

BRIEF REPORT

Relationship of Cigarette-Related Perceptions to Cigarette Design Features: Findings From the 2009 ITC U.S. Survey

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ABSTRACT

Introduction: Many governments around the world have banned the use of misleading cigarette descriptors such as “light” and “mild” because the cigarettes so labeled were found not to reduce smokers’ health risks. However, underlying cigarette design features, which are retained in many brands, likely contribute to ongoing belief that these cigarettes are less harmful by producing perceptions of lightness/smoothness through lighter taste and reduced harshness and irritation.

Methods: Participants ($N = 320$) were recruited from the International Tobacco Control U.S. Survey conducted in 2009 and 2010, when they answered questions about smoking behavior, attitudes and beliefs about tobacco products, and key mediators and moderators of tobacco use behaviors. Participants also submitted an unopened pack of their usual brand of cigarettes for analysis using established methods.

Results: Own-brand filter ventilation level ($M 29\%$, range 0%–71%) was consistently associated with perceived lightness ($p < .001$) and smoothness ($p = .005$) of own brand. Those whose brand bore a light/mild label (55% of participants) were more likely to report their cigarettes were lighter [71.9% vs. 41.9%; $\chi^2(2) = 38.1, p < .001$] and smoother than other brands [75.5% vs. 68.7%; $\chi^2(2) = 7.8, p = .020$].

Conclusion: Product design features, particularly filter ventilation, influence smokers’ beliefs about product attributes such as lightness and smoothness, independent of package labels. Regulation of cigarette design features such as filter ventilation should be considered as a complement to removal of misleading terms in order to reduce smokers’ misperceptions regarding product risks.

INTRODUCTION

There is compelling evidence that the availability of “low-tar” cigarettes as marketed beginning in the late 1960s did not lead to any meaningful reduction in the health risks associated with smoking (Harris, Thun, Mondul, & Calle, 2004; Thun & Burns, 2001; U.S. Department of Health and Human Services, 2001). Low-tar cigarettes appear to have been engineered to provide a compelling illusion of reduced intakes while failing to produce reductions in smokers’ intakes of harmful smoke constituents. Filter ventilation, in particular, provided for lower machine generated levels of tar, nicotine, and carbon monoxide while also creating the perception of a lighter taste and reduced irritation to the smoker (except under conditions where vents

were completely blocked (Kozlowski & O'Connor, 2002; U.S. Department of Health and Human Services, 2001). However, the tobacco industry had considerable success in marketing low-tar cigarette brands, including to smokers who might otherwise have quit (Kozlowski et al., 1998; Tindle et al., 2006). Having now recognized the fact that low-tar cigarettes offer no real benefit to smokers, many governments have restricted the use of product descriptors such as “light,” “mild,” and “low tar” on packages and in advertising.

In 2010, the U.S. Food and Drug Administration (FDA) banned the use of these particular misleading brand descriptors from packs and in advertising. Longitudinal evidence shows that the removal of these misleading terms in other markets has not had a sustained impact on smokers’ beliefs, with many smokers

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continuing to believe that “lighter” cigarettes are less harmful (Borland et al., 2008; Yong et al., 2011). This is likely to be because manufacturers simply replaced the banned terms with new ones (e.g., smooth, fine), as well as using pack colors, to suggest “lightness”/“smoothness” (Bansal-Travers, Hammond, Smith, & Cummings, 2011; King & Borland, 2005; Mutti et al., 2011). However, consumer perceptions depend not only on descriptors and pack colors but also on how the product is engineered to impact on sensory responses to the smoke (Rees et al., 2009). It has been hypothesized that the sensory features of low-tar cigarettes (driven primarily by filter ventilation, a feature many smokers are unaware of [Kozlowski et al., 1996]) contribute proximately to beliefs about relative harm, independently of any particular descriptive term or color coding on the pack (Borland et al., 2004; Elton-Marshall et al., 2010; Kozlowski & O’Connor, 2002; Shiffman, Pillitteri, Burton, Rohay, & Gitchell, 2001).

This study sought to explore the relationship between selected product design features such as filter ventilation and cigarette length on smokers’ perceptions about sensory effects of their cigarettes. The study was undertaken in a national sample of adult cigarette smokers in the United States in 2009 and 2010, before the misleading brand descriptors were legally removed from cigarette packs and in advertising, and so afforded the opportunity to test for the effect of cigarette design, above and beyond the familiar descriptors, on perceptions of brand lightness and smoothness.

