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PREP advertisement features affect smokers' beliefs regarding potential harm

Andrew A Strasser¹, Kathy Z Tang¹, Michael D Tuller¹, and Joseph N Cappella²

¹Transdisciplinary Tobacco Use Research Center, University of Pennsylvania, 3535 Market Street, Suite 4100, Philadelphia, PA, USA

²Annenberg School of Communications, University of Pennsylvania, 3620 Walnut Street, Philadelphia, PA, USA

Abstract

Background—The Institute of Medicine report on potential reduced exposure products (PREPs) recommends that advertising and labelling be regulated to prevent explicitly or implicitly false or misleading claims. Belief that a product is less harmful may increase use or prevent smoking cessation.

Objective—To determine the effect of altering advertisement features on smokers' beliefs of the harm exposure from a PREP.

Methods—A Quest advertisement was digitally altered using computer software and presented to participants using web-based television recruitment contracted through a survey company. 500 current smokers completed demographic and smoking history questions, were randomised to view one of three advertisement conditions, then completed eight items assessing their beliefs of the harmfulness of the product. Advertisement conditions included the original, unaltered advertisement; a “red” condition where the cigarette packages were digitally altered to the colour red, implying increased harm potential; and a “no text” condition where all text was removed to reduce explicit product information. Polytomous logistic regression, using “incorrect,” “unsure” and “correct” as outcomes, and advertisement type and covariates as predictors, was used for analyses.

Results—Participants randomised to the “no text” advertisement were less likely to be incorrect in their beliefs that Quest cigarettes are lower in tar, less addictive, less likely to cause cancer, have fewer chemicals, healthier and make smoking safer.

Conclusions—Smokers can form false beliefs about the harmfulness of PREP products based on how the PREPs are marketed. Careful examination must be undertaken to provide empirical evidence to better formulate regulatory principles of PREP advertising.

The Institute of Medicine (IOM) report, *Clearing the Smoke*, on tobacco harm reduction defines a product as harm reducing if it lowers total tobacco related mortality and morbidity,

Correspondence to: Andrew A Strasser, PhD, Transdisciplinary Tobacco Use Research Center, University of Pennsylvania, 3535 Market Street, Suite 4100, Philadelphia, PA 19104, USA; strasse3@mail.med.upenn.edu.

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even though its use may involve continued exposure to tobacco-related toxicants.¹ However, potential reduced exposure products (PREPs) must be critically evaluated to identify reductions in exposure to harmful substances, and to determine if there is an association between reduced toxicant exposure and reduced harm to health.² Additionally, a principal recommendation of the IOM report is a call for firm regulation of the advertising and labelling of PREPs to prevent false or misleading claims, both explicitly or implicitly.²

Limited research has been conducted on PREP advertisement and marketing campaigns. In a study using advertisements to examine smokers' perceptions of the harmfulness of regular cigarettes, "light" cigarettes and PREP products, smokers perceived the PREP products (that is, Omni, Eclipse, Advance) as having fewer health risks and carcinogens than light cigarettes.³ Further, despite no explicit text stating such, smokers believed the PREP advertisements conveyed positive health messages. This result illustrates the potential effect misleading text and implicit messages may have on smokers' beliefs. Shiffman and colleagues⁴ similarly report that smokers had expectations of harm reduction that exceeded the content presented, after being read text about Eclipse, a type of PREP. In a subsequent study, smokers reported that a hypothetical PREP had reduced harm risk after hearing about the product during a telephone survey.⁵ Collectively, the results of these studies illustrate the impact advertising can have on beliefs and expectations of harm reduction qualities of PREPs, and support the need to further study this aspect of PREP research.

