



Short Communication

E-cigarette use and disparities by race, citizenship status and language among adolescents

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HIGHLIGHTS

- 10.3% of adolescents ever used e-cigarettes.
- Foreign-born individuals were less likely to have used e-cigarettes.
- Those who spoke English-only at home more likely to have used e-cigarettes.
- Whites were more likely to have used e-cigarettes, relative to Latinos.
- Predictors of e-cigarette and cigarette use varied.

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ABSTRACT

Introduction: E-cigarette use among adolescents is on the rise in the U.S. However, limited attention has been given to examining the role of race, citizenship status and language spoken at home in shaping e-cigarette use behavior.

Methods: Data are from the 2014 Adolescent California Health Interview Survey, which interviewed 1052 adolescents ages 12–17. Lifetime e-cigarette use was examined by sociodemographic characteristics. Separate logistic regression models predicted odds of ever-smoking e-cigarettes from race, citizenship status and language spoken at home. Sociodemographic characteristics were then added to these models as control variables and a model with all three predictors and controls was run. Similar models were run with conventional smoking as an outcome.

Results: 10.3% of adolescents ever used e-cigarettes. E-cigarette use was higher among ever-smokers of conventional cigarettes, individuals above 200% of the Federal Poverty Level, US citizens and those who spoke English-only at home. Multivariate analyses demonstrated that citizenship status and language spoken at home were associated with lifetime e-cigarette use, after accounting for control variables. Only citizenship status was associated with e-cigarette use, when controls variables race and language spoken at home were all in the same model.

Conclusions: Ever use of e-cigarettes in this study was higher than previously reported national estimates. Action is needed to curb the use of e-cigarettes among adolescents. Differences in lifetime e-cigarette use by citizenship status and language spoken at home suggest that less acculturated individuals use e-cigarettes at lower rates.

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1. Introduction

Use of electronic cigarettes (i.e. e-cigarettes) among adolescents in the U.S. is becoming increasingly common. Between 2011 and 2012, the percentage of adolescents who had ever tried e-cigarettes more than doubled from 3.1% to 6.5% (Dutra & Glantz, 2014). During that same time, current use increased from 1.1% to 2.0% (Dutra & Glantz,

2014) and has continued to increase since (Barnett, Soule, Forrest, Porter, & Tomar, 2015). This parallels a more than two-fold increase in adolescent exposure to televised e-cigarette advertisements between 2011 and 2013 (Duke et al., 2014), which is important considering exposure to pro-tobacco marketing is associated with increased e-cigarette use and intent to use among adolescents (Agaku & Ayo-Yusuf, 2014; Farrelly et al., 2015).

The health effects of e-cigarettes are of growing concern. E-cigarettes are aerosolized nicotine and produce a vapor; this vapor may contain chemicals such as propylene glycol, glycerol and flavoring

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(Yamin, Bitton, & Bates, 2010). E-cigarette vapor contains many of the harmful toxins found in conventional cigarettes, including formaldehyde, acetaldehyde, cadmium, lead and others, although frequently at lower levels (Goniewicz et al., 2014; Harrell, Simmons, Correa, Padhya, & Brandon, 2014). Currently, e-cigarettes are only regulated by the Food and Drug Administration if they are being marketed for therapeutic use (U.S. Food and Drug Administration, 2015), leaving the federal government with limited ability to curtail potential harm. While there is limited research on the long-term impact of e-cigarette use, short-term impacts have been documented including impaired respiratory function (Callahan-Lyon, 2014).

E-cigarettes also pose harm to adolescent health because they are strongly associated with use of combustible tobacco products. Over 80% of e-cigarette smokers have used conventional cigarettes (Camenga et al., 2014; Chapman & Wu, 2014) and e-cigarette use is associated with increased odds of using hookah (Camenga et al., 2014), indicating a large overlap between users of e-cigarettes and other tobacco products. Among adults and adolescents, e-cigarettes are seen as a safer alternative to cigarettes and potential cessation aid (Ambrose et al., 2014; Amrock, Zakhar, Zhou, & Weitzman, 2015; Camenga et al., 2015; Choi & Forster, 2013), despite the inconsistent evidence of the veracity of these beliefs (Brown, Beard, Kotz, Michie, & West, 2014; Grana, Popova, & Ling, 2014). Simultaneously, e-cigarettes may function as a gateway to conventional cigarette use (Kmietowicz, 2014). Specifically, using e-cigarettes more than doubles the intent to smoke conventional cigarettes among adolescents (Bunnell et al., 2015), and smoking e-cigarettes predicts future conventional cigarette use (Leventhal, Strong, & Kirkpatrick, 2015). Given that e-cigarettes have higher up-front costs, e-cigarettes have to be used for almost two months before the costs match those of conventional cigarettes (Vinik, 2014). As a result, financial motivations may incentivize a switch from e-cigarettes to conventional cigarettes. Finally, some have argued that increased use and acceptance of e-cigarettes may cause harm by making traditional cigarette smoking socially acceptable (Fairchild, Bayer, & Colgrove, 2014; Schraufnagel et al., 2014).

