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Reduced nicotine content cigarette advertising: How false beliefs and subjective ratings affect smoking behavior

Melissa Mercincavage[a], Megan L. Saddleson[a], Emily Gup[a], Angela Halstead[a], Darren Mays[b], Andrew A. Strasser[a,*]

[a] Center for Interdisciplinary Research on Nicotine Addiction, Department of Psychiatry, University of Pennsylvania Perelman School of Medicine, 3535 Market Street, Suite 4100, Philadelphia, PA 19104, United States
[b] Department of Oncology, Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, 3300 Whitehaven Street, NW, Suite 4100, Washington, DC 20007, United States

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ABSTRACT

Introduction: Tobacco advertising can create false beliefs about health harms that are reinforced by product design features. Reduced nicotine content (RNC) cigarettes may reduce harm, but research has not addressed advertising influences. This study examined RNC cigarette advertising effects on false harm beliefs, and how these beliefs – along with initial subjective ratings of RNC cigarettes – affect subsequent smoking behaviors. We further explored whether subjective ratings moderate associations between false beliefs and behavior.
Methods: Seventy-seven daily, non-treatment-seeking smokers (66.2% male) participated in the first 15 days of a randomized, controlled, open-label RNC cigarette trial. Participants viewed an RNC cigarette advertisement at baseline before completing a 5-day period of preferred brand cigarette use, followed by a 10-day period of RNC cigarette use (0.6 mg nicotine yield). Participants provided pre- and post-advertisement beliefs, and subjective ratings and smoking behaviors for cigarettes smoked during laboratory visits.
Results: Viewing the advertisement increased beliefs that RNC cigarettes contain less nicotine and are healthier than regular cigarettes (p's < 0.001 and 0.011), and decreased the belief that they are less likely to cause cancer (p = 0.046). Neither false beliefs nor subjective ratings directly affected smoking behaviors. Significant interactions of strength and taste ratings with beliefs (p's < 0.001), however, indicated that among smokers with less negative initial subjective ratings, greater false beliefs were associated with greater RNC cigarette consumption.
Conclusions: Smokers may misconstrue RNC cigarettes as less harmful than regular cigarettes. These beliefs, in conjunction with favorable subjective ratings, may increase product use.

1. Introduction

The U.S. Food and Drug Administration (FDA) has the authority to regulate tobacco products (U.S. Congress, 2009), including the ability to mandate a reduction in cigarette nicotine content. This action is proposed to decrease tobacco-related morbidity and mortality (Benowitz and Henningfield, 1994; Hatsukami et al., 2010b; Henningfield et al., 1998; USDHHS, 2014) and is supported empirically: reduced nicotine content (RNC) cigarette use generally decreases dependence and toxicant exposure without increasing smoking behaviors, and may facilitate cessation (Benowitz et al., 2007, 2012; Benowitz et al., 2006; Donny et al., 2015; Hammond and O'Connor, 2014; Hatsukami et al., 2010a; Hatsukami et al., 2012). If the FDA implements a reduced nicotine content standard, however, it is unclear how product marketing (e.g., labeling, advertising) may affect RNC cigarette use and acceptance. The tobacco industry falsely marketed "light" cigarettes as reduced harm products to maintain sales, and may promote RNC cigarettes similarly. Studies are thus needed to evaluate the impact of RNC cigarette marketing and determine if additional regulation is warranted.

RNC cigarettes are not equivalent to "light" or "ultra-light" cigarettes. The former contain tobacco genetically modified to

* Corresponding author.
E-mail addresses: melmer@upenn.edu (M. Mercincavage), msaddleson@gmail.com (M.L. Saddleson), emily.gup@uphs.upenn.edu (E. Gup), ahals@upenn.edu (A. Halstead), darren.mays@georgetown.edu (D. Mays), strasse3@mail.med.upenn.edu (A.A. Strasser).

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have lower nicotine content; the latter manipulate product design features (e.g., filter ventilation) to deliver less nicotine yield yet have nicotine content comparable to regular/"full-flavor" cigarettes (USDHHS, 2001). Smokers can "compensate" for such design features to increase nicotine intake by modifying their smoking behaviors (e.g., increasing daily consumption, blocking filter vents), increasing intake of other, harmful constituents (USDHHS, 2001). In contrast, little to no compensation occurs with long-term RNC cigarette use (Bandiera et al., 2015; Donny et al., 2015; Hatsukami et al., 2015; Mercincavage et al., 2016) because they contain insufficient extractable nicotine and do not reward these behaviors.

Despite these distinctions, a concern with a nicotine reduction approach is that consumers may believe RNC cigarettes to be less harmful, as occurred with "light" cigarettes and other potential reduced exposure products (PREPs) largely due to their marketing (Hamilton et al., 2004; O'Connor et al., 2005; Parascandola et al., 2009; Shadel et al., 2006; Shiffman, 2004; Shiffman et al., 2007, 2001). Thus, if RNC cigarettes are marketed similarly, false beliefs about their safety may increase smokers' use or decrease quitting likelihood. Further, at-risk, non-smoking youth may be more likely to experiment with these products and potentially initiate longer-term use. To our knowledge, however, no studies have experimentally tested how RNC cigarette beliefs affect smoking behavior (i.e., product use) – a critical indicator of both abuse liability and product acceptance. Additionally, data is needed regarding the impact of RNC advertisements and their content (e.g., implicit and explicit claims about product safety) on beliefs about product risks. Explicit content may directly affect specific false beliefs: e.g., "low tar" statement increases belief that product has less tar. Conversely, implicit content can indirectly affect specific beliefs that consequently determine overall product impressions: e.g., lighter colors within advertisements incrementally increase individual beliefs that product has less nicotine and tar, resulting in an overall impression of reduced harm (Bansal-Travers et al., 2011).

