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Sociodemographic disparities in e-cigarette retail environment: Vape stores and census tract characteristics in Orange County, CA

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ABSTRACT

Research shows disproportionate availability of tobacco retailers in disadvantaged neighborhoods, but little is known about the neighborhood correlates of e-cigarette specialty retailers (i.e., "vape stores"). We compiled addresses for all vape stores in Orange County (OC) (n = 174), CA, using a systematic internet search. Using American Community Survey data, we investigated the spatial structure and census tract correlates of vape store count. 23.4% of census tracts had at least one vape store, and those areas had higher percentage Hispanic population. Multivariate zero-inflated Poisson regressions revealed a higher incidence rate of vape stores in tracts with larger proportions of Hispanics, lower population density, and greater tobacco retailer density, net of other sociodemographic factors and zoning. These results suggest nicotine control initiatives in the age of e-cigarettes must consider the locational strategies of e-cigarette retailers, which are more common in Hispanic communities and areas already marked by tobacco retail activity.

1. Introduction

Since their introduction to the US market in 2007, the use of electronic cigarettes ("e-cigarettes") has risen dramatically. Among adults, the prevalence of lifetime e-cigarette use has climbed from 3.3% in 2010 (King et al., 2015) to over 12% in 2014 (Schoenborn and Gindi, 2015). The rate of past-month use among US teenagers has similarly increased, from 1.5% in 2011 to 16% in 2015 among high schoolers (Singh et al., 2016), signaling a troubling rise in teenage nicotine use at a time of historically low adolescent tobacco use (Johnston et al., 2016).

Debate continues among the public health community about the potential net benefits versus risks of e-cigarettes. On the one hand, e-cigarettes may be less deleterious than conventional cigarettes (Farsalinos and Polosa, 2014), with one estimate stating that e-cigarettes are 95% less harmful than smoking (McNeill et al., 2015), although this claim has been criticized (The Lancet, 2015). E-cigarettes may be a net benefit in so far as they reduce exposure to combustible tobacco or help smokers to quit conventional cigarettes. However, although some studies report high rates of smoking cessation among intensive e-cigarette users (Biener and Hargraves, 2015), there is also evidence of dual use of e-cigarettes and conventional cigarettes, rather than cessation, among smokers (Al-Delaimy et al., 2015; Grana et al., 2014). A review of the cessation literature found only very low to low effectiveness of e-cigarettes in helping smokers quit, and the evidence on smoking reduction was assessed as very low to moderate (Malas et al., 2016). On the other hand, recent reports link e-cigarette use to greater openness to future tobacco use (Bunnell et al., 2015; Coleman et al., 2014; Wills et al., 2015) and increased likelihood of conventional smoking in follow-up interviews among tobacco-abstinent adolescents and young adults (Leventhal et al., 2015; Spindle et al., 2017). A recent meta-analysis found an association between e-cigarette use among teens and later initiation of conventional tobacco use (Soneji et al., 2017). Soneji et al. (2017) conclude that the balance of costs and benefits of e-cigarettes is *negative*, meaning that more harm is done via teen tobacco initiation than life years saved from tobacco cessation. Therefore, even if e-cigarettes are less harmful than cigarette smoking at the individual level, they may not result in population level health improvements. Moreover, nicotine exposure is disruptive to neurological development (Dwyer et al., 2008), and e-cigarette-related injuries are an emerging public health concern (Toy et al., 2017). These issues related to e-cigarettes led the US Food and Drug Administration to expand its regulatory scope over e-cigarettes in 2016 (Department of Health and Human Services, 2014). Taken together, this literature on balance suggests that e-cigarette retailers can serve as risk enablers in a community setting.

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While recent studies have identified higher rates of e-cigarette use in contexts where e-cigarettes are more available (Bostean et al., 2016; Giovenco et al., 2016a; Lippert, 2016), little is known about the neighborhood correlates of e-cigarette availability. To address this gap, we investigate the area-level correlates of vape store count in Orange County (OC), CA, the sixth most populous county in the nation at over 3 million residents. Drawing on theory and prior research on the interplay among community efficacy, demographic composition, and health (Corburn, 2009; Fitzpatrick and LaGory, 2011), we examine data on locations of vape stores, which are retailers of electronic nicotine delivery systems (ENDS) who do not sell tobacco products, combined with American Community Survey data to assess the community-level correlates of e-cigarette availability. Specifically, we examine neighborhood exposure to vape stores using zero-inflated Poisson models to investigate how socioeconomic (e.g., education, poverty) and demographic (e.g., race/ethnicity, nativity) composition, and tobacco retailer density, are associated with tract-level vape store count in OC. We conceptualize e-cigarette neighborhood retail environment, specifically vape store count, as a community-level risk factor for population nicotine use, a view that is consistent with the mix of findings linking e-cigarette use to both tobacco cessation (for review, see Malas et al., 2016), as well as with dual use of e-cigarettes and conventional cigarettes (Al-Delaimy et al., 2015) and tobacco initiation (Spindle et al., 2017).

