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RESEARCH ARTICLE

Trends in E-Cigarette Awareness and Perceived Harmfulness in the U.S.

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Introduction: Electronic cigarettes (e-cigarettes) are gaining in popularity as an alternative to regular cigarettes, as they are viewed as potentially less harmful. However, it remains unclear how awareness about e-cigarettes is permeating through the general U.S. population. This study seeks to extend previous research and examine trends in e-cigarette awareness and perceived harmfulness, and their association with smoking-cessation efforts.

Methods: Data from three cycles (2012, 2013, and 2014) of the Health Information National Trends Survey were combined into a single data set. Controlling for survey year, multivariate logit models were used to determine the association between demographic characteristics and e-cigarette awareness, perceived harmfulness, quit attempts, and quit intentions. Data were analyzed in 2015.

Results: Awareness of e-cigarettes increased from 77.1% in 2012 to 94.3% in 2014. Controlling for demographic characteristics, e-cigarette awareness significantly increased in both 2013 and 2014, relative to 2012. Perception that e-cigarettes were less harmful than regular cigarettes declined from 50.7% in 2012 to 43.1% in 2014. Among smokers, no relationship was observed between e-cigarette awareness and past-year quit attempts or quit intentions, but those that viewed e-cigarettes as less harmful were less likely to have a past-year quit attempt.

Conclusions: These analyses reveal a continued increase in overall public awareness of e-cigarettes and shifting harm perceptions relative to regular cigarettes. New regulatory oversight by the U.S. Food and Drug Administration may have major effects on both dimensions, which are worth continued monitoring.

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INTRODUCTION

Electronic cigarettes (e-cigarettes) are battery-operated devices that convert liquid containing nicotine into vapor that the consumer inhales. The liquid is often supplemented with other additives to enhance the flavor and make inhaling feel less caustic. Various e-cigarette products have been on the U.S. market since 2007, with major tobacco companies entering the market in 2014. U.S. consumers' awareness about e-cigarettes has grown rapidly with a concomitant increase in usage.[1] The rapid growth in e-cigarette use is running counter to the trend in regular cigarette use, which continues to drop.[2,3]

Market analysis shows that during the 5-year period from 2009 to 2014, e-cigarette market share for all tobacco products more than doubled each year.[4,5] E-cigarette advertising is not currently banned from TV or other media, unlike advertising for traditional tobacco products.[6] With increased advertising and growing market share, e-cigarettes are gaining in popularity as an alternative to regular cigarettes—particularly among younger demographic groups.[6,7] Public health professionals have expressed concern that advertising strategies

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that successfully increased smoking rates in the 1950s, 1960s, and 1970s, augmented with social media campaigns, will promote e-cigarette use and create a new generation of smokers who adopt the habit in their teens. Advertisements tout the reduced harm of e-cigarettes and the ability to smoke "anywhere."[8]

Product manufacturers' claims that e-cigarettes deliver less of some harmful chemicals than regular cigarettes have been borne out in laboratory comparisons.[9,10] However, one study found that many e-cigarettes flavorings contain diacetyl and acetyl propionyl, which are associated with respiratory disease called "popcorn lung" when inhaled.[11] The Centers for Disease Control and Prevention and public health officials support more study into claims that switching to e-cigarettes may be an effective method to assist in smoking-cessation efforts.[12] Two 2011 studies showed that significantly more smokers reported smoking reduction or cessation at 4 months post-intervention by using e-cigarettes, relative to a comparison group that did not use e-cigarettes.[13,14] However, other studies have found that smokers are less likely to quit when using e-cigarettes.[15,16] Hence, e-cigarette ads' claims for their positive effect on smoking harm reduction or aiding in smoking cessation have not been consistently supported.

On the regulatory front, the U.S. Food and Drug Administration issued statements warning of impending evaluation and oversight for e-cigarette companies' claims that their products offer increased safety and harm reduction to smokers.[17] In May 2016, the Food and Drug Administration announced that it would begin to regulate e-cigarettes in the same way as other tobacco products. What effect this will have on the industry is unclear, but early analysis suggests that it will hurt many of the small shops that have been at the forefront of the products' growth.[18]

The purpose of this paper is to expand on the work of Tan and Bigman[19] to examine trends in e-cigarette awareness and beliefs about harm among various U.S. demographic groups, and whether the awareness levels and harm perception of e-cigarettes are associated with quit attempts or quit intentions for smokers. The Tan and Bigman[19] study employed a cross-sectional approach, and the analysis helped to determine early measures of e-cigarette perceptions. However, recently available data make identifying trends and changes in awareness and beliefs regarding e-cigarettes possible. Trend analysis is particularly relevant for the topic of e-cigarettes, given the growth of the industry, advertising campaigns, and media attention it has received. The results of this paper can inform public health efforts to understand discrete groups' attitudes and beliefs about e-cigarettes and help to estimate the potential health impacts of the e-cigarette on at-risk populations.

METHODS

The analysis for this study was completed in two steps. First, a replication of the earlier cross-sectional analysis completed by Tan and Bigman[19] was conducted. This analytic model was then extended across time to identify trends in e-cigarette awareness and beliefs about their potential harmful health effects. Replicating prior research is an important step in the scientific process that has received significant attention,[20] and is considered a "best practice" in health research prior to extension.[21]

Data Sample

Data for this replication and extension study were taken from the Health Information National Trends Survey (HINTS). HINTS is a National Cancer Institute–sponsored annual survey of American households, using a stratified nationally representative sample to explore the public's use of cancer-related information. The National Cancer Institute began administering HINTS biennially in 2003. For this study, the fourth version of HINTS (HINTS 4) was used, which was administered in three separate cycles: 2012, 2013, and 2014. For each of these cycles, data were collected using a postal address frame and a mailed questionnaire. The mailed survey employed a stratified probability sample of the U.S. adult, civilian, non-institutionalized population.[22]

Measures

A single item of interest was used across the three cycles of HINTS 4 (2012, 2013, and 2014) to gauge respondent awareness and perception of potential harm from e-cigarettes: *New types of cigarettes are now available called electronic cigarettes (also known as e-cigarettes or personal vaporizers). These products deliver nicotine through a vapor. Compared to smoking cigarettes, would you say that electronic cigarettes are … much less harmful/less harmful/just as harmful/more harmful/much more harmful/I've never heard of electronic cigarettes?*

Data from the three cycles of HINTS survey data were recoded into two dichotomous variables. The first variable sought to compare the sociodemographic factors related to those who were unaware of e-cigarettes (defined by those who answered *I've never heard of electronic cigarettes*) versus those who had some awareness of e-cigarettes. For ease of interpretability, this variable was reverse coded so that those who are aware of e-cigarettes had a positive response. The second variable sought to categorize harm perceptions of e-cigarettes into less harmful versus equally or more harmful, among those with a familiarity of e-cigarettes.

Coding for respondents' status as smokers, former smokers, and non-smokers was replicated in all three data sets. Smoking status was defined in the same manner for this study and the original study, defining non-smokers as those who have smoked <100 cigarettes during their lifetime, current smokers as those who have smoked >100 cigarettes and are still smoking every day or most days, and former smokers as those who have smoked ≥ 100 cigarettes in their lifetime and are not smoking now. For comparability and consistency, sociodemographic variables (gender, age, race/ethnicity, income, and education) were aggregated into categories used in the original Tan and Bigman study.[19]