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Journal

Substance Use and Misuse, 55(14)

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Publication Date

2020

DOI

10.1080/10826084.2020.1823417

Peer reviewed

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Author manuscript

Subst Use Misuse. Author manuscript; available in PMC 2021 April 26.

Published in final edited form as:

Subst Use Misuse. 2020 ; 55(14): 2395–2402. doi:10.1080/10826084.2020.1823417.

Are Waterpipe Café, Vape Shop, and Traditional Tobacco Retailer Locations Associated with Community Composition and Young Adult Tobacco Use in North Carolina and Virginia?

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Abstract

Purpose: We examined whether waterpipe café, vape shop, and traditional tobacco retailer (e.g. stores selling cigarettes, cigars, smokeless tobacco) locations were associated with census tract composition and tobacco use among young adults in North Carolina and Virginia.

Methods: We identified waterpipe cafés, vape shops, and traditional tobacco retailers in North Carolina and Virginia and conducted multivariable analyses between community characteristics (gender, race, ethnicity, education, college enrollment, and poverty) and density per 1000 population. Using fall 2017 data from 1099 young adults residing in North Carolina and Virginia, we conducted logistic regression analyses to determine whether tobacco retailer density and proximity were associated with tobacco use.

Results: Waterpipe café, vape shop, and traditional retailer density were higher in communities with more people who were Hispanic, college-educated, and college-enrolled (each $p < .05$). Waterpipe café and traditional retailer density were higher in communities with more people living below the poverty level (each $p < .05$). Waterpipe café density was higher in communities with

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Supplemental data for this article is available online at https://doi.org/10.1080/10826084.2020.1823417

Declaration of interest

The authors report no conflict of interest.

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more people who were male ($p < .05$), while traditional retailer density was lower ($p < .05$). Waterpipe café and vape shop proximity were associated with increased likelihood of waterpipe tobacco use in the past 6 months (each $p < .05$; unadjusted). Traditional retailer proximity and waterpipe café, vape shop, and traditional retailer density were not associated with tobacco use.

Conclusions: Waterpipe cafés and vape shops are located in both impoverished and college-educated communities in North Carolina and Virginia, similar to where traditional tobacco retailers are located. Further research is needed to examine associations with tobacco use.

Keywords

Young adult; tobacco use; electronic cigarettes (electronic nicotine delivery systems – preferred); waterpipe

Introduction

Today's tobacco landscape includes not only traditional products like cigarettes, cigars, and smokeless tobacco but also waterpipe tobacco (i.e. hookah) and electronic cigarettes (e-cigarettes), products commonly used among young adults (Wang et al., 2018). Waterpipe tobacco and e-cigarette use are significant public health concerns, especially among young adults, who have the highest rates of use among adult age groups and are susceptible to nicotine addiction (Kasza et al., 2017; Schulenberg et al., 2019; Wang et al., 2018). According to 2014 National Adult Tobacco Use data (the most recent available by state and age), 17.7% and 23.7% of 18–24 year olds, and 2.0% and 4.0% of 25–34 year olds in North Carolina and Virginia, respectively, reported current waterpipe tobacco use (Office on Smoking and Health, 2019). According to 2017 Behavioral Risk Factor Surveillance System data, 10.5% and 10.8% of 18–24 year olds and 7.1% and 8.4% of 25–34 year olds in North Carolina and Virginia, respectively, reported current e-cigarette use (Centers for Disease Control and Prevention, n.d.). Those who smoke waterpipe tobacco are exposed to high levels of toxicants, including carcinogenic polycyclic aromatic hydrocarbons, carbon monoxide (a cardiovascular and central nervous system toxicant), heavy metals, and volatile aldehydes (cardiovascular toxicants). Even infrequent water-pipe tobacco use is associated with negative health harms, such as lung-related abnormalities and arterial stiffness (Rezk-Hanna et al., 2018; Tzortzi et al., 2018; Yano et al., 2015). Health risks associated with e-cigarette use range from physical health symptoms including cough, headache, and dizziness to increased risk of pulmonary disease and myocardial infarction (Alzahrani et al., 2018; Benowitz & Fraiman, 2017; King et al., 2019).

