

Effect of health messages about “Light” and “Ultra Light” cigarettes on beliefs and quitting intent

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Abstract

Objective—To test the impact of three health messages focusing on vent holes, sensory effects of Light and Ultra Light cigarettes, or health consequences of smoking, respectively, on beliefs and quitting intentions.

Design—In the course of a random digit dialed telephone survey, subjects were randomised to hear one of three messages. To test the effects of the messages, beliefs and quitting intentions were assessed both pre- and post-message.

Participants—Daily smokers (n = 2120) of Regular (46%), Light (39%), and Ultra Light (15%) cigarettes in the USA. The sample was weighted to match the US smoker population on age, sex, and ethnicity.

Main outcome measures—Beliefs were summarised on three dimensions: Safety (reduced health risk), Delivery (lower tar and nicotine delivery), and Sensation (less harsh). Quitting interest was captured by the “quit index”, an aggregate measure of quitting interest and intent.

Results—The message focusing on smokers’ sensory perceptions of Light and Ultra Light cigarettes resulted in the most positive change in beliefs about safety, delivery, and intent to quit, and was particularly effective among those who believed that these cigarettes were less harsh. The effect was most pronounced among young adults, and among smokers of Light and Ultra Light brands who most endorsed their sensory benefits.

Conclusions—Addressing smokers’ sensory experience that Light and Ultra Light cigarettes feel less harsh may be a promising strategy for changing their misconceptions about these cigarettes and enhancing their interest in quitting. Media counter-advertising on Lights and Ultra Lights, focusing on sensory aspects of these cigarettes, may be an important part of tobacco control efforts.

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A recent survey of US smokers reported in this issue¹ demonstrated that smokers of cigarettes classified as “Light” and “Ultra Light” cigarettes continue to believe that Lights and Ultra Lights (L/ULs) pose less health risks

than Regular cigarettes, despite the wide availability of contrary evidence. (Brand classes are conventionally defined by their delivery in a smoking machine, by the Federal Trade Commission (FTC) method²: Regulars = more than 15 mg tar; Lights = 7–15 mg tar; Ultra Lights = 1–6 mg tar.) Going beyond descriptive data on beliefs associated with smoking “reduced yield” brands, there is a public health need for interventions that can impact smokers’ beliefs about these brands and help move them towards quitting. If L/UL brands do provide smokers with a sense of a “safe haven” from the health consequences of smoking, and thus deter quitting, then accurate messages may be able to unmask the illusory safe haven, and thus encourage quitting.

Prior research suggests that debunking myths about L/ULs may well influence attitudes towards quitting. Many US smokers of L/ULs report that they would be more likely to quit smoking if they knew that these brands conferred no protection from the risks of smoking.³ Kozlowski and colleagues⁴ tested the effects of exposing Light cigarette smokers to a health message about Lights on their beliefs and interest in quitting. The 60 second message addressed health risks, tar and nicotine delivery, ventilation, and sensory aspects of these cigarettes. Smokers exposed to the message improved their factual understanding of the issue, and increased their reported interest in quitting smoking. A recent report by Kozlowski and colleagues⁵ suggests that exposure to a campaign to counter-market L/UL cigarettes via messages helped to change beliefs about these brands and to promote interest in cessation in a real world setting.

What message strategies might be most effective in changing smokers’ beliefs and intentions? An important part of the strategy has been to educate smokers about the myth that L/ULs result in less toxicity. To make this message believable and explain the discrepancy between the nominal FTC delivery figures, which are seen as authoritative, and actual delivery, messages have helped smokers understand the role of ventilation holes, and their blockage, in this process. These messages explain that vent holes dilute the smoke during machine measurements but are often blocked by smokers (see Kozlowski⁶).

An alternative message strategy is based on addressing smokers’ sensory perceptions of L/ULs. This strategy is based in part on theoretical and empirical work on illness

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perception and common sense models of illness.^{7,8} This work shows that peoples' interpretations of their own somatic experience, shaped by common sense beliefs about disease causation—often medically incorrect—are major influences on perceived health threat and health protective behaviour. In this instance, the common sense belief that sensory "harshness" is a useful marker for systemic toxicity, applied to the sensory experience of L/ULs, could lead smokers to believe that L/ULs are safer than Regular cigarettes. Indeed, earlier work with teen smokers^{9,10} suggested that experience and interpretation of bodily sensations associated with smoking influenced subsequent smoking behaviour, and cognitive interventions to change these interpretations could influence later smoking behaviour.¹¹ Consistent with this notion, qualitative work done for this study suggested that for many smokers, the experience that L/UL cigarettes caused less coughing and simply "felt lighter"—less harsh or strong on their throat and chest—was often taken as convincing evidence that the cigarettes were less toxic and hazardous, thus making it difficult for smokers to accept and believe abstract information indicating that L/ULs were in fact no safer (see Kozlowski *et al.*¹). Quantitative analyses in Shiffman and colleagues¹ confirmed the qualitative data—many smokers found the sensation of smoking L/ULs lighter and less harsh than Regular cigarettes. Moreover, smokers who found L/ULs less harsh were also likely to believe they were safer. This suggested that addressing smokers' sensory experience of L/ULs, and their interpretation of it, might be an essential ingredient in effective messages about L/UL cigarettes.