One type of PREP, Quest, uses genetically modified tobacco to provide three levels of progressively reduced nicotine. Quest is marketed as a way to step down to become nicotine-free. However, an investigation of 50 smokers found significant increases in total puff volume and carbon monoxide boost when smoking the lowest nicotine level Quest compared to the highest nicotine level Quest.⁶ Forty per cent of participants had at least a 20% increase in carbon monoxide boost when smoking the lowest nicotine level Quest compared to the highest nicotine level Quest. Further, a digital analysis technique⁷ of the tar stain intensity in the used Quest filters suggests a relative increase in carcinogen-containing tar when smoking the lower nicotine level Quest compared to the higher nicotine level.⁸

Owing to the potential for Quest to be a harm-increasing product, there is a need to better understand smokers' beliefs about the harmfulness and safety of the product. A study of 200 regular smokers who reported never previously reading or hearing about the product had their beliefs about Quest assessed after viewing a print advertisement for 30 seconds.⁹ Smokers tended to believe falsely that Quest was lower in tar (44% of respondents), would help them quit smoking (40%), and made smoking safer (31%) compared to regular cigarettes. Those with less education, with lower nicotine dependence and men tended to be incorrect more often.

The current study was designed to determine whether altering design features of the advertisement would be associated with smokers having fewer false beliefs about the harmfulness of the product. A Quest advertisement was digitally altered with computer software to create alternative versions; one in which Quest was implied to be more harmful by changing the packaging to red and aligning the packages horizontally; and another with all text removed, thus minimising the explicit information available about the product.

Package and advertisement colouring have long been used by the tobacco industry to convey strength, harshness and nicotine level of their products, and to appeal to the adventurousness and danger-seeking traits of smokers.^{10–13} For this reason, a red condition was designed to imply Quest was a more harmful product. Wording and phrasing—for example, tar numbers,¹⁴ and the use of the labels “light,” “low tar” and “low nicotine” have been used to convey reduced harm, and to allay smokers’ health concerns, with smokers being effectively misled.^{15–18} Based on this previous research, we created an advertisement version with all text removed.

The purpose of the current study is to provide a first step to demonstrate the effect altering explicit and implicit components of PREP advertising can have on smokers’ beliefs of harm reduction. The hypothesis for the study was that smokers in the no-text condition would have fewer false beliefs and more uncertain responses relative to the original advertisement; and smokers viewing the red advertisement condition would have fewer false beliefs about the harmfulness of the product.

METHODS

Advertisement design

The original Quest advertisement (see fig 1A) was altered using Photoshop 7.0 (Adobe Systems; Mountain View, CA, USA). For the “no-text” altered advertisement, all text other than the nicotine level labels under the cigarette packages and text on the packages was replaced with background image using the clone stamp tool (see fig 1B). For the “red” altered advertisement, the outer cigarette packages (0.6 mg and 0.05 mg) were shifted to align horizontally equal with the central (Quest 2: 0.3 mg nicotine) cigarette package. In addition, the 0.6 mg and 0.05 mg nicotine packages were scaled up and down in size respectively, to match the size of the central package. The arrows between the packages were removed using the clone stamp tool, and finally the colour of the cigarette packages was changed to red using the curves dialogue box (see fig 1C).

Participant recruitment

Participants were a random sample of US residents, aged 18 and older with home or work access to a personal computer. The study was conducted online by Knowledge Networks (Menlo Park, CA, USA). Its panel includes a large number of households that have been recruited through random digit dialling procedures and who have agreed to accept free web TV equipment and service in exchange for completing periodic surveys online. The web TV equipment uses internet cable to deliver programming and study materials to a residence, where it is viewed on a television, and responses made using a keyboard and mouse. The panel recruitment completion rate was 83% and the study qualification rate was 72%. Participants were recruited during July and August 2006, and the median completion time was 21 minutes. Eligible participants were those between the ages of 18 and 65, who report currently smoking a minimum of five daily cigarettes and a minimum 100 cigarettes in their lifetime. Of the 556 participants who completed the study, 42 reported having previously seen a Quest cigarette advertisement and 12 reported having tried at least one Quest cigarette. Ten participants responded in the affirmative to both items. These participants

were excluded because their previous exposure to Quest could affect their responses. An additional 12 participants who reported having difficulty seeing the advertisement on their television were also removed from the dataset. The final sample included 500 participants, with 174 in the original condition, 166 in the no-text condition and 160 in the red condition.

