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Susceptibility, Trial, and Current Use Prevalence of Cigarettes, E-cigarettes, Cigars, Snus, and Snuff Products in Mexican-Americans Adults at Texas-Mexico Border

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Authors

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ABSTRACT

Introduction: US tobacco prevalence estimates often combine Hispanic subgroups, distorting a precise view of specific tobacco use patterns across culturally, geopolitically, and even genetically diverse ethnicities. National and regional data are commonly discordant given the variation in Hispanic samples, and often do not include non-cigarette tobacco product prevalence. Cameron Country Hispanic Cohort (CCHC) participants at the Texas-Mexico border provide a unique opportunity to observe tobacco use patterns in an ethnically homogenous Mexican-American population.

Methods: 1,672 CCHC participants completed questionnaires examining susceptibility (open to use), trial (ever-use), and current use (past 30-day use) of cigarettes, e-cigarettes, cigars, snus, and snuff products. The present study reports cross-sectional prevalence for each tobacco product outcome and examines demographic associations.

Results: Susceptibility was associated with young age for all products, highest in never-users of e-cigarettes, among which 15% of those aged 18-29 were susceptible. Susceptibility in never-users of e-cigarettes, snus, and cigars was associated with US-acculturation. Over half of participants had tried cigarettes, and ever-users of all products were more likely male. Logistic regression found e-cigarette trial was associated with young age and higher educational attainment, US-acculturation, and being single. Nearly one in five participants currently use cigarettes, while current use for each other product remains under 3%.

Conclusions: Prevalence of current tobacco use - chiefly from cigarettes - is higher in our sample than in national estimates for Mexican-Americans, and while a significant portion have tried cigars and e-cigarettes, overall current use of non-cigarette tobacco products is low in our sample.

INTRODUCTION

Tobacco use in any form is known to increase risk for both heart disease and cancer (Piano et al., 2010, Lushniak, Samet, Pechacek, Norman, & Taylor, 2014) the two most common causes of death among Hispanic Americans (Dominguez et al., 2014). In 2019, the Centers for Disease Control and Prevention estimated that 8.8% of adults of Hispanic/Latino descent reported current use of cigarettes (Cornelius, Wang, Jamal, Loretan & Neff, 2020). However, when examining Americans of Mexican heritage specifically, this prevalence rose to 19.1% (Martell, Garrett & Caraballo, 2016). Prevalence of smokeless forms of tobacco (specifically chewing tobacco and snuff) in Hispanic Americans is estimated to be 0.5% in adults and 2.4% among middle and high school students (Cornelius, Wang, Jamal, Loretan & Neff, 2020; Wang et al. 2019). However, these estimates were based on all Hispanics and therefore may not accurately represent patterns of use among specific subgroups of Hispanics, such as Mexican Americans, among whom there are distinct patterns of tobacco use (Martell, Garrett & Caraballo, 2016).

Electronic cigarettes (e-cigarettes) entered the market in 2007 and rapidly gained in popularity, especially among young adults (Gilreath et al., 2016). E-cigarettes, along with cigars, cigarillos, hookah, and snus products, have become increasingly popular in recent years, and pose significant health threats to users (Rom, Pecorelli, Valacchi & Reznick, 2015). National data from 2012-14 indicate that among Hispanics overall, daily use of e-cigarettes is lower compared to all other ethnic groups in the United States (Sharapova, Singh, Agaku, Kennedy & King, 2018), while regional studies suggest that trial of e-cigarettes among Hispanics is similar to that of their non-Hispanic white peers and higher than among non-Hispanic blacks (Webb, Hooper & Kolar, 2016). Such divergent results may be attributed in part to these studies examining Hispanics as a whole, rather than as subgroups of Hispanics (e.g., Mexican American vs. Cuban American), among whom there are distinct patterns of tobacco use (Martell, Garrett & Caraballo, 2016).

Lower socioeconomic (SES) groups and ethnic minorities, including Mexican Americans, have been a target of tobacco advertising since the 1980s (Yerger, Przewoznik & Malone, 2007), which exerts one of the strongest influences on both the uptake and continued use of tobacco products (Lushniak, Samet, Pechacek, Norman & Taylor, 2014). As a result, Mexican Americans are disproportionally affected by tobacco-related health disparities (Benowitz, Blum, Braithwaite & Castro, 1998). Moreover, recent evidence suggests this pattern has not changed:

Mexican American non-smokers still report higher exposure to tobacco marketing compared to non-Hispanic whites (Rose, Anesetti-Rothermel, Elmasary & Niaura, 2017), and exposure to e-cigarette marketing via internet and social media (Harrera, Wilkinson, Cohn, Perry & Fisher-Hoch, 2018) among Mexican Americans is associated with e-cigarette use. A better understanding of current tobacco use patterns, including e-cigarette, smokeless, and cigar product use among this vulnerable population is necessary to guide development of interventions to prevent the uptake of these products by susceptible individuals and to inform the development of cessation programs and campaigns among users.

The Cameron County Hispanic Cohort (CCHC) in South Texas is a representative sample of Mexican Americans located across three border cities. The CCHC provides a unique perspective on the health status of a traditionally high-risk, low-income, difficult-to-reach ethnic group that is understudied and underrepresented in national cohort data (Fisher-Hoch et al., 2010). This population provides a view into the tobacco behaviors of an ethnic group with international influences and a unique bi-cultural perspective. Cameron County lies on the US-Mexico border within one of the poorest regions in the United States with a median household income of $38,800 and a 25.5% poverty rate (United States Census Bureau, 2019). The primary purpose of the CCHC is to measure the burden of obesity and diabetes in Cameron County and the surrounding areas, as well as potential risk factors, means of access to health services, and related conditions (Fisher-Hoch et al., 2010).

