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Original investigation

# Neighborhood Variation in the Price of Cheap Tobacco Products in California: Results From Healthy Stores for a Healthy Community

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## Abstract

**Background:** Retail marketing surveillance research highlights concerns about lower priced cigarettes in neighborhoods with a higher proportion of racial/ethnic minorities but focuses almost exclusively on premium brands. To remedy this gap in the literature, the current study examines neighborhood variation in prices for the cheapest cigarettes and a popular brand of cigarillos in a large statewide sample of licensed tobacco retailers in a low-tax state.

**Methods:** All 61 local health departments in California trained data collectors to conduct observations in a census of eligible licensed tobacco retailers in randomly selected zip codes (n = 7393 stores, completion rate=91%). Data were collected in 2013, when California had a low and stagnant tobacco tax. Two prices were requested: the cheapest cigarette pack regardless of brand and a single, flavored Swisher Sweets cigarillo. Multilevel models (stores clustered in tracts) examined prices (before sales tax) as a function of neighborhood race/ethnicity and proportion of school-age youth (aged 5–17). Models adjusted for store type and median household income.

**Results:** Approximately 84% of stores sold cigarettes for less than \$5 and a Swisher Sweets cigarillo was available for less than \$1 in 74% of stores that sold the brand. The cheapest cigarettes cost even less in neighborhoods with a higher proportion of school-age residents and Asian/Pacific Islanders.

**Conclusions:** Neighborhood disparities in the price of the cheapest combustible tobacco products are a public health threat. Policy changes that make all tobacco products, especially combustible products, less available and more costly may reduce disparities in their use and protect public health.

**Implications:** Much of what is known about neighborhood variation in the price of combustible tobacco products focuses on premium brand cigarettes. The current study extends this literature in two ways, by studying prices for the cheapest cigarette pack regardless of brand and a popular brand of flavored cigarillos and by reporting data from the largest statewide sample of licensed tobacco retailers. Significantly lower prices in neighborhoods with a higher proportion of youth and of racial/ethnic groups with higher smoking prevalence are a cause of concern. The study results underscore the need for policies that reduce availability and increase price of combustible tobacco products, particularly in states with low, stagnant tobacco taxes.

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## Introduction

Higher prices for tobacco products discourage initiation, reduce consumption, promote quitting, and prevent relapse.<sup>1</sup> Therefore, widespread availability of cheap, combustible tobacco constitutes a significant public health concern, both in the United States and in other countries.<sup>2</sup> In California, where this study was conducted, the \$0.87 per pack cigarette tax ranked 37th among the 50 states and had not increased for almost two decades. Before voters approved a tobacco tax increase in 2016, the average cigarette pack price was \$5.47.<sup>3</sup> In addition, California young adults, women, African Americans, and heavy smokers were significantly more likely than others to take advantage of cigarette price promotions practically every time they see one.<sup>4</sup>

Data sources for monitoring tobacco prices in the United States are typically aggregated to states or designated market areas.<sup>5</sup> Unfortunately, these large geographies make it impossible to answer important research questions about how tobacco companies or retailers manipulate prices to target specific groups by age or race/ethnicity. To remedy this concern, a growing number of studies examine neighborhood variation in cigarette prices by comparing advertised prices from randomly sampled stores.<sup>6,7</sup> The majority of such studies typically monitor cigarette prices for popular premium brands. For example, Marlboro cost less in neighborhoods with a lower median household income and in neighborhoods with a higher proportion of Hispanic residents, even after adjusting for store type.<sup>8-10</sup> Newport, the leading brand of menthol cigarettes, cost less in neighborhoods with a higher proportion of African American residents<sup>8-10</sup> and in neighborhoods with a higher proportion of residents who are school-age youth.<sup>11,12</sup>

Fewer studies monitor cigarette prices for discount brands. In one city in Great Britain, a study documented that pack prices clustered at three modes and that the minimum advertised price was 61% of the maximum advertised price.<sup>13</sup> In Minneapolis convenience stores, the average price for a discount brand was 16% less than that of a premium brand from the same manufacturer and 25% less than the menthol variety from the same unidentified premium brand.<sup>14</sup> The menthol price was not correlated with the proportion of nonwhite residents or youth; however, the discount variety cost less in neighborhoods with a higher proportion of nonwhite residents. In our previous research, the most popular discount brands were not as widely available as the most popular premium brands<sup>9</sup>; therefore, this study assessed the price of the cheapest cigarette pack regardless of brand.