Measures

Covariates

Demographic: Sex, race and ethnicity, age, education, smoking history, nicotine dependence and preferred cigarette brand information were collected at the beginning of the session. Nicotine dependence was assessed using the Fagerstrom test for nicotine dependence (FTND;¹⁹), a six-item scale with a score range from 0–10, such that higher scores reflect greater nicotine dependence.

Intention to reduce harm: Intention to try to quit smoking was assessed as a single item—how likely is it that you will try to quit smoking in the next three months? Reducing number of daily cigarettes was assessed as a single item—how likely is it that you will try to reduce the number of cigarettes you smoke each day in the next three months? Response options for both questions were: (1) I definitely will not; (2) I probably will not; (3) I probably will; (4) I definitely will.⁴²⁰ These two items were included to identify smokers who might be most likely to use a PREP, and to examine if their beliefs differed from those not contemplating harm reduction strategies. Both measures were dichotomously scored as “will” versus “will not,” as few participants characterised themselves using “definitely” or “definitively not” options.

Outcome measures

Quest beliefs: An eight-item series of questions assessed beliefs about Quest cigarettes. These items were previously used in an evaluation of smokers' beliefs about Quest cigarettes.⁹ The eight items are: (a) Quest cigarettes are lower in nicotine than regular cigarettes, which was considered a true statement based on the advertisement materials; (b) Quest cigarettes are lower in tar than regular cigarettes; (c) Quest cigarettes are less addictive than regular cigarettes; (d) Quest cigarettes are less likely to cause cancer than regular cigarettes; (e) Quest cigarettes have fewer chemicals than regular cigarettes; (f) Quest cigarettes are healthier than regular cigarettes; (g) Quest cigarettes make smoking safer; and, (h) Quest cigarettes help people quit smoking. Items (b–h) were considered false statements, based on advertisement information. Participant response options for each item include: 1=definitely not true, 2=not true, 3=unsure, 4=true, 5=definitely true, which were subsequently scored as incorrect, unsure or correct, based on content of the original advertisement. For example, if a participant responded “true” or “definitely true” to item a, Quest cigarettes are lower in nicotine than regular cigarettes, then the response was scored correct based on ad content. However if a participant responded “true” or “definitely true” to item (h) Quest cigarettes help people quit smoking, the response was scored incorrect based on the warning label statement.

Procedures

Participants completed standard demographic, smoking history, nicotine dependence and intentions to reduce harm questions before being randomised to one of three Quest advertisement conditions: (1) no text; (2) original; and (3) red. Participants were asked to view the advertisement for the entire 30 seconds it was displayed, and then were asked to complete the Quest beliefs items. Participants were paid \$10 for their participation in the study. The study protocol was approved by the University of Pennsylvania institutional review board.

Data analysis

Analyses were conducted using Statview 5.0.1 (SAS Institute, Cary, NC, USA). Descriptive statistics were used to characterise the overall sample and each advertisement group. Analysis of variance (ANOVA) and χ^2 tests were used to identify advertisement group differences. Incorrect, unsure and correct response rates were calculated for each Quest beliefs item by advertisement condition to characterise the distribution of responses. Polytomous logistic regression was used to examine the effect of advertisement type on each item of the Quest beliefs. The outcome variables were scored as incorrect, unsure and correct, and are presented in pairwise comparisons with the incorrect (0) group (table 3). The referent advertisement was the original, unaltered Quest advertisement. Covariates and the two intention to reduce harm items were initially included and a final model was achieved with backward elimination with an alpha=0.20 removal criterion. Final models are reported in table 2.

