

# Smokers' beliefs about "Light" and "Ultra Light" cigarettes

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## Abstract

**Objective**—To assess beliefs about the tar and nicotine delivery characteristics and health benefits of Light and Ultra Light cigarettes among cigarette smokers.

**Design**—Random digit dialed telephone survey conducted in September 1999.

**Subjects**—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 about Light and Ultra Light cigarettes were summarised on three dimensions: Safety (reduced health risk), Delivery (lowered tar and nicotine delivery), and Sensation (less harsh).

**Results**—Most smokers believed Lights and Ultra Lights were less harsh and delivered less tar and nicotine. On average, smokers believed that Lights afforded a 25% reduction in risk, and Ultra Lights a 33% reduction in risk. Light and Ultra Light cigarette smokers evaluated the risks of their own cigarette types more favourably. Light smokers had greater interest in quitting than Ultra Light smokers. Quitting intention was modestly related to beliefs about these cigarettes. Believing that Lights and Ultra Lights delivered less tar and nicotine and that they were less harsh each independently contributed to the belief that these cigarettes were safer.

**Conclusions**—Many Light and Ultra Light smokers believe that smoking these cigarettes impart a substantial health benefit, due in part to their experience that these cigarettes are less harsh and the belief that these cigarettes deliver less tar.

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Keywords: Light; Ultra Light; smokers' beliefs

The use of "Light" and "Ultra Light" cigarettes has increased dramatically since the introduction of these brands in the 1950s and 1960s.<sup>1,2</sup> The majority of cigarettes currently sold in the USA are those designated as Light and Ultra Light, and these brands now constitute approximately 82% of the market share.<sup>3</sup> In the UK, over one third of all smokers report smoking Light, Mild, or Ultralight cigarettes.<sup>4</sup>

Historically, and continuing to the present time, Light and Ultra Light cigarettes (hereafter referred to as L/UL) were marketed to

appeal to health concerned smokers<sup>5</sup> and positioned as an alternative to quitting.<sup>6</sup> These cigarettes were thought to yield substantial reductions in toxin exposure and pose less health risks to smokers. However, the purported health benefits and risk reduction from smoking L/UL cigarettes has not been realised. Epidemiological data indicate that smoking L/ULs has little or no health benefit.<sup>7</sup> When lung cancer, cardiovascular disease, and mortality rates are compared over time between smokers of L/UL and Regular cigarettes, little if any differences are found.<sup>8,9</sup>

As noted by Kozlowski and Pillitteri,<sup>10</sup> research has previously shown that smokers are not well informed about the health risks of L/UL cigarettes. In fact, many smokers harbour misperceptions about the health risks of these brands, and these misperceptions may deter cessation. A national survey by Kozlowski and colleagues<sup>11</sup> showed that when asked the reasons for smoking L/UL cigarettes rather than Regular cigarettes, a substantial number of smokers gave health related responses based on misperceptions about these cigarettes (for example, L/ULs give you less tar, give you less nicotine, are less risky, and are a step toward quitting). In the same survey, less than 10% of the sample knew that one Light cigarette can be equivalent to one Regular cigarette in terms of tar yield. Similarly, a survey of adult smokers in the UK found that 28% of smokers thought that L/ULs were less harmful than Regular cigarettes.<sup>4</sup> Information about nominal tar and nicotine levels is not only not informative, but may be misleading. Cohen<sup>12</sup> used a 1994 survey to assess how smokers process and make inferences from published tar and nicotine delivery figures. The results suggested that the majority of smokers could not correctly judge the relative tar levels of cigarettes; the tar levels of smokers' own brands were often underestimated because of descriptors such as "light" and "mild" that imply lower tar delivery; and smokers were misinformed about the true meaning of tar yield numbers.