Too little is known about neighborhood variation in price of other combustible tobacco products. This study also focuses on cigarillos, a product category that raises several public health concerns: fruit, sweet, and alcohol flavors that appeal to youth, misperceptions that cigarillos are less harmful than cigarettes, and marketing that promotes concurrent use of tobacco and marijuana.<sup>15-19</sup> In Washington, DC, the average price per cigarillo was less than \$1 for the brand Black & Mild.<sup>20</sup> In addition, the unit price was significantly lower in neighborhoods with a higher proportion of African Americans. However, determining whether this association is independent of neighborhood income was impossible because race and income were so highly correlated. The current study extends this literature by examining neighborhood variation for the price of a different popular brand in a representative sample of licensed tobacco retailers in California. The analyses examine percentage of youth and young adults and adjusted for neighborhood income.

An alternative explanation to target marketing by race and/or income for the observed disparities in cigarette and cigarillo prices is that neighborhoods characterized by socioeconomic disadvantage contain a disproportionately higher concentration of tobacco retailers.<sup>21,22</sup> The theory that prices fall as the number of retailers in a market rises<sup>23</sup> predicts that tobacco products would cost less at stores with more competitors nearby. However, our previous research found that the number of tobacco retailers in a neighborhood was associated with slightly higher prices for Newport and was unrelated to the price of Marlboro.<sup>11</sup> The current study extends this literature by examining variation in price of cheap combustibles as a function of neighborhood demography. To our knowledge, the current study is unique in examining the number and proximity of nearby competitors and the prices in those stores.

## Methods

This study reports a subset of data from the baseline evaluation for a statewide campaign in California, *Healthy Stores for a Healthy Community*, which is, a collaboration between tobacco use prevention, nutrition, alcohol abuse prevention, and other public health partners.<sup>24</sup> The campaign goals are to improve the health of Californians through changes in community stores and to educate people about how point-of-sale marketing influences consumption of unhealthy products. In a statewide sample of licensed tobacco retailers, all 61 county and municipal local health departments assessed retail availability and marketing for tobacco, alcohol, and food and beverage items. The current study uses data for all tobacco prices from the core survey.<sup>24</sup>

## Sample

Beginning with a state licensing list of 36777 tobacco retailers, the sampling frame excluded stores that prohibited minors (e.g., bars or nightclubs that sell alcohol), required paid memberships (e.g., Costco), or restricted entry (e.g., military bases, state or national parks). For each of the 61 local health departments, a target sample size was based on the number of tobacco retailers within the jurisdiction and their funding level. Sample sizes were designed to yield minimum margin of errors for a percentage: 0.05 for the largest local health department, 0.075 for mid-size departments, and 0.10 for the smallest departments. Within each jurisdiction, zip codes were randomly selected until the target sample size was reached: 8128 eligible tobacco retailers in 616 randomly selected zip codes.

## Data Collection

Programmed using the iSurvey application, a 30-question core survey assessed the availability and marketing for tobacco products, including product availability, presence of interior and exterior marketing materials, and price. Following a train-the-trainers model, approximately 200 local health department leaders participated in several hours of in-person instruction, field practice, and an online quiz. These leaders then recruited and trained more than 700 data collectors, including health department staff, environmental health inspectors, and nearly 300 youth volunteers. Every jurisdiction used a standardized training protocol and manual, the same slide set with pictures and speaker notes, and online quizzes. In the field, data collectors referred to a pocket guide for key instructions and could access telephone support for questions. Between June and September 2013, data collectors completed marketing assessments in 7393 stores (completion rate = 91%).

The core survey averaged 8 min per store. Data collectors classified stores into 1 of 11 categories using standard definitions.<sup>9</sup> These were collapsed into the following: convenience, drug/pharmacy, liquor store, small market/deli/produce market, supermarket, discount store (including dollar stores and Wal-Mart), gas station kiosks, hookah cafe/tobacco shops, and other.