The eight items of Quest beliefs were selected a priori as the outcome measures, based in part on the results from Shadel and colleagues.⁹ However, cumulative belief scores were not used because we wanted to be able to identify the subtlety of how each item was affected by the advertisement differences, which in turn could be better applied to future research of this type. For this reason as well as the potential for the no-text advertisement to produce unsure responses, we elected to use a three-level outcome measure to detect differences between being incorrect versus unsure, and incorrect versus correct.

RESULTS

Descriptive statistics

The participant sample was 55% male and 87% white, 7% African American, and 3% reported more than one race; 5% identified themselves as Hispanic irrespective of race. Mean age of participants was 55.1 (SD 11.7); 92% had completed high school and 15% had completed a college degree. Participants smoked an average of 24.6 (SD 26.0) daily cigarettes and had been smoking for 39.3 (SD 11.7) years. Mean nicotine dependence was 4.22 (SD 2.2). Sixteen per cent of participants reported their preferred brand as an ultra-light, 42% smoked a light brand and 42% smoked a regular brand. Most (74%) participants smoked non-menthol cigarettes; few (3.4%) smoked an unfiltered cigarette. Participant characteristics did not differ by advertisement group (see table 1). Response rates for each Quest belief item are presented in table 2.

Polytomous logistic regression analyses (see table 3) indicate that those with education beyond high school were 2.55 times more likely to be unsure than incorrect, and 3.6 times more likely to be correct than incorrect when responding to the item: Quest cigarettes are lower in nicotine than regular cigarettes.

Those participants in the no-text condition were 2.04 times more likely to be unsure than incorrect when responding to the item: Quest cigarettes are lower in tar than regular cigarettes.

Those participants in the no-text condition were 2.23 times more likely to be unsure than incorrect and 3.10 times more likely to be correct than incorrect when responding to the item: Quest cigarettes are less addictive than regular cigarettes.

Participants in the no-text condition were 2.68 times more likely to be correct than incorrect when responding to the item: Quest cigarettes are less likely to cause cancer than regular cigarettes.

Participants in the no-text condition were 2.30 times more likely to be unsure than incorrect and 3.76 times more likely to be correct than incorrect when responding to the item: Quest cigarettes have fewer chemicals than regular cigarettes; and females were less likely to be correct than incorrect.

Those in the no-text condition were 3.62 times more likely to be unsure than incorrect and 3.98 times more likely to be correct than incorrect when responding to the item: Quest cigarettes are healthier than regular cigarettes; those planning to try to quit smoking in the next three months were more likely to be incorrect than unsure or correct.

Those in the no-text condition were 2.52 times more likely to be unsure than incorrect and 3.12 times more likely to be correct than incorrect when responding to the item: Quest cigarettes make smoking safer; and females were less likely to be correct than incorrect. Additionally, there was a trend for those planning to quit smoking being incorrect more often than being unsure or correct.

Advertisement condition had no effect on the item: Quest cigarettes help people quit smoking. However, females, those planning to try quit smoking and younger participants tended to be incorrect more often than being unsure or correct. And, those with more than a high school education were more likely to be incorrect than correct.

DISCUSSION

The IOM report on PREPs recommends that the promotion, advertising and labelling of PREPs are firmly regulated to prevent false or misleading claims, either explicit or implicit. This study is an initial attempt to investigate how altering the advertisement of one type of PREP may affect smokers' beliefs related to the harmfulness of the product. Results suggest that altering components of an advertisement can affect smokers' beliefs about their potential harm exposure.

Overall, there were no differences in incorrect beliefs between the original advertisement group and the red condition group. We had hypothesised that smokers in the red advertisement condition would have fewer false beliefs compared to the original advertisement. The no-text group was least likely to be wrong about the product in most instances. Specifically, participants viewing the “no-text” advertisement condition were less likely to be incorrect in their beliefs that Quest cigarettes are: lower in tar, less addictive, less likely to cause cancer, have fewer chemicals, healthier and make smoking safer.

