



Original Investigation

Inequitable Distribution of FTP Marketing by Neighborhood Characteristics: Further Evidence for Targeted Marketing

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Abstract

Introduction: Flavored tobacco products (FTPs) are disproportionately used among young people and racial/ethnic minority populations. However, few studies have examined the retail distribution of such product marketing beyond menthol cigarettes. This study created geographic-based predictions about marketing of FTPs (overall, cigarettes, cigars, e-cigarettes, and smokeless) in stores across Washington, DC neighborhoods. We examined neighborhood-level demographic correlates of the amount of FTP and non-FTP marketing.

Methods: We conducted photographic audits of interior and exterior tobacco marketing in 96 Washington, DC tobacco retailers visited by 149 young adult respondents between 2018–2019. We created a geographic predictive surface of overall and product-specific tobacco marketing and then estimated the average predicted amount of marketing at the census-tract level using zonal statistics. Using linear regression, we examined neighborhood demographic correlates (race/ethnicity, family poverty, and youth population under 18) of FTP and non-FTP marketing.

Results: The predicted amount of non-FTP ads/displays were evenly distributed with no neighborhood variability (Range 8.46–8.46). FTP marketing overall was geographically concentrated with greater range across neighborhoods (Range 6.27–16.77). Greater FTP marketing overall and flavored cigar marketing was available in neighborhoods with higher percentages of Black residents. Flavored cigar marketing was less available in neighborhoods with more Hispanic residents, but there was greater flavored smokeless tobacco marketing. Nonflavored marketing overall and by product did not vary across neighborhoods.

Conclusions: This study provides evidence of disproportionate distribution of FTP marketing in Black neighborhoods, especially for flavored cigars, at the point-of-sale. Policies that restrict the sale of FTPs may enhance health equity.

Implications: Tobacco marketing has frequently been shown to be more prevalent in neighborhoods with lower household income and more Black residents. Using geographic-based predictions, we find that greater flavored tobacco marketing in these neighborhoods, not decreased marketing for nonflavored tobacco, is driving this disparity. Targeting Black neighborhoods with increased marketing of flavored tobacco products, which has been found to be more appealing, easier to use, and harder to quit is a social justice issue.

Introduction

The Family Smoking Prevention and Tobacco Control Act of 2009 banned sales of cigarettes with characterizing flavors such as mint, cherry, and wine, although menthol cigarettes were exempted and remained available to consumers.¹ Further, other noncigarette products such as cigars and cigarillos, smokeless tobacco, hookah, and e-cigarettes are still sold in a variety of flavors. In April 2021, the FDA announced an intention to ban menthol cigarettes and flavored cigars nationwide, but such restrictions are not yet enacted.²

Use of flavored tobacco products has been linked to smoking initiation,³ progression to regular smoking,⁴ and decreased ability to quit.⁵ In 2014–2015, almost 68% of young adults and 72% of youth tobacco users used a flavored tobacco product (FTP) in the past 30 days,⁶ with slightly lower youth FTP use rates of 64% by 2018.⁷ Flavored products may be linked with disproportionate use in racial/ethnic sub-populations. In particular, among all smokers (age 12 years and up) menthol cigarettes are used by 85% of Black, and 47% of Hispanic smokers compared with only 29% of White smokers.⁸ Nationally, higher percentages of Black, Hispanics, and other non-Hispanic adult tobacco users are flavored noncigarette smokers compared with White non-Hispanic tobacco users.⁹ Additionally, despite lower prevalence of smoking, lower intensity (fewer cigarettes per day), and frequency (nondaily use) Black smokers have similar tobacco-related disease burden to White smokers, which is hypothesized to be related to menthol use.¹⁰

One reason for these differences may be differential marketing of FTPs. Prior studies have found that tobacco products are marketed more heavily and are more widely available in neighborhoods with lower income, more Black residents, and greater urbanicity.^{11,12} There is clear evidence that mentholated cigarettes, the only remaining flavored cigarette on the market, have been targeted to Black and Hispanic populations.^{13,14} A primary venue for this targeting has been through retail stores. Reviews of retail audit studies have found significantly more menthol advertisements in areas with higher proportions of Black residents^{11,15} or near schools with more Black students.¹²