In the present study, we sought to update knowledge about attitudes and beliefs about L/UL cigarettes to assess whether smokers continue to harbour misperceptions about these cigarettes. In a large, nationally representative sample, we assessed current beliefs about the health benefits of L/UL cigarettes, relating these to smoker characteristics and to interest in quitting smoking. We additionally assessed other dimensions of attitudes and beliefs about L/ULs, such as

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beliefs about their sensory characteristics, which were considered potentially important in motivating and maintaining smoking of L/UL brands. Finally, we explored whether misconceptions about L/ULs were equally common among subgroups such as young adult smokers (ages 18–25), who appear likely to be the next battleground in smoking control as prevention efforts, legal restrictions, and settlement agreements impact those under 18 years of age.

### Subjects and methods

#### SUBJECTS

A total of 2205 adult smokers, aged 18 years and over, consented to and completed a telephone interview. Eighty five respondents (4%) were excluded from the analyses because they indicated that they did not smoke daily, resulting in a sample of 2120 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 Light and Ultra Light smokers who had switched brands.

#### PROCEDURE

Telephone calls were made to randomly selected telephone numbers from a list of US households provided by Survey Sampling Inc. Regional quotas were assigned based on the state-by-state prevalence of cigarette smoking (from the Behavioral Risk Factor Surveillance System<sup>13</sup>) to ensure a nationally representative sample.

Interviews were conducted by 206 interviewers between 23 September and 6 October 1999. Most calls were made Sunday through Thursday evenings from 5:00 pm to 9:30 pm; some were made during the day on Saturday and Sunday to reach respondents who might be unavailable at other times. If a randomly selected household could not be reached, it was called three times at least two hours apart over at least two days. If no one was reached after this, the next listed number was called. If that number did not result in a completed interview, the caller returned to the first number, and then back to the second, before proceeding to more numbers. This was meant to maximise the chances that interviews were completed with the initially selected numbers. When a household was reached, the caller asked at random for the youngest/oldest male/female adult (18 or older) in the household (that is, it was not assumed that the person answering the phone was a randomly selected or representative member of the household). If the randomly chosen adult was not a smoker, the interviewer identified any adult smokers in the household, selecting one for interview using the random schedule for youngest/oldest male/female adult.

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.

#### ASSESSMENTS

Subjects were classified as Regular, Light, or Ultra Light smokers based on self reported responses to this question, which are known to be accurate.<sup>14</sup> Smoking history questions were included in the telephone interview (for example, number of cigarettes smoked per day, number of years smoking, number of previous quit attempts, and the Fagerstrom test for nicotine dependence (FTND)<sup>15</sup>). Beliefs about L/ULs and questions on interest in quitting were also included.

#### *Beliefs about Light and Ultra Light cigarettes*

Respondents were asked to assess the truth of a series of statements about the health risks of L/ULs cigarettes in comparison to Regulars (five point scale ranging from 1 = “definitely not true” to 5 = “definitely true”). Composite variables were constructed to reflect beliefs about L/ULs, based on an examination of the item intercorrelations. Three composites were formed, as follows: beliefs that L/ULs are healthier or safer (hereafter referred to as “Safety”) was composed of ratings indicating that L/ULs are “safer”, “healthier”, and “less likely to cause cancer” (Cronbach’s  $\alpha = 0.84$ ); beliefs indicating that L/ULs deliver less tar or nicotine (“Delivery”) consisted of ratings that L/ULs give you “less tar” and “less nicotine” ( $\alpha = 0.76$ ); a score indexing sensations related to L/ULs (“Sensations”) averaged ratings indicating that “you cough less smoking Lights”, “Lights feel smoother on your throat”, and “Lights feel easier on your chest” ( $\alpha = 0.83$ ). Two other constructs were assessed by single items: “Light cigarettes are less addictive” (“Less addictive”) and “Smoking Light cigarettes makes it easier to quit smoking completely” (“Help quit”). (Other items related to beliefs about L/ULs were administered but were not analysed because they overlapped with those presented and did not cleanly load on any one composite score.) On all of these items, smokers of Regular and Light brands were asked about Light cigarettes; smokers of Ultra Light brands were asked about Ultra Light cigarettes.