The advent of these products has led to additional retail environments, such as waterpipe cafés, where customers can purchase and consume waterpipe tobacco, and vape shops, which sell e-cigarettes and other vaping devices. These tobacco retailers offer an additional location for consumers and potential consumers to be exposed to tobacco-related marketing and purchase products.

A number of community characteristics are associated with the density of and proximity to traditional tobacco retail outlets. Density refers to the availability of the product, indicated by the *number* of tobacco retailers in a specified area. Proximity refers to how accessible the

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product is, or the *distance* from a specified location to the nearest tobacco retailer (Kong et al., 2020). For example, greater density of tobacco retailers is found in lower-income and racial minority communities, which contributes to disparities in smoking and health (Fakunle et al., 2016, 2019; Farley et al., 2019; Kong et al., 2020; Lee et al., 2017; Loomis et al., 2013; Peterson et al., 2011; Ribisl et al., 2017; Rodriguez et al., 2013; Yu et al., 2010). Traditional tobacco retailer location has been associated with youth and young adults smoking (Abdel Magid et al., 2020; Cantrell et al., 2015; Finan et al., 2019; Henriksen et al., 2008; Lipperman-Kreda et al., 2012; McCarthy et al., 2009; Paynter & Edwards, 2009; Robertson et al., 2015), but a recent review concluded the relationship is inconsistent, with authors concluding there is sufficient support for the association between density and youth use, but not proximity (Nuyts et al., 2019).

There is limited research on whether these relationships exist for waterpipe cafés and vape shops. Waterpipe cafés have been reported near large colleges (Kates et al., 2016), and proximity has been associated with increased waterpipe use (Kassem et al., 2015; Smith et al., 2011). However, the waterpipe cafée studies relied on self-reported proximity instead of objective measures such as geocoding waterpipe café location and participant residence. Vape shop density has been reported to be higher in predominantly white areas by one study (Giovenco, Duncan, et al., 2016) but in areas with more racial or ethnic minorities by other studies (Bostean et al., 2018; Dai et al., 2017; Venugopal et al., 2020; Wheeler et al., 2020). Vape shop proximity to schools is reportedly lower in communities with higher proportions of people living below the poverty line (Venugopal et al., 2020). Vape shops have also been reported near colleges (Dai & Hao, 2017). Additionally, one study found that vape shop density near schools in New Jersey was associated with ever and current e-cigarette use (Giovenco, Casseus, et al., 2016). We are not aware of studies that have assessed the density or proximity of vape shops within a defined radius from an individual's place of residence and the association with use. More research is needed to understand whether these new types of tobacco retailers strategically inhabit disparate communities, and whether density of and proximity to these establishments are associated with tobacco use.

The primary objective of this study was to examine the associations between community characteristics and retailer density and proximity for three distinct retailer types: water-pipe cafés, vape shops, and traditional tobacco retailers. Our secondary aim was to examine whether retailer density and proximity were associated with tobacco use.

Methods

Data from multiple sources were combined for this study: traditional retailer locations were obtained from North American Industry Classification System (NAICS) codes, waterpipe café and vape shop locations were obtained from ReferenceUSA and Yelp, community-level data were obtained from the American Community Survey (ACS), and participant locations and tobacco use data were from the Assessment of the Post-College Experience (ACE II) study. For the purposes of this study, waterpipe cafés were defined as places that sold and served waterpipe tobacco onsite, and vape shops were defined as places that primarily sold e-cigarettes or other vaping devices. Details on each data source and the measures used are below.