The purpose of the present study was to test this sensory information strategy against the vents information strategy. We also tested these messages against a health warning about the effects of smoking in general that did not specifically mention L/UL cigarettes. In a randomised trial, smokers were exposed to one of three messages. The first message strategy ("vents") focused on providing information about blocking of ventilation holes on cigarette filters, emphasising that "vent blocking" could make L/ULs as toxic as Regular cigarettes. A second message strategy ("feel") noted and then debunked smokers' sensory experience that L/ULs "feel lighter". A third, control message ("health") simply reinforced the dangers of smoking, without specifically addressing L/ULs. To test the effects of the three messages, beliefs about L/ULs and quitting intentions were assessed both pre- and post-message.

Methods

SUBJECTS

Using regional quotas to ensure a nationally representative sample, telephone calls ($n = 14\,081$) were made to randomly selected telephone numbers drawn from directories. After eliminating disconnected numbers, fax machines, and businesses (29% of numbers),

14 081 numbers were tried: 13% were not reached and 25% refused or aborted the interview, resulting in a response rate of 62%. Among respondents who consented to be interviewed, 75% were from non-smoking households, and the remaining 25% completed interviews. A complete description of the methods, demographic characteristics of the sample, and the survey results can be found elsewhere.¹

A total of 2205 adult cigarette smokers, aged 18 and over, participated in a random digit dialled telephone interview. Eighty five respondents (4%) who did not smoke daily were excluded from analyses, resulting in a sample of 2120 smokers (46% Regular, 39% Light, and 15% Ultra Light smokers). The resulting data were weighted by sex, age, and ethnicity to represent US smokers, as characterised in the 1997 National Health Interview Survey. This same sample was also analysed for a separate report on smokers who had switched brands.

ASSESSMENTS

Telephone interviews included an assessment of smoking history, beliefs about L/ULs, and interest in quitting (see Shiffman *et al.*¹). Subjects were classified as Regular, Light, or Ultra Light smokers based on self reported responses to the question "What type of cigarettes do you smoke most often—Regular, Light, or Ultra Light cigarettes?". We characterised smokers into brand groups based on this self classification. Kozlowski and colleagues¹² have shown that such self characterisations are generally accurate, and, conversely, that smokers generally cannot accurately report the actual numeric values for their brands' FTC tar delivery. For several questions, smokers of Regular and Light cigarette brands were asked about Lights; smokers of Ultra Light brands were asked about Ultra Lights. Light and Ultra Light smokers were also asked an open ended question regarding their reason for smoking L/UL cigarettes rather than Regular cigarettes; responses were coded independently by two raters ($\kappa = 0.86$; see appendix for the question). Following this assessment, the interviewer read one of three messages, as indicated by random assignment. Immediately following exposure to the message, respondents were asked to rate the believability of the message (see appendix for the question). Beliefs about L/ULs and interest in quitting were reassessed after exposure to the message, using questions identical to those administered before the message exposure.

Beliefs about Light and Ultra Light cigarettes

The perceived health impact of L/ULs was assessed before and after message exposure by asking respondents to assess the truth of a series of statements about these cigarettes in comparison to Regulars (see appendix for the question). Using the average of the responses to these statements, three composite variables were constructed (based on examination of the item intercorrelations) to reflect beliefs about

Table 1 Messages

Health message

Medical studies show that smoking cigarettes is dangerous to your health. Cigarette smoke contains carbon monoxide. Smoking causes lung cancer, heart disease, emphysema, and may complicate pregnancy, including fetal injury, premature birth, and low birth weight. Quitting is the only way to eliminate the dangers of smoking completely. Now there are more ways to quit than ever before.

Vents message

Some smokers use Light cigarettes to minimise the dangers of smoking. Their intentions are good. But recent medical news shows that Lights are just as toxic as Regulars. Lights have vent holes on the filter which are supposed to reduce the toxins. But the tobacco companies designed it so you cover the vent holes when you smoke, making Lights just as dangerous as Regular cigarettes. Quitting is the only way to eliminate the dangers of smoking completely. Now there are more ways to quit than ever before.

Feel message

Some smokers use Light cigarettes to minimise the dangers of smoking. Their intentions are good. Once they switched, they felt better because Lights seemed smoother on their throat and easier on their chest. Recent news says that Lights were designed to make you feel better. But medical studies show that Lights can cause increased risk of permanent gene damage and heart disease. And tobacco company documents say Lights can deliver the same amount of tars and toxins as Regular cigarettes. Quitting is the only way to eliminate the dangers of smoking completely. Now there are more ways to quit than ever before.