Additionally, following Kozlowski and colleagues,<sup>11</sup> respondents were asked to estimate the number of Light and Ultra Light cigarettes, respectively, someone would have to smoke to get the same amount of tar in one Regular cigarette. 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”).

#### *Interest in quitting*

Quitting interest was assessed by five different questions. (1) A 0–10 scale asked about overall interest in quitting smoking (0 = “not at all interested” to 10 = “very interested”). (2) Smokers were also asked a variation of the Contemplation Ladder<sup>16</sup> in which they placed

Table 1 Demographic and smoking characteristics of subjects by type of smoker

Variable	Type of smoker			All subjects
	Regular	Light	Ultra Light	
N	944	816	360	2120
Weighted %	46.9	38.5	14.5	100
Sex*				
% Male	62.0 <sup>a</sup>	48.8 <sup>b</sup>	38.9 <sup>c</sup>	53.5
% Female	38.0	51.2	61.1	46.5
Race*				
% White	73.7 <sup>a</sup>	79.7 <sup>b</sup>	83.4 <sup>b</sup>	77.4
% Black	15.5	8.1	10.0	11.8
% Hispanic	7.7	7.3	5.1	7.2
% Other	3.1	5.0	1.5	3.6
Education*				
% HS grad	54.4 <sup>a</sup>	49.9 <sup>a</sup>	40.1 <sup>b</sup>	50.6
% Some college	29.8	31.2	31.6	30.6
% College graduate	15.8	18.8	28.3	18.8
Age	40.9 <sup>a</sup> (0.53)	40.1 <sup>a</sup> (0.56)	43.8 <sup>b</sup> (0.90)	41.0 (0.35)
CPD	21.8 <sup>a</sup> (0.41)	21.2 <sup>a</sup> (0.45)	19.5 <sup>b</sup> (0.57)	21.2 (0.27)
Years smoked	21.0 <sup>ab</sup> (0.49)	20.0 <sup>a</sup> (0.51)	22.0 <sup>b</sup> (0.84)	20.8 (0.33)
FTND	4.9 <sup>a</sup> (0.10)	4.5 <sup>b</sup> (0.12)	4.0 <sup>c</sup> (0.16)	4.6 (0.07)
Quit attempts	2.1 <sup>a</sup> (0.10)	2.4 <sup>b</sup> (0.14)	2.2 <sup>ab</sup> (0.17)	2.2 (0.07)

Means with different letters are significantly different at  $p \leq 0.05$ . Numbers in parentheses are standard errors.

\*Differences assessed using pairwise  $\chi^2$  tests of association.

CPD, cigarettes per day, FTND, Fagerstrom test for nicotine dependence; HS High school.

themselves in one of five categories: "I have no thoughts of quitting", "I think I need to consider quitting someday", "I think I should quit but I'm not quite ready", "I'm starting to think about how to change my smoking patterns", or "I'm taking action to quit such as cutting down or enrolling in a program". (3) Smokers also rated the probability they would quit within the next year (five point scale ranging from 1 = "very unlikely" to 5 = "very likely"). Finally, smokers stated (4) whether they were "seriously considering quitting in the next six months" (yes/no) and (5) whether they were "planning to quit smoking in the next 30 days" (yes/no). The last two items are the critical factors in defining the Contemplation and Preparation stages of Prochaska and DiClemente's<sup>17</sup> Stages of Change. (The full definition of stages also includes quit attempts in the past year. Since exposure to messages obviously could not affect past behaviour, we only included future intentions in the measure.)

Using the five different interest in quitting items described above, a composite "quit index" was created 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 ( $\geq 3$  on five point scale); 3 = some interest in quitting ( $\geq 5$  on 0–10 scale); 2 = at least feel the need to quit someday ( $\geq 2$  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 individual items included in the composite (average  $r = 0.81$ ), and captured much of the variance in the individual items (canonical correlation = 0.94).