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Tobacco retailer locations

Because North Carolina and Virginia do not require tobacco retailer licensing at the state level, we purchased a list of potential tobacco retailers in North Carolina and Virginia from the NAICS Association, LLC in January 2018 (n = 16,137). The following NAICS codes were used to identify traditional tobacco retailers: 445110 (supermarkets/grocery stores), 445120 (convenience stores), 453991 (tobacco stores), 447110 (gasoline with convenience), 452311 (warehouse clubs/supercenters), 451212 (newsstands), 445310 (beer, wine, liquor stores), 446110 (pharmacies), 452311 (discount department stores), and 447190 (other gasoline stations). Two study team members independently manually reviewed the list and removed duplicates (n = 282) and retailers that do not sell tobacco products (e.g. CVS Pharmacy, Target, n = 771). Any discrepancies were discussed with a third member and resolved (Hayes & Krippendorff, 2007).

Because NAICS codes do not capture waterpipe cafés or vape shops, we searched ReferenceUSA (ReferenceUSA, 2019) an internet-based reference source for business data, and Yelp, an internet-based business directory and crowd-sourced review forum, following strategies used in previous research (Cawkwell et al., 2015; Lee et al., 2016). We searched ReferenceUSA and Yelp in March 2018, using multiple terms for each type of retailer (e.g. hookah, hookah bar, e-cigarette) to identify waterpipe cafés (n = 362) and vape shops (n = 875). See Supplemental File for additional details on the process used. Waterpipe café and vape shop addresses were geocoded at the street address level. For traditional retailers, we used purchased geocoded data for mapping with census tract data. Most (97%) retailers were geocoded at the street address level, and 3% were geocoded at the street intersections, street centroid, or zip-code levels. We identified 16,321 unique geocoded tobacco retailers in North Carolina and Virginia, including 15,084 traditional tobacco retailers, 362 waterpipe cafés, and 875 vape shops.

Tobacco retailer density and proximity

We calculated density as census tract-level outlet density per 1000 population for each type of retailer (traditional, waterpipe café, vape shop) separately. We calculated proximity as driving distance in miles from the participant's home address to the nearest retailer for each of the retailer types separately using the Network Analyst-Closest Facility analysis tool in ArcGIS. Density was calculated for all census tracts within North Carolina and Virginia; proximity was calculated in North Carolina and Virginia tracts with a participant address. We used ArcGIS Desktop V.10.7.1. for all geocoding, mapping, and density and proximity calculations (Environmental Systems Research Institute (ESRI), 2019).

Community characteristics

We defined a community as a census tract and used ACS 2017 5-year census tract-level data (U.S. Census Bureau, n.d.). We examined the percentage of people who were male, Black, Hispanic, had a bachelor degree or higher (college-educated), college-enrolled, and living below the poverty line as community-level predictors, based on previous studies indicating these factors may be associated with tobacco retailer location or tobacco use (Bostean et al., 2018; Giovenco, Duncan, et al., 2016; Lee et al., 2017; Peterson et al., 2011; Smith et al., 2011).

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Survey participants

We analyzed survey data collected from the ACE II cohort study, an ongoing study of young adults' tobacco behaviors that began in fall 2010. In 2010, 3146 freshmen from 11 colleges in North Carolina and Virginia were recruited to the cohort, an oversample of those who had ever used smokeless tobacco, currently smoked, or were male. Additional details on cohort recruitment are published elsewhere (Spangler et al., 2014; Wolfson et al., 2014). The Wake Forest School of Medicine Institutional Review Board approved this study. For the present study, we used Wave 10 (fall 2017) participant data, with a response rate of 65.2% (1914/2934). A majority of respondents (57%) reported living in North Carolina or Virginia during Wave 10; for feasibility of assessing the retail environment, we limited the sample to participants living in those two states (n = 1099).

Participants' residential locations

We asked participants their current address during the fall 2017 survey. A total of 1782 participants reported their residential address. Of these, 1757 (98.6%) were successfully geocoded at the street address level. Of these, 1099 participants had addresses in North Carolina or Virginia.