In 2015, the CCHC's tobacco use survey was expanded to include four tobacco products (e-cigarettes, cigars/cigarillos, chewing tobacco/snuff, and snus) in addition to cigarettes. New and follow-up participants detailed their use patterns of these five products, providing a unique opportunity to examine patterns of tobacco product use in this ethnically homogenous sample. Thus, the present study utilizes these data to estimate the prevalence of susceptibility to use, along with ever and current use, of the five tobacco products among adults aged 18 and over in select counties along the Texas-Mexico border. Associations between demographic characteristics and susceptibility and trial of the five tobacco products also are examined.

METHODS

Study Sampling and Design

Participants in this study are drawn from the ongoing CCHC in three Texas cities (Brownsville, Laredo, and Harlingen). These cities are situated on or close to the Texas-Mexico border with predominantly

Mexican American populations. Ongoing since 2004, the CCHC now consists of 4,800 participants recruited using a two-stage cluster sampling frame of households in randomly selected census blocks mainly from the first to third quartiles of socio-economic status (SES), as determined by the 2000 or 2010 US Census according to the enrollment date (Fisher-Hoch et al., 2010; Watt et al., 2016). All members of these census blocks were invited to participate in the CCHC, visiting the clinical research units (CRU) where laboratory, clinical, socio-demographic, and behavioral measures were assessed in the participant's primary language (Fisher-Hoch et al., 2010).

In 2015, items probing tobacco use were revised to reflect changes in regularly available tobacco products. The revised measures were given to newly recruited participants at baseline as well as to existing participants during their 5 to 10-year follow-up visit. The present analysis is cross-sectional and is based on four years of participant data (January 2015 to December 2018), a subset of 1,672 adults aged 18 years and over that received and completed the tobacco use questionnaire and other demographic and household questionnaires. While the overall initial response rate for the CCHC is 71% (Fisher-Hoch et al., 2010), the current analytic sample includes 34.8% of all participants. On the average, the participants in the current sample are older, more educated, more likely to be married, widowed, and/or retired. Additionally, more were born in and completed their education in Mexico, and more respondents speak Spanish as their primary language, compared to CCHC participants that were not included in the analysis. The study protocols were approved by the University of Texas Health Science Center at Houston (UTHealth), Committee for the Protection of Human Subjects (CPHS). Participants signed the consent form for their study participation at each study visit.

Measures

Products examined in the analysis included cigarettes and four categories of alternative tobacco products: e-cigarettes, cigar products (cigars, cigarillos or filtered cigars), snus (orally used tobacco in pouches), and snuff products (loose, moist, orally used tobacco often called "dip" or "chew"). We examined three tobacco-related outcomes: susceptibility to use, ever-use (trial), and current use for each of the five tobacco products. Overall prevalence for each outcome and product type was calculated, as well as prevalence of the outcomes by demographic categories.

"Susceptibility to tobacco product use" is a three-item construct that combines behavioral intentions with peer influence (Pierce, Choi, Gilpin, Farkas & Merritt, 1996) and is a strong and consistent predictor of

cigarette and other tobacco product use among those who have never used the products (Carey, Wilkinson, Harrell, Cohn & Perry, 2018; Spelman et al., 2009). Items include: “Do you think that you will try the following products soon?”, “Do you think you will be smoking any of the following products a year from now?”, and “If one of your best friends were to offer you any of the following products, would you smoke it?” Among never-users, participants who respond “definitely not” to all three items were classified as not susceptible to use of that product. Those responding “yes” to at least one item were classified as susceptible to the product.

Individuals who responded “yes” to “Have you tried [the product], even a puff or two?” were classified as ever-users for each type of product. “Current use” was defined as having used the product “every day” or “some days” in the past 30 days.

Demographic variables examined included gender, age, level of education, primary language spoken, country of birth, country of education, marital status, and employment status. Gender was reported as male or female, and participant age at the time of the interview was categorized into four age groups (18-29 years, 30-44 years, 45-59 years, and 60+ years), as well as examined continuously.

Educational attainment was examined in four categories: individuals whose highest academic years completed were 6th grade or below, those completing between 7th and 11th grade, those that completed high school or obtained their GED, and those who reported any amount of higher learning. Educational attainment was also assessed in continuous years, coded from 0 (no education) to a maximum of 20 (four years postgraduate experience or higher).

Primary language spoken was determined based on which language participants used to complete the questionnaire. Country of birth and country of education were examined separately as proxies for acculturation as both are validated measures (Cruz, Wilkinson, Bondy & Koehly, 2012). While these variables overlap considerably, 15% of participants reported completing the majority of their education in a country in which they were not born.

Marital status was reported as either single, married, divorced/separated, or widowed at the time of the interview. Employment status at the time of the interview was determined using data collected regarding retirement age and current job status. Participants were classified into one of four groups: working full time, working part time,

retired, and a combination of those that reported being unemployed, never working, and other.

Statistical Methods

Unweighted and weighted proportions of participant demographics were reported, and for continuous variables (age and educational attainment), weighted means were reported (Table 1). Four-year weighted prevalence estimates were calculated for those individuals who reported as susceptible to each product, had ever used each product, and currently used each product at the time of the interview (Table 2). Sampling weights were applied to account for age and sex imbalances to help the analysis to be more representative of the populations of three Texas-Mexico border cities (Brownsville, Harlingen, and Laredo). All percentages reported in the text are weighted unless otherwise specified.