## STATISTICAL ANALYSIS

Characteristics, beliefs, and quitting intentions were contrasted in the three types of smokers (Regular, Light, and Ultra Light) using two tailed pairwise independent  $t$  tests for continuous level variables, and  $\chi^2$  statistics for categorical variables. To account for complex sampling and weighting, all analyses were conducted using SUDAAN<sup>18</sup> which adjusts variance estimates for weighting and/or complex sampling designs.

## Results

### DEMOGRAPHICS AND SMOKING HISTORY

Table 1 depicts the demographic and smoking characteristics of the sample. Smokers of Regular, Light, and Ultra Light cigarettes differed in several respects. In comparison to Regular cigarette smokers, Light and Ultra Light smokers were more likely to be women (odds ratio (OR) = 1.71 for Lights; OR = 2.56 for Ultra Lights;  $p = 0.0001$ ). Ultra Light smokers differed from the other two groups in several other ways—they were significantly older, smoked fewer cigarettes per day, had been smoking longer, and were less nicotine dependent, as assessed by the FTND (table 1). Light cigarette smokers were also significantly less dependent than Regular smokers. All groups of smokers were equally likely to have previously tried to quit smoking. Of the sample, 71.0% had made at least one quit attempt, but Light smokers tended to report more prior quit attempts than Regular smokers. Ultra Light smokers, however, did not report more prior quit attempts than Regular smokers.

### BELIEFS ABOUT LIGHT AND ULTRA LIGHT CIGARETTES

#### Health risks of Light and Ultra Light cigarettes (0–10 scale)

All smokers evaluated the risk of Light and Ultra Light cigarettes, respectively, on a 0–10 scale, where 0 designated the risk of not smoking at all and 10 designated the risk equal to that of a Regular cigarette. As fig 1 shows, Ultra Lights were consistently regarded as safer than Lights. Light cigarette smokers estimated the risk of both Light ( $p = 0.03$ ) and Ultra Light ( $p = 0.004$ ) cigarettes lower than Regular smokers did. Ultra Light smokers, in turn, estimated the risks of both cigarette types lower than Lights smokers did ( $p = 0.006$  and  $p = 0.002$ , respectively)—in other words, even though they did not smoke them, Ultra Light smokers thought Light cigarettes were safer than Light smokers did. Smoking Lights (mean (SE) score 7.6 (0.06)) or Ultra Lights (6.8 (0.07)) was thought to impart lower risk than smoking Regulars (both means were significantly less than 10, the risk of smoking a Regular cigarette;  $p < 0.0001$ ). All three types of smokers believed that Ultra Light cigarettes were less hazardous than Lights (mean difference 0.78,  $p < 0.0001$ ). Although most smokers thought that smoking Lights or Ultra Lights was closer in risk to smoking Regulars than to not smoking at all, 8.7% thought that Light cigarettes were closer in risk to not smoking ( $< 5$  on 0–10 scale), while

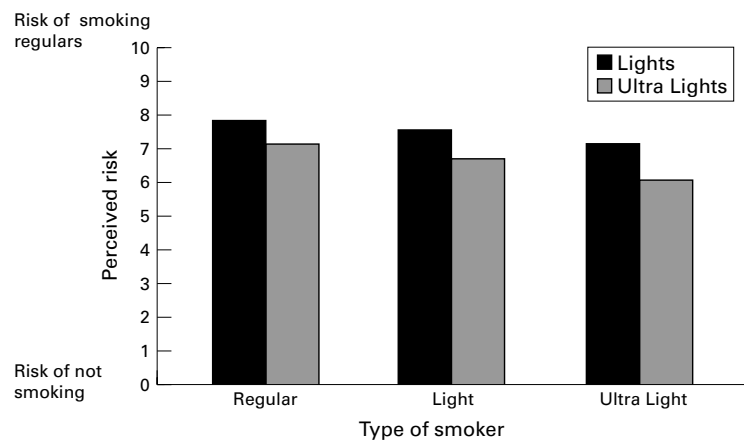


Figure 1 Perceived risk of smoking Light and Ultra Light cigarettes in comparison to regular cigarettes.