Tobacco use

Participants were asked whether they had ever used each of the following products: cigarettes, e-cigarettes or other vaping devices, little cigars or cigarillos, cigars, waterpipe tobacco, and smokeless tobacco. Response options were *yes, in the past week; yes, in the past 30 days, but more than a week ago; yes, in the past 6 months, but more than 30 days ago; yes, in the past year, but more than 6 months ago; yes in the past 2 years, but more than a year ago; yes, more than 2 years ago*; and *no, never*. Those who responded they had used a product within the past 6 months were coded to have used that product. We combined all products into an "any tobacco use" variable. For "any tobacco use" and cigarette use, we examined past 30-day use, as the samples were sufficient to conduct analyses.

Participant demographics

We measured participants' sex, race, ethnicity, and mother's education (an indicator of socioeconomic status [SES]) in fall 2010. We asked participants their age at each wave. All geocoded participants' residential locations, tobacco retailers' locations, tobacco retailer density per tract, and ACS data sets were merged using the census tract Federal Information Processing Standard (FIPS) code and then merged with the proximity and survey data using participant ID (Ard et al., 2017; Song et al., 2009; Sparling et al., 2016).

Statistical analyses

We constructed models with census tract tobacco outlet density per 1000 population as the outcome and census tract characteristics as the predictor variable. Standard regression models assume that census tracts are independent. However, we expect that census tracts that are geographically closer share more characteristics than census tracts that are further apart. Because of the concern that census tracts may not be independent, we used spatial regression models to assess spatial autocorrelation. We identified a significant census tract clustering of

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traditional tobacco outlet density (Moran's $I = 0.06$, $p < .0001$), vape shop density (Moran's $I = 0.001$, $p < .001$), and waterpipe café density (Moran's $I = 0.001$, $p < .001$). To address spatial autocorrelation, we fit spatial regression models rather than standard linear regression models when examining the impact of census tract characteristics on tobacco outlet density. Linear regression models with spatial autocorrelation were fit using PROC MIXED in SAS V9.4.

We constructed bivariate and multivariable mixed-effects logistic regression models with density and proximity measures predicting participant tobacco use. To control for the potential correlation of responses among participants living in the same census tract, we used a random intercept model and treated each census tract as a random factor. We fit models using PROC GLIMMIX in SAS V9.4. We report odds ratios and 95% confidence intervals for tobacco use for the bivariate models. Due to few significant findings with bivariate models, we present only bivariate (unadjusted) models for tobacco use, instead of adjusted models.

We performed analyses using weights to account for oversampling males and students who reported current tobacco use on the screener survey. Sampling weights correspond to the inverse probability of being selected from the screener survey; we also applied a non-response adjustment (Pfeffermann et al., 1998). We calculated unweighted descriptive statistics for demographic characteristics such as age, race, ethnicity, and mother's education to reflect the sample. We calculated weighted prevalence rates for tobacco use to reflect the population. We conducted analyses using SAS version 9.4.

Results

Community characteristics

At the community (census tract) level, the mean percentage of male residents was 48.9 (SD = 4.8), the mean percentage of Black residents was 21.1 (SD = 21.3), the mean percentage of Hispanic residents was 8.5 (SD = 9.0), the mean percentage of college-educated residents was 32.7 (SD = 20.7), the mean percentage of residents enrolled in college was 27.0 (SD = 15.8), and the mean percentage of residents living below the poverty line was 11.1 (SD = 10.0). Density per 1000 population was greatest for traditional retailers (mean = 0.88 stores, range = 0–9), followed by vape shops (mean = 0.05 stores; range = 0–4), and waterpipe cafés (mean = 0.02; range = 0–5; see Figure 1).