There is also evidence of racial/ethnic target marketing of noncigarette products in retail stores. In a national study, flavored little cigars/cigarillos were more prevalent in neighborhoods with higher proportions of Black residents.¹⁶ This may be particularly prevalent in cities/locations that have a high population of Black residents. For example, prior studies in Washington, DC, which is a city with the 9th largest population of African Americans in the US and has more Black than White residents,¹⁷ found more exterior advertising for little cigars and cigarillos in neighborhoods with more Black residents,¹⁸ and a Los Angeles study similarly found greater availability of little cigars and cigarillos in areas with more Black and Hispanic residents and more flavored little cigar/cigarillo availability in Black neighborhoods.¹⁹ In contrast, a study in Minnesota stores found that areas with more Black and Asian residents had less smokeless tobacco marketing than stores in areas with more White

residents,²⁰ perhaps corresponding to higher prevalence of smokeless tobacco use among non-Hispanic White adults.²¹ A national study found that e-cigarette availability was initially low in neighborhoods with more Black residents, but expanded into these neighborhoods between 2012 and 2017, following the uptick in e-cigarette use in the US.²² Overall, these studies suggest differential product marketing by neighborhood. To add to the extant literature, our study specifically assesses neighborhood differences in the retail marketing of flavored and nonflavored cigarette and noncigarette products in Washington, DC neighborhoods.

The current study used photographic surveillance data from stores visited by a sample of young adult noncurrent tobacco users (ages 18–24). These young adults were study participants who represented a group at risk for flavored tobacco use. Young adult noncurrent tobacco users are an important target for tobacco marketing since many are of legal age to purchase tobacco and age of tobacco initiation and progression to regular use has been increasing into the young adult years.²³ Additionally, while Washington DC youth smoked cigarettes at slightly below the national average in 2018 (8.1% vs. 8.8%), disparities existed among adults. Cigarette smoking rates were 22.2% among African American residents, and 8.8% of Hispanic residents compared with an average of 14.3% of all residents.²⁴

We then used geostatistical methods to generate predictions about the expected amount of marketing of flavored tobacco products in neighborhoods across Washington, DC including e-cigarettes which are classified as tobacco products in DC statute. At the time of the data collection in 2018–2019, Washington DC did have a Tobacco 21 sales restriction in place effective as of February 18, 2017 but did not have an FTP sales restriction. We also examined neighborhood-level demographic correlates of the amount of flavored and nonflavored tobacco marketing to better contextualize targeted marketing of these products by neighborhood demographics.

Methods

The study design and protocol were approved by the Advarra IRB (formerly Chesapeake IRB) (Protocol: Pro00020538) and the University of Kentucky IRB (Protocol: 51579).

Data Collection

Store Identification

As part of a larger study that assessed exposure to tobacco marketing among young adults who were not current (e.g., past 30-day use) tobacco users in Washington, DC ($n = 149$), respondents reported their store visiting in real-time via text messaging or an app on their phone over a 14-day period. Respondents reported 240 store visits over the data collection period (Supplementary Figure 1). However, 28 reports of store visits were ineligible as they were outside of Washington, DC or did not sell tobacco (e.g., CVS). The final sample of 212 store visits were mapped and geocoded (via street address)

to an existing list of tobacco retailers with a tobacco retailer license or through searching commercial databases (e.g., Yelp, Dun, & Bradstreet), if reported stores were not on the license list. Some stores were visited by the same respondent multiple times during the data collection period or by multiple respondents. There were 109 stores that were reported more than once. Potentially eligible unique stores ($n = 103$) were visited by a trained data collector (not a study respondent) within 6 weeks of the participants' visit to verify whether the store was in business and sold tobacco products. From this verification phase, 7 visited stores were deemed ineligible (6 did not sell tobacco and 1 was out of business). This assessment left a total of 96 eligible stores. Conceptually, this sample of retailers represent those that were frequented by these young adults during their routine daily activities.

Store Visiting

Following an approach to tobacco retail marketing surveillance used in prior studies, the data collector took cell phone camera photographs of the exterior of each eligible store and all exterior tobacco marketing.^{25,26} Inside the store, the data collector also took comprehensive photographic surveillance of all interior tobacco advertising and displays using unobtrusive camera glasses (Pivothead Durango, Pivotvision.com) which took a high-resolution photograph every second. The data collector was trained to have minimal contact with store personnel while taking pictures. They did not make a purchase. Interior photographs were completed in under 5 minutes per store. All data collection was completed between 2018 and 2019.

Advertising/Display Identification

Two trained research assistants examined all store photographs and cropped visible tobacco advertisements and product displays (i.e., branded movable structures that hold tobacco products, combining advertising, and product presentation),²⁷ excluding photographs of persons or any individually identifying information. Product availability (e.g., packs alone) were not coded. A supervisory coder reviewed all photos and coding for accuracy (more detail about coding described below).