Rao Scotts Chi-square tests were used to examine associations between the categorical variables and susceptibility (Table 3), ever-use (Table 4) of the five products types. Weighted proportions of non-missing data are reported along with 95% confidence intervals (CI) for the percent of individuals who reported as susceptible to use, as ever-users of, or current users of each product type. Confidence intervals for weighted percentages were calculated using the Agresti-Coull method (Dean & Pagano, 2015), provided there was at least one participant with an affirmative response. Logistic regression was used to obtain odds ratios (OR) for susceptibility, trial, and current use, adjusted for gender, age, level of education, and country of education. ORs and 95% CIs are reported in the text only.

Current use or past 30-day use of alternative tobacco products was low for each product examined [(e-cigarettes (*n*=17), cigars (*n*=32), snus (*n*=1), and snuff (*n*=0)], and thus additional analyses by demographic factors were not conducted. Due to low sample sizes, categorical analyses of demographic variables are not reported for susceptibility to cigarettes given never trying them (*n*=34), or for ever-use of snus products (*n*=15).

Finally, many comparisons were made, and statistically significant associations may best be regarded as exploratory. Missing data accounted for less than 3.5% of observations for all analyses. Statistical significance level was set at $\alpha=0.05$ and all statistical analyses were conducted in Stata 15.1 (StatCorp, 2017).

RESULTS

Demographics

The final sample consisted of 1,672 study participants which extrapolated to a population of 160,692 (Table 1). After sampling weights

were applied, 57.8% of the participants were women, and the mean age was 47.1 years (range: 18 to 94 years). Spanish was the primary language, as 59.3% of participants prefer to use Spanish rather than English. Over half (54.2%) the participants were born in Mexico. The majority (62.4%) had completed high school or obtained their GED, with just under half of the population completing their education in Mexico (48.8%). Over half (61.2%) of the population reported being currently married, 24.1% were single, 9.3% divorced, and 5.5% widowed at the time of the interview. Working individuals made up just over half of the population (52.1%), 15.6% of the population was retired, and the remaining 32.4% were unemployed, had never worked, or could not work for other reasons.

Susceptibility

Overall, 3.8% (95% CI: 2.2–6.5) of participants were susceptible to using cigarettes, 7.1% (95% CI: 4.9–10.3) to e-cigarettes, 5.4% (95% CI: 3.6–8.0) to cigar products, 6.4% (95% CI: 4.2–9.7) to snus products, and 6.4% (95% CI: 4.2–9.5) to snuff products (see Table 2).

As can be seen in Tables 3a and 3b, males reported higher rates of susceptibility (range: 5.7% – 7.3%) than females (range: 4.8% – 7.0%) for each tobacco product, although the differences were not statistically significant. Males had significantly greater odds for susceptibility to all non-cigarette products (e-cigarettes OR: 1.84 (95% CI: 1.21–2.79), cigars OR: 1.91 (95% CI: 1.18–3.09), snuff OR: 1.98 (95% CI: 1.27–3.08), and snus OR: 2.09 (95% CI: 1.3–3.28)) compared to females (data not shown).

Across all products, susceptible individuals were on average 7.9 years younger than non-susceptible individuals. The highest rates of susceptibility were found in the youngest age group (18 to 29 years) across all tobacco product types, with statistically significant differences in e-cigarettes ($p<.01$) and cigars ($p<.05$). Age was significantly inversely associated with susceptibility to e-cigarettes (OR: 0.75, 95% CI: 0.61–0.93; data not shown).

Participants who primarily speak English were over two times more likely to be susceptible to use of e-cigarettes ($p<.05$), cigars ($p<0.001$), and snus ($p<.05$) but not snuff ($p>.05$) products. Participants born in the US were more susceptible to alternative types of tobacco products, but these differences were minimal and not significant. Individuals that obtained the majority of their education in the US were nearly twice as susceptible to the use of every type of tobacco product than those educated in Mexico, with findings significant in e-cigarette and snus ($p<.05$

for both) products. Those who competed their education in Mexico reported decreased susceptibility to all non-cigarette products (e-cigarettes OR: 0.54 (95% CI: 0.33–0.89), cigars OR: 0.48 (95% CI: 0.27–0.85), snuff OR: 0.51 (95% CI: 0.30–0.87), and snus OR: 0.52 (95% CI: 0.31–0.89)) compared to those who completed their education in the US (data not shown).

Higher levels of education offered a slight protective effect against susceptibility to all tobacco products, but was only significant against snuff susceptibility (OR: 0.77, 95% CI: 0.61–0.98; data not shown). Single individuals were significantly more susceptible to use of cigar products than married, divorced, or widowed participants ($p<.05$), but no other associations between marital status and product susceptibility were found. Participants that were employed part time had the lowest reported rates of susceptibility to the four alternative tobacco products however no associations with employment status were significant.

Ever Use

Overall prevalence of ever-use was 59.1% (95% CI: 53.1–64.8) for cigarettes, 10.1% (95% CI: 7.2–14.0) for e-cigarettes, 18.2% (95% CI: 14.1–23.2) for cigar products, 1.2% (95% CI: 0.6–2.2) for snus products, and 2.8% (95% CI: 1.6–4.8) for snuff products (see Table 2).

Males were significantly more likely than female participants to have ever tried each individual product type (cigarettes: $p<.001$, e-cigarettes, cigars, and snuff: $p<.01$; Tables 4a and 4b). Males also were more likely ($p<.001$) to have tried multiple products than females. Odds of ever use were significantly higher in males for each category of tobacco product than females (Cigarettes OR: 3.71 (95% CI: 2.97–4.64), e-cigarettes OR: 2.40 (95% CI: 1.62–3.56), cigars OR: 3.51 (95% CI: 2.55–4.83), snuff OR: 11.35 (95% CI: 3.93–32.77), and snus OR: 6.38 (95% CI: 1.79–22.83)). Age was inversely associated with ever-use of e-cigarettes, with younger participants significantly more likely to have tried the product (OR: 0.66, 95% CI: 0.54–0.80; data not shown).