L/ULs. The first composite included beliefs that L/ULs are safer (henceforth referred to as “safety”) and was composed of ratings indicating that L/ULs are “safer,” “healthier,” and “less likely to cause cancer” (internal consistency, Cronbach’s $\alpha = 0.84$). The second composite included beliefs indicating that L/ULs offer lower delivery (“delivery”) and consisted of ratings that L/ULs give you “less tar” and “less nicotine” ($\alpha = 0.76$). The third composite indexed sensations related to L/ULs (“sensations”) and averaged ratings indicating that L/ULs “feel smoother on your throat,” “feel easier on your chest,” and “you cough less smoking Lights” ($\alpha = 0.83$).

Before and after hearing the message, respondents were also asked to estimate the risk of smoking Lights and Ultra Lights, respectively, relative to the risk of not smoking (designated “0”) and the risk of smoking Regulars (designated “10”) (see appendix for the question).

Interest in quitting

Quitting interest and intention were assessed in several ways, as described in Shiffman and colleagues¹: (1) a 0–10 rating of overall interest in quitting; (2) a Contemplation Ladder based on the work of Biener and Abrams¹³; (3) a rating of likelihood of quitting within the next year; (4) smokers stated whether they were “seriously considering quitting in the next six months” (yes/no); and (5) they stated whether they were “planning to quit smoking in the next 30 days” (yes/no). Questions 4 and 5 are the critical items defining the contemplation and preparation stages of Prochaska and DiClemente’s Stages of Change model¹⁴ (eliminating reference to prior quitting, which could not be changed by the intervention). These items were all administered before and after message exposure (see appendix for the questions).

The above items about quitting interest and intention were drawn from both the stages of change assessment,¹⁴ which is primarily sensitive to changes proximal to quitting, and assessments of interest in quitting and the Contemplation Ladder,¹³ which discriminate among smokers with less advanced quit

interest (that is, those within Prochaska and DiClemente’s “Precontemplation stage”). To summarise interest in quitting in a single score we created a composite “quit index”, drawing from the five separate items described above, and scored as follows: 6 = planning to quit in the next 30 days; 5 = thinking of quitting in the next six months; 4 = likely to quit in the next year (≥ 3 on five point scale); 3 = some interest in quitting (≥ 5 on 0–10 scale); 2 = at least feel the need to quit someday (≥ 2 on the Contemplation Ladder); 1 = no expectation of or interest in quitting (score of 1 on the Contemplation Ladder). Subjects were assigned the highest score for which they were eligible. This composite correlated well with the constituent variables (average $r = 0.81$), and captured much of the variance in the set of items that constitute the “quit index” (canonical correlation = 0.94).

MESSAGES

The three different messages are shown in table 1. All three messages ended in a “call to action” for quitting smoking, noting the availability of smoking cessation treatment. The “Health” message was crafted by assembling the standard text of the Surgeon General’s warnings that currently must appear on US cigarette packs, thus modelling the current “usual care”. This message served as the “control” message; it did not specifically address L/UL cigarettes and was not intended to contain novel information.

The authors and advertising specialists crafted the other two novel messages to reflect the respective constructs. The two messages addressing L/ULs both note that the design of L/ULs permits compensatory smoking behaviour that undermines smokers’ effort to reduce their exposure. Both also explicitly state that these cigarettes can be as toxic as Regular cigarettes. The “vents” message noted that blocking of vents on cigarette filters results in L/ULs being just as toxic as Regular cigarettes (for example, Kozlowski *et al.*,⁴ Djordjevic *et al.*¹⁵). The “Feel” message noted smokers’ experience that L/ULs feel better on the throat and chest, but then explained that this does not reflect any health benefit and these cigarettes can lead to increased risk of gene damage and heart disease. (for example, Kozlowski *et al.*,⁴ Hecht¹⁶). The messages were not strictly matched in detail on length and wording, and in fact differ in the way they present information, but were instead designed to be realistic and persuasive messages that might be used in a patient communication or a media message limited to 30 seconds.

STATISTICAL ANALYSIS

The effect of the messages on indices of beliefs and the “quit index” was tested using regression on change scores (pre- and post-message—this also addressed the fact that the groups differed somewhat at baseline despite randomisation to groups) with message as an independent variable; main effects of message and type of smoker (Regular, Light, or Ultra Light) were evaluated. We also evaluated

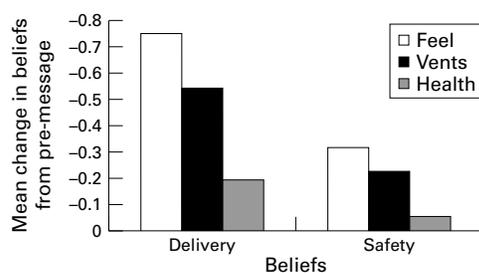


Figure 1 Changes in beliefs about Light and Ultra Light cigarettes from pre- to post-message.

interactions between the two. Other independent variables and interactions were tested to assess whether other variables moderated message effects. To account for complex sampling and weighting, all analyses were conducted using SUDAAN software,¹⁷ which adjusts variance estimates for weighting and/or complex sampling designs.