Measures

Advertisement/Display

Each advertisement and interior display was independently coded by trained two coders for interior (any tobacco marketing inside the store) vs. exterior location (including any tobacco advertising on the storefront or in the parking lot or premises), brand, product type, advertisement or display, and flavored vs. tobacco/nonflavored. Coders met to reconcile any discrepancies. Product type was categorized as: cigarettes, cigars (cigars, cigarillos, and little cigars), e-cigarettes (including e-hookah), and smokeless tobacco (chewing tobacco, snuff, and snus). We trained coders to identify FTPs consistent with the same practices used to train store auditors to conduct in-person FTP audits through standardized assessments such as those co-developed by the lead author.²⁸ Total ads/displays were summed by product and flavored status at the store level. If advertisements included both flavored and nonflavored types of the same brand/product they were coded as flavored (e.g., Swisher Sweets cigarillos ad picturing a variety of flavored and nonflavored varieties). As in prior studies, advertisements for menthol predominant brands (e.g., Newport, Salem, Kool) were coded as flavored unless they specifically advertised a nonmenthol variety (e.g., Newport Red).¹⁵ If advertisements just had a brand name with no specific flavor

identifiers (e.g., flavor descriptors, green color when typical signage is red, pictures, or flavor packaging), ads were coded as nonflavored. Ads that could not be determined as flavored or nonflavored due to photo quality were omitted from the analysis ($n = 5$). [Supplementary Figure 2](#) shows coding examples.

Store

At the store level, we examined store type as: (1) grocery/supermarket; (2) gas/convenience or convenience store; (3) drug store; (4) beer, wine, or liquor store; or (5) other (e.g., pharmacy/drug store, tobacco specialty store, warehouse/club store, mass merchandiser).

Neighborhood Correlates

We obtained census tract demographics from the American Community Survey (2013–2017) 5-year estimates for Washington, DC. We included (1) percent Black residents, (2) percent Hispanic residents, (3) percent of households under poverty, and (4) percent youth residents (aged under 18).

Data Analysis

Based on the marketing from the 96 visited stores, we created an average of the amount of marketing overall, and by product and flavor type and the percent of stores that contained that type of marketing material. We conducted paired t-tests of flavored and nonflavored marketing by overall and by product type. We then used the results from the 96 stores to create predictive surfaces for the city using ordinary kriging for the amount of overall and product-specific flavored and nonflavored ads/displays—an approach previously used to predict tobacco prices.¹⁸ Kriging is a geostatistical approach used to interpolate/predict the values of the primary variable (i.e., ads/displays) at unsampled locations based on generalized least-squares regression against the observed values of surrounding data points, weighted according to spatial covariance values.²⁹ In ordinary kriging, the mean is assumed to be an unknown constant within the neighborhood of each predicted value and the best linear unbiased predictor is produced by minimizing the mean square prediction error. A search radius constructed from all the stores within the sample was used to create each continuous predictive surface, where the likely amount of product-specific flavored tobacco ads/displays could be extracted at a resolution of 30 meters by 30 meters. All predictive surfaces were generated via the Geostatistical Analyst extension in ArcGIS for Desktop Advanced Version 10.7.1, ESRI 2019.

Zonal statistics conducted in 2021 produced an average predicted amount of flavored tobacco marketing overall and by tobacco product category for each census tract from the resulting predictive surfaces. We included (1) cigarettes, (2) cigars (including large cigars, little cigars, and cigarillos), (3) e-cigarettes/e-hookah, and (4) smokeless tobacco (including snuff, chew, dip, and snus). We only included census tracts (154 tracts) covered by at least 50% of the predicted surface. This was to be conservative as predictions are weighted by geographic proximity so where there were fewer stores in close proximity the estimates are less reliable. We conducted multivariable linear regression analyses of the neighborhood-level correlates, assessed as 10-unit changes, of each of the average predicted amounts of flavored and nonflavored tobacco marketing byproduct and overall at the census tract level. Results used a Bonferroni adjustment for multiple comparisons and report the 95% Confidence Intervals (CI) however with significance assessed at $p < .0025$. For nonflavored products due to low predicted variability by

neighborhood (Supplementary Table 1) we did not conduct linear regression. All analyses were completed in SAS Version 9.4 (Cary, NC).

Results

Study Tobacco Retailer Characteristics

Of the 96 stores included in the analysis, predominant store types were gas/convenience or convenience stores (45%), grocery/supermarkets (20%), followed by beer, wine, and liquor stores (13%). Stores were located in all 8 wards of Washington, DC with most in Ward 2, an ethnically-diverse area in the central business district in the Northwest section of the city.

