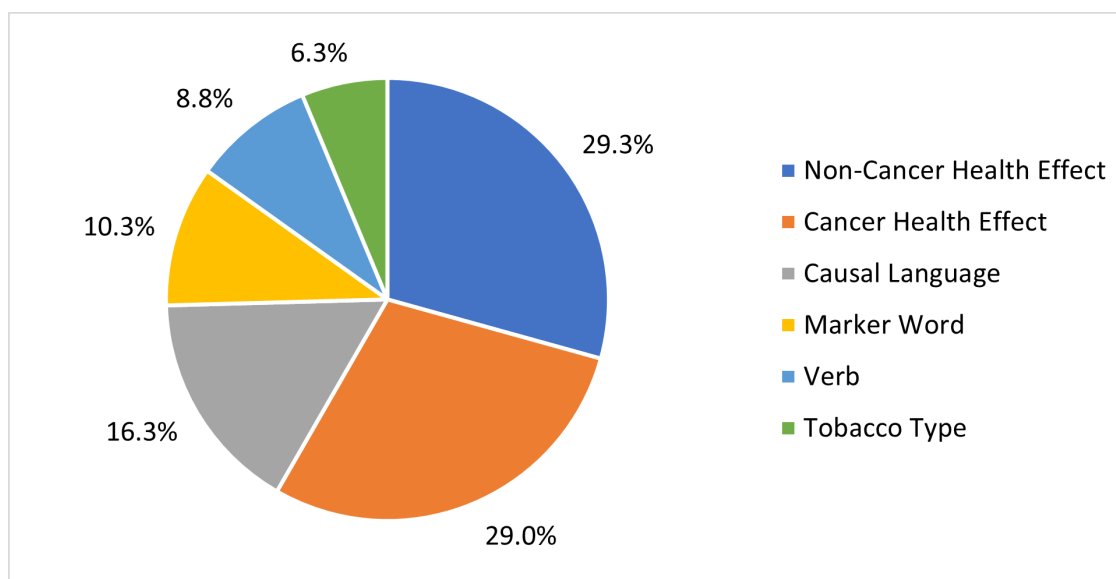
**Figure 1** Relative importance of warning attributes on encouraging cigar users to quit from choice-based conjoint experiment (n=959).

Table 3 Part-worth utilities of warning attributes on encouragement to quit smoking cigars from choice-based conjoint experiment (n=959)

Warning attribute	Levels of warning attribute	Mean part-worth utilities	95% CI
Non-cancer health effect	Heart disease and blood clots	46.6	42.0 to 51.1
	Heart disease	17.4	14.5 to 20.4
	Blood clots	-17.2	-19.8 to -14.7
	None	-46.8	-51.8 to -41.8
Cancer health effect	Oral cancer and colon cancer	44.1	39.4 to 48.8
	Oral cancer	0.7	-2.0 to 3.4
	Colon cancer	-2.7	-5.2 to -0.1
	None	-42.1	-47.2 to -37.0
Causal language	Causes	11.8	8.7 to 14.8
	Increases the risk	1.0	-1.6 to 3.5
	Can cause	0.5	-1.6 to 2.6
	Is associated with	-13.2	-16.0 to -10.4
Marker word	DANGER	6.6	4.7 to 8.6
	WARNING	1.9	0.2 to 3.6
	None	-8.5	-10.6 to -6.5
Verb	Smoking	-0.3	-2.0 to 1.4
	Use	-1.1	-2.7 to 0.4
	None	1.4	-0.4 to 3.3
Tobacco type	Tobacco	1.9	0.4 to 3.5
	Cigar	-1.9	-3.5 to -0.4

(-13.2; 95% CI -16.0 to -10.4). The phrases 'can cause' and 'increases the risk' did not make a statistically significant difference in warning choice. For marker words, the most encouraging word was 'DANGER' (6.6; 95% CI 4.7 to 8.6). 'WARNING' was less encouraging (1.9; 95% CI 0.2 to 3.6). Not including a marker word made a warning significantly less encouraging (-8.5; 95% CI -10.6 to -6.5). The magnitude of the effects of the verb and tobacco type was substantially smaller than most other attribute comparisons. For tobacco type, including tobacco as the product descriptor (1.9; 95% CI 0.4 to 3.5) was significantly more encouraging than including cigar as the product descriptor (-1.9; 95% CI -3.5 to -0.4). The use of verbs in the warning did not show significant differences, but using no verb (ie, saying tobacco causes (health effect)...) appeared to trend the highest in terms of encouraging quitting compared using the words 'smoking' or 'use'.

