



## Soda intake and tobacco use among young adult bar patrons: A cross-sectional study in seven cities

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### ABSTRACT

Young adults are among the greatest consumers of sugar sweetened beverages, and they also have high smoking rates. However, few studies address the relationship between these risk behaviors; this study examined the relationship between soda consumption and smoking among young adult bar patrons, a high-risk understudied population. A cross-sectional survey of young adult bar patrons (between January 2014 and October 2015) was conducted using randomized time location sampling (N = 8712) in Albuquerque, NM, Los Angeles, CA, Nashville, TN, Oklahoma City, OK, San Diego, CA, San Francisco, CA, and Tucson, AZ. The survey found the prevalences of daily regular soda intake ranged from 32% in San Diego to 51% in Oklahoma City and current smoking ranged from 36% in Los Angeles, CA to 49% in Albuquerque, NM. In multinomial multivariate models with no soda consumption as the reference group and controlling for demographics and location, non-daily (OR = 1.24, 95% CI = 1.05, 1.47) and daily smokers (OR = 1.34, 95% CI = 1.08, 1.66) were both more likely to drink regular soda compared to not drinking any soda. No effects were found for diet soda consumption. These linked risks suggest that comprehensive health promotion efforts to decrease sugar sweetened beverage consumption and tobacco use, among other risky behaviors, may be effective in this population.

### 1. Introduction

To reduce risk for nutrient inadequacy, unhealthy body weight, and chronic disease, the 2015–2020 Dietary Guidelines for Americans recommend a shift to healthier eating patterns that limit daily consumption of added sugars to < 10% of daily calories (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2016). Young adults consume 50–60% more added sugars than these recommendations (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2016). Average daily added sugars intake as a percent of calories in young adult males aged 19 to 30 is 15%, and in young adult females aged 19–30 it is 16% (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2016). Young adults are also among the greatest consumers of sugar-sweetened beverages (SSB) (Dietary Guidelines Advisory Committee, 2015), which account for almost half of all added sugars consumed by the U.S. population (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2016). High SSB intake in young adults is strongly associated with race, education, and economic factors

(Han and Powell, 2013; Park et al., 2016a, 2016b), has been shown to vary by geographic location (Park et al., 2016a, 2016b), and to be associated with other high-risk behaviors such as low physical activity (Kristal et al., 2015; Park et al., 2016a, 2016b), smoking (Kristal et al., 2015; Park et al., 2016a, 2016b), and alcohol intake (Park et al., 2016a, 2016b). Soda is the most heavily consumed SSB by young adults (Han and Powell, 2013).

Young adulthood is a period between adolescence and adulthood that includes many transitions during which healthy behaviors may be encouraged or disrupted (Arnett, 2000). Health behavior change programs for young adults have primarily targeted college campuses; however, young adults not attending college display risky behaviors at similar or higher levels than college students (Oesterle, 2013). Bars and nightclubs attract young adults who did not attend or dropped out of college, in addition to college students and college graduates, and interventions in these venues are an efficient way to reach high risk individuals (Fallin et al., 2015). Risky behaviors in young adults often occur (Hair et al., 2009). No study, to our knowledge, has examined SSB intake in young adult bar patrons.

Abbreviations: SSB, sugar-sweetened beverage; MCAR, missing completely at random; FIML, full information maximum likelihood; BRFS, Behavioral Risk Factor Surveillance System

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Smoking is a marker for other unhealthy behavior patterns. For example, among those with illicit substance use disorders, smokers are more likely to choose riskier routes of drug administration (Harrell et al., 2012). Among those with chronic health conditions, those who are smokers are more likely to be non-compliant with medical recommendations (Sherman and Lynch, 2014). In the present study, we compared the association between soda consumption and smoking among young adult bar patrons in seven different regions of the US: Nashville, TN, Oklahoma City, OK, Albuquerque, NM, Tucson, AZ, San Diego, CA, Los Angeles, CA, and San Francisco, CA.