METHODS

ITC Supplemental Survey and Pack Collection

The data are from the International Tobacco Control (ITC) U.S. Survey, a prospective cohort telephone survey of a nationally representative sample of adult smokers (≥ 18 years) conducted since 2002 to evaluate the psychosocial and behavioral effects of tobacco control policies (Fong et al., 2006). The survey gathers data on smoking behavior, attempts at cessation, attitudes and beliefs about tobacco products, policy awareness, and key mediators and moderators of tobacco use behaviors (e.g., perceived risk, quit intentions). Technical information about the survey design, retention and replenishment rates, weighting, response rates, and contact protocols can be found elsewhere (International Tobacco Control Policy Evaluation Survey, 2011). Between November 2009 and January 2010, adult smokers who had completed the Wave 7 survey (conducted from October 2008 to February 2009) were recontacted to assess awareness of newly enacted FDA regulatory authority (see Fix et al., 2011). After completing this supplemental survey, respondents who smoked more than 10 factory-made cigarettes per day were offered a \$25 USD incentive to submit an unopened pack of their usual brand of cigarettes. Of 1,862 Wave 7 participants, 678 completed the Wave 7.5 interview and met pack collection eligibility criteria, and 320 returned an unopened pack. Compared with the Wave 7 participants who did not send a pack at Wave 7.5, pack returners were more likely to be White (94% vs. 83%, $p < .001$) and aged 55 and above (46% vs. 36%, $p < .001$), but were comparable on sex and median Heaviness of Smoking Index (HSI) score. These data collection methods were reviewed and approved by the Roswell Park Cancer Institute Institutional Review Board and the University of Waterloo Human Research Ethics Committee.

Analysis of Cigarette and Package Design

Unopened cigarette packs received at Roswell Park were catalogued, placed in -20°C storage until testing, and conditioned to 22°C and 60% relative humidity prior to testing for physical characteristics. Testing procedures followed previously published methods (O’Connor et al., 2008; O’Connor, Wilkins, Caruso, Cummings, & Kozlowski, 2010). Due to instrumentation problems, ventilation and pressure drop data are available only for standard diameter cigarettes ($N = 293$). Since specific design features may be used in combination in order to achieve cigarette delivery targets (Hoffmann & Hoffmann, 1997), we concentrated on three features: filter ventilation, filter density (a proxy for efficiency), and filter paper overwrap (obscures otherwise smokable tobacco that is not consumed in machine testing; Grunberg, Morse, Maycock, & Kozlowski, 1985). We also assessed cigarette length (100s vs. Kings) and brand mentholation.

Cigarette Perceptions

Participants answered two questions asking them to compare their current brand to others on the market (regardless of any experience with other brands).

- Are your cigarettes lighter in taste or more intense in taste? (Lighter, About the Same, More Intense)
- Are your cigarettes harsher or smoother on your throat? (Harsher, About the Same, Smoother)

An additional three questions probed beliefs about cigarettes labeled or otherwise designated as “light” as less harmful, smoother, and lower in tar intake compared with regular cigarettes. These items were combined into a summated scale of lights misperceptions (range 0–12; Cronbach’s $\alpha = .70$), wherein higher scores meant more misperceptions about the product’s risks. This measure was included to examine whether perception of one’s own brand’s sensory attributes were an extension of more generalized beliefs about light cigarettes. Participants also provided information on their gender, age, race/ethnicity, education, income, and heaviness of smoking (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989).

Data Analysis

All analyses were conducted using SPSS 21.0 (IBM). Basic descriptive analysis assessed bivariate means and standard deviations. Multivariate logistic and linear regression (within the generalized linear model framework to maximize use of available data) was used to examine relationships among perceptions of cigarettes, demographic and smoking person-level factors, and product characteristics.