### Tobacco Prices

The two price outcomes in the core survey were price of cheapest cigarette pack regardless of brand, and price of a single, flavored Swisher Sweets cigarillo, one of the top-selling brands in the United States.<sup>25</sup> Prices could be requested or observed, and the priority differed by product. Based on our pilot studies, data collectors were trained to first ask for cigarette price and to first look for advertised cigarillo price. Data collectors were trained to use either method to obtain price and to record whether sales tax was included. Cigarette brand was not recorded because our pilot studies revealed that the same lowest price may be available for multiple brands. Interrater reliability was not assessed. However, previous studies that used similar methods (albeit fewer observers) obtained good agreement about price of cigarettes<sup>6,9</sup> and cigarillos.<sup>20</sup>

### Neighborhood Demographics

Previous studies examined tobacco prices as a function of neighborhood demography defined by census tracts,<sup>26</sup> census block groups,<sup>20,27</sup> and store-centered buffers.<sup>14</sup> Although zip code was the sampling unit, the current study modeled stores clustered in census tracts because there was insufficient clustering within block groups, and zip codes are larger than a typical “neighborhood” in previous research. Tracts were characterized using intercensal estimates (GeoLytics, Inc.) for median household income, race (% African American, Asian/Pacific Islander, and other nonwhite residents), ethnicity (% Hispanic), percentage of school-age youth (aged 5–17), percentage of young adults (aged 18–24), and population density.

### Localized Competition

Using ArcGIS v10.1, all stores were geocoded to latitude/longitude (mapping rate = 99.8%), and distance between all stores was computed in roadway miles. Tobacco retailer density for each tract was calculated as retailers per 1000 residents. Proximity measured distance to the nearest tobacco retailer.

### Analyses

Cigarettes were sold in 98.0% of stores, and valid data for price (with sales tax information) was obtained in 94.0% of those stores. For analysis, we excluded cigarette prices that were less than the sum of federal and state taxes (\$1.88 in 2013,  $n = 94$ ) and greater than \$15.00 ( $n = 6$ ). All cigarette prices were computed to exclude sales tax. San Francisco prices included the city’s 20-cent litter mitigation fee.

Single Swisher Sweets cigarillos were sold in 57.2% of stores, and valid price data were obtained in 93.4% of those stores. For analysis, we excluded prices greater than \$2.00 ( $n = 22$ ) because there was a large break in the distribution at that price. We were concerned that higher prices indicated that data collectors inadvertently recorded price for larger pack sizes. All cigarillo prices were computed to exclude sales tax. Weighting variables were not applied because analyses focus on subsamples with valid price.

The current study reports two approaches to the analysis. Using HLM 7.0 software, multilevel modeling (stores nested within census tracts) examined price as a function of store type and distance to nearest competitor as well as neighborhood demographics (including tobacco retailer density). The number of stores per tract ranged from 1 to 21 (mean = 3.9, SD = 2.9). Two-level multilevel models with random intercepts and robust standard errors were used to test the relationship between neighborhood characteristics and local competition (proximity—level 1 and tobacco retailer density—level 2) while controlling for store type. Models without predictors were fit for each price, and intraclass correlation coefficients (ICCs) were computed. Unadjusted models were fit for level 1 predictors: (a) store type with convenience store as the reference group and (b) distance to nearest tobacco retailer (grand mean centered). While controlling for store type (level 1), the next set of models examined unadjusted relationships between price and level 2 predictors: (a) race/ethnicity (% African American, % Asian/Pacific Islander, % other/multiple races, % Hispanic), (b) age (% school age youth and % young adults), (c) median household income, (d) population density, and (e) tobacco retailer density. The census variables were standardized based on statewide data. The measures were treated as continuous because a preliminary examination of quartiles suggested that associations with price were linear.