Table 1 shows the overall and product-specific tobacco marketing from visited stores ($n = 96$) by flavored and nonflavored ads/displays. Across the 96 stores we coded 1840 ads/displays. We dropped 5 ads that could not be determined due to poor image quality. Of the remaining 1835, 44% were nonflavored, 53% were flavored, and 3% included both a flavored and nonflavored product and were counted as flavored as described in the coding rules. Stores showed an average of 19.1 tobacco ads/displays with an average of 10.6 of those for a flavored product and 8.5 for a nonflavored product. Almost all visited stores (95%) had tobacco marketing with 78% of stores having cigar marketing, 76% having cigarette marketing, 50% having e-cigarette marketing, and 39% having smokeless tobacco marketing. On average, 49% of flavored products ad/displays per store were for flavored cigars (mean 5.2), 29% were for menthol cigarettes (mean 3.1), 8% were for flavored smokeless products (mean 0.8), and 4% were for flavored e-cigarettes (mean 0.4). For nonflavored marketing, on average 48% was for cigarettes (mean 4.5), 34% for cigars (mean 2.9), 14% for e-cigarettes (mean 1.2) and 13% for smokeless (mean 1.1). There were significant differences in the average amount of flavored versus nonflavored marketing for cigars and e-cigarettes.

Predicted Tobacco Marketing by Flavor Type

Figure 1, Panel A shows the percent of Black residents by census tract across Washington, DC neighborhoods ranging from 1.03 to 100% overlaid with Ward level adult smoking rates to give a broader context to our neighborhood analysis. In DC, where the smoking rate in 2017 was 14.3%, areas with higher proportion of Black residents also have much higher smoking rates up to 24% in Ward 8.²⁴ These neighborhoods were also highly correlated with percent of families under Federal poverty ($r = 0.6$). Based on the predictive mapping of store products, shown in Figure 1, Panel B the predicted surface of flavored ads/displays across Washington, DC ranged from 6.27 to 16.77 and mapped to similar vulnerable neighborhoods shown in

Panel A. Nonflavored ads/displays (Panel C), in contrast, had a predicted range from 8.46 to 8.46 and were evenly distributed.

Figure 2, shows the distribution of the predicted ads/displays for each type of FTP, cigarettes (Panel A), cigars (Panel B), smokeless (Panel C), and e-cigarettes (Panel D) showing different patterns for the various products. The predicted surface of flavored cigarettes (i.e., menthol) marketing ranged from 4.14 to 4.15, and showed consistency throughout the city. There was a greater range for flavored cigar ads/displays, ranging from 1.54 to 12.1, with a higher concentration in Ward 7 and 8 also corresponding to the area with the highest proportion of Black residents. In contrast, predicted flavored smokeless tobacco (range 0.19 to 2.25) and e-cigarette (range 0.01 to 3.83) marketing had a smaller range and was evenly distributed across the city.

Linear Regression Analysis

Adjusted linear regression analyses (Table 2) examined neighborhood correlates (percent under 18, percent Black residents, percent Hispanic residents, percent families under the household poverty limit) of the predicted average number of ads/displays overall and of each product type for flavored products at the census tract level. Due to lack of variability of the predicted range for nonflavored products at the census tract level (See Supplementary Table 1), we did not conduct linear regression for nonflavored products. For ease of interpretation, we have scaled the correlates to correspond to one unit change in marketing for every 10-unit increase in percent of residents with that characteristic in the neighborhood. All neighborhood characteristics are included in adjusted models.

For flavored ads/displays, percent of residents under 18 was not significantly associated with the predicted amount of flavored marketing overall or by product type in the census tract. However, for every 10-percentage point increase in Black residents, the mean number of flavored ads/displays overall was predicted to be greater by 0.6 flavored marketing materials ($b = 0.6$, $SE: .04$ $p < .0001$), while holding other variables constant. The same was true for the number of flavored ads/displays for cigar products, which was predicted to have 0.5 more marketing materials ($b = 0.45$ $SE: .05$ $p < .001$) for every 10-percentage point increase in Black residents. However, for every 10-percentage point increase in households under poverty, there was a negative association with amount of flavor marketing overall ($b = -0.29$ $SE: .08$ $p = .0002$). While for every 10-percentage point increase in Hispanic residents (range was 0 to 42% in DC census tracts covered by the predictive surface), the predicted number of flavored cigar ads/displays was 0.81 marketing materials less ($b = -0.81$ $SE: 0.14$ $p < .0001$) but the predicted amount of flavored smokeless tobacco ads/displays was .27 more ($b = .27$

Table 1. Overall and product-specific tobacco marketing from visited stores ($n = 96$) by flavored and nonflavored ads/displays

	Total ads/displays		Flavored ads/displays		Nonflavored ads/displays		p^b
	Mean (SD) ^a	% ^a	Mean (SD)	%	Mean (SD)	%	
Overall	19.1 (15.5)	94.8	10.6 (9.2)	85.4	8.5 (7.9)	88.5	.07
Cigarette	7.3 (7.5)	76.1	3.1 (3.4)	65.6	4.1 (4.5)	64.6	.07
Cigar	8.1 (8.1)	78.1	5.2 (5.6)	72.9	2.9 (4.7)	68.7	.002
E-cig	1.6 (2.1)	50.0	0.4 (0.9)	23.9	1.2 (1.9)	42.7	.001
Smokeless	1.9 (3.1)	38.5	0.8 (1.5)	28.1	1.1 (1.9)	34.4	.22

SD: Standard Deviation.