## 2. Method

### 2.1. Participants and procedure

Data was analyzed from one wave of the National Party Culture Study, a large study of tobacco use among young adult bar patrons collected between January 2014 and October 2015. Methods have been described elsewhere (Lisha et al., 2016; Thrul et al., 2016), and were originally developed as a way to reach under-studied populations in the locations they frequent (Lee et al., 2014; Ling et al., 2014). In brief, time-location sampling was used to generate a sample of young adults from bars in Albuquerque, Los Angeles, Nashville, Oklahoma City, San Diego, San Francisco, and Tucson. Using a well-established methodology (Magnani et al., 2005; Muhib et al., 2001), venues, dates, and times were randomly selected from a list of bars and clubs frequented by young adults in each city. The research team worked with marketing consultants with expertise in young adult nightlife to identify party promoters, DJs, and other entertainers and opinion leaders in each of the cities to create a census of bars and nightclubs popular among young adults. In addition, focus groups with young adult bar patrons were used to identify additional venues and to validate which venues were popular. The process of generating and validating the list of bars was iterated multiple times until saturation was achieved (no new popular venues were named by respondents beyond those already listed). Venues, dates and times for survey administration were randomly selected from the lists in each city. Eligible participants (present in bar at randomly selected time, age 18–26, and not visibly intoxicated) were approached to fill out a paper survey and receive a \$5 incentive (response rate 77%). Staff were mainly young adults (under 30 years old) comfortable working in a bar environment, and all received training on survey methods, human subjects research, and completed supervised field trials for data collection. Lastly, “secret shoppers” were used to monitor adherence to data collection protocols. All study procedures were reviewed and approved by the Committee on Human Research (institutional review board) at the University of California San Francisco.

### 2.2. Measures

In order to minimize survey respondent burden while allowing for a greater number of questions to be asked, the surveys used a planned missing data three-form design - a set of core questions were asked of all participants, while another set of items was asked only to two-thirds of participants (Graham et al., 2006).

### 2.3. Demographics

Demographic variables were asked of all participants including age (calculated from date of birth), sex (male vs. female), self-reported sexual orientation (dichotomized into “straight” vs. any other sexual orientation), education (in college, college graduate, college dropout/never attended college), and race/ethnicity. Race/ethnicity was determined by 2 questions: “Are you of Hispanic/Latino, or Spanish origin?” and “What is your race?” and responses were combined to create 4 categories (non-Hispanic Black, non-Hispanic White, non-

Hispanic Other, Hispanic).

### 2.4. Tobacco

All participants were asked “During the past 30 days, on how many days did you: Smoke at least one cigarette?” Current smokers were those who reported any cigarette use in the last 30 days. Current smokers were divided into daily (smoked on 30 of the past 30 days) and non-daily smokers (smoked on 1–29 of the past 30 days) (Kalkhoran et al., 2016; Lisha et al., 2016).

### 2.5. Main outcome: soda variables

Two items, “On average how many cans or bottles of SODA do you drink EACH DAY?” and, “Is most of the soda you drink diet or regular?” were combined to create our 3-level outcome variable indicating whether people were soda drinkers, diet soda drinkers or did not drink any soda. Individuals were considered to be soda drinkers if they indicated that they drank at least one soda per day on average. These items were part of the three-form design and therefore were only asked of two-thirds of the participants.

### 2.6. Analytical plan

First, descriptive statistics were used to characterize the overall sample, and by soda drinking status. Next, univariate analyses examined differences on all the variables between soda consumption category. This portion of the analysis was completed using SAS (SAS Institute, 2008). Lastly, multinomial logistic regression models were fitted using the 3-level soda consumption category as the outcome variable with “no soda” as the reference category. Independent variables included smoking behavior, sociodemographics, and the city where the data was collected. Analysis was completed using *Mplus* (Muthén and Muthén, 2007). Missing data was handled using full information maximum likelihood (FIML), which allows all observations to be used. Due to the three-form planned missing design we can assume the data was missing completely at random (MCAR) (Graham et al., 2006). Data from all the variables in the model is used to create estimates so that no observations are dropped. In this method, missing values are not replaced or imputed, but the missing data is handled within the analysis model. The FIML method has been shown to produce more accurate estimates in model estimations by adjusting for the uncertainty caused by missing data (McArdle and Hamagami, 1992).

## 3. Results

### 3.1. Sample characteristics

The current study included 8712 participants. Overall the samples were evenly split between males and females and the mean age was approximately 23 years old (Table 1). Race/ethnicity reflected the population in different cities, with more Hispanics in Albuquerque, Los Angeles, San Diego and Tucson and more Asians in Los Angeles and San Francisco. The sample included a range of educational backgrounds, with 22.9% reporting no college, 42.1% reporting that they were currently in college and 35.0% reporting that they were college graduates. The sample was mainly heterosexual (81.9%), though the number of non-heterosexual participants was much higher than the 6.4% national prevalence of 18 to 29-year-olds identifying as LGBT (Gates and Newport, 2012). Overall, approximately 57% of the participants reported daily soda intake; rates of daily diet soda intake ranged between 9% in San Diego to 23% in Oklahoma City and regular soda intake, between 32% in San Diego to 51% in Oklahoma City. Rates of current (past 30 day) smoking ranged from 36% in Los Angeles to 49% in Albuquerque. Among smokers, 30% were daily smokers, ranging from 24% in San Diego to 44% in Oklahoma City.

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