Research must also consider RNC cigarette design features, which may produce subjective responses that strengthen false product beliefs. For example, in addition to their misleading marketing, "light" cigarettes contained filter-ventilation that produced sensory perceptions of a "lighter" or "smoother" taste (Kozlowski and O'Connor, 2002; O'Connor et al., 2013), reinforcing smokers' false beliefs about lower harm (Elton-Marshall et al., 2015; Green et al., 2015; Mutti et al., 2011). While smokers generally provide negative subjective ratings of RNC cigarettes (Benowitz et al., 2007, 2012; Mercincavage et al., 2016; Strasser et al., 2007), implying lower use likelihood, few studies have associated these ratings with subsequent smoking behaviors. The available evidence demonstrates no clear association (Mercincavage et al., 2016). Studies thus must evaluate how subjective ratings of RNC cigarettes affect product use behaviors and beliefs to address whether their design features, like those of "light" cigarettes, reinforce false beliefs about product safety.

Our prior work demonstrated that advertising for a previously commercially-available RNC product that heavily marketed its low nicotine appeal (i.e., Quest®; Vector Tobacco Inc.) affected smokers' beliefs about the product's overall health risks (Lochbuehler et al., 2016; Strasser et al., 2008). This work, however, did not consider product use behaviors or subjective ratings. Because no studies have investigated how beliefs about RNC cigarette risks influence actual product use, the present exploratory study examined changes in product risk beliefs after viewing an unaltered advertisement, and how these beliefs and subjective ratings affected subsequent smoking behaviors (i.e., daily cigarette consumption, total puff volume) when provided with the first in a series of "step-down" RNC cigarette products (i.e., Quest 1® cigarettes). Finally, we investigated possible moderating effects of subjective ratings on associations between false beliefs and use behaviors. This approach, although exploratory, is high novel, as this study is the first to use experimental data to examine the interplay between RNC cigarette advertising, subjective responses, and smoking behaviors – a critical next step in providing the FDA with comprehensive evidence to evaluate implications of a low nicotine content standard. Specifically, we sought to understand marketing influences on these outcomes when using a novel cigarette product with a reduced nicotine content (not yield) similar to what the FDA could mandate in the future. Findings may inform future decisions regarding regulation of cigarette nicotine content and related marketing.

2. Material and methods

2.1. Participants and design

We performed secondary analyses on data from the first 15 days of a 35-day, randomized, controlled, open-label laboratory trial of RNC cigarettes, detailed elsewhere (Mercincavage et al., 2016). Smokers interested in trying a new low nicotine cigarette product were recruited from the Philadelphia area using digital and print advertisements, or were former study participants. A telephone interview determined initial eligibility; eligible participants were ≥ 21 years old, exclusively smoked ≥ 15 non-menthol, filtered cigarettes/day, smoked regularly for ≥ five years, and had no plans to quit smoking in the next two months. Participants were excluded if they drank ≥ 25 alcohol-containing drinks/week; were currently using marijuana or nicotine-containing products; self-reported a history of any psychiatric condition other than depression, a past year myocardial infarction, or a substance use disorder in the past five years; were pregnant/lactating; or provided an initial carbon monoxide (CO) sample <10 ppm.

Analyses included only participants who completed the first 15 trial days, indicated no prior Quest cigarette use, and were randomized to Quest 1® RNC cigarette (as opposed to Quest 2®, 3®, or preferred brand cigarette) use to control for nicotine content effects. Seventy-seven individuals met these criteria; of these individuals, 55.8% and 44.2% indicated they had heard and not heard of Quest cigarettes, respectively.

2.2. Procedure

Participants completed an initial laboratory visit to provide written informed consent, verify eligibility, and smoke three cigarettes with 45 min between each: the first standardized time since last cigarette; the next two were smoked through topography equipment to assess puffing behavior. After each cigarette smoked through topography equipment, participants provided pre- and post-cigarette CO samples, and completed post-cigarette subjective rating forms. After the first cigarette, participants completed demographic, smoking history, and Quest cigarette beliefs (i.e., pre-advertisement beliefs) questionnaires. Following the second cigarette, participants viewed a Quest cigarette advertisement and again completed the beliefs questionnaire (i.e., post-advertisement beliefs). Subsequent visits occurred every five days (i.e., not every day) and were identical in format with the exception of viewing the advertisement. Participants smoked their own preferred brand cigarettes during the initial visit and next five days. At the Day 5 visit, before the third cigarette, participants were provided with Quest 1 RNC cigarettes (0.6 mg FTC-measured nicotine yield) free-of-charge for 10 days. Thus, all Day 0 cigarettes and the first two Day 5 cigarettes were participants' own brand, while the third Day 5 cigarette and all Day 10 cigarettes were RNC cigarettes; this design allowed for direct comparisons in product use behaviors and subjective responses between RNC and own brand cigarettes under identical conditions, as well as over time within a spe-