Results

GLOBAL RATING OF MESSAGES

Subjects generally found all three messages believable (rated at 4.2 (SE 0.02) on a five point scale ranging from "not believable at all" to "very believable"). However, smokers found the Feel (4.1 (0.04)) and Vents (4.1 (0.05)) messages significantly less believable than the Health message (4.5 (0.04); $p < 0.001$). This was equally true for all types of smokers. There was no interaction between type of smoker and message group.

BELIEFS ABOUT LIGHT AND ULTRA LIGHT CIGARETTES

We examined change in smokers' beliefs about L/ULs after exposure to the messages, by message group. (It should be noted that Light cigarette smokers assessed beliefs about Lights, and Ultra Light smokers assessed beliefs about Ultra Lights, so beliefs were assessed about *different* cigarettes depending on the type of smoker.) On average, exposure to all the messages reduced beliefs that L/ULs yield lower tar and nicotine delivery, as evidenced by an overall mean (SE) decrease of -0.49 (0.02) in stated beliefs ($p < 0.0001$ for the hypothesis

of no change). More importantly, beliefs were affected differentially by each message (fig 1). Those hearing the messages that addressed L/ULs—the Feel and Vents messages—demonstrated significantly more movement toward skepticism than those hearing the generic Health message (table 2). Further, the Feel message was significantly more effective than the Vents message in promoting movement away from the belief that L/ULs have diminished delivery. Regular, Light, and Ultra Light smokers reacted similarly to the different messages (interaction $p = 0.56$).

The messages also significantly and differentially affected beliefs about the safety of L/UL cigarettes. Smokers who heard the Feel message showed significantly greater movement away from believing in the safety of L/ULs compared to those who heard the Health message (fig 1, table 2). Additionally, smokers exposed to the Feel message showed significantly more movement toward scepticism than those exposed to the Vents message. Not surprisingly, collapsing across all three messages, a greater change in safety beliefs was seen for Light and Ultra Light smokers than for Regular smokers (contrasts among smoker types, $p = 0.006$, respectively). However, there were no differential effects of the three messages by type of smoker ($p = 0.15$).

Participants also assessed the perceived risks of Lights and Ultra Lights, respectively, rating their risk compared to Regular cigarettes, on the one hand, and to non-smoking, on the other. Following exposure to the messages, the greatest change in the perceived risk of Light cigarettes was produced by the Feel message; its impact was significantly greater than either the vents or Health message (table 2). The impact of the Vents message on perceived risk was not significantly different than that of the Health message. There was no difference in perceived risk of Light cigarettes ($p = 0.92$) by type of smoker. As shown in table 2, the results for Ultra Light cigarettes were exactly parallel. The Feel message produced greater impact than either the Vents or Health messages. The impact of the Vents message was equal to that

Table 2 Mean (SE) change in beliefs about Light/ Ultra Light cigarettes and interest in quitting by message and type of cigarette smoked

	Feel			Vents			Health			Mean scores by message group for Regular, Light, and Ultra Light smokers combined		
	Regular	Light	UL	Regular	Light	UL	Regular	Light	UL	Feel	Vents	Health
Delivery composite	-0.68 ¹ (0.07)	-0.76 (0.08)	-0.93 ² (0.11)	-0.53 (0.06)	-0.56 (0.07)	-0.52 (0.09)	-0.19 (0.04)	-0.19 (0.05)	-0.22 (0.05)	-0.75 ^a (0.05)	-0.54 ^b (0.04)	-0.19 ^c (0.03)
Safety composite	-0.21 ¹ (0.05)	-0.35 ² (0.05)	-0.57 ² (0.11)	-0.18 (0.04)	-0.29 (0.05)	-0.22 (0.07)	-0.03 (0.03)	-0.07 (0.03)	-0.07 (0.05)	-0.32 ^a (0.03)	-0.23 ^b (0.03)	-0.06 ^c (0.02)
Risk of Light cigarettes	-0.57 (0.16)	-0.55 (0.12)	-0.70 (0.19)	-0.22 (0.11)	-0.25 (0.11)	-0.16 (0.19)	-0.11 (0.09)	-0.08 (0.07)	-0.16 (0.17)	-0.58 ^a (0.09)	-0.22 ^b (0.07)	-0.11 ^b (0.06)
Risk of Ultra Light cigarettes	-0.75 (0.18)	-0.77 (0.15)	-0.98 (0.22)	-0.28 (0.15)	-0.39 (0.13)	-0.42 (0.19)	-0.08 (0.13)	-0.23 (0.08)	-0.12 (0.19)	-0.79 ^a (0.11)	-0.34 ^b (0.09)	-0.15 ^b (0.07)
Quit Index	0.06 ¹ (0.05)	0.17 (0.05)	0.34 ² (0.13)	-0.08 (0.06)	-0.06 (0.04)	0.04 (0.08)	0.03 (0.04)	-0.04 (0.03)	0.18 (0.11)	0.14 ^a (0.04)	-0.05 ^b (0.03)	0.02 ^b (0.03)

For beliefs and ratings of Light/ Ultra Light cigarettes, a negative number indicates less acceptance of Light/ Ultra Light cigarettes. For the "quit index", a positive number indicates an increase in interest in quitting.