DISCUSSION

In this first CBC study of attributes of cigar warnings, we found that the health effects specified in the cigar warnings were the most important factors encouraging participants to quit cigars of the warning attributes that we tested. These two attributes accounted for more than half of the relative importance of finding a warning statement encouraging to quit cigars, and health effects that were cancer-related or non-cancer-related had similar effects. Specifically, having at least two health effects mentioned

in the warning statement was more important than having one health effect mentioned in a warning statement. Other important factors were the use of causal language and a marker word. Tobacco type had a small but significant effect on encouragement to quit, but verb attributes had no significant effect.

Our study found that non-cancer health effects are as important as cancer health effects. People who smoke cigarettes generally report that health concerns are their primary reasons to quit smoking.⁴² In a separate study, we found no difference in the perceived message effectiveness of warning statements with cancer versus non-cancer health effects.⁷ In fact, out of 37 health effects, the top five health effects included oral cancer, colon cancer and oesophageal cancer, followed by lung disease and blood clots.⁷ Our findings indicate that messages with both cancer and non-cancer health effects can be similarly important in terms of motivating people to quit smoking cigars.

In our experiment, the number of health effects mentioned in the warnings was a result of the combination of two attributes (cancer and non-cancer health effect attributes), rather than one attribute itself. However, there is evidence in our study that including two health effects at once appears more effective than one effect alone. Although some of the FDA-proposed cigar warnings,⁹ FDA-proposed cigarette warnings⁴³ and currently enacted tobacco warnings worldwide include multiple health effects,⁴⁴ no work to date seems to have examined

whether including multiple health effects makes warnings more effective. This is a specific area that needs additional research, both to assess whether multiple health effects, in general, are better and how to specifically choose which health effects to include together (similar health effects, cancer and non-cancer together, etc).

We found that the causal language included in the warning was important in encouraging quitting. Consistent with a study of sugar-sweetened beverage warnings that found ‘causes’ to be more effective at discouraging use than other, weaker language,¹⁴ we found that direct causal language, for example, ‘cause’, was important to encouraging adults to quit cigars. Interestingly, the theoretical construct of psychological distance may explain this finding, as stronger causal language reduces psychological distance and creates greater certainty about the negative effects of cigar use, making warnings more discouraging.⁴⁵ A study of snus found that the wording ‘causes cancer’ and ‘damages your health’ were most alarming to participants.⁴⁶

Previous health warning studies have found mixed results around marker words, even though they are a recommended feature of warnings.^{11 15 16} An e-cigarette warning experiment found that marker words increased warning recall but had no effect on attention to the warnings, perceived message effectiveness, appeal or purchase intention.¹⁶ Another experimental study on sugar-sweetened beverages found that marker words increased perceived message effectiveness.¹¹ However, a recent experimental study of messages about the health effects of tobacco and alcohol co-use found no significant effects of marker words on perceived message effectiveness.⁴⁷ Our study contributes to this literature by showing that although marker words are less important than other factors in warning text development, including a marker word may make warnings more effective and has no significant drawback. Future warnings should consider using direct causal language and the ‘danger’ or ‘warning’ marker word.

Although this study is limited by its convenience sample, it had a large sample size, and evidence indicates that experimental studies of tobacco control demonstrate the same pattern of statistical significance and effect direction in convenience samples as representative samples.⁴⁸ Although the experimental design allows us to quantify the relative importance of each attribute and level, it only examines choice behaviour and not actual quitting. There is evidence that choice experiments can accurately predict behaviour, and a meta-analysis has found that choice experiments ‘produce reasonable predictions of health-related behaviours.’^{49 50} Additionally, we included attributes that were previously identified as important in warning labels, but the addition of other attributes could alter the importance of the attributes examined here.

Future cigar warning labels should include the health effects of cigar use and consider including multiple health effects in each warning. Policymakers should consider including a mix of warning statements focused

on cancer and non-cancer health effects in future warning sets. Using causal language and the ‘danger’ or ‘warning’ marker word are likely to help further encourage people to quit smoking cigars. Based on our findings, ‘DANGER: Tobacco causes heart disease and blood clots’ is an example of a highly effective warning statement for cigars.

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Competing interests KC is an employee of Sawtooth Analytics, whose software was used for the study design, data collection and analysis. All other authors declare they have no conflicts of interest.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill (IRB # 20-0871). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

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