RESULTS

Participant and Cigarette Characteristics

Four individuals were excluded for sending ineligible products (unfiltered cigarettes or small cigars). Of the 316 usable packs available for analysis, a total of 186 unique brand styles were received, 76% of which were made by one of the three largest

manufacturers (Philip Morris, RJ Reynolds, and Lorillard). In terms of product size, 1% ($N = 3$) were short (~72 mm), 42% ($N = 133$) were King length (~80–85 mm), 51% ($N = 162$) were long length (~100 mm), and 5% ($N = 17$) were extra long (~120 mm). Most (92%, $N = 291$) were standard diameter, 7% ($N = 22$) were labeled slim, and 1% ($N = 3$) were labeled wide. Light/mild descriptors (e.g., light, ultra-light, mild, medium) appeared on 55% of packs. Menthol brands accounted for 24% ($N = 75$) of the total. Brands returned had a mean ventilation level of 29% (SD 15.0; range 0%–71%), a filter density of 119.6 mg/cc (SD 11.8; range 99.5–171.8), and an overwrap length of 5.2 mm (SD 1.3; range 3.8–15.6).

The sample was 51% female, 94% White, had a median age of 53 years, median HSI score of 3, and 28.5% reported low household income. Female smokers were more likely to use 100s cigarettes (63% vs. 46%, $p = .005$), and these were also more common among older smokers (age <40 = 25%; age 40–54 = 51%; age 50+ = 66%; $p < .001$). Ventilation, filter density, and overwrap length were not significantly associated with participant sex or age.

Product Perceptions and Cigarette Characteristics

A majority of participants believed their own brand was lighter in taste (59%) and smoother on the throat (73%) compared with other brands. These beliefs were interrelated [$\chi^2(1) = 42.6$, $p < .001$], with 52% of respondents saying their brand was both lighter and smoother than other brands. Table 1 summarizes the relationships of these beliefs to selected cigarette design features. Only the degree of filter ventilation was consistently associated with both perceived lightness and smoothness. Smokers of King size cigarettes were less likely to say their cigarette brand

was lighter (48% vs. 65%, $p = .009$), but no effect was seen for smoothness. Menthol status was not associated with a brand's perceived lightness or smoothness. Those whose cigarette brand explicitly bore a light/mild product descriptor were more likely to report that their cigarettes were lighter (72% vs. 42%, $p < .001$) but not smoother (76% vs. 68%, $p = .149$) compared with those smoking brands without such descriptors. Perceptions of lightness were related to the lights misperceptions measure [$F(2,261) = 6.05$, $p = .003$], with those perceiving their brand as lighter having higher scores. A similar association was not seen for perceptions of smoothness ($p = 0.34$).

Table 2 describes logistic regression results for independent correlates of believing one's own brand to be lighter and smoother compared with other brands. Having a light/mild descriptor, higher ventilation, higher filter density, and lower HSI score were predictors of perceiving one's own brand as lighter. None of the demographic or design features were significant independent predictors of beliefs about own brand smoothness. When looking at the conjoint belief (own brand is both lighter and smoother), strong effects were seen for light/mild descriptors, HSI, ventilation, and filter density. Interestingly, cigarette length emerges as a significant factor for the conjoint belief, but was not significant for either belief on its own.

DISCUSSION

This study found that perceptions about the lightness and smoothness of smoker's own brand were significantly related to the presence of a light/mild descriptor and to the filter ventilation level of respondents' usual brand of cigarettes. Cigarette

Table 1. Participant's Reported Beliefs Versus Average Cigarette Design Characteristics

Are your cigarettes light in taste or more intense in taste?		Ventilation (%)	Filter density (mg/cc)	Overwrap (mm)
Lighter	<i>N</i>	153	166	167
	<i>M</i>	34.3	121.2	5.3
	<i>SD</i>	14.7	14.7	1.5
About the same	<i>N</i>	46	48	48
	<i>M</i>	23.5	115.8	5.4
	<i>SD</i>	10.9	8.8	1.3
More intense	<i>N</i>	69	71	71
	<i>M</i>	19.6	117.4	5.0
	<i>SD</i>	13.1	8.5	0.7
		$F(2,267) = 31.01$, $p < .001$	$F(2,284) = 7.53$, $p = .001$	$F(2,286) = 1.25$, $p = .287$
Are your cigarettes harsher or smoother on your throat?		Ventilation (%)	Filter density (mg/cc)	Overwrap (mm)
Harsher	<i>N</i>	28	28	28
	<i>M</i>	23.2	117.7	5.1
	<i>SD</i>	13.5	10.6	1.1
About the same	<i>N</i>	49	52	52
	<i>M</i>	24.8	117.3	5.3
	<i>SD</i>	11.4	9.0	1.0
Smoother	<i>N</i>	191	207	208
	<i>M</i>	30.9	120.3	5.3
	<i>SD</i>	15.7	10.0	1.5
		$F(2,267) = 5.62$, $p = .004$	$F(2,286) = 2.38$, $p = .094$	$F(2,287) = 0.29$, $p = .751$

Note. Bolded values indicate statistically significant mean differences.