Mean years of education in participants reporting having ever used the products were 11.4 (95% CI: 10.8–12.0) for cigarettes, 12.3 (95% CI: 11.4–13.2) for e-cigarettes, 11.9 (95% CI: 10.9–13.0) for cigars, and 11.8 (95% CI: 10.5– 13.0) for snuff products. Ever-use of cigarettes (OR: 1.11, 95% CI: 1.00–1.24) and cigars (OR: 1.21, 95% CI: 1.03–1.43) was found to be significantly associated with higher educational attainment (data not shown).

Primary language English speakers were significantly more likely to have ever tried e-cigarette ($p<.01$) and snuff products ($p<.05$) than

Spanish speakers, while cigarette and cigar trial varied little by primary language. Participants born in the US were significantly more likely than those born in Mexico to have ever tried e-cigarettes (13.3% US vs 7.1% Mexico, $p<.05$) and snuff products (4.8% US vs 1.3% Mexico, $p<.01$). Rates of ever-use for all products except cigarettes were lower in participants who were educated in Mexico, with snuff (OR: 0.26 95% CI: 0.10–0.70), and snus (OR: 0.24, 95% CI: 0.06–0.98) product use being significantly inversely associated (data not shown). Single participants were more likely to have tried e-cigarette products than married, divorced, or widowed participants ($p<.01$). No associations with employment status were found.

Current Use

The prevalence of current use of each of the product types are included in Table 2. The highest prevalence was observed for current use of cigarettes (18.6%); 1.3% currently use e-cigarettes, 2.3% currently use cigars, 0.03% currently use snus, and no participants reported currently using snuff.

Age was significantly inversely associated with current cigarette use (OR: 0.74, 95% CI: 0.64–0.88). Both cigarette (OR: 1.48, 95% CI: 1.09–2.02) and cigar (OR: 3.51, 95% CI: 1.61–7.62) current users were more likely to be male ($p<.01$; data not shown). Current users of cigarettes were more likely to be educated in the US, however this was not significant. Due to the low rates of current use, and small sample sizes within groups, further categorical analysis of demographic variables were not conducted for current use of the alternative tobacco products.

DISCUSSION

Susceptibility

Individuals in the youngest age group were the most susceptible to each of the tobacco products, consistent with findings in previous literature (Wang et al., 2019). Participants who spoke English, were born in, or educated in the US were overall more susceptible to use of tobacco products than those who primarily spoke Spanish or were born in or educated in Mexico. Current US national estimates (Trinidad et al., 2017) and longitudinal data (Kamke, Sabado-Liwag, Rodriquez, Perez-Stable & El-Toukhy, 2020) show that susceptibility to all tobacco products are higher in Hispanic youth than in non-Hispanic white youth, suggesting that US acculturation is a strong indicator of susceptibility, regardless of ethnicity, and that those situated along the Texas-Mexico border may have unique protective factors that reverse this increased susceptibility generally seen in Hispanic Americans. Product advertisement, health

education, tobacco laws, and many other factors are likely at play that increase susceptibility for those more accultured to the US, especially those aged 18-29 years.

E-cigarettes were the products that individuals were most susceptible to using if they had never tried them before. This may be due to e-cigarette use often being perceived as less harmful than traditional, combustible forms of tobacco use by young adults (Xu, Guo, Liu, Liu & Wang, 2016; Amrock, Lee & Weitzman, 2016), as well as the powerful influence of marketing of these products, which offers a more personalized user experience through the variety of appealing flavors and customization of nicotine content and batteries (Harrell et al., 2017; Villanti et al., 2017).

Tobacco companies use these perceptions and the lack of e-cigarette regulations to market e-cigarettes as safer, “cooler,” and more socially acceptable alternatives to smoking (Haardörfer et al., 2017; Padon, Maloney & Cappella, 2017), and target known susceptible markets such as college students, commonly using themes of freedom, independence, adventure, or success to appeal to a younger audience (Haardörfer et al., 2017; Padon, Maloney & Cappella, 2017). Accordingly, those more acculturated to the US may be more susceptible to tobacco products, possibly due to the abundance of print and web-based advertising in English, peer connections, or other sociocultural factors.

Ever Use

The results of our analysis exceed previously reported estimates of cigarette ever-use in Mexican Americans nationally (43.5% for men and 22.8% for women; e.g., Blanco et al., 2014; Perez-Stable et al., 2001) and in Texas (54.0% for men and 20.1% for women; e.g., Odani et al., 2018). Indeed, ever-use of each tobacco product was highest in male participants, more than double females in non-cigarette product categories. This is consistent with the majority of research suggesting that among Hispanics, males are the dominant consumer base of tobacco products (Wilkinson et al., 2005) and should be targeted for cessation programs and education regarding the harmful health effects associated with the products.

The prevalence of ever-use of cigar products in our sample is higher than reported estimates of lifetime use of cigars in Mexican men (8.8%) and women (< 1.0%; Kaplan et al., 2014). There are many demographic similarities between ever-users of cigarette and cigar products, including higher mean ages than observed in e-cigarette and snuff ever-users. This indicates a potential shift in preference of tobacco product trial by generation, suggesting that older individuals preferred to

have tried traditional, combustible forms of tobacco in the past, and are unlikely to try additional smokeless or e-cigarette products as they have emerged on the market. The youngest age group (18-29 years) is less likely to ever-use traditional, combustible cigarettes than other age groups, which is partially attributable to intense non-smoking campaigns targeted towards youth, but also to the growing popularity of e-cigarette products (Haardörfer et al., 2017; Padon, Maloney & Cappella, 2017).