The results of this study are important in light of the recent IOM report,²¹ *Ending the tobacco problem: a blueprint for a nation*, which calls for Congressional legislation to limit visually displayed tobacco advertising to text-only, black and white format. Results from this study suggest that the text in an advertisement can also be misleading. That is not to conclude that text should be banned, but phrasing and labelling ought to be carefully examined so that smokers are not misled into underestimating the harmfulness of a product. Text can be confusing, leading to smokers’ misunderstanding of complicated information, such as has been reported on tar numbers,¹⁴ and “light” and “low tar” labelling.¹⁶ Text can also make implicit suggestions. For example, the prominence of the text in the Quest advertisement, which reads “get on the road to nicotine free,” suggests this is something beneficial and important about the product. However, because Quest does not have decreased levels of tar, the exposure to carcinogen-containing compounds does not diminish. But, a smoker may reason that being nicotine-free may be good because nicotine is addictive, and if nicotine is lowered then addiction is lowered and quitting is easier. Similarly, smokers report believing that “light” cigarettes will help them quit smoking.²²

All three conditions had about one-quarter of participants (original=25.9%, no text=23.2%, red=27.5%) report that Quest would help them quit smoking; a similar rate was reported in a different participant sample.⁹ This statement is scored based on the content of the advertisement and does not reflect outcomes of clinical data. In the original and red advertisement conditions in this study, a warning label states “this product is NOT intended for use in quitting smoking.” Although this outcome measure did not differ by advertisement condition, it importantly demonstrates the magnitude of effect advertising can have on product beliefs. Further, those contemplating trying to quit smoking were more likely to be incorrect about Quest’s ability to help them quit. One commonality between all three advertisement conditions, and a potential explanation for the similar rate of false beliefs for Quest as a cessation aid, is the Quest packaging and labels: 1 low nicotine, 2 extra low nicotine, and 3 nicotine free (see fig 1). Research suggests cigarette labelling with “light” has had similar effect on beliefs regarding cessation.²² Future research using multiple versions of text and image editing could empirically test what specific aspects lead to false inferences. Additionally, evaluating what advertisement components are viewed, attract attention and are repeatedly viewed might elucidate target areas where false beliefs are being conveyed, or distracting images are embedded. One approach to this type of research involves eye tracking. In an investigation of cigarette warning labels, Fischer and colleagues²³ reported that participants rarely viewed cigarette warning labels and those who did, did so for a short duration. These results could partially explain why we observed no

difference in the “Quest helping to quit smoking” item between advertisements with and without the warning label.

There are a few limitations of the study that should be noted. Firstly, only three conditions being examined do not provide a comprehensive view of the effect of all advertisement manipulations on beliefs. Secondly, participants viewing only one version of the Quest advertisement does not allow for within-subject comparisons that could determine which groups respond best to specific advertisement features. While our results illustrate that smokers’ beliefs may be directed by viewing different advertisement versions of the same PREP product, there are a multitude of explicit and implicit, text and image, colour and graphic alterations that could be examined to establish comprehensive regulatory recommendations. Other research has exposed smokers to multiple cigarette and PREP advertisements, which allows comparison between products and to develop a relative scale. We elected to do a single exposure, between-subject design and assess Quest belief items only post-advertisement exposure so as not to prime the participant with the belief items of interest. Attitudes towards a product have been shown to differ during spontaneous versus retrieval inference processing, when explicit versus implicit information has been presented,²⁴²⁵ and moderated by level of involvement with the topic (for example, quit intention²⁶). Also, our research design precludes us from definitively stating that our participants did not have these beliefs before being randomised to viewing the advertisements, although all participants used in analyses were Quest advertising and Quest use naïve, and our data (see table 1) suggest advertisement groups were very similar on many characteristics.

Another limitation of this study was that we only used an advertisement from one type of PREP. Research in our laboratory has reported that smokers will alter their smoking behaviour to take greater total puff volume as the nicotine level decreases in Quest.⁶ Carbon monoxide boost, a biochemical marker of smoke exposure, also increased as Quest nicotine level decreased. Because of the potential for this product to deliver increased levels of harm exposure, the seriousness of smokers falsely believing they are using a reduced harm product increases. It was for this reason we elected to focus on this particular product. However, other PREPs also employ similar colour schemes (for example, Eclipse and Accord), and advertisement phrasing that has had comparable results on smokers’ beliefs (see Shiffman *et al*⁴).