¹ ² Means that have different superscripts differ significantly. Means without superscripts do not differ from the other two ($p < 0.05$).

^a ^b ^c For comparisons of the mean scores (see last column), means with different letters indicate significant differences between messages ($p < 0.05$).

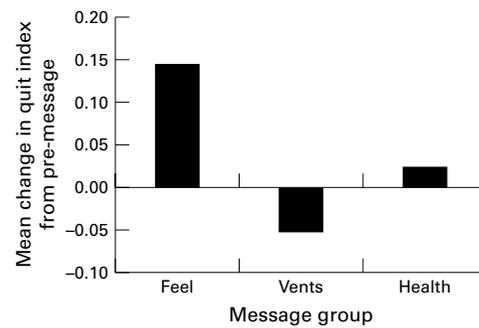


Figure 2 Changes in “quit index” from pre- to post-message.

of the Health message. There was no effect by type of smoker ($p = 0.59$).

INTEREST IN QUITTING

The effect of message exposure on interest in quitting was assessed by analysing pre-post changes in quitting interest and intention, as captured by the “quit index”. Exposure to the messages resulted in a modest but significant overall increase in quitting interest (0.04 (0.02), $p = 0.04$). As shown in table 2, the Feel message produced the greatest increase in average quit index scores, significantly higher than either the Vents or Health messages, each of which actually resulted in lower quit index scores (fig 2). The impact of the Vents message on interest in quitting was not significantly different than that of the Health message.

Table 3 Mean (SE) “quit index” change by moderators

	Feel	Vents	Health
Years smoked*			
< 20	0.26	-0.06	0.05
$p < 0.025^\dagger$	(0.06)	(0.06)	(0.04)
≥ 20	0.03	-0.05	0.00
	(0.03)	(0.04)	(0.03)
Sex			
Male	0.07	-0.05	0.04
$p < 0.08$	(0.05)	(0.05)	(0.04)
Female	0.23	-0.06	0.01
	(0.05)	(0.04)	(0.04)
Ethnicity			
Caucasian	0.12	-0.04	0.02
NS	(0.04)	(0.03)	(0.03)
Non-caucasian	0.25	-0.08	0.02
	(0.10)	(0.12)	(0.07)
Initial “quit index” score‡			
< 4	0.41	0.09	0.16
$p < 0.005$	(0.07)	(0.04)	(0.05)
≥ 4	-0.08	-0.12	-0.03
	(0.03)	(0.04)	(0.03)
Sensation belief§			
≤ 3	0.02	-0.09	0.03
$p < 0.03$	(0.04)	(0.04)	(0.05)
> 3	0.24	-0.02	0.02
	(0.06)	(0.06)	(0.03)
Sensory factors as reason for smoking L/ULs¶			
Endorse	0.35	-0.04	0.06
NS	(0.10)	(0.06)	(0.04)
Non-endorse	0.10	-0.02	-0.02
	(0.05)	(0.05)	(0.06)
Delivery			
≤ 3	0.12	-0.13	-0.03
NS	(0.05)	(0.06)	(0.03)
> 3	0.17	0.01	0.07
	(0.06)	(0.04)	(0.04)

*Median split.

†p Values indicate the test of the interaction between message and moderator.

‡Subjects with an initial score of 6 on the “quit index” were removed from the analysis, since they could not increase their scores.

§Differences among messages are only significant among those who initially expressed belief in sensory benefits of L/ULs ($p < 0.0001$), and not among those who did not ($p < 0.50$).

¶Assessed only among smokers of L/UL brands.

We also tested each message to assess whether the observed shifts following the message exposures were reliable (that is, we tested against the hypothesis of “no change”, or the hypothesis that the change score was = 0). Only the Feel message was found to produce significant movement towards quitting (test v no change, $p < 0.0001$); there was no significant change in the groups that heard the Vents and Health messages. Analysis by individual change rather than by group mean change revealed similar findings. Smokers exposed to the Feel message showed significant net positive change: 15.0% shifted towards greater quit interest, while 8.2% regressed; 2.6% increased their “quit index” by 3 or more. In contrast, neither the Vents nor the Health message produced significant positive gain. Of those who heard the Vents message, 9.6% increased their quit interest (0.4% by 3 points or more), but 11.0% regressed. Among those who heard the Health message, 8.3% increased their quit interest (0.7% by 3 points or more), and 6.9% regressed. The net positive movement (distribution by positive, versus negative or no change) was significantly greater in the Feel group than in the other two groups ($\chi^2 = 17.4$, $p < 0.002$).

Collapsing across all messages, Ultra Light smokers showed the largest increase (0.19 (0.06)) in quit interest, significantly greater than both the Light smokers (0.02 (0.02)) and Regular smokers (0.01 (0.03); $p = 0.01$ for each comparison); Regular and Light smokers showed similar overall change ($p = 0.76$). However, the differential effects of specific messages were not related to smoker type—that is, there was no smoker type by message interaction ($p = 0.28$).