^aMean and percent are among all eligible stores visited $n = 96$.

^bPaired t-test of flavored and nonflavored means significant at $p < .05$.

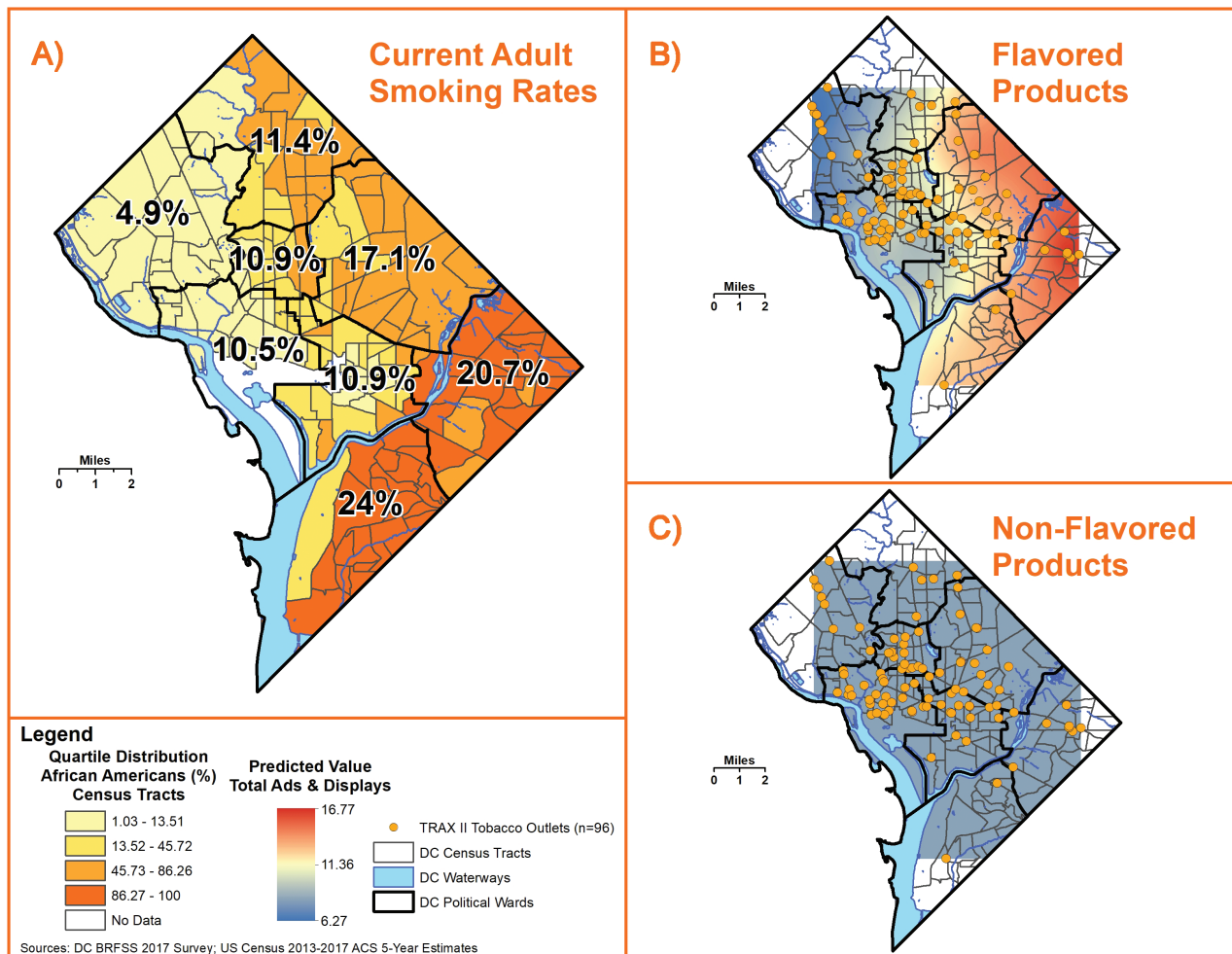


Figure 1. Black population distribution and Ward adult smoking rates and predicted surfaces of overall flavored and nonflavored tobacco marketing. Sources: DC BRFSS 2017 Survey, US Census 2013–2017 ACS 5-Year Estimates.