More than one in five adults under the age of 30 had tried e-cigarettes, over two times more prevalent than in any other age group in our sample and higher than in national estimates reported for all Hispanic (11.5%) and non-Hispanic white (16.9%) US adults in 2018 (Villarroel, Cha & Vahratian, 2020). With traditional cigarette use decreasing in young adults both in our sample and across the nation (Cornelius et al., 2019), this clear association with younger age and e-cigarette trial is cause for concern. Individuals who may have otherwise never tried tobacco products are initiating use of e-cigarettes, likely as a result of the attractive variety of flavors available (Harrell et al., 2017; Villanti et al., 2017), customizability, and tobacco industry marketing that presents them as healthier, more socially acceptable alternatives to smoking (Haardörfer et al., 2017; Padon, Maloney & Cappella, 2017). When compared to the prevalence of smokeless product trial in our sample, it is clear that e-cigarettes, despite being the newest on the market out of the products examined, are responsible for a significant portion of tobacco trial in Mexican Americans, specifically among younger generations.

Apart from the strong association with young age, higher prevalence of e-cigarette trial was observed in participants who were male, born in the US, primarily spoke English, had some form of higher education, and were single. Nearly one in every three male participants in the youngest age group (18 to 29 years) reported trying e-cigarettes, compared to one in eight females of the same age. These associations closely align with susceptibility findings and define target demographics at which to aim education, prevention, and cessation campaigns. In Mexico, manufacturing, advertising, and sales of e-cigarette products is prohibited (Institute for Global Tobacco Control, 2019; Food & Drug Administration, 2019), which may serve as a protective factor against susceptibility and trial in individuals who have emigrated from Mexico.

Current Use

Current use of cigarettes in our sample is more prevalent than in recent estimates of current use in Mexican Americans (9.8%)[43] and Hispanic-Americans (10.1%) in 2017 US nationally representative

samples, and more similar to the rate of current use in non-Hispanic white Americans (15.7%-16.6%; Jamal et al., 2016). Comparatively, in Mexico, 2017 estimates of current cigarette use in adults were 16.3%, with 25.2% of males and 8.2% of females. These gender-based differences are similar to those found in our sample and other cohorts of Mexican heritage populations in the US (Wilkinson et al., 2005) which underscores the possibility that gender-based social influence transcends national borders. Mexican Americans living along the Texas-Mexico border are not following national declining trends in cigarette use, in part due to a unique combination of widespread product availability, targeted advertising campaigns (Yerger, Przewoznik & Malone, 2007), and sociocultural influences from Mexico that perpetuate trial and continued use of traditional tobacco products (Institute for Global Tobacco Control, 2019).

Non-cigarette current use, (under 3% for each product) suggests that while trial of these products is not insignificant, very few ever-users are currently consuming the products, indicating a preference towards cigarettes over e-cigarette, cigar, snus, and snuff products in our sample, and providing a clear target at which to focus cessation efforts.

Acculturation

Current evidence suggests that among Mexican American populations, the longer a person resides in US, the stronger the influence of mainstream US culture on a wide variety of behaviors (Barcenas et al., 2007). With regards tobacco use, this influence is evidenced through increased risk of becoming susceptible, ever using (Wilkinson et al., 2009), or becoming current users of cigarettes and other tobacco products with increased time spent in the US (Wilkinson et al., 2009). However, the border is a unique context, and continued research on macro-, socio-cultural- and individual-level influences on tobacco use in this population that contribute to the differences and similarities seen in tobacco-related behaviors between the US and Mexico is warranted to better characterize this unique population.

Limitations

Potential limitations of this study include the reliance upon self-reported tobacco use and susceptibility, which may introduce bias. While this analysis relies on cohort data, the four years of tobacco questionnaires provide a cross-sectional view of prevalence of use and susceptibility to the examined products in individual participants, not allowing us to draw conclusions based on time or causality. Since this study focused on tobacco use and susceptibility in a Mexican American cohort in a unique geographic location, results cannot be generalized to

other populations and are not necessarily representative of national Mexican American prevalence estimates. In addition, the participants in the current analysis are older and thus have more years of education, are more likely to be married, widowed, or retired, when compared to the rest of the CCHC. A higher proportion of participants from this sample was born in and completed their education in Mexico and speak Spanish as a primary language compared to rest of the cohort. These differences may have served to decrease prevalence of e-cigarette use and increase cigarette prevalence. Data on hookah product use and susceptibility was not available, so an all-encompassing view of tobacco use could not be determined, and demographics of hookah users could not be assessed for the population at hand. While low prevalence of tobacco product use is a positive health outcome result (some of which may be due to underreporting), low reported prevalence limits our ability to fully analyze demographic characteristics of users in order to fully understand the scope of the problem and target interventions.

Conclusion

This study sought to provide a comprehensive view of the prevalence of four tobacco products – cigarettes, e-cigarettes, cigars, snus, and snuff prevalence – among Mexican Americans residing along the Texas-Mexico border, a historically vulnerable population. These cross-sectional estimates provide insights into the prevalence, patterns of susceptibility, trial and current use of the four tobacco products. As such the data may be used to guide prevention and cessation interventions targeted towards the specific subgroups of Mexican Americans that are more likely to use each of these products. Further multi-level studies are required to examine the factors that influence susceptibility, trial, and use of tobacco products in similar high-risk populations of Mexican Americans residing along the Texas-Mexico border, in order to inform public health policy and actions benefitting future generations.

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Declaration of Interests
The authors declare that they have no competing interests.