MODERATORS OF THE MESSAGE EFFECTS

We examined relevant demographic and smoking history variables to explore whether the messages might have differential effects on quitting interest among different subgroups of smokers. Means and standard errors for the change in “quit index” scores by various moderators are shown in table 3. We compared the effects on young adults (ages 18–25 years) versus others: age moderated the effect of the messages ($p < 0.01$). The superiority of the Feel message was most pronounced among young adults (fig 3). Number of years smoking demonstrated effects similar to those of age ($p < 0.025$; not shown). There was a trend for sex to also moderate the message effect ($p = 0.08$); women who heard the Feel message had the greatest increase in quit interest. Analysis of ethnic differences was complicated because the sample was predominately Caucasian, precluding a detailed break-out of non-Caucasian subgroups. We assessed ethnic differences by comparing Caucasians to non-Caucasians. The largest increase in quit interest was noted among non-Caucasians who heard the Feel message, but the interaction between ethnicity and message was not significant ($p = 0.54$).

We also assessed the effects of the messages at different levels of baseline quitting interest

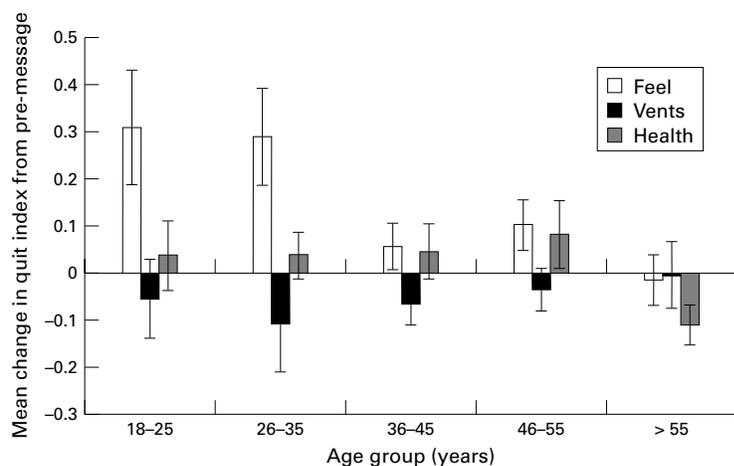


Figure 3 Changes in "quit index" from pre- to post-message by message and age.

(after removing those initially committed to quitting within 30 days ("quit index" = 6), as they could not increase their "quit index"). Because of ceiling effects and regression to the mean, we expected that the most positive change would occur among smokers who were initially less interested in quitting at baseline, and this was confirmed: more change was evident among those initially less interested in quitting ("quit index" < 4; 0.22 *v* -0.08; *p* < 0.0001). More importantly, there was a baseline level by message interaction (*p* < 0.005). As table 3 shows, the superiority of the Feel message was most evident among those initially less interested in quitting ("quit index" < 4).

Theoretically relevant baseline characteristics were also examined as potential moderators. In particular, we examined how the messages interacted with the beliefs they were meant to address. This addresses the specificity of the messages and the fidelity of the message strategy. The effects of the Feel message (which addressed the effects of the sensory experience of smoking L/ULs) were expected to be strongest among those who, at baseline, believed that L/ULs produced less harsh sensations. Indeed, this was the case. There were differential effects of the message by baseline beliefs (*p* < 0.03). Only among those who initially believed that L/ULs felt lighter did the Feel message have significant impact on interest in quitting (*p* < 0.0001); the effect was not significant among those who did not endorse these beliefs (*p* = 0.64). We also assessed the differential impact of the messages according to whether respondents who smoked L/UL cigarettes cited lighter sensations as a reason for doing so (based on an open ended question). The largest increase in quitting interest was noted among those who heard the Feel message and cited sensory factors as a reason for smoking L/UL brands, however the effect was not quite significant (*p* = 0.11).

Since the Vents message was designed primarily to address beliefs about the delivery characteristics of L/UL cigarettes, we assessed whether baseline delivery beliefs moderated

the effect of the messages. There was no interaction between baseline beliefs about the delivery of L/UL brands and the message effects (*p* = 0.58).

Discussion

This randomised experimental study demonstrated that smokers' beliefs about L/ULs and their quitting intentions could be positively influenced by Health messages, and that different message strategies had differential effects. Two different messages addressing beliefs about L/ULs were compared—one emphasising how the sensory experiences of L/ULs can be deceptive (Feel), and one emphasising how cigarette ventilation can undermine nominal reductions in yield (Vents). The Feel message yielded consistently better results in changing both beliefs and quitting intentions. Similarly, the Feel message resulted in greater changes in beliefs and increased interest in quitting compared to the message about the general hazards of smoking (Health).