SE: .05 $p < .0001$). Potentially due to more widespread marketing of menthol cigarettes in Washington DC, there was no significant relationship between percent of Black residents with menthol cigarette marketing. E-cigarette and smokeless tobacco marketing were also not significantly related to the percent of Black or Hispanic residents in the census tract.

Discussion

This study demonstrates that the distribution of tobacco marketing at tobacco retailers frequented by young adults varies by flavor status, neighborhood characteristics, and tobacco product type. Overall patterns of tobacco marketing in this study are similar to findings in other studies, with more marketing of tobacco in areas with more minority residents. Based on our geospatial prediction, we found that much of the difference in retail tobacco marketing was due to disproportionate and inequitable distribution of flavored versus nonflavored products. That is, predicted amounts of tobacco marketing for nonflavored products were geographically more evenly distributed and had a narrower range and lower high end. Flavored products, in contrast, had a wider predicted range with more advertising in areas with more Black residents. Additionally, while nonflavored tobacco marketing did not differ significantly by

neighborhood demographics, flavored marketing, particularly for cigars, was more prevalent in areas with a higher concentration of Black residents. This result is consistent with findings for greater cigar marketing in predominantly Black neighborhoods.^{16,18,19} Flavored cigars are also used at higher rates among Black smokers, suggesting a relationship between point-of-sale marketing and product use.³⁰ Flavored cigar products appear to also be disproportionately and inequitably targeted to Black communities in Washington DC, while not being heavily marketed in Hispanic neighborhoods at this time, similar to national findings on little cigar/cigarillo exterior store advertising.¹⁶ Hispanic/Latino residents comprise about 10% of the Washington DC population and tend to live in areas that are more ethnically and socioeconomically diverse than do Black residents, potentially limiting targeted marketing to this population. Flavored smokeless tobacco marketing was also less prevalent in areas with higher concentrations of Hispanic residents, perhaps related to more smokeless marketing in neighborhoods with more White residents as found in prior studies.^{11,20}

Our findings did differ from prior studies in not showing significant relationships with menthol cigarette marketing in Black neighborhoods.^{15,31} While there is long-standing “African-Americanization” of menthol cigarettes,¹⁴ we found that menthol cigarettes are widely marketed throughout Washington, DC perhaps