Community characteristics and density

Density was associated with community characteristics in adjusted models (Table 1 and Supplemental Figures). Waterpipe café density was higher in areas with a higher percentage of people who were male ($p = .03$), Hispanic ($p = .004$), college-educated ($p < .001$), college-enrolled ($p < .001$), or living below poverty ($p = .04$). Vape shop density was higher in areas with a higher percentage of people who were Hispanic ($p < .001$), college-educated ($p = .03$), or college-enrolled ($p < .001$). Traditional retailer density was higher in areas with a higher percentage of people who were Hispanic ($p = .02$), college-educated ($p = .02$),

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college-enrolled ($p < .001$), or living below the poverty level ($p < .001$). Traditional retailer density was lower in areas with a higher percentage of people who were male ($p = .002$).

Participant characteristics

Our analytic sample consisted of 1099 respondents, of whom 47.8% were male, 83.6% White, and 5.5% Hispanic, with a mean age of 25.2 (SD = 0.6). Almost one-third (32.7%) reported using a tobacco product within the past 30 days, including 7.8% reporting cigarette use in the past 30 days. Within the past 6 months, 9.2% reported e-cigarette use, followed by cigar (7.6%), waterpipe (6.8%), and smokeless tobacco (2.9%).

Tobacco retailer density/proximity and use

Waterpipe café (OR = 0.9; 95% CI = 0.9–0.98) and vape shop proximity (OR = 0.9; 95% CI = 0.8–0.997) were associated with increased association of waterpipe tobacco use in the past 6 months. Traditional retailer proximity was not associated with any of the tobacco use outcomes. Waterpipe café, vape shop, and traditional retailer density were not associated with any of our tobacco use outcomes in unadjusted models (Table 2).

Discussion

Our primary objective was to examine associations between community characteristics and retailer density for waterpipe cafés, vape shops, and traditional tobacco retailers. Our findings extend previous research indicating traditional tobacco retailers are often located near areas with high concentrations of ethnic minority populations and people living below the poverty line (Fakunle et al., 2016, 2019; Farley et al., 2019; Kong et al., 2020; Lee et al., 2017; Loomis et al., 2013; Peterson et al., 2011; Ribisl et al., 2017; Rodriguez et al., 2013; Yu et al., 2010). More waterpipe cafés, vape shops, and traditional retailers were located in areas with a higher percentage of Hispanic residents. Similarly, more waterpipe cafés and traditional tobacco retailers were located in areas with a higher percentage of persons living below the poverty line.

We also found that as the percentage of residents with a college education and residents enrolled in college increased in an area, the number of waterpipe cafés, vape shops, and traditional retailers increased. This echoes other research showing waterpipe cafés and vape shops are commonly found near colleges (Dai & Hao, 2017; Kates et al., 2016). Owners of these establishments may be targeting communities with large populations of college students and other young adults, as rates of e-cigarette and waterpipe use are highest among young adults (Wang et al., 2018).

The duality of tobacco retailers locating in areas with high concentrations of Hispanic residents, people living below the poverty level, and college-educated residents appears contradictory and suggests other factors might be in play. For example, urban areas are more densely populated than suburban and rural areas. Therefore, urban communities of all types are likely to be closer to each other and to tobacco retail outlets than in less urban communities. While we did not control for urbanicity within the present analyses, others have identified a stronger effect of density in rural than urban areas (Dai et al., 2017). Future research should further explore this relationship.