Table 2 Smokers' beliefs about the number of Light or Ultra Light cigarettes equivalent to one Regular cigarette in terms of tar delivery

	Type of smoker			All subjects %
	Regular (%)	Light (%)	Ultra Light (%)	
<i>Number of Light cigarettes</i>				
1	19.8	20.5	14.3	19.3
2	45.8	51.9	47.0	48.3
3+	34.4	27.6	38.7	32.4
Mean*	2.2 <sup>ab</sup>	2.1 <sup>a</sup>	2.3 <sup>b</sup>	2.1
SE	(1.02)	(1.02)	(1.03)	(1.01)
<i>Number of Ultra Light cigarettes</i>				
1	15.4	12.4	6.4	12.9
2	15.9	18.9	20.7	17.7
3+	68.7	68.7	72.9	69.3
Mean	3.1 <sup>ab</sup>	3.0 <sup>a</sup>	3.4 <sup>b</sup>	3.1
SE	(1.03)	(1.03)	(1.03)	(1.02)

Means with different letters are significantly different at  $p \leq 0.05$ .

\*Differences assessed using pairwise independent  $t$  tests.

Table 3 Mean ratings for beliefs about Light and Ultra Light cigarettes by type of smoker (1–5 scale)

Beliefs	Type of smoker			All subjects
	Regular	Light	Ultra Light*	
<i>Safety</i>	1.8 <sup>a</sup>	2.1 <sup>b</sup>	2.6 <sup>c</sup>	2.0
(0.03)	(0.04)	(0.07)	(0.07)	(0.03)
% Endorsed†	9.5	17.3	32.7	15.9
<i>Delivery</i>	3.0 <sup>a</sup>	3.4 <sup>b</sup>	3.8 <sup>c</sup>	3.3
(0.05)	(0.05)	(0.05)	(0.05)	(0.03)
% Endorsed	43.3	56.5	72.1	52.6
<i>Sensation</i>	2.7 <sup>a</sup>	3.7 <sup>b</sup>	4.0 <sup>c</sup>	3.3
(0.04)	(0.05)	(0.06)	(0.06)	(0.03)
% Endorsed	33.5	72.6	78.3	55.4
<i>Addictive</i>	1.7 <sup>a</sup>	1.8 <sup>a</sup>	2.2 <sup>b</sup>	1.8
(0.04)	(0.04)	(0.07)	(0.07)	(0.03)
% Endorsed	8.6	9.8	18.2	10.5
<i>Help quit</i>	2.2 <sup>a</sup>	2.4 <sup>a</sup>	2.9 <sup>b</sup>	2.4
(0.05)	(0.05)	(0.07)	(0.07)	(0.03)
% Endorsed	17.2	23.4	38.0	22.6

Means with different letters are significantly different at  $p \leq 0.05$ . Numbers in parentheses are standard errors.

\*Smokers of Ultra Light cigarettes rated Ultra Light brands; smokers of Light and Regular cigarettes rated Light brands.

†Scored above 3 on composite or variable (that is, “probably” or “definitely” true).

20.9% believed the risk of Ultra Light cigarettes was closer to that of not smoking. Among Ultra Light smokers, 27.1% believed the risk of smoking Ultra Lights was closer to that of not smoking at all than to smoking Regulars (rating < 5); this was also true of 22.1% of the Light smokers.