The second approach utilized spatial regression techniques because a covariance analysis revealed that prices between nearby stores were positively correlated even after accounting for neighborhood characteristics and the other variables in the multilevel model. The spatial regression modeling allowed us to adjust for these unknown factors to ensure that inferences about the primary factors are still valid. Separate spatial regression models examined price of cheapest pack and cigarillo as a function of store type and neighborhood (census tract) demography. The reason for conducting spatial regression analyses was to take into account that the influence of neighborhood characteristics diminishes, as the distance increases from the tract in which each store is located (i.e., correlated errors). Analyses were performed using Python 3.5.

## Results

Table 1 summarizes the distribution of store type and tract-level demographics for the total sample, the subset with price for cheapest pack regardless of brand, and the subset with price for a flavored Swisher Sweets cigarillo. Convenience stores were the most prevalent store type in all three samples, and neighborhood demographics were comparable. The average tract in the total sample contained 0.9 tobacco retailers per 1000 residents. The average distance to the nearest competitor was 1.3 miles (SD = 3.8), and 16.5% of observed stores were located within 500 feet of another tobacco retailer.

As shown in Table 2, the average price for the cheapest cigarette pack regardless of brand was \$4.33 (SD = 0.97). More than three in four (83.5%) stores sold cigarettes for less than \$5. The average price for a flavored Swisher Sweets cigarillo was \$0.93 (SD = 0.30). Of the stores that sold this brand, 73.0% charged less than \$1. Even after removing outliers, the maximum price for the cheapest cigarette pack was 6.6 times greater than the lowest price. The maximum cigarillo price was 10.5 times the lowest price.

Initial multilevel models indicated significant variation in price across census tracts (variance estimate between stores=0.236,  $p$  values < .001; model not shown). For the cheapest cigarettes, 25.1% of the total variance (ICC = 0.251) was between tracts as opposed to

between stores. As shown in Table 3, store type explains some variation in the cheapest pack, with lower prices found in tobacco shops and higher prices in small market, supermarkets, discount stores, and gas kiosks compared to convenience stores. In bivariate models, the cheapest pack price was significantly lower in tracts with higher proportions of African American and Hispanic residents, in neighborhoods with higher proportions of school-age youth and young adults, and in neighborhoods with lower median household income.

In a multivariate model that adjusted for store type, neighborhood demographics, the cheapest cigarette pack cost \$0.17 less for each SD increase in the proportion of school-age youth (equivalent to a 5.7 percentage point increase;  $p < .001$ ). The price was \$0.04 less for each SD increase in the proportion of Asian/Pacific Island residents ( $p < .05$ ). In addition, the cheapest pack cost less in lower income neighborhoods (an estimated \$0.22 for each SD decrease in median household income,  $p < .001$ ). The proportion of young adults did

**Table 1.** Descriptive Statistics for Store Type and Neighborhood Demographics for Analysis Samples and Total Sample: Healthy Stores for a Healthy Community, California (2013)<sup>a</sup>

Store characteristics	Store with cheapest pack price		Stores with single Swisher sweets Price		All HSHC stores unweighted	
	N = 6687		N = 3928		N = 7392	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<b>Store type</b>						
Convenience	2084	31.1	1537	39.0	2171	29.4
Pharmacy	427	6.4	233	5.9	470	6.4
Liquor	1020	15.2	699	17.7	1154	15.6
Small market	1578	23.5	799	20.3	1775	24.0
Supermarket	594	8.9	98	2.5	636	8.6
Discount store	117	1.7	41	1.0	126	1.7
Gas kiosk	407	6.1	276	7.0	446	6.0
Tobacco shop/hookah bar	316	4.7	234	5.9	381	5.2
Other	168	2.5	27	0.7	233	3.2
Distance to nearest competitor (miles)	1.4	3.6	1.2	3.2	1.3	3.8
<hr/>						
	N = 1823		N = 1524		N = 1874	
<b>Neighborhood traits (Census tracts)</b>						
	Mean	SD	Mean	SD	Mean	SD
<b>Race/ethnicity</b>						
% African American	5.3	8.0	5.3	7.8	5.3	8.0
% Asian/Pacific Islander	10.0	12.8	9.9	12.6	10.0	12.8
% Other/multiple race	16.0	11.0	16.6	11.2	16.0	11.0
% Hispanic	34.4	25.5	35.8	25.9	34.3	25.5
<b>Age</b>						
% School-age youth (ages 5–17)	17.3	5.7	17.6	5.7	17.3	5.7
% Young adults (ages 18–24)	10.3	6.4	10.4	6.4	10.4	6.5
Household median income	59,925	26,928	58,477	58,477	59,999	26,955
Population density	6065	8303	9169	8382	6095	8305
Tobacco retailers (per 1000 residents)	0.9	0.8	1.0	0.9	0.9	0.7

<sup>a</sup>Prices were cheapest pack of cigarettes regardless of brand and single Swisher Sweets.