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Table 1. Demographics of study participants (n=1,672; N=160,692).

	Unweighted (n=1,672)		Weighted (N=160,692)	
	n	%	%	95% CI*
Gender				
Male	595	35.6	42.2	39.5-45.1
Female	1,077	64.4	57.8	54.9-60.6
Age (years)				
18-29	215	12.9	19.8	16.3-23.8
30-44	379	22.7	25.4	21.0-30.4
45-59	507	30.3	30.4	27.2-33.7
60+	571	34.2	24.4	20.2-29.2
Educational Attainment				
≤ 6th grade	412	24.6	16.0	12.8-19.9
7th-11th grade	414	24.8	21.6	18.0-25.8
12th or GED	362	21.7	25.2	21.9-28.7
Some college	484	29.0	37.2	31.2-43.6
Weighted Mean (95% CI): 11.2 years (10.7-11.8 years)				
Primary Language				
English	454	28.0	40.7	33.7-48.1
Spanish	165	72.0	59.3	51.9-66.3
Country of Birth				
Mexico	160	64.6	54.2	48.3-60.0
United States	581	35.4	45.8	40.0-51.7
Country of Education				
Mexico	955	59.7	48.8	42.2-55.4
United States	644	40.3	51.2	44.6-57.8
Marital Status				
Single	352	21.1	24.1	20.1-28.6
Married	121	61.3	61.2	56.2-66.0
Divorced/Separated	167	10.0	9.3	6.8-12.6
Widowed	126	7.6	5.5	3.9-7.7
Employment status				
Full-Time	476	28.8	35.1	29.9-40.6
Part-Time	268	16.2	17.0	14.6-19.7
Retired	328	19.8	15.6	12.1-19.8
Not working[$]	583	35.2	32.4	28.3-36.8

*95% Confidence Interval; [$]Unemployed, Never worked, or Other

Table 2. Overall prevalence of susceptibility to, ever use of, and current use of cigarettes, e-cigarettes, cigars, snus, and snuff products (n=1,672; N=160,692)

	Susceptible to use*			
	Unweighted		Weighted	
	n	%	%	95% CI[$]
Cigarettes	34	4.3	3.8	2.2-6.5
E-cigarettes	104	6.9	7.1	4.9-10.3
Cigars	76	5.4	5.4	3.6-8.0
Snus	87	5.4	6.4	4.2-9.7
Snuff	91	5.7	6.4	4.2-9.5

	Ever Used			
	Unweighted		Weighted	
	n	%	%	95% CI[$]
Cigarettes	841	51.4	59.1	53.1-64.8
E-cigarettes	116	7.2	10.1	7.2-14.0
Cigars	197	12.2	18.2	14.1-23.3
Snus	15	0.9	1.2	0.6-2.2
Snuff	32	2.0	2.8	1.6-4.8

	Currently Use**			
	Unweighted		Weighted	
	n	%	%	95% CI[$]
Cigarettes	258	15.8	18.6	14.8-23.1
E-cigarettes	32	2.0	1.3	0.5-3.0
Cigars	1	0.1	2.3	1.3-4.0
Snus	0	0.0	0.03	0.0-0.2
Snuff	32	2.0	0.0	--

* Susceptibility measured in participants that reported never trying the given product;
** Product use in the past 30 days; [$]95% Confidence Interval

Table 3a. Demographic characteristics of susceptibility to alternative tobacco products in participants who have never tired the given product (n=1,672; N=160,692)

	Susceptibility to e-cigarettes				Susceptibility to cigars			
	Unweighted (n=104)		Weighted (N=9,176)		Unweighted (n=76)		Weighted (N=6,324)	
	n	%	N	95% CI*	n	%	N	95% CI*
Gender								
Male	48	9.4	7.3	4.6-11.4	34	7.5	6.3	3.5-11.0
Female	56	5.6	7.0	3.9-12.1	42	4.3	4.8	2.7-8.3
			(p=.9068)				(p=.4749)	
Age (years)								
18-29	24	13.6	14.8	7.2-27.3	16	8.9	11.1	5.0-22.1
30-44	24	7.2	6.6	3.8-11.1	17	5.6	4.5	1.9-9.5
45-59	28	6.0	4.8	2.2-9.5	22	5.0	3.1	1.6-5.5
60+	28	5.3	4.9	2.8-8.3	21	4.2	4.4	2.3-8.0
			(p=.0061)				**(p=.0121)**	
Educational Attainment								
≤ 6th grade	23	6.0	5.3	2.1-11.5	20	5.3	3.9	2.0-7.4
7th-11th grade	28	7.5	7.6	4.4-12.5	18	5.1	5.8	3.0-10.6
12th or GED	26	8.0	9.3	4.1-18.9	20	6.5	7.2	2.7-16.4
Some college	27	6.1	6.1	3.2-10.9	18	4.7	4.4	1.9-9.0
			(p=.5836)				(p=.5817)	
Primary Language								
English	44	11.6	11.1	7.0-17.0	34	9.5	9.4	5.6-15.3
Spanish	56	5.2	4.9	2.4-9.5	39	3.8	3.0	1.6-4.7
			(p=.0271)				**(p=.0002)**	
Country of Birth								
Mexico	58	6.0	6.2	3.9-9.7	45	4.9	4.5	2.8-7.0
United States	43	8.5	8.2	4.7-13.6	29	6.1	6.3	3.3-11.6
			(p=.3694)				(p=.3512)	
Country of Education								
Mexico	44	5.0	4.3	2.5-7.1	33	3.9	3.7	2.0-6.4
United States	53	9.5	9.3	5.9-14.2	39	7.5	7.1	54.1-11.9
			(p=.0176)				(p=.0778)	
Marital Status								
Single	35	11.6	10.8	5.3-20.1	22	7.4	9.1	4.2-18.0
Married	50	5.4	5.9	3.2-10.4	36	4.1	3.4	1.9-5.7
Divorced[%]	9	5.9	7.0	2.4-16.9	9	6.5	8.4	2.9-19.7
Widowed	9	7.9	4.0	1.7-8.3	8	7.2	3.8	1.5-8.3
			(p=.2753)				**(p=.0381)**	
Employment status								
Full-Time	32	7.6	38.5	4.2-16.2	25	6.5	5.7	2.7-11.0
Part-Time	15	6.2	4.3	2.3-7.8	10	4.4	3.1	1.5-6.0
Retired	18	5.9	5.8	2.8-11.3	13	4.6	5.7	2.3-12.4
Not working[$]	38	7.3	7.6	4.1-13.4	27	5.3	6.2	2.5-13.5
			(p=.5132)				(p=.7148)	