#### Perceived tar delivery of Light and Ultra Light cigarettes in comparison to Regular cigarettes

Table 2 shows the number of Light or Ultra Light cigarettes respondents thought were needed to equal the tar and nicotine delivery of one Regular cigarette. On average, half of all smokers thought that it was necessary to smoke two Light cigarettes and three Ultra Light cigarettes to get as much tar as from a single Regular cigarette. Although research indicates that L/ULs can deliver as much tar and nicotine as Regular cigarettes, only 19.3% of all smokers said that one Light cigarette is equivalent in tar delivery to one Regular cigarette; almost half thought that one Light delivered approximately half the tar of a Regular, and about one third thought they could smoke three or more Lights before being exposed to the amount of tar in one Regular cigarette. Similarly, table 2 shows that only 12.9% of all smokers reported that one Ultra Light cigarette delivers the same amount of tar as one Regular cigarette. Among Ultra Light smokers, only 6.4% thought one Ultra Light cigarette was equal to one Regular cigarette. Almost three quarters of Ultra Light smokers thought they could smoke three or more Ultra Lights before incurring the tar exposure of one Regular.

Smokers of Light and Regular cigarettes did not differ from each other in how they evaluated the delivery of either kind of cigarette ( $p = 0.09$  for Light cigarettes;  $p = 0.49$  for Ultra Light cigarettes). However, smokers of Ultra Light brands were more favourable than Light smokers in their evaluation of Light cigarette brands—that is, they thought it would take more Lights to equal the delivery of one Regular cigarette ( $p = 0.002$ ; table 2).

#### Beliefs about Light and Ultra Light cigarettes in comparison to Regular cigarettes (composite variables)

When asked a series of questions about whether L/ULs were safer in comparison to Regulars, smokers tended to express doubt about the safety advantages of L/ULs (table 3). On average, respondents rated statements about safety at 2.0, equivalent to “probably not true”. However, 15.9% of smokers found the claims credible (that is, scored above the midpoint of 3). Statements about reduced delivery were more credible, with the mean rating falling between “probably true” and “might or might not be true”; more than half found the claims credible. Statements about milder sensations of L/ULs fared similarly, with the mean rating favouring the statements, and the majority endorsing them. Smokers were doubtful that L/ULs were less addictive or would promote quitting (table 3).

There were substantial differences in beliefs about L/ULs by type of smoker (table 3). We first compared beliefs about Light cigarettes among Regular and Light smokers. Though still showing doubt about these benefits, Light smokers (compared to smokers of Regulars) believed Lights were safer ( $p < 0.0001$ ), delivered less tar and nicotine ( $p < 0.0001$ ), and produced milder sensations ( $p < 0.0001$ ).

Light and Regular smokers did not differ in their view of their addictiveness ( $p = 0.17$ ) nor their utility for quitting ( $p = 0.09$ ). These results were confirmed in a multivariate analysis (MANOVA) assessing the impact of type of smoker ( $p < 0.0001$ ).

We then examined the beliefs of Ultra Light smokers about Ultra Light cigarettes, comparing them to the beliefs of Light smokers about Light cigarettes. As shown in table 3, smokers of Ultra Light cigarettes believed their cigarettes were safer ( $p < 0.0001$ ), delivered less tar and nicotine ( $p < 0.0001$ ), produced lighter sensations ( $p < 0.0001$ ), were less addictive ( $p < 0.0001$ ), and more helpful for quitting ( $p < 0.0001$ ).

The different dimensions of beliefs about L/UL cigarettes were correlated: beliefs that they were safer, delivered less tar and nicotine, and produced milder sensations all correlated with each other ( $r_s = 0.49$ ). In a multiple regression equation, beliefs about delivery and sensations each made independent and roughly equal contributions to predicting the belief that L/ULs were safer ( $\beta_{\text{Delivery}} = 0.31$ ,  $p < 0.0001$ ;  $\beta_{\text{Sensory}} = 0.27$ ,  $p < 0.0001$ ).

#### INTEREST IN QUITTING

Overall quitting interest was modest, with the average smoker expressing some interest in quitting, but not reporting being likely to quit in the next year. Less than one out of 10 smokers was planning to quit in the next 30 days (9.7% of Regular smokers, 9.4% of Light smokers, and 6.9% of Ultra Light smokers), though one out of three smokers were contemplating quitting within six months (35.9% of Regular smokers, 39.5% of Light smokers, and 33.9% of Ultra Light smokers).