**Table 2.** Price of Cheapest Pack of Cigarettes and Single Swisher Sweets Cigarillo, by Store Type: California, 2013

Store type	Cheapest pack of cigarettes			Single Swisher sweets		
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD
Convenience	2084	4.12	0.67	1537	0.93	0.26
Pharmacy	427	4.19	0.45	233	1.41	0.38
Liquor	1020	4.08	0.70	699	0.85	0.25
Small market	1578	4.55	1.13	799	0.86	0.26
Supermarket	594	4.90	1.02	98	1.12	0.23
Discount store	117	4.19	0.75	41	0.82	0.23
Gas kiosk	407	4.32	0.83	276	0.98	0.30
Tobacco shop/hookah bar	316	3.65	0.76	234	0.78	0.21
Other	168	6.06	1.78	27	0.95	0.28
Total	6711	4.33	0.97	3944	0.93	0.30

**Table 3.** Multilevel Model of Cheapest Cigarette Pack (Before Sales Tax) as a Function of Store Type and Neighborhood Demographics: California, 2013<sup>a</sup>

	Unadjusted models		Multivariate model		Spatial model	
	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>
Level 1 (Store characteristics, <i>n</i> = 6687)						
Intercept			4.16	<.001	4.12	<.001
Store type						
Convenience	Ref	Ref	Ref	Ref	Ref	Ref
Pharmacy	0.05	.070	0.04	.133	0.06	.167
Liquor	-0.02	.448	-0.01	.837	-0.01	.868
Small market	0.42	<.001	0.44	<.001	0.44	<.001
Supermarket	0.77	<.001	0.75	<.001	0.77	<.001
Discount store	0.17	.016	0.21	.002	0.21	.006
Gas kiosk	0.16	<.001	0.13	.002	0.14	.002
Tobacco shop/hookah bar	-0.41	<.001	1.75	<.001	-0.37	<.001
Other	1.79	<.001	-0.40	<.001	1.73	<.001
Distance to nearest competitor (miles)	0.04	<.001	0.03	<.001	0.03	<.001
Level 2 (Tract characteristics, <i>n</i> = 1823)						
Race/ethnicity						
% African American	-0.04	.011	-0.01	.756	-0.02	.459
% Asian/Pacific Islander	0.03	.084	-0.04	.031	-0.05	.029
% Other/multiple race	0.02	.470	0.02	.319	0.02	.407
% Hispanic	-0.14	<.001	0.00	.904	-0.04	.113
Age						
% School-age youth (ages 5–17)	-0.20	<.001	-0.17	<.001	-0.12	<.001
% Young adults (ages 18–24)	-0.08	<.001	-0.03	.119	-0.02	.178
Household median income	0.22	<.001	0.22	<.001	0.12	<.001
Population density	0.03	.081	0.09	.003	0.00	.884
Tobacco retailer density (per 1000 residents)	0.00	.824	0.03	.102		

<sup>a</sup> Level 2 coefficients represent the change in price for one standard deviation increase in respective census measure.

not predict cigarette price in the adjusted model, and other neighborhood correlates of pack price did not persist.

There was significant variation in the price of one flavored Swisher Sweets cigarillo across census tracts (between tract variance = 0.011, *p* value <.001, ICC = 0.122; model not shown). Compared to the price in convenience stores, a flavored Swisher Sweets cost significantly more in pharmacies, supermarkets, and gas kiosks and significantly less in small markets and tobacco shops (see Table 4). In bivariate models, the product cost significantly less in tracts with higher proportions of African American and Hispanic residents, in tracts with higher proportions of school-age youth and young adults, and in tracts with higher population density. In a multivariate model that adjusted for store type, neighborhood income, and other tract demographics, the product cost \$0.03 less for each SD increase in the proportion of school-age youth (equivalent to a 5.7 percentage point increase; *p* <.001). A flavored Swisher Sweets was also cheaper in low-income neighborhoods (\$0.04 less with each standard deviation decrease in median household income, *p* <.001). However, no differences in cigarillo price by neighborhood race/ethnicity persisted in the adjusted model.