The differential effect of the Feel message may be due to its strategy of directly and empathetically addressing smokers' sensory experience of the mildness of L/ULs, which might otherwise be a barrier to accepting abstract scientific data that these cigarettes are essentially equivalent to Regulars. Results from a survey of L/UL smokers in the USA¹ showed that L/UL smokers endorse the sensory benefits of L/ULs (more so than abstract health benefits). Indeed, the superiority of the Feel message was evident primarily among smokers who initially stated that L/ULs produced less harsh sensations. The efficacy of this message is consistent with research on symptom perception and common sense models of illness, which suggest that people often apply common sense models to interpret bodily experiences and draw conclusions—often erroneous conclusions—about health threats and appropriate health protective behaviour (that is, if it feels milder, it must be safer (see Brownlee *et al*⁷). Thus, smokers regard the less harsh sensations of smoking L/ULs as concrete, personal confirmation of their safety, reinforcing their decision to smoke L/ULs as a way of protecting their health. This cognitive process may make it hard to displace this belief unless the sensory experiences and associated beliefs are addressed. These sensory phenomena and the cognitive processes associated with them appear to be important influences on smoking behaviour among L/UL smokers, and should be addressed in targeted health messages.

The effect of the Feel message was robust and general, affecting smokers of Regular, Light, and Ultra Light cigarettes. The impact of this message on Regular smokers is perhaps a bit surprising, as it does not speak to their current cigarette brand. However, the Feel message may have addressed beliefs held by smokers of Regulars even about their own cigarette brands, or it may have spoken to prior brief experiences of trying a L/UL cigarette. The Feel message was also notably effective

among young smokers, women, and minorities, all of whom are important targets for tobacco control. The broad appeal of the Feel message, and its appeal to special target groups, suggests its broad utility as a media intervention.

In contrast to the Feel message, which addressed smokers' sensory experience, the Vents message may have been too complex (relying on a technical explanation of how L/ULs are constructed) or may have been seen as blaming the smoker for blocking vents (despite the attempt to avoid doing so). Although the Vents message actually provided more objective information, the information appeared to have been psychologically less effective in promoting changes in beliefs, attitudes, and intentions.

As expected, the effect of a single exposure to a Health message appeared modest; it did not convert large numbers of smokers to immediate commitment to quit. However, the effects were meaningful. Small changes in stated intention to quit have substantial impact on subsequent behaviour. Among subjects who heard the Feel message, 5.5% of those who were initially thinking of quitting in the next six months, subsequently indicated that they would plan to quit within a month. Among those not initially interested in quitting in the next six months 5.8% advanced to that stage. In prior research,¹⁸ advances in quit intention of this magnitude were associated with a doubling or tripling in the likelihood of making a quit attempt in the following month. Over a large population of smokers, effects of this magnitude could be significant.

However, we would not claim that the message exposures tested in the study themselves had such enduring effects. The experimental delivery of the messages lacked almost all of the essential elements of a good information campaign¹⁹: it consisted of a single, very brief exposure to a text-only message, read over the phone by an unvalidated source (that is, an unknown interviewer). However, the fact that exposure under even these untoward conditions had an effect suggests that the effects could be quite substantial under more optimal conditions—repeated exposure to well crafted messages from authoritative sources. It is well established that repeated exposure to advertising messages has cumulative effects and dramatically enhances their impact on behaviour.^{20 21} Research has also shown that elements of execution (for example, visual elements, music, authority) add to a message's impact on behaviour.¹⁹ This suggests that a campaign of well crafted media advertisements carrying these messages and/or a campaign of repeated counselling along these lines by health care providers could substantially increase interest in quitting smoking, which would yield significant public health benefit.

The study's methodological strengths and limitations moderate interpretation of our findings. The study was based on a large representative sample of US smokers, and generalisation to populations in other parts of the

world remains to be tested. A strength of the study was its combination of population survey methods (ensuring representativeness) with a randomised experimental design (ensuring clear assessment of the message effects). Further, the messages tested were developed based on qualitative and quantitative research. A limitation of the study is that it did not assess actual quitting behaviour, but focused on self reported intentions. However, the quit intention assessments incorporated into the "quit index" have been shown to predict subsequent behaviour, including participation in smoking interventions, making quit attempts, and actual successful cessation, as long as two years after an initial assessment.^{13 18 22} Further research should follow smokers to observe whether their changes in beliefs persist and/or lead to actual changes in behaviour following exposure to Health messages.

The study did not include a control group that was not exposed to any messages. This would have helped assess the effect of simply repeating the assessments without any intervening intervention. However, our focus was on contrasting three different interventions; since all groups were subject to repeated pre-post assessment, this does not confound the results or conclusions. Also, it was notable that in many instances the Health message, which reflects standard practice in warnings, produced no change at all, suggesting little reactivity. It is possible that respondents, having given a particular answer on the first administration of a question, may have felt constrained to give a similar answer when asked the same question again only minutes later. In that sense, our estimates of the amount of change caused by the intervention are likely to be conservative.