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Our secondary aim was to examine whether retailer density and proximity were associated with tobacco use. In unadjusted models, we identified associations between proximity to water-pipe cafés and vape shops and past 6-month waterpipe use, suggesting those who live closer to cafés and vape shops are more likely to use. Vape shops and waterpipe cafés in this study were located in areas with higher levels of college education and college enrollment. Past studies have shown that waterpipe use is more common among college students (Kassem et al., 2015; Kates et al., 2016). Many of our participants were recent graduates or enrolled in graduate school, which may help explain the associations between proximity and waterpipe use. However, these findings should be interpreted with caution as these were unadjusted models and the findings were marginally significant. We found few associations between density or proximity and use in unadjusted models, none of which were associated with traditional retailer locations. We propose several potential explanations for this. In examining the associations between tobacco retailer density/proximity and use, we focused on a young adult population in two states (North Carolina and Virginia) and used participants' home addresses. In contrast, other studies that found associations between traditional retailer location and smoking focused on youth and schools, based on the premise that many youth walk to school and pass retailers on the way (Paynter & Edwards, 2009). Our sample of young adults may be more mobile (having the use of motor vehicles) and be able to access retail outlets over a much larger range of distances. In this case, density and proximity near home might not influence use. In addition, work location may be important for understanding how retailer location influences tobacco use. Future studies might consider driving distance or driving time to work. It is also possible that young adults are using the Internet to purchase products. However, the limited research on this indicates rates of purchasing tobacco online are low (Hrywna et al., 2004; McKeganey et al., 2019). Lastly, the lack of association may be due to a small number of tobacco users in our sample.

Our findings have several implications for policy. Strategies to reduce tobacco retailer density and proximity include retailer licensing, which reduces the number of retailers in a given location, thereby reducing tobacco marketing exposure to youth and young adults (Ribisl et al., 2017). However, many tobacco retailer licensing programs do not include newer tobacco retailers such as waterpipe cafés and vape shops. Our findings suggest waterpipe cafés and vape shops in North Carolina and Virginia are located in areas similar to traditional retailers. Thus, we might expect waterpipe cafés and vape shops to have similar effects on tobacco use initiation as traditional retailers do. We did not identify an association between traditional retailer location and use in our sample, however, we suspect that is due to our small sample of users. Future studies among larger samples of tobacco users are needed to examine this association. However, because the locations of waterpipe cafés and vape shops are similar to those of traditional retailers, municipalities should ensure vape shops and waterpipe cafés are not exempt from any required tobacco retailer licenses. Second, smoke-free and e-cigarette-free campus policies have had significant effects in reducing the density of vape shops (Dai & Hao, 2017). Encouragingly, colleges with tobacco-free campus policies had lower odds of having a waterpipe café nearby (Kates et al., 2016). Therefore, colleges that aim for tobacco-free policies that include all tobacco products may also impact tobacco retailer density and proximity near campus. Third, there is not a systematic method for tracking waterpipe cafés or vape shops, as there is for traditional

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retailers. Identifying these establishments as tobacco retailers or as a new code would allow both policymakers and researchers to further track and assess the scope of tobacco retailers within their communities.

This study is subject to several limitations. First, there is no widespread database or tracking source for waterpipe cafés or vape shops like there are tobacco retailers (e.g. NAICS codes), so, we identified these retailers using different methods. We may not have identified all retailers (we only used eight total search terms), some retailers may have been misidentified (Giovenco, 2018; Lee et al., 2018), or some retailers may have closed. This highlights a need to systematically track and capture these novel tobacco retailers to allow for future monitoring and surveillance. Second, our sample consisted of a cohort of young adults residing in North Carolina and Virginia. North Carolina and Virginia are tobacco-growing states in the southern US. Thus, our findings may not be generalizable to those outside this region. Finally, tobacco use data were from respondents at Wave 10 of a cohort study. Women, those whose mothers have a college education and never users of tobacco products at Wave 1 were more likely to participate at Wave 10 than their respective counterparts. Additionally, the use of mother's education may not be representative of participants' SES at Wave 10. Strengths include this is one of few studies to examine multiple retailer types within the same study and focuses on young adults, who are a susceptible population more likely to frequent waterpipe cafes.

With the changing tobacco retail environment, it is important to consider not only traditional tobacco retailers, but also waterpipe cafés and vape shops in surveillance and policy efforts. Among our sample of young adults in North Carolina and Virginia, census tract levels of race, ethnicity, and education levels were associated with waterpipe café and vape shop density and proximity. Tobacco control policies targeting tobacco retailers should include waterpipe cafés and vape shops.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

Funding for this study was provided by the National Cancer Institute of the National Institutes of Health under Award Number R01CA141643. J.L.K.'s time on this study was supported by grant numbers K01CA25323501 and P50CA180907 from the National Cancer Institute and the FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration. The funders had no role in designing the study, collecting, analyzing, or interpreting data, writing the manuscript, or deciding to submit the manuscript for publication.