Price outcomes were consistently related to measures of localized competition at the store level (distance to nearest competitor) but not at the tract level (tobacco retailer density). In multivariate models, the price of the cheapest pack cost \$0.03 more with each additional mile to the nearest competitor (see Table 3). A flavored Swisher Sweets cigarillo cost \$0.01 more with each additional mile to the nearest competitor (see Table 4). Tobacco retailer density was not a predictor of these prices in either bivariate or multivariate models.

Accounting for spatial autocorrelation did not appear to alter the main findings about neighborhood correlates of price, although it did change the magnitude and significance of some predictors (see Tables 3 and 4). Specifically, a small negative association between cigarillo price and proportion of young adults that was significant in the multilevel model was not significant in the spatial regression model.

## Discussion

This study documented the widespread availability of cheap combustible tobacco products in a state with low and stagnant tobacco tax at the time of data collection. In 2013, the average price for the cheapest pack of cigarettes in this California sample was \$4.33, which is 20.8% less than the average pack price in the state,<sup>10,28</sup> 22.6% less than what California smokers reported paying without discounts, and 4.8% less than reported price including discounts.<sup>29</sup> On average, the cheapest cigarette pack cost less than the regional market basket prices for a pound of ground beef (\$4.62), potato chips (\$4.41), or roasted coffee beans (\$4.81) and less than a half-gallon of ice cream (\$4.60).<sup>30</sup> On average, a popular brand of flavored cigarillos (Swisher Sweets) cost \$0.93 for a single unit, and it was available for less than \$1 in 73% of stores that sold the brand. There was surprising variation in the price of cheap combustible tobacco products: The maximum price for the cheapest cigarette pack was 6.6 times the lowest price, and the maximum price for a single cigarillo was 10.5 times the lowest price for the same brand.

Variation in prices by neighborhood demographics is also a cause for concern. In California, the cheapest pack cost significantly less in



**Table 4.** Multilevel Model of Single Swisher Sweets Cigarillo Price (Before Sales Tax) as a Function of Store Type and Neighborhood Demographics: California, 2013<sup>a</sup>

	Unadjusted models		Multivariate model		Spatial model	
	Coef.	<i>p</i>	Coef.	<i>p</i>	Coef.	<i>p</i>
Level 1 (Store characteristics, <i>n</i> = 3928)						
Intercept			0.93	<0.001	0.93	<0.001
Store type						
Convenience	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Pharmacy	0.48	<.001	0.48	<.001	0.48	<.001
Liquor	-0.08	<.001	-0.07	<.001	-0.07	<.001
Small market	-0.07	<.001	-0.05	<.001	-0.05	<.001
Supermarket	0.18	<.001	0.17	<.001	0.17	<.001
Discount store	-0.09	.022	-0.06	.156	-0.05	.209
Gas kiosk	0.05	.014	0.05	.013	0.05	.005
Tobacco shop/hookah bar	-0.14	<.001	-0.13	<.001	-0.13	<.001
Other	0.04	.517	0.04	.460	0.04	.435
Distance to nearest competitor (miles)	0.01	.011	0.01	.032	0.01	<.001
Level 2 (Tract characteristics, <i>n</i> = 1524)						
Race/ethnicity						
% African American	-0.02	<.001	-0.01	.093	-0.02	.032
% Asian/Pacific Islander	-0.002	.764	-0.01	.179	-0.01	.448
% Other/multiple race	0.004	.662	0.00	.577	0.01	.466
% Hispanic	-0.03	<.001	-0.01	.369	-0.01	.234
Age						
% School-age youth (5–17 yrs.)	-0.04	<.001	-0.03	<.001	-0.03	<.001
% Young adults (18–24 yrs.)	-0.03	<.001	-0.01	.050	-0.01	.077
Household median income	0.05	<.001	0.04	<.001	0.02	.013
Population density	-0.01	.019	0.00	.468	0.00	.881
Tobacco retailer density (per 1000 residents)	0.004	.423	0.01	.193		