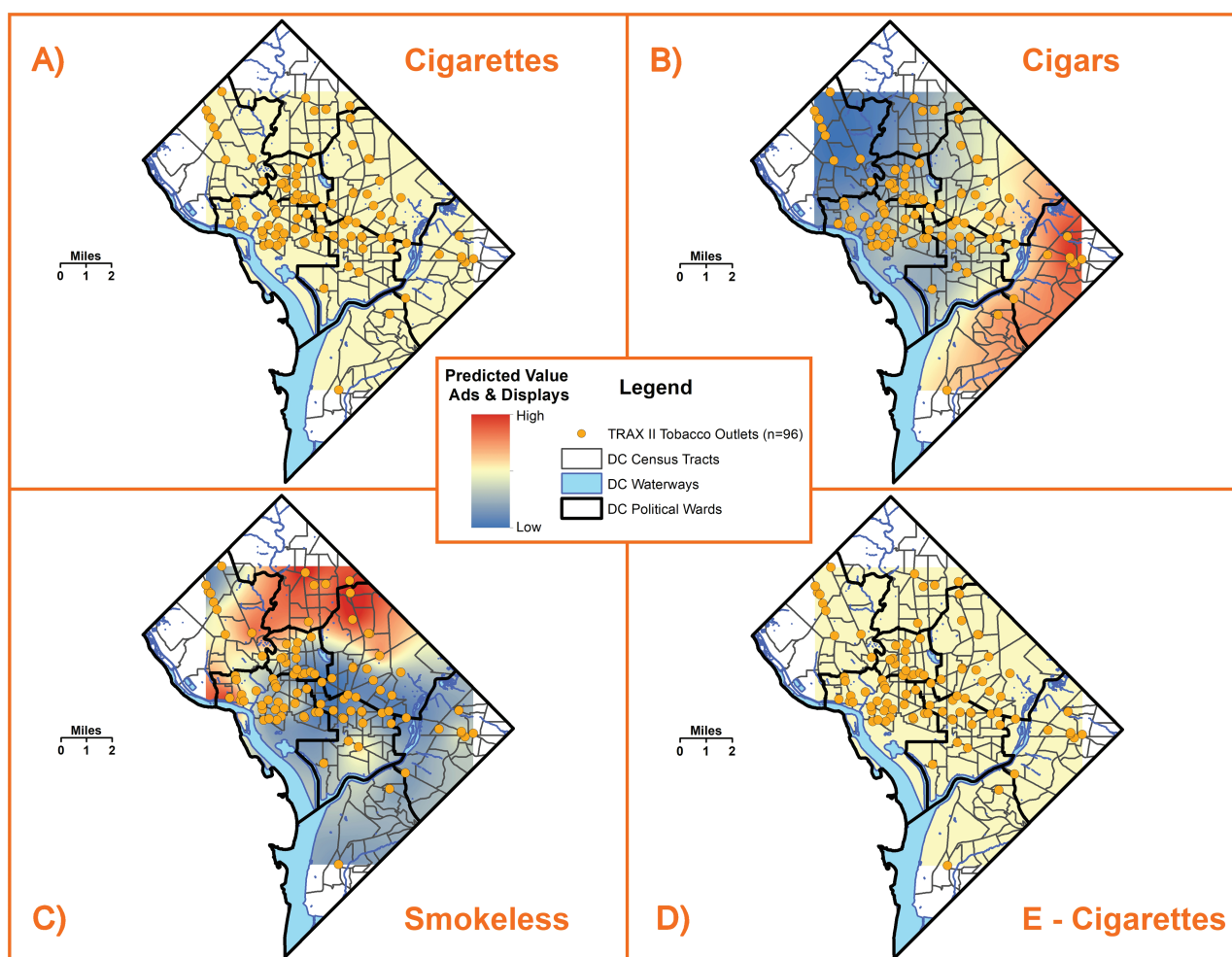


Figure 2. Predicted surfaces of flavored tobacco marketing by product type. Sources: DC BRFSS 2017 Survey, US Census 2013–2017 ACS 5-Year Estimates.

Table 2. Adjusted linear regression with Bonferroni adjustment of flavored tobacco marketing by census tract neighborhood characteristics (census tracts, $n = 154$)

Demographic Characteristic	Overall		Flavored Cigarette		Flavored Cigar		Flavored E-Cig		Flavored Smokeless	
	B (SE) (95% CI)	<i>p</i>	B (SE) (95% CI)	<i>p</i>	B (SE) (95% CI)	<i>p</i>	B (SE) (95% CI)	<i>p</i>	B (SE) (95% CI)	<i>p</i>
Under 18	-0.07 (0.15) (-0.36, 0.22)	.63	0.00 (0.00) (-0.00, .00)	.99	0.07(0.16) (-0.25, 0.40)	.65	-0.00 (0.00) (-0.00, 0.00)	.21	0.07 (0.05) (-0.04, 0.18)	.19
Percent Black	0.59 (0.04) (0.51, 0.68)	<.0001*	0.00 (0.00) (-0.00, 0.00)	.60	0.45 (0.05) (0.35, 0.53)	<.0001*	-0.00 (0.00) (-0.00, 0.00)	.85	0.01 (0.02) (-0.03, 0.04)	.74
Percent Hispanic or Latino	-0.21 (0.12) (-0.45, 0.04)	.10	0.00 (0.00) (0.00, 0.00)	.05	-0.81(0.14) (-1.09, -0.54)	<.0001*	-0.00 (0.00) (-0.00, 0.00)	.65	0.27 (0.05) (0.18, 0.35)	<.0001*
Percent household living under 100% FPL	-0.29 (0.08) (-0.44, -0.14)	0.0002*	0.00 (0.00) (-.00, 0.00)	.73	.02(.08) (-0.14, 0.18)	.81	0.00 (0.00) (-0.00, 0.00)	.49	-0.06(0.03) (-0.11, 0.00)	.05

FPL: Federal Poverty Level

Significance assessed at $*p < .0025$ due to multiple comparisons.

reflecting broader taste preferences for menthol cigarettes among smokers in a city with a large Black population. The tobacco industry has a long history of targeting specific tobacco products to minority and socio-economically disadvantaged populations.^{13,32} However, in our study we found that the additional marketing of

flavored products in Black neighborhoods was not simply due to marketing to residents under poverty. While it has previously been noted that “selectively marketing a more dangerous product to select populations highlights that menthol cigarettes pose not just a public health problem, but a social justice problem as well,”³³ this

argument can be more broadly applicable to noncigarette tobacco products as well. Flavored tobacco products may enhance tobacco product appeal and attraction.³⁴ Internal tobacco industry documents corroborate geodemographic “micro-marketing” by cigarette companies, targeting in-store promotions based on area and store demographics.¹¹ Inequitable marketing of these types of appealing flavored products may be a major factor implicated in tobacco use disparities and higher tobacco use burden in already vulnerable populations.³⁵ Our results suggest that beyond menthol cigarettes, flavored products overall, and specifically cigars, may also be a social justice issue for Black communities.