The mean (SE) quit index score was 3.6 (0.04). Based on the mean quit index scores, Light smokers had the greatest interest in quitting (3.7 (0.06)), significantly greater than that of Ultra Light smokers (3.4 (0.10);  $p = 0.002$ ). Regular smokers achieved an intermediate quit index score (3.5 (0.06)) that was significantly different from Light smokers ( $p = 0.005$ ) but not Ultra Light smokers ( $p = 0.32$ ).

#### ASSOCIATION OF BELIEFS AND INTEREST IN QUITTING

For the Light and Ultra Light smokers, correlations were computed between interest in quitting and beliefs about their cigarettes. If believing that one's current cigarette is safe serves to reduce motivation for quitting, then such beliefs should be associated with low interest in quitting (that is, a negative correlation should be observed). The quit index correlated  $-0.15$ ,  $-0.12$ , and  $-0.07$  with the Safety, Delivery, and Sensation indices, respectively ( $p < 0.001$  for Safety and Delivery;  $p = 0.11$  for Sensation). Light and Ultra Light smokers who believed their cigarettes were safer, milder, or delivered less tar and nicotine were currently less interested in quitting, but only very slightly so. Among smokers of L/UL brands, beliefs about sensation also demonstrated a curvilinear relationship with the quit index ( $p < 0.05$ ): interest

in quitting was lowest among those who either denied or strongly endorsed the belief that L/UL cigarettes were less harsh.

#### Discussion

The majority of smokers in this national sample smoke cigarettes with nominally reduced yields, so called Light and Ultra Light cigarettes. Consistent with prior research,<sup>11-19</sup> the data demonstrate that many smokers of L/ULs continue to harbour misconceptions about these cigarettes. Despite evidence that the health benefits are modest or negligible,<sup>8-9</sup> smokers' estimate that Lights provide a 25% reduction in risk and that Ultra Lights provide a 33% reduction in risk, compared to Regular brands. Similarly, although research shows that L/UL cigarettes often deliver as much tar as Regular cigarettes,<sup>20</sup> few smokers understand this, and many believe that L/ULs very substantially reduce tar yield by factors of 2 (Lights) or 3 (Ultra Lights). Reductions of this magnitude are not consistently shown, even in the estimates derived from smoking machine tests using the FTC method,<sup>7</sup> which are generally recognised to mislead smokers and to underestimate actual human exposures.<sup>21-22</sup>

Smokers' misconceptions about the delivery characteristics and safety of L/ULs do not appear to be accidental. Tobacco industry documents<sup>6</sup> indicate that these brands and their marketing campaigns were intended to achieve exactly this result. Thus, the marketing of L/UL cigarettes continues to deceive substantial numbers of smokers. Over the years, the US government was inadvertently complicit in this deception, promoting the FTC test for tar and nicotine yields even when it became clear that the test results were unrelated to actual exposure to tobacco derived toxins.<sup>10-23</sup> Recently, the FTC itself has repudiated the meaningfulness of these numbers and the underlying assays method (<http://www.ftc.gov/bcp/conline/pubs/alerts/smokealrt.htm>). However, many smokers continue to be misled.

Analysis of smokers' beliefs about L/UL cigarettes suggests that beliefs about their safety are fed both by the idea that these brands deliver less tar and nicotine and by the sense that these brands are less harsh to smoke. Many smokers report smoking L/ULs because of their perceived mildness. Smokers' perceptions of harshness were associated with beliefs about safety even when beliefs about tar and nicotine delivery were factored out, and were especially important among those who did not believe that L/ULs actually reduced these deliveries. Beliefs based on these sensory impressions may be psychologically important because they provide a particularly fundamental basis for belief in the health benefit of L/ULs. Research on interpretation of somatic states and sensations suggests that they often influence behaviour even when they are not actually biologically relevant.<sup>24</sup> In this case, smokers' experience that L/ULs seem less harsh when smoked may confirm their belief that these cigarettes are less harmful, and their belief that they are taking appropriate steps to