All participants were US residents and therefore the international implications are reduced. Regulation of tobacco advertising, cigarette warning labels and PREP availability vary between countries.⁵²⁷ However, the impact of common harm-focused information campaigns on smokers’ knowledge of smoking harm has had promising results in several countries.^{27–29} Effective regulation strategies in one country may also be effective elsewhere, and clearly are needed, as internationally, smokers and ex-smokers believe PREPs to be less harmful.⁵

This study demonstrates that removal of explicit text information can affect smokers’ beliefs about the harmfulness of Quest cigarettes. What remains to be investigated is the effect inserting accurate explicit information and inserting accurate implicit information have on

smokers' understanding that Quest is a harmful product. In the current study, the red condition altered image features to unsuccessfully convey increased harm. It is plausible that a condition with complementary text and image features would have been associated with a more accurate understanding of harm exposure. These are important and timely issues. With the IOM recommendations to regulate how PREPs are marketed, and most recently to regulate cigarette advertising to text-only, it is essential to understand that text can be misleading and carry implicit claims. Additionally, some smokers may not read text, or allocate little time doing so. It is conceivable that a text-only advertisement will be completely ignored and thus make the accuracy of the content irrelevant. An alternative consideration is that images can attract attention and convey accurate information and appropriate warnings, if constructed properly. If smokers will allow merely a cursory exposure to an advertisement it is important they receive accurate product information, regardless of whether the information is conveyed with text, image or both.

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What this paper adds

- ▶ Potential reduced exposure products (PREPs) are being marketed to smokers as a means to reduce their level of harm exposure.
- ▶ The current study digitally edited a print advertisement of one type of PREP to examine the impact that changing colouring and package positioning, and removing text would have on smokers' perceptions of the harmfulness of the product.
- ▶ Results show that smokers who viewed the advertisement condition with text removed had fewer incorrect beliefs on the harmfulness of the product.
- ▶ Current recommendations call for regulation of cigarette and PREP marketing, including restricting advertisements to black and white and text-only.
- ▶ Results from this study suggest that text can lead to incorrect understanding of harm from PREPs and suggest that content of advertisement text should be carefully evaluated.

Figure 1.
Digitally altered Quest advertisements. (A) The original, unaltered advertisement; (B) the no-text advertisement; (C) the red advertisement.

Table 1

Descriptive statistics and smoking characteristics by advertisement type

Descriptive measure	Overall (n = 500)	Original (n = 174)	No-text (n = 166)	Red (n = 160)	Test statistic
Sex (% male)	54.6	56.8	52.6	54.4	$\chi^2 = 2.4, p = 0.26$
Age, mean (SD)	55.2 (11.7)	55.0 (11.9)	56.2 (12.1)	54.3 (11.3)	$F = 0.66, p = 0.52$
Education					$\chi^2 = 2.6, p = 0.27$
(% high school graduate)	91.6	91.4	89.2	94.3	
(% = college graduate)	15.4	17.8	15.1	13.1	
Race					$\chi^2 = 0.9, p = 0.95$
(% White)	87.6	88.2	87.2	87.5	
(% African-American)	6.8	6.1	7.9	7.5	
Years smoking, mean (SD)	39.4 (11.7)	39.6 (12.4)	39.8 (11.9)	38.6 (10.8)	$F = 0.17, p = 0.84$
Daily cigarettes, mean (SD)	24.6 (26.3)	22.7 (20.6)	24.4 (26.6)	26.6 (28.7)	$F = 0.77, p = 0.46$
Nicotine dependence, mean (SD)	4.22 (2.2)	4.27 (2.2)	4.02 (2.3)	4.38 (2.2)	$F = 1.1, p = 0.34$
Preferred cigarette type					$\chi^2 = 2.0, p = 0.70$
(% Ultra-light)	16.4	15.8	16.4	16.9	
(% Light)	41.8	46.2	39.4	39.6	
(% Regular)	41.8	38.0	44.2	43.3	
Try to quit					$\chi^2 = 1.5, p = 0.48$
(3 months; % yes)	37.4	34.5	40.8	36.9	
Reduce daily cigarettes					$\chi^2 = 1.8, p = 0.40$
(3 months; % yes)	65.2	62.2	69.1	64.4	

