



U.S. adults' addiction and harm beliefs about nicotine and low nicotine cigarettes[☆]



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ABSTRACT

This research described U.S. adults' beliefs about nicotine and low nicotine cigarettes (LNCs) using the nationally-representative Health Information National Trends Survey (HINTS-FDA 2015; $N = 3738$). About three quarters of people either were unsure of the relationship between nicotine and cancer or incorrectly believed that nicotine causes cancer. People who were non-White, less educated, age 65+, and never established smokers were most likely to be unaware that nicotine is not a cause of cancer. More than a quarter of people held the potentially inaccurate beliefs that LNCs would be less harmful and addictive than typical cigarettes. Whites were more likely than Blacks to believe LNCs were less harmful than typical cigarettes, and never smokers were more likely to believe this than established quitters. Whites and people with at least a college degree were more likely to believe that LNCs would be less addictive than typical cigarettes. Overall, we found that many people, particularly the demographic subgroups identified here, held incorrect beliefs about nicotine and potentially inaccurate beliefs about LNCs. Findings should be considered in assessing the public health impact of marketing low nicotine products. Incorrectly believing that nicotine causes cancer could discourage smokers from switching to safer nicotine-containing alternatives, and could lead nonsmokers to experiment with low nicotine tobacco products, believing that cancer risk would be reduced. Findings underscore the need to educate the public on the health effects of nicotine and LNCs, and can help public health practitioners determine which subgroups should be prioritized in targeted educational efforts.

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1. Introduction

Historically, U.S. smokers have had a poor understanding of the health consequences of smoking (Chapman & Liberman, 2005; Weinstein et al., 2005). They have persistently held the inaccurate belief that certain varieties of cigarettes (e.g., light and low tar) were lower risk than others (Cummings et al., 2004; National Cancer Institute, 2001), even after tobacco advertisements making these claims were restricted by legislation in 2009 (Yong et al., 2015). While smokers' overall understanding of the harms of tobacco use has improved over time (US Department of Health and Human Services, 2014), many still hold potentially inaccurate beliefs about the relative harms of low nicotine cigarettes (Hatsukami et al., 2013) and other classes of nicotine-containing products (Kiviniemi & Kozlowski, 2015; Borland et al., 2011) that could result in negative public health consequences. Some of these beliefs may be due to poor understanding of health effects of

nicotine (Cummings et al., 2004; Bansal et al., 2004a). For example, while smokers may understand that nicotine causes addiction (US Department of Health and Human Services, 2014), they may not understand (Mooney et al., 2006) that most smoking-related disease is not caused by nicotine, but rather other chemicals present in tobacco or formed by tobacco combustion (US Department of Health and Human Services, 2014).

Public health could be negatively impacted in several ways if people fail to understand nicotine's role in tobacco-related disease. For example, smokers who believe that nicotine is the main cause of tobacco-related disease may be less willing to use nicotine replacement therapies (NRT) to support quit attempts (Shiffman et al., 2008a; Ferguson et al., 2011). Further, these smokers could be less willing to switch to a potentially less risky tobacco product that still contains nicotine. Additionally, people who believe that nicotine is a main cause of harm may believe that cigarettes (and other products) with lower levels of nicotine would be less risky. This could encourage smokers who want to avoid the health consequences of smoking to switch to lower nicotine products instead of quitting, such as when smokers switched to "light" cigarettes because they thought they would reduce the risk of smoking without having to quit (Kozlowski et al., 1998). As youth nonsmokers think about tobacco use on a continuum of harm (Ambrose et al., 2014), and harm perceptions have predicted smoking initiation

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among youth (Ambrose et al., 2014; Song et al., 2009), believing that a product is lower risk could encourage experimentation among susceptible non-smokers.

Several studies suggest that many smokers incorrectly believe nicotine causes tobacco-related cancer. A national representative survey of smokers (Cummings et al., 2004; Bansal et al., 2004b) and a focus group study of ethnically diverse smokers (Carpenter et al., 2011) found that over half of respondents were unaware that nicotine does not cause tobacco-related cancer. Additionally, a study of adult smokers found that most participants believed nicotine caused numerous other smoking-related ailments, including stroke, asthma, diabetes, gum disease, and emphysema (Mooney et al., 2006).

Research has also examined smokers' harm beliefs about low nicotine cigarettes (LNCs), or cigarettes labeled as "low nicotine." While cigarettes marketed as "light" had lower machine-measured nicotine yield due to ventilation holes, the way that smokers used them did not reduce smoker exposure to nicotine. (National Cancer Institute, 2001) LNCs rely on low nicotine content tobacco rather than ventilation holes, and the use of at least some varieties of LNCs has resulted in reduced nicotine exposure (Hatsukami et al., 2010; Dermody et al., 2015). LNCs with a range of reduced nicotine levels have been marketed in the U.S. (e.g., Quest cigarettes (Strasser et al., 2007)), and often have been used in studies of smoking behavior and nicotine addiction (e.g., Spectrum cigarettes (Richter et al., 2016)). Smoking LNCs in the same manner and frequency as typical cigarettes results in the same exposure to harmful chemicals other than nicotine, and could lead to increased exposure to harmful chemicals if smokers modify smoking behavior to compensate for lower nicotine levels (Hatsukami et al., 2010; Strasser et al., 2007; O'Connor et al., 2007a). However, several studies found that smokers hold potentially inaccurate beliefs about LNCs in general, believing they are safer than other cigarettes. A nationally representative survey of smokers found that over half believed that LNCs were less dangerous than regular cigarettes (Cummings et al., 2004). Further, an experimental study (Strasser et al., 2008) found that smokers assigned to view ads for one brand of LNCs believed them to be healthier and safer, and believed that switching to them could reduce exposure to tar, carcinogens, and other chemicals. Another study found that smokers believed LNCs to be associated with a lower risk of lung cancer, other cancers, emphysema, bronchitis, heart disease, and stroke (Hatsukami et al., 2013). These findings are especially important to consider in light of a tobacco industry document review that found that several tobacco companies developed LNCs in part because the companies believed smokers would be interested in LNCs due to the perception that LNCs were healthier (Dunsby & Bero, 2004).