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Table 2. Logistic Regression Models Associating Demographic Characteristics and Cigarette Design to Self-Assessed Cigarette Lightness and Smoothness

	Lighter		Smoother		Lighter and smoother	
	OR	95% CI	OR	95% CI	OR	95% CI
Age (continuous)	1.02	0.99, 1.05	1.00	0.98, 1.03	1.01	0.99, 1.05
Female (ref = male)	0.98	0.53, 1.80	1.08	0.61, 1.90	1.44	0.77, 2.71
Light/mild descriptor (ref = other)	2.98	1.57, 5.67	1.40	0.75, 2.59	3.66	1.87, 7.15
100s length (ref = King)	1.45	0.75, 2.79	1.39	0.75, 2.56	2.47	1.25, 4.89
Menthol (ref = non-menthol)	1.93	0.93, 3.98	1.20	0.61, 2.35	1.85	0.88, 3.90
Heavy smoking index (0–6)	0.70	0.54, 0.91	0.87	0.69, 1.10	0.67	0.51, 0.88
Ventilation (%)	1.06	1.03, 1.09	1.02*	1.00, 1.04	1.06	1.03, 1.09
Filter density (mg/cc)	1.07	1.03, 1.11	1.04*	1.00, 1.08	1.07	1.03, 1.11
Overwrap (mm)	0.88	0.65, 1.19	0.93	0.70, 1.21	0.85	0.63, 1.15
N analyzed	251		259		251	

Note. OR = odds ratio; CI = confidence interval.

Bolded values are $p < .05$; * $p < .06$.

length (100s vs. King) and filter density also contributed independently to these perceptions. Although some might consider these findings moot in light of the fact that light and mild descriptors have now been banned in the United States, the experience in countries that banned these misleading descriptors earlier is that beliefs about “lighter”/“smoother” cigarettes being less harmful persist. First, the banned terms have been replaced by other terms (e.g., smooth; fine) or by color coding (gold, blue, and silver) that are evidently also able to produce or reinforce the beliefs of some smokers that their usual brands are less harmful (Bansal-Travers, O’Connor, Fix, & Cummings, 2011; Hammond, Doxey, Daniel, & Bansal-Travers, 2011; Mutti et al., 2011). It is likely that where a set of descriptive terms has long been established, and along with them sensory and cognitive expectancies about the products (O’Connor et al., 2007), the simple removal of particular terms will be insufficient to alter consumer perceptions, especially since the design features themselves are correlated with the original label remain in effect. The implication, then, is that removing specific words is not sufficient by itself to alter misperceptions about the relative risks of the brand of cigarettes they smoke. As others have advocated (Kozlowski & O’Connor, 2002; Yong et al., 2011), regulators should look to restrict the use of cigarette engineering features that are likely to produce or reinforce smoker misperceptions of product safety.

The key strength of this study is in relating smoker’s product-related perceptions to actually observed characteristics of their cigarettes. The main weakness of this study is that we can only examine the relationship between product perceptions and product design in those who actually provided packs. Those who returned packs were more likely to be older and White compared with ITC Wave 7 participants who did not complete the supplemental data collection. So, the sample here is not fully representative of U.S. smokers. That said, further exploring relationships between sensory experience with products and cognitive beliefs about own brand and other products may be important for understanding consumer responses to both novel tobacco products (Institute of Medicine, 2011) and to products claiming “substantial equivalence” to existing products (Center for Tobacco Products, 2012).

Broadly, the current findings provide supporting evidence for limiting the use of cigarette engineering features such as

filter ventilation because there is substantial evidence that these product features inappropriately influence consumer perceptions about product risk (Kozlowski & O’Connor, 2002; Yong et al., 2011).

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DECLARATION OF INTERESTS

RJO has consulted for the FDA (Tobacco Products Scientific Advisory Committee, Tobacco Constituents Subcommittee) with regard to tobacco product regulation. KMC has consulted with various manufacturers of stop smoking medications in the past and currently serves as a paid expert witness in litigation against cigarette manufacturers.

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