1.1. Theoretical background

Countless studies have shown that health risks tend to accumulate in communities predominated by socially marginalized groups, including racial/ethnic minorities and low income individuals. Such findings are consistent with theory and evidence on both racial/ethnic disparities in residential outcomes as well as the deliberate targeting of lower-status neighborhoods by industries that threaten community health. Community composition reflects broader exclusionary processes in the housing market that select lower-income individuals into poorer communities, and homeseekers of color into more disadvantaged and racially-segregated neighborhoods, than their non-Hispanic White counterparts of similar economic status (Iceland and Nelson, 2008; Iceland and Wilkes, 2006; Sharp and Iceland, 2013). Because the housing stock in communities with vice stores, including alcohol and tobacco retailers, is generally less desirable than neighborhoods lacking these risks, minority and lower-income households are often over-represented in such neighborhoods (Lee et al., 2017; Rodriguez et al., 2013). Moreover, neighborhoods predominated by minority and low-income households are deliberately targeted by alcohol and tobacco industries, as social disadvantages like concentrated poverty and racial segregation undermine the capacity for communities to collectively mobilize against industry efforts to sell unhealthy goods locally (Sampson et al., 1997). Evidence we review below shows how both processes—residential sorting, and industry targeting of socially marginalized communities—produce ecological correlations between neighborhood racial/ethnic and socioeconomic composition and the density of retailers catering to health-risk behaviors such as tobacco use.

1.2. Empirical evidence on tobacco retail environment and sociodemographic correlates

Evidence from decades of tobacco research shows that nicotine retailers tend to be located in areas with certain sociodemographic characteristics (Hyland et al., 2003; Loomis et al., 2013a; Schneider et al., 2005; Yu et al., 2010), and are often given incentives from manufacturers to sell tobacco products (Feighery et al., 2003). Given that the neighborhood retail environment is associated with nicotine use behaviors, it is not surprising that smoking prevalence is often higher in neighborhoods where tobacco retailers are disproportionately located. Several sociodemographic correlates have been linked to greater tobacco availability in neighborhoods, including racial/ethnic composition, education and income, age, urbanicity and/or population density.

Many studies find greater tobacco retailer density in census tracts with a higher percentage of Black or Hispanic residents (Hyland et al., 2003; Rodriguez et al., 2013; Schneider et al., 2005; Yu et al., 2010). Similarly, some areas characterized by lower income or lower education are more likely to have tobacco retailers and higher retailer density (Hyland et al., 2003; Lee et al., 2017; Loomis et al., 2013b; Rodriguez et al., 2013; Yu et al., 2010); indeed, income is among the strongest predictors of outlet density (Fakunle et al., 2010, 2016). Additionally, age may be an important area-level correlate of tobacco retail, although findings are mixed. Adolescents and young adults have often been targeted by tobacco marketing, and adolescents who live near tobacco retailers are more likely to smoke (West et al., 2010); yet some studies find that there is an inverse association between proportion of residents under age 18 and tobacco retailer density in some areas (Loomis et al., 2013a). Finally, studies generally show a positive association between tobacco outlet density and urban areas (Rodriguez et al., 2013), which are characterized by greater population density. However, not all studies find associations between sociodemographic characteristics and tobacco retail environment in neighborhoods (Duncan et al., 2014), and some find associations only in some areas (Loomis et al., 2013a), highlighting the importance of conducting such studies in a variety of geographic areas.

An additional sociodemographic factor associated with tobacco use that has been largely overlooked in the literature on tobacco retail environment, and that may moderate the association between racial/ethnic composition and local tobacco availability, is the percent of the population that is foreign-born. Smoking prevalence tends to be lower among the foreign-born, but there are important differences by race-ethnicity and nativity, combined. Some Asian groups have high rates of smoking, particularly among foreign-born males (Chae et al., 2006). For instance, smoking prevalence among Asians in California ranges from over 20% among Koreans and approximately 16% among Vietnamese, to 8% among South Asians (Tang et al., 2005). Among Latinos, smoking prevalence is generally higher among US-born Latinos than immigrants (Bostean et al., 2017b; Kaplan et al., 2014), consistent with the well-known Hispanic paradox (Markides and Coreil, 1986). These differences in smoking across race-ethnic and immigrant groups may translate into differences in neighborhood retail environment by not only race-ethnicity, but also nativity. Moreover, some studies have found an association between neighborhood context, specifically living in an ethnic enclave, and smoking behaviors among Asians (Kandula et al., 2009), yet with a few exceptions (e.g., Lee et al., 2017), Asian populations have largely been omitted from studies of tobacco retail environment. Thus, research is needed that examines whether race-ethnicity (including percent Asian population) and nativity, combined, are predictors of nicotine use behaviors.

Considering the evidence from the smoking literature that sociodemographic factors are associated with neighborhood retail environment, it is important to understand whether these patterns hold for the availability of emerging tobacco-related behaviors, particularly e-cigarettes. Other studies have shown that vice stores (such as tobacco, fast food, and alcohol retailers) tend to be clustered in the same areas (Kwate and Loh, 2016), suggesting that tobacco retailer density may be an important correlate of vape store neighborhood retail environment, in addition to sociodemographic factors.

To date, only a handful of studies have examined the sociodemographic characteristics of areas where e-cigarette retailers are located, and they provide mixed evidence about the correlates of e-cigarette neighborhood retail environment. One study examined the availability of e-cigarettes at tobacco retailers nationwide in the US (Rose et al., 2014), finding that e-cigarettes were more available in areas with higher income and lower percent Black or Hispanic residents—patterns that are opposite of those observed for tobacco retail. However, the