protect their health. Such beliefs, confirmed as they are by personal sensory experience that dovetails with smokers' implicit theories of how smoking causes harm,<sup>25</sup> may be hard to displace through provision of abstract scientific data. Research with teen smokers suggests that interventions intended to modify these beliefs can influence smoking.<sup>26</sup> Strategies for influencing smokers' beliefs by directly addressing these sensory experiences may have incremental utility in unmasking and uprooting smokers' misconceptions about L/ULs and influencing these smokers to give up the false "safe harbour" of L/ULs and move towards quitting instead. Such strategies warrant empirical test.<sup>27</sup>

The cross sectional survey did not allow us to evaluate the impact of L/ULs on interest in quitting or actual quitting, since we studied self selected groups of smokers long after they had adopted these brands. We found that smokers of Light brands were more interested in quitting than smokers of Ultra Lights; smokers of Regular brands were intermediate. It is not clear how this relates to the idea that L/UL smokers adopt these brands as a way to manage their discomfort with smoking and its health hazards. In particular, the fact that interest in quitting does not line up with nominal delivery of the preferred brand suggests that there are particular segments smoking L/UL cigarettes, and that these brands cannot be regarded as being simply on a continuum of delivery. In our sample, current beliefs about the health benefits of L/ULs were only slightly associated with lower interest in quitting; a stronger correlation would have supported the link between perceived risk and interest in quitting. Note that we did not assess perceived absolute risk, but only comparative risk across cigarette types; this may have failed to capture important variance in perceived risk. In any case, adoption of L/ULs may have kept smokers of these brands smoking in the past when they might otherwise have quit.

The study's limitations include the lack of longitudinal data that might better sort out the relation between brand choices, risk perceptions, attempts to quit, and actual cessation. Our study was also limited to self report—brand type was characterised by the smoker, and no behavioural measures of quitting were obtained. At the same time, the study benefited from a large and representative sample of US smokers and from reliable measures of key constructs. The study also relied primarily on closed ended quantitative queries: qualitative inquiry and cognitive analysis may help deepen our understanding of smokers' thinking about reduced yield claims and L/UL brands and uncover the cognitive processes that underlie their decision making about L/UL cigarettes.

The finding that substantial minorities believe they accrue health benefits from smoking L/UL brands supports the contention that smokers have been misled and deceived by cigarette manufacturers' advertising.<sup>22</sup> Extrapolating from the observations in this sample to the US population of 47 million

smokers,<sup>28</sup> we estimate that 15 million smokers believe that Lights deliver 33% less toxins than Regular brands; twice as many believe this about Ultra Lights. In addition, over one million US smokers believe that Lights are essentially safe to smoke (90–100% risk reduction *v* Regulars), and almost two million believe this about Ultra Lights.

Regulatory oversight is needed to remediate the harm caused by this continuing deception. The introduction of new regulatory frameworks is the underlying focus of several research and policy initiatives. For example, the European Union released a proposed directive in November 1999 that would continue the trend to reduce further the machine measured tar levels of cigarettes.<sup>29</sup> This could conceivably perpetuate the message that reductions in machine measured yields are medically meaningful. At the same time, the proposed directive calls for the elimination of descriptors such as "Light" and "low tar" in the European Union,<sup>29,30</sup> which could ameliorate the false impression promulgated by these promotional terms.

Attention to these regulatory challenges is made more urgent by the prospect that the tobacco industry will soon be marketing novel "reduced risk" cigarettes.<sup>31</sup> The recent announcements by tobacco companies, including RJ Reynolds, Brown & Williamson, and Star Scientific, indicating their intention to market products that claim to reduce toxicity, evoke uncomfortable echoes of the marketing of L/ULs. Without regulatory oversight of such claims, based on independent, scientific evaluation both of the relevant toxicology and the psychology of these products and their marketing, we risk repeating the experience of "Lights", which has helped perpetuate the massive morbidity and mortality caused by tobacco.

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