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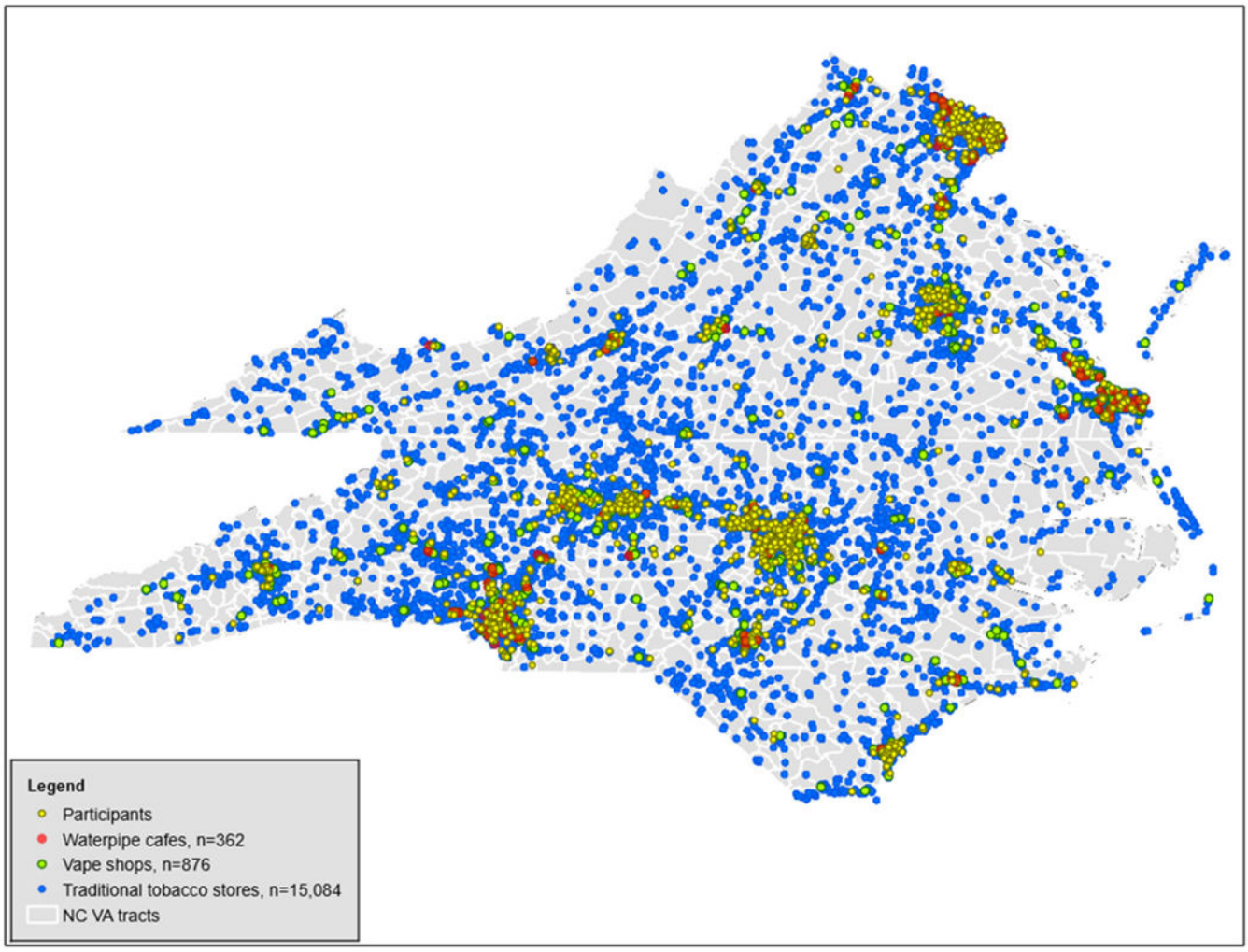

Figure 1.
Locations of waterpipe cafés, vape shops, and traditional tobacco retailers in North Carolina and Virginia.