Table 2

Percentage distribution of incorrect, unsure and correct responses for Quest belief items

Quest belief	Advertisement	% Incorrect	% Unsure	% Correct
(a) Quest cigarettes are lower in nicotine than regular cigarettes	Original	5.7	54.0	40.2
	No text	6.7	57.0	36.4
	Red	1.9	51.2	46.9
(b) Quest cigarettes are lower in tar than regular cigarettes	Original	20.8	69.9	9.3
	No text	11.5	78.8	9.7
	Red	22.5	71.9	5.6
(c) Quest cigarettes are less addictive than regular cigarettes	Original	24.9	60.7	14.4
	No text	12.1	66.1	21.8
	Red	20.0	66.2	13.8
(d) Quest cigarettes are less likely to cause cancer than regular cigarettes	Original	12.7	65.9	21.4
	No text	6.1	66.3	27.6
	Red	13.8	61.6	24.6
(e) Quest cigarettes have fewer chemicals than regular cigarettes	Original	18.4	71.3	10.3
	No text	9.1	73.9	17.0
	Red	21.3	68.1	10.6
(f) Quest cigarettes are healthier than regular cigarettes	Original	20.7	56.3	23.0
	No text	7.3	64.8	27.9
	Red	14.4	59.4	26.2
(g) Quest cigarettes make smoking safer	Original	16.2	57.8	26.0
	No text	7.3	59.8	32.9
	Red	16.3	55.6	28.1
(h) Quest cigarettes help people quit smoking	Original	25.9	60.3	13.8
	No text	23.2	61.0	15.8
	Red	27.5	63.1	9.4

Table 3

Polytomous logistic regression results for eight items of Quest beliefs

Quest belief	Odds ratio (95% CI)	p Value
(a) Quest cigarettes are lower in nicotine than regular cigarettes		
Incorrect (0) vs unsure (1)		
No text ad	0.81 (0.31 to 2.12)	0.66
Red ad	2.23 (0.67 to 10.35)	0.17
Cigarette type (1 = light; 2 = regular)	0.46 (0.19 to 1.12)	0.08
Education (HS = 0; >HS = 1)	2.55 (1.00 to 6.49)	0.05
Incorrect (0) vs correct (1)		
No text ad	0.70 (0.25 to 1.87)	0.47
Red ad	3.31 (0.83 to 13.15)	0.09
Cigarette type (1 = light; 2 = regular)	0.51 (0.21 to 1.27)	0.15
Education (HS = 0; >HS = 1)	3.6 (1.40 to 9.33)	0.01
(b) Quest cigarettes are lower in tar than regular cigarettes		
Incorrect (0) vs unsure (1)		
No text ad	2.04 (1.11 to 3.74)	0.02
Red ad	0.95 (0.56 to 1.61)	0.85
Incorrect (0) vs correct (1)		
No text ad	1.90 (0.78 to 4.6)	0.16
Red ad	0.56 (0.22 to 1.44)	0.23
(c) Quest cigarettes are less addictive than regular cigarettes		
Incorrect (0) vs unsure (1)		
No text ad	2.23 (1.23 to 4.04)	0.01
Red ad	1.35 (0.80 to 2.3)	0.26
Incorrect (0) vs correct (1)		
No text ad	3.10 (1.48 to 6.50)	0.01
Red ad	1.18 (0.57 to 2.46)	0.65
(d) Quest cigarettes are less likely to cause cancer than regular cigarettes		
Incorrect (0) vs unsure (1)		
No text ad	2.10 (0.94 to 4.60)	0.06
Red ad	0.86 (0.45 to 1.64)	0.64
Incorrect(0) vs correct (1)		
No text ad	2.68 (1.13 to 6.35)	0.03
Red ad	1.05 (0.50 to 2.22)	0.89
(e) Quest cigarettes have fewer chemicals than regular cigarettes		
Incorrect (0) vs unsure(1)		
No text ad	2.30 (1.18 to 4.50)	0.02
Red ad	0.85 (0.49 to 1.48)	0.56
Education (HS = 0; >HS = 1)	1.44 (0.88 to 2.35)	0.15
Try to quit (1 = will try to quit)	0.64 (0.39 to 1.05)	0.08
Incorrect (0) vs correct (1)		