In interpreting differential response to the messages, we must consider that the messages were not identically matched in other respects. The Health message was far less novel, both in concept (smoking is harmful) and in wording, as it was adapted from warnings that appear in all cigarette advertising. This is realistic, at least in developed countries—the message that smoking is harmful is timeworn, and newer and more focused messages may have more impact. (It is possible that a novel message on health consequences would have done better.) The Health message was also slightly shorter than the others, and the Feel message was longer than the Vents message. The messages also differed in some secondary content; the Vents message addressed the intentions and actions of the tobacco industry, while the Feel message only mentioned the industry in the context of empirical support for full delivery from L/UL brands. The Feel message mentioned gene damage as a consequence of smoking while the others did not. Thus, the thematic message strategies were not completely isolated for study in the messages, and other components may have added variance to the results. It is possible that some combination of message content and novelty

influenced the messages' effectiveness. However, the strong specificity of the findings—notably that the superiority of the Feel message was concentrated among those who initially believed L/ULs were less harsh—strongly suggests that the intended thematic elements were responsible for the observed effects.

The messages were also limited to very brief text passages, and almost certainly understate the impact of well developed media messages or physician communications. The impact of any actual implementation will depend substantially on how the messages are crafted and delivered. Ideally, actual advertisements should be tested for effects on attitudes, beliefs, and intentions before being implemented.

The results of the study have implications for several aspects of tobacco control. Clinically, it suggests that health care providers should determine which patients smoke Light or Ultra Light cigarettes, and find opportunities to dispel misconceptions about L/ULs and to move smokers towards quitting smoking. For public health communication, the testing of alternative message approaches is an important foundation for health promotion campaigns, to ensure that the media messages have the desired impact on beliefs and behaviour. Mass media messages that counter the appeal of L/UL brands (and emerging novel cigarette designs claiming reduced risk) may be an important part of a tobacco control campaign. Since the majority of US and European smokers currently smoke L/ULs, this message could reasonably form the nucleus of a public health campaign against smoking. The fact that exposure to messages debunking beliefs about L/ULs yielded increased interest in quitting helps to validate the idea that smokers' adoption of L/UL cigarettes, and their beliefs that they protect them from risk, deters movement towards quitting. It was notable that a message that recounted the health harms from smoking in general (the Health message) did not substantially increase interest in quitting, whereas one that effectively debunked beliefs about L/ULs did. This research showed that a message that addressed smokers' sensory experience with L/ULs—the fact that they feel less harsh or strong and are less likely to acutely elicit coughing—is likely to have the most impact on smokers' beliefs, attitudes, and quitting intentions, and forms a promising basis for a public information campaign.

Appendix

Question on the reason for smoking Light/Ultra Light cigarettes

"What is the main reason that you smoke Light/ Ultra Light cigarettes rather than Regular cigarettes?"

Question on the "believability" of the messages

"How believable is the information in the statement? Is it very believable (scored 5), somewhat believable (4), neither believable or not believable (3), not very believable (2), or not at all believable (1)?"

Questions on beliefs about Light and Ultra Light cigarettes

"I'm going to read you some statements about how Light/ Ultra Light cigarettes* compare to Regular cigarettes. For each one**, please tell me whether you

think it is definitely true (scored as 5), probably true (4), might or might not be true (3), probably not true (2), or definitely not true (1)."

SAFETY

1. Light/ Ultra Light cigarettes are safer
2. Light/ Ultra Light cigarettes are healthier
3. Light/ Ultra Light cigarettes are less likely to cause cancer

DELIVERY

4. Light/ Ultra Light cigarettes give you less tar
5. Light/ Ultra Light cigarettes give you less nicotine

SENSATIONS

6. Light/ Ultra Light cigarettes feel smoother on your throat
 7. Light/ Ultra Light cigarettes feel easier on your chest
 8. You cough less smoking Light/ Ultra Light cigarettes
- *Smokers of Regular and Light cigarettes were asked about Light cigarettes; Ultra Light cigarette smokers were asked about Ultra Light cigarettes.

**Item order was rotated.

"Using any number from 0 to 10, how would you rate the health risks of smoking Light/ Ultra Light cigarettes? Imagine a scale that goes from 0 to 10, where 0 is the health risk of not smoking at all and 10 is the health risk of smoking Regular cigarettes. How would you rate the health risks of smoking Light/ Ultra Light cigarettes?"

Questions on interest in quitting

1. "On a scale from 0 to 10 where 0 is "not at all interested" and 10 is "extremely interested," how interested are you in quitting smoking?"
2. "I'm going to read you five statements which describe where various smokers are in their thinking about quitting. Please tell me which statement best describes where you are now in terms of thinking about quitting."
 - I'm taking action to quit such as cutting down or enrolling in a program (scored as 5)
 - I'm starting to think about how to change my smoking patterns (4)
 - I think I should quit but I'm not quite ready (3)
 - I think I need to consider quitting someday (2)
 - I have no thoughts of quitting (1)
3. "What are the chances that you will try to quit smoking in the next year? Would you say you are very likely (5), somewhat likely (4), neither likely or unlikely (3), somewhat unlikely (2), or very unlikely (1)?"
4. "Are you seriously considering quitting smoking in the next 6 months?" Yes/No
5. "Are you planning to quit smoking in the next 30 days?" Yes/No

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