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Table 1.

Community characteristics as predictors of tract-level density (adjusted).

	% Male		% Black		% Hispanic		% Bachelor's degree or higher		% College-enrolled		% Below poverty	
Outcomes	***B* (SE)**	***p* value**	***B* (SE)**	***p* value**	***B* (SE)**	***p* value**	***B* (SE)**	***p* value**	***B* (SE)**	***p* value**	***B* (SE)**	***p* value**
Waterpipe café density per 1000 population (tract level)	0.0011 (0.0005)	.03	0.0001 (0.0001)	.56	0.0007 (0.0002)	.004	0.0006 (0.0002)	<.001	0.0017 (0.0001)	<.001	0.0006 (0.0003)	.04
Vape shop density per 1000 population (tract level)	−0.0005 (0.0006)	.39	−0.0002 (0.0002)	.26	0.0013 (0.0003)	<.001	0.0004 (0.0002)	.03	0.0015 (0.0002)	<.001	0.0005 (0.0004)	.20
Traditional retailer density per 1000 population (tract level)	−0.0094 (0.0031)	.002	0.0005 (0.0009)	.56	0.0042 (0.0017)	.02	0.0024 (0.0011)	.02	0.0035 (0.0009)	<.001	0.0170 (0.0018)	<.001

Note. Models are listed by row and include all community composition characteristics as predictors, adjusting for all other community-level predictors. Bold indicates significant at $p < .05$.

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Table 2.

Density and proximity as predictors of tobacco use (unadjusted).

	Odds ratio (95% CI)					
	Past 30 days		Past 6 months			
Predictor	**Any tobacco use**	**Cigarette use**	**E-cigarette use**	**Cigar use**	**Waterpipe use**	**Smokeless tobacco use**
Waterpipe café density per 1000 population (tract level)	1.3 (0.4, 4.2)	0.7 (0.2, 3.0)	2.1 (0.5, 8.2)	3.0 (0.9, 10.1)	1.9 (0.3, 14.1)	0.8 (0.1, 7.4)
Vape shop density per 1000 population (tract level)	0.5 (0.1, 1.6)	0.7 (0.2, 2.7)	0.6 (0.1, 3.0)	0.4 (0.1, 2.0)	0.4 (0.05, 4.0)	1.2 (0.2, 7.0)
Traditional retailer density per 1000 population (tract level)	1.1 (0.9, 1.4)	1.1 (0.8, 1.5)	1.1 (0.8, 1.5)	1.2 (0.9, 1.7)	0.8 (0.5, 1.3)	0.9 (0.6, 1.5)
Proximity to nearest waterpipe café in miles driving	1.0 (0.98, 1.02)	1.0 (0.99, 1.02)	0.98 (0.96, 1.01)	1.00 (0.98, 1.02)	0.9 (0.9, 0.98)	1.0 (0.9, 1.02)
Proximity to nearest vape shop in miles driving	1.0 (0.95, 1.04)	1.0 (0.98, 1.1)	0.9 (0.9, 1.01)	1.0 (0.9, 1.03)	0.9 (0.8, 0.997)	0.9 (0.8, 1.1)
Proximity to nearest traditional retailer in miles driving	0.9 (0.7, 1.1)	1.0 (0.8, 1.3)	0.9 (0.7, 1.2)	0.7 (0.5, 0.9)	0.7 (0.4, 1.04)	0.8 (0.5, 1.3)

Note. Bivariate logistical regression models. An odds ratio <1 means the outcome is associated with a decrease in the number of miles and an increase in proximity.

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