Several studies suggest that the public may be unaware that cigarettes described as "low nicotine" are not necessarily less addictive. Although studies using cigarettes with varying levels of nicotine content have found that "very low nicotine cigarettes" (cigarettes with dramatically reduced nicotine content, e.g., 0.05 mg yield) can be minimally addictive, cigarettes with less dramatic reductions in nicotine (e.g., 0.3 mg yield) are not less addictive than typical cigarettes (Hatsukami et al., 2010; Dermody et al., 2015; Donny et al., 2014; Lee & Kahende, 2007). A nationally representative survey found that more than one-third of smokers believed LNCs were less addictive (Cummings et al., 2004), and a study of undergraduate smokers and nonsmokers found that most believed LNCs were less addictive than Marlboro Lights (O'Connor et al., 2007a). A survey of Quitline callers found that 16% believed that switching to LNCs could improve one's chances of quitting (Bansal-Travers et al., 2010).

Smokers who intend to quit or who recently quit could be particularly susceptible to smoking LNCs if they believe that they present lower health risks. Research specifically on beliefs about nicotine and LNCs in these smoker subgroups is sparse and inconsistent. One study found that a higher proportion of smokers who were trying to quit believed nicotine caused cancer (Bansal-Travers et al., 2010), compared to nationally representative samples of smokers (Bansal et al., 2004b).

However, another study found that smokers who intended to quit within the next year were less likely to hold this belief (Cummings et al., 2004).

1.1. Purpose of the current study

This study was exploratory and addressed several gaps in the literature on beliefs about nicotine and LNCs. First, this study assesses how beliefs among smokers intending to quit and recent quitters may differ from other smokers, addressing inconsistencies in the literature (Cummings et al., 2004; Bansal-Travers et al., 2010). Second, this study examines these beliefs among people who have never been established smokers (never smokers). Previous research on beliefs about nicotine and LNCs rarely included never smokers, and this group is important to study as they may be more interested in trying tobacco products perceived as less risky (Shiffman, 2004; Czoli & Hammond, 2014). Third, the current study assesses differences in these beliefs among demographic subgroups. Identification of these subgroups can help public health practitioners prioritize providing accurate information about LNCs and nicotine to those who need it most.

2. Method

2.1. Participants and design

We analyzed data from a special round of the Health Information National Trends Survey (HINTS) conducted by the National Cancer Institute in partnership with the FDA (HINTS-FDA 2015). HINTS-FDA 2015 ($N = 3738$) is a cross-sectional, probability-based nationally representative survey of U.S. non-institutionalized civilian adults aged 18 or older. The data were collected in 2015 through self-administered mail surveys sent to a random sample of non-vacant residential addresses. The weighted response rate was 33%. Additional methodological information is available elsewhere (Westat, 2015).

2.2. Measures

2.2.1. Nicotine beliefs

Two items assessed the beliefs that nicotine is the main substance in cigarettes that causes addiction and cancer: "Nicotine is the main substance in tobacco that makes people want to smoke," and "The nicotine in cigarettes is the substance that causes most of the cancer caused by smoking." Response categories for both included *Strongly disagree*, *Disagree*, *Agree*, *Strongly agree*, and *Don't know*. Because the first statement is true, we recoded responses as incorrect if they were *Disagree* or *Strongly disagree*. Because the second statement is false, we recoded responses as incorrect if they were *Agree* or *Strongly agree*. This recoding approach is consistent with past research (Cummings et al., 2004; Bansal et al., 2004a; Mooney et al., 2006).

2.2.2. Low nicotine cigarette beliefs

Two items assessed LNC beliefs. First, respondents rated whether a cigarette advertised as "low nicotine" would be more or less harmful than a typical cigarette. Second, respondents rated whether a cigarette advertised as "low nicotine" would be more or less addictive than a typical cigarette. Both items had five response options that ranged from *Much less [harmful to your health/addictive] than a typical cigarette* to *Much more [harmful to your health/addictive] than a typical cigarette*, with a midpoint of *Equally [harmful to your health/addictive]*. LNCs include a range of nicotine levels, and their addictiveness and harmfulness depend on their nicotine level (Hatsukami et al., 2010; Donny et al., 2014). Therefore, because it is not clear which responses are correct, we retained the full range of response options.

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