*95% Confidence Interval; [%]Divorced or separate; [$]Unemployed, Never worked, or Other

Table 3b. Demographic characteristics of susceptibility to alternative tobacco products in participants who had never tried the given product (n=1,672; N=160,692).

	Susceptibility to snus				**Susceptibility to snuff**			
	Unweighted **(n=87)**		Weighted (N=8,107)		Unweighted **(n=91)**		Weighted (N=8,858)	
	n	%	N	95% CI*	n	%	N	95% CI*
Gender								
Male	43	7.7	6.3	3.1-11.7	43	7.9	5.7	3.0-10.2
Female	44	4.2	6.6	3.6-11.6	48	4.6	6.8	3.8-11.9
			(p=.9127)				(p=.6727)	
Age (years)								
18-29	15	7.3	10.3	4.8-20.2	16	7.9	9.4	4.1-19.3
30-44	20	5.6	7.3	3.1-15.1	21	5.9	7.8	3.5-16.0
45-59	27	5.6	4.5	2.1-9.1	27	5.6	4.5	2.0-9.1
60+	25	4.6	4.5	2.5-7.6	27	4.9	4.6	2.6-7.7
			(p=.1870)				(p=.2862)	
Educational Attainment								
≤ 6th grade	21	5.2	4.9	1.8-11.1	23	5.8	5.1	2.0-11.4
7th-11th grade	21	5.3	5.6	3.0-10.1	26	6.6	6.8	3.8-11.6
12th or GED	23	6.6	7.9	3.4-16.5	23	6.7	8.1	3.5-16.8
Some college	22	4.9	6.6	22.9-13.4	19	4.3	5.4	2.6-10.6
			(p=.7722)				(p=.7003)	
Primary Language								
English	37	8.8	10.2	6.0-16.7	35	8.5	9.7	5.7-15.8
Spanish	48	4.3	4.3	2.0-8.7	53	4.7	34.4	2.1-8.8
			(p=.0433)				(p=.0626)	
Country of Birth								
Mexico	48	4.7	5.2	3.2-8.3	53	5.2	5.6	3.5-8.8
United States	36	6.5	7.8	4.7-12.6	35	6.5	7.2	4.1-12.1
			(p=.0975)				(p=.3847)	
Country of Education								
Mexico	37	4.0	4.3	1.9-8.7	41	4.5	4.0	2.3-6.6
United States	44	7.2	7.9	4.8-12.6	44	7.4	8.0	4.9-12.7
			(p=.1602)				**(p=.0294)**	
Marital Status								
Single	24	7.1	7.8	3.5-15.7	26	7.8	7.0	2.9-15.0
Married	46	4.7	5.8	3.2-10.3	48	5.0	6.0	3.3-10.5
Divorced[%]	9	5.6	8.2	3.0-18.8	9	5.7	8.4	3.1-19.3
Widowed	8	6.7	3.3	1.3-7.2	8	6.7	3.3	1.3-7.2
			(p=.6122)				(p=.7155)	
Employment status								
Full-Time	30	6.6	7.8	3.4-15.9	30	6.8	37.2	3.2-14.7
Part-Time	11	4.3	2.9	1.4-5.6	13	5.1	3.1	1.6-5.8
Retired	16	5.1	5.9	2.6-10.9	15	4.8	5.2	2.3-10.7
Not working[$]	30	5.4	7.4	3.4-14.7	33	5.9	7.8	3.6-15.4
			(p=.4291)				(p=.4446)	

*95% Confidence Interval; [%]Divorced or separate; [$]Unemployed, Never worked, or Other

Table 4a. Demographic characteristics of participants who had ever used the given products (n=1,672; N=160,692).