Despite the concern over e-cigarettes among adolescents, limited research has examined disparities. Currently, racial disparities in e-cigarette use exist, with minorities having lower odds of e-cigarette use than whites (Dutra & Glantz, 2014; Lippert, 2014). However, much of the research has focused on making comparisons between blacks and whites (Dutra & Glantz, 2014; Lippert, 2014). To date, the impact of citizenship status and language spoken in the household has been overlooked. These are important oversights given the multilingual and immigrant populations in the U.S. These constructs can measure facets of acculturation, which has been associated with conventional smoking behaviors (Baluja, Park, & Myers, 2003; Gorman, Lariscy, & Kaushik, 2014). Thus, this study will address these shortcomings by exploring whether or not race, citizenship status, and language spoken at home influence e-cigarette use among adolescents and also examine if these associations differ for conventional cigarette use.

2. Materials and methods

2.1. Data source

Data come from the 2014 Adolescent California Health Interview Survey (CHIS). This cross-sectional telephone survey of California adolescents, ages 12–17, was administered in English, Spanish, Mandarin, Cantonese, Vietnamese, Korean, and Tagalog and was designed to be representative of California adolescents living in households (California Health Interview Survey, 2015). CHIS includes replicate weights and adjustments to account for differential selection probabilities, non-response bias, and stratification (California Health Interview Survey, 2015). Overall, 1052 adolescents completed the survey. A response rate of 37.2% was achieved, which is comparable to other population-based telephone surveys (California Health Interview

Survey, 2015). Missing data were imputed using hot deck imputation by CHIS investigators (California Health Interview Survey, 2015). Data were publically available and did not require IRB approval.

2.2. Variables

The main outcome of interest was whether or not respondents had ever used e-cigarettes in their lifetimes (yes versus no). Race, citizenship status and language spoken at home were included as demographic predictors in analyses. Race/ethnicity was measured using a series of dummy variables (i.e. non-Latino white, non-Latino Asian, non-Latino other race and Latino). Citizenship status was measured using three categories: US citizen, naturalized citizen and non-citizen. Language spoken at home was measured using a dichotomous measure (English-only versus any language other than English with or without English also being spoken). Non-Latino whites, US citizens, and individuals living in a home with any language other than English spoken served as the respective reference categories in analyses. For bivariate analyses, secondary school type was examined as a predictor. Secondary school type was measured using three categories: middle school or lower, high school and not attending school/other.

Gender, age, household poverty level, and conventional cigarette use were included as control variables in multivariate analyses. Males served as the reference group for gender. Age was measured continuously. Poverty level was measured using a dichotomous measure, with those under 200% of federal poverty level (FPL) serving as the reference group. For conventional smoking, never smokers served as the reference category.

2.3. Analyses

All analyses were conducted using Stata 14.0 and using replicate weights, as appropriate. Univariate statistics (i.e. means and frequencies) were run for all measures. The percentage of lifetime e-cigarette users was calculated for each of the categorical demographic predictors and control variables. Chi-squared tests were used to determine if e-cigarette use was associated with each variable. For age, a t-test was performed to compare average age among e-cigarette ever and never users, in addition to comparing usage rates by race using a chi-squared test. Three separate binary logistic regression models were run to predict odds of e-cigarette from race, citizenship status and language spoken at home. The same models were then fitted with conventional cigarette smoking, age, gender and poverty level as control variables. These three models were then replicated, with ever use of conventional cigarette smoking as an outcome, and e-cigarette use as a control.

3. Results

Among the sample, 10.31% and 6.99% of respondents used e-cigarettes and cigarettes in their lifetimes, respectively. As Table 1 shows, lifetime e-cigarette use was more common among ever-smokers of traditional cigarettes as compared to never smokers of traditional cigarettes (47.09% versus 7.54%; $p < .001$). Lifetime e-cigarette users were older than never users ($p < .05$). When e-cigarette use rates were examined by age, 12 to 17 year olds had rates of 5.95%, 7.70%, 5.35%, 9.37%, 20.49% and 12.58% respectively ($p < .05$). Overall, race and secondary school type were not associated with lifetime e-cigarette use. Lifetime e-cigarette use was more common among adolescents living in households over 200% of FPL (13.69% versus 6.77%; $p < .01$). Citizenship status was associated with lifetime e-cigarette use ($p < .01$). Specifically, US citizens had the highest rates (11.44%) and non-citizens had the lowest rates (1.46%; $p < .01$). Those who lived in homes where only English was spoken had higher rates of lifetime e-cigarette use than those who lived in homes where any language other than English was spoken (13.89% versus 6.76%; $p < .05$).

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