Strengths and Limitations

This study had a number of limitations. Because we collected data only from stores visited by young adult noncurrent tobacco users, we did not collect data from a random sample of stores and did not have a large number of stores in the sample. Our predictive surface does not distinguish between retailer types, however, the distribution of stores types in our study was broadly consistent with a 2011 study of all tobacco retail stores in Washington DC showing 41% convenience/gas convenience, 11% grocery/supermarkets, and 21% liquor stores.¹⁸ Convenience stores which typically have more tobacco marketing than other store types are slightly more represented in our sample than they are in the overall environment, but liquor stores which also have more tobacco marketing are slightly less represented.³⁶ Thus, on average our estimates in unsampled location are expected to be similar to those found in the actual store mix in unsampled locations, though these assumptions would need to be tested in future studies. Additionally, stores were distributed throughout the city and represented stores that appealed to young adults, who are often the target of tobacco industry marketing. Flavors in tobacco, specifically, are a tactic used to attract new users including young adults.^{37,38}

Additionally, our geostatistical modeling approach allowed us to generate predicted values of the amount of marketing for most of the city similar to approaches that have predicted tobacco prices across neighborhoods.¹⁸ In future studies with additional stores, these predictions can be validated and predicted values can be improved and broadened. We limited our assessment to tobacco marketing advertisements and displays, and did not assess other aspects of marketing such as availability, price, placement, or promotions of tobacco products, which may be associated with differential targeting by neighborhood characteristics.^{12,18} Data collection was also completed prior to the January 2020 Federal enforcement policy against the sale of flavored e-cigarette cartridge products other than tobacco or menthol, however, e-cigarette marketing in Washington DC stores was generally low prior to this restriction.³⁹ The study provides a one-time snapshot of tobacco marketing and does not allow us to determine marketing changes over time. Finally, this study does not account for other sources of tobacco marketing such as online or through social media which are growing and also influential with this age group.⁴⁰ However, 74% of young adult smokers report noticing tobacco ads or promotions in stores.⁴¹ Regulating tobacco marketing through multiple avenues would help to reduce tobacco use in young adults.

The study also provides a number of strengths. Using predictive surfaces is an innovative methodology for examining disparities at the neighborhood level and is also a low-cost approach. As with other studies of tobacco retailers,^{42,43} we did not need to visit all or

most stores to uncover patterns of marketing by neighborhood as we were able to draw on the expected geographic clustering of store marketing environments (i.e., we expected nearby stores to be more similar than more distant stores due to local competition and similar customer base).⁴⁴ Additionally, the rapid photo technique used in the current protocol was a low-cost, low-burden approach to conducting store audits. As found in prior studies,^{25,26} it provides an unobtrusive, comprehensive record of the interior and exterior store environment as seen by a consumer, allows us to go back to our existing photographic data for more detail without having to revisit stores, requires little training and subjective judgment from store auditors, and it is an approach that can be used in other areas to conduct audits. Coders were also trained to identify flavored and nonflavored marketing in processes similar to those used to train in-person store auditors enhancing the consistency with other studies. However, testing the validity of such coding against store audit approaches is important for future development of this methodology.

Overall, disparities in tobacco marketing appeared to be associated with higher amounts of flavored, but not nonflavored, tobacco marketing in Black neighborhoods in an urban setting. Numerous localities have restricted sales on FTPs.⁴⁵ For example, New York City’s restriction on flavored product sales (excluding menthol) led to decreased odds of youth ever using FTPs or any tobacco after the restrictions came into effect.⁴⁶ Restrictions on flavored cigar sales in Providence, Rhode Island led to decreased sales of flavored cigars, but increased sales of ambiguously named products (“concept” flavors) suggesting some product substitution.⁴⁷ In June 2021, the DC Council passed a bill restricting the sale of flavored tobacco including menthol cigarettes and flavored cigars, and e-cigarettes. It would be noteworthy to see how marketing and use patterns change with the passage of this regulation. Our study could serve as a type of baseline for assessment of future marketing changes. Other states and localities can take similar approaches. At the national level, the FDA announced plans to restrict the sales of menthol cigarettes and extend the flavored cigarette ban to products like cigars as a health equity issue. Taking such action could have beneficial disparity-reducing effects in Black communities that are experiencing inequitable targeted marketing of FTPs^{48,49} and a disproportionate burden of tobacco-related morbidity and mortality.

Supplementary Material

A Contributorship Form detailing each author’s specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

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Declaration of Interests

KM Ribisl is a paid expert consultant in litigation against e-cigarette and tobacco companies. Although author AAR is an FDA/CTP employee, this work was not done as part of his official duties. This publication reflects the views of the author and should not be construed to reflect the FDA/CTP’s views or policies. All other authors have no conflicts of interest to disclose.

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Data Availability

Deidentified data are available upon request from the PI, Dr. Shyanika Rose, by applicants who complete an approved data sharing request and with human subjects protections approval.

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