	Ever used cigarettes				Ever used e-cigarettes			
	Unweighted (n=841)		Weighted (N=87,275)		Unweighted (n=116)		Weighted (N=14,521)	
	n	%	N	95% CI*	n	%	N	95% CI*
Gender								
Male	418	71.8	72.2	66.4-77.4	65	11.3	14.4	10.5-19.3
Female	423	40.2	49.4	41.4-77.4	51	4.9	7.0	4.0-11.9
			(p=.0000)				**(p=.0044)**	
Age (years)								
18-29	107	50.2	54.8	45.3-64.0	35	16.6	21.4	13.4-32.4
30-44	204	55.7	64.2	55.2-72.4	29	8.0	10.1	5.3-18.1
45-59	257	51.8	60.7	50.9-68.8	26	5.3	6.0	3.0-11.4
60+	273	48.8	55.7	46.3-64.6	26	4.7	5.2	2.1-11.6
			(p=.3009)				**(p=.0007)**	
Educational Attainment								
≤ 6th grade	187	46.1	52.2	42.4-61.8	20	5.0	3.6	1.8-6.8
7th-11th grade	212	51.8	56.9	47.9-65.4	29	7.2	7.0	3.4-13.3
12th or GED	181	51.0	56.4	48.5-64.0	30	8.5	10.8	6.3-17.7
Some college	261	56.1	66.6	56.5-73.6	37	8.0	14.6	8.9-22.9
			(p=.0796)				**(p=.0221)**	
Primary Language								
English	264	60.1	62.1	54.1-69.5	52	12.0	15.5	9.6-23.9
Spanish	554	48.4	57.7	50.7-64.3	60	5.3	6.5	3.8-10.9
			(p=.2933)				**(p=.0072)**	
Country of Birth								
Mexico	511	49.1	58.0	49.9-65.7	54	5.2	7.1	3.9-12.4
United States	316	55.8	61.0	53.6-68.0	60	10.6	13.3	9.6-18.3
			(p=.5332)				**(p=.0170)**	
Country of Education								
Mexico	462	49.3	60.1	52.2-67.5	49	5.3	7.3	3.8-13.1
United States	343	54.5	59.0	51.8-65.9	64	10.3	13.4	9.2-19.2
			(p=.8213)				(p=.0661)	
Marital Status								
Single	184	52.7	57.2	48.5-65.4	42	12.2	16.7	10.4-25.7
Married	513	51.5	60.1	52.4-67.4	58	5.9	8.6	5.5-13.2
Divorced[%]	91	55.5	66.0	52.7-77.1	11	6.8	5.0	1.5-12.6
Widowed	50	41.3	42.4	28.6-57.4	5	4.2	3.6	1.0-9.7
			(p=.1595)				**(p=.0059)**	
Employment status								
Full-Time	280	60.6	66.3	59.1-72.8	37	8.0	9.3	6.0-14.6
Part-Time	131	50.2	57.5	46.5-67.8	17	6.6	14.2	7.1-26.0
Retired	168	52.2	59.6	47.7-70.4	16	5.0	4.5	0.9-13.4
Not working[$]	255	44.4	52.7	42.3-62.8	46	8.1	11.6	6.6-19.5
			(p=.0825)				(p=.2788)	

*95% Confidence Interval; [%]Divorced or separate; [$]Unemployed, Never worked, or Other

Table 4b. Demographic characteristics of participants who had ever used the given products (n=1,672; N=160,692).

	Ever used cigars				Ever used snuff			
	Unweighted (n=197)		Weighted (N=26,167)		Unweighted (n=32)		Weighted (N=4,012)	
	n	%	N	95% CI*	n	%	N	95% CI*
Gender								
Male	123	21.4	26.0	20.9-31.9	27	4.7	5.6	2.9-10.0
Female	74	7.08	12.5	7.5-19.9	5	0.5	0.8	0.2-2.3
			(p=.0020)				**(p=.0007)**	
Age (years)								
18-29	31	17.4	20.5	12.0-32.7	8	3.8	4.9	1.9-10.9
30-44	60	16.5	22.3	15.1-31.7	9	2.5	3.1	1.0-7.8
45-59	54	11.0	15.9	10.6-23.2	13	2.6	2.7	1.1-5.8
60+	52	9.4	14.8	10.4-20.5	2	0.4	0.8	0.0-3.4
			(p=.3219)				(p=.1574)	
Educational Attainment								
≤ 6th grade	26	6.5	13.1	7.1-22.6	3	0.7	1.4	0.1-5.4
7th-11th grade	52	12.8	16.5	11.1-23.8	10	2.5	2.1	0.9-4.4
12th or GED	42	11.9	15.5	10.3-22.8	7	2.0	4.0	1.5-9.2
Some college	77	16.8	23.6	17.3-31.3	12	2.6	3.0	1.1-6.8
			(p=.0584)				(p=.4829)	
Primary Language								
English	74	17.1	19.6	14.2-26.4	21	4.8	5.3	2.4-10.5
Spanish	117	10.3	17.5	12.3-24.3	10	0.9	1.3	0.4-3.3
			(p=.5692)				**(p=.0218)**	
Country of Birth								
Mexico	103	10.0	18.6	12.5-26.7	12	1.2	1.1	0.5-2.4
United States	88	15.7	18.1	13.1-24.4	20	3.6	4.8	2.4-9.0
			(p=.9045)				**(p=.0017)**	
Country of Education								
Mexico	89	9.6	16.4	11.8-22.2	7	0.8	1.3	0.1-4.5
United States	99	15.9	20.0	15.0-26.2	24	3.9	4.3	2.7-6.7
			(p=.2601)				**(p=.0248)**	
Marital Status								
Single	47	13.6	17.5	12.5-24.0	11	3.2	4.6	2.0-9.5
Married	115	11.6	18.5	12.3-26.7	17	1.7	2.2	1.0-4.5
Divorced[%]	25	15.3	19.9	10.9-33.2	4	2.5	3.1	0.1-9.3
Widowed	8	6.7	13.7	4.5-32.1	0	0.0	0.0	0.0
			(p=.9157)				(p=.2765)	
Employment status								
Full-Time	73	15.8	21.7	15.2-29.9	17	3.7	4.7	1.8-10.5
Part-Time	31	12.1	14.9	9.4-22.7	2	0.8	0.7	0.0-2.9
Retired	32	10.1	14.2	9.3-21.1	3	0.9	1.6	0.2-5.4
Not working[$]	59	10.4	18.2	10.8-28.8	10	1.8	2.4	1.1-4.9
			(p=.4126)				(p=.0861)	

*95% Confidence Interval; [%]Divorced or separate; [$]Unemployed, Never worked, or Other

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