<sup>a</sup>Level 2 coefficients represent the change in price for one standard deviation increase in respective census measure.

neighborhoods with a higher proportion of youth, which is consistent with previous research in this state<sup>10</sup> and in New York.<sup>12</sup> This is the first study that we are aware of to observe lower prices for cigarettes in neighborhoods with a higher proportion of Asian/Pacific Islanders. Asian men have among the highest smoking rates of any group in California, at 15.6%, with even higher rates for Vietnamese men (18.6%) and Chinese men (16.7%).<sup>31</sup>

Consistent with a previous study in Washington, DC,<sup>20</sup> a single cigarillo cost significantly less in neighborhoods with a higher proportion of African-American residents. In the current study, that difference persisted after controlling for median household income. The association was smaller in California than in the DC study, which may reflect differences between brands as well as population demography. In California, neighborhood variation in the price of cigarettes and a flavored cigarillo suggest that school-age youth, African Americans, Asian/Pacific Islanders, and residents of lower income neighborhoods have greater access to combustible tobacco products at significantly lower prices. The patterns are consistent with tobacco industry documents that describe research about geodemographic targeting of vulnerable populations.<sup>7,32</sup> The study results suggest that availability of lower-priced cheap combustible products may contribute to socioeconomic and racial/ethnic disparities in their use.<sup>33,34</sup>

The current study also found that cigarettes and cigarillos cost less as the distance to the nearest competitor decreased. These findings are consistent with the idea that localized competition promotes lower prices, although the association was small. Future research should consider how alternative measures of retailer density (e.g., gravity-based measures) or other features of the environment (e.g., retailer proximity to schools, arterial roadway location, whether the store sells gasoline) also explain variation in tobacco prices.

Strengths of this study are the large, representative sample of licensed tobacco retailers, and the availability of data for comparable prices from nearby stores. One limitation of the study is that price at nearby competitors was bounded by zip code, therefore nearby competitors in unobserved zip codes were not considered. Because we did not collect brand information about the cheapest pack, we cannot know the extent to which this factor explains variation in price, or may be related to other predictors in the model. Given concerns about the use of menthol cigarettes by youth and disadvantaged populations, future research should record whether the cheapest cigarettes were available in a menthol variety and assess whether it cost the same or less than a nonmenthol variety of the same brand.

Other limitations of the current study are that cigarillo price was limited to a single brand and nearly half of stores did not sell the brand or single-packaged variety. Because cigarillos vary in length, shape, weight, and pack material, even among “single sticks,” we did not impute a single-stick price from multiunit packs or record the cheapest cigarillo regardless of brand. Among other reasons to implement product standardization, such regulation would ensure that neighborhood variations in price for multiple brands reflect price differentials for truly equivalent products.

The study findings have implications for federal, state, and local strategies to decrease the affordability and availability of cigarettes and flavored cigarillos that may deter youth uptake of tobacco and reduce tobacco-related disparities. The US Food and Drug Administration has the authority to establish a minimum pack size for cigarillos, establish a minimum price for all tobacco products, and ban flavored tobacco altogether.<sup>35,36</sup> State and local governments also have legal authority to establish minimum price and pack size for cigarillos and little cigars.<sup>17,37–39</sup> In addition, more than 50 cities

or counties adopted sales restrictions on flavored tobacco that withstood legal challenges.<sup>40</sup> In Boston, Massachusetts, for example, a city-wide regulation significantly reduced neighborhood disparities in the retail availability of single, flavored cigars per 100 youth.<sup>41</sup> Finally, this study and others suggest that restrictions to limit the quantity of tobacco retailers and increase the distance between them may decrease competition and serve to increase the price of tobacco products.<sup>42</sup> The impact of such policies on disparities in the availability and price of cigarettes, cigarillos and other tobacco products warrants further study.

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## Declaration of Interests

None declared.

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