Quest belief	Odds ratio (95% CI)	p Value
No text ad	3.76 (1.57 to 9.00)	0.01
Red ad	0.97 (0.42 to 2.22)	0.94
Sex (1 = male; 2 = female)	0.37 (0.18 to 0.75)	0.01
(f) Quest cigarettes are healthier than regular cigarettes		
Incorrect (0) vs unsure (1)		
No text ad	3.62 (1.76 to 7.44)	0.01
Red ad	1.54 (0.84 to 2.81)	0.16
Sex (1 = male; 2 = female)	0.72 (0.42 to 1.22)	0.21
Try to quit (1=will try to quit)	0.53 (0.31 to 0.90)	0.02
Incorrect (0) vs correct (1)		
No text ad	3.98 (1.80 to 8.83)	0.01
Red ad	1.78 (0.89 to 3.56)	0.10
Sex (1 = male; 2 = female)	0.43 (0.23 to 0.79)	0.01
Try to quit (1 = will try to quit)	0.51 (0.28 to 0.93)	0.03
(g) Quest cigarettes make smoking safer		
Incorrect (0) vs unsure (1)		
No text ad	2.52 (1.20 to 5.29)	0.01
Red ad	0.96 (0.52 to 1.77)	0.90
Sex (1 = male; 2 = female)	0.63 (0.36 to 1.09)	0.09
Try to quit (1 = will try to quit)	0.59 (0.34 to 1.03)	0.06
Incorrect (0) vs correct (1)		
No text ad	3.12 (1.41 to 6.92)	0.01
Red ad	1.14 (0.57 to 2.25)	0.71
Sex (1 = male; 2 = female)	0.47 (0.25 to 0.85)	0.01
Try to quit (1 = will try to quit)	0.62 (0.34 to 1.15)	0.13
(h) Quest cigarettes help people quit smoking		
Incorrect (0) vs unsure (1)		
No text ad	1.20 (0.71 to 2.04)	0.50
Red ad	0.99 (0.59 to 1.67)	0.98
Sex (1 = male; 2 = female)	0.56 (0.36 to 0.86)	0.01
Try to quit (1 = will try to quit)	0.57 (0.37 to 0.89)	0.01
Education (HS = 0; >HS = 1)	0.73 (0.47 to 1.13)	0.16
Age	1.04 (1.02 to 1.05)	0.01
Incorrect (0) vs correct (1)		
No text ad	1.43 (0.68 to 3.03)	0.35
Red ad	0.74 (0.33 to 1.65)	0.46
Sex (1 = male; 2 = female)	0.37 (0.19 to 0.71)	0.01
Try to quit (1 = will try to quit)	0.46 (0.24 to 0.91)	0.02
Education (HS = 0; >HS = 1)	0.52 (0.27 to 0.98)	0.04
Age	1.05 (1.02 to 1.08)	0.01
FTND	0.90 (0.78 to 1.04)	0.16

HS, high school; FTND, Fagerstrom test for nicotine dependence. Referent condition is original advertisement. Results presented as odds ratio with 95% confidence intervals.