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## The changing retail landscape for tobacco: Dollar stores and the availability of cheap cigarettes among tobacco-related priority populations

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### Abstract

**Introduction:** Dollar stores are rapidly altering the retail landscape for tobacco. Two of the three largest chains sell tobacco products in more than 24,000 stores across the U.S. We sought to examine whether dollar stores are more likely to be located in disadvantaged neighborhoods and whether dollar stores charge less for cigarettes than other tobacco retailers.

**Methods:** Data were collected from a statewide random sample of licensed tobacco retailers in California (n=7,678) in 2019. Logistic regression modeled odds of a census tract containing at least one dollar store as a function of tract demographics. Linear mixed models compared price of the cheapest cigarette pack by store type, controlling for tract demographics.

**Results:** Census tracts with lower median household income, rural status, and higher proportions of school-age youth were more likely to contain at least one dollar store. The cheapest cigarette pack cost less in dollar stores compared to all store types examined except tobacco shops. Estimated price differences ranged from \$0.32 (95% CI: 0.14, 0.51) more in liquor stores and \$0.39 (95% CI: 0.22, 0.57) more in convenience stores, to \$0.82 (95% CI: 0.64, 1.01) more in small markets and \$1.86 (95% CI: 1.61, 2.11) more in stores classified as “other”.

**Conclusions:** Dollar stores may exacerbate smoking-related inequities by contributing to the availability of cheaper cigarettes in neighborhoods that are lower-income, rural, and have greater proportions of youth. Pro-equity retail policies, such as minimum price laws and density reduction policies, could mitigate the health consequences of dollar stores’ rapid expansion.

### Introduction

In the US, dollar store chains now outnumber Walmart locations five to one.<sup>1</sup> Two of the largest chains, Family Dollar and Dollar General, began selling tobacco products in 2012 and 2013, respectively. Since that time, they have opened over 5,400 new store

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locations,<sup>2–5</sup> and now operate over 24,000 stores across the US.<sup>2,4</sup> Moreover, the dollar store phenomenon is not unique to the US. Countries across Asia,<sup>6</sup> Europe,<sup>7</sup> and North America<sup>8</sup> are witnessing similar growth in the discount retail sector. For example, Poundland operates nearly 900 stores in the United Kingdom and the Republic of Ireland, serving an estimated 7,000,000 customers per week.<sup>9</sup> The stores are a source of inexpensive flavored nicotine e-liquids, sold at 1 GBP.<sup>10</sup> Through their rapid expansion and business strategy of selling products at the lowest possible price to the most price-sensitive consumers, dollar stores are quickly altering the retail landscape for tobacco. Lower cigarette prices remove barriers to smoking initiation and disincentivize quitting, particularly among low-income and younger consumers.<sup>11,12</sup> Dollar stores may exacerbate tobacco-related inequities by increasing retail access to tobacco in already inundated communities and offering tobacco products at lower prices than competitors.

Prior research has documented higher tobacco retailer density in neighborhoods with larger proportions of low-income,<sup>13</sup> African American,<sup>14</sup> and Hispanic residents.<sup>14</sup> Higher density and proximity are associated with various smoking behaviors, including current and lifetime smoking,<sup>15–17</sup> lower odds of quitting,<sup>18</sup> and higher risk of relapse.<sup>18,19</sup> As a result, density reduction policies, some of which explicitly seek to reduce the inequitable distribution of tobacco retailers across communities,<sup>20</sup> have become an increasingly popular approach to tobacco control.<sup>21</sup> The high density and continued expansion of dollar stores poses a challenge to these efforts. Popular media reports indicate that dollar stores typically locate in low-income, rural, and predominantly racial and ethnic minority communities, and one recent study found closer dollar store proximity in higher poverty and majority racial and ethnic minority neighborhoods in U.S. metropolitan areas.<sup>22,23</sup> However, save for the aforementioned study, these associations have yet to be examined in the scientific literature. Generating such evidence can support local policy-makers in developing effective pro-equity density reduction policies.

Price is one of the main drivers of tobacco use, and the tobacco industry uses multiple strategies to maintain low cigarette prices and retain price-sensitive consumers.<sup>24</sup> Prior evidence suggests that among all types of tobacco retailers, cigarette prices are lower, and price discounts more common, in tobacco shops, pharmacies, and convenience stores, even after controlling for neighborhood socio-demographic characteristics.<sup>25–28</sup> For example, a 2012 study of US tobacco retailers found that single-pack prices for Marlboro Red, Newport, and the cheapest pack of cigarettes (regardless of brand) were lower in pharmacies than in liquor stores, small grocery stores, supermarkets, and convenience stores, but were not significantly different in tobacco shops.<sup>25</sup> In a 2016 California study, the price of the cheapest pack of cigarettes (regardless of brand) in convenience stores ranged from \$0.13 lower than in gas kiosks to \$0.75 lower than in supermarkets, but was \$0.40 higher than in tobacco shops.<sup>27</sup> In a 2019 US study, the price of the cheapest pack of cigarettes (regardless of brand) was lower in convenience stores than in all other store types examined except tobacco shops and mass merchandise stores.<sup>26</sup> Dollar stores were not examined separately in the aforementioned studies, and require investigation as a unique retail category.

To fill these research gaps, the current study examines whether neighborhoods with higher proportions of priority populations—defined by higher rates of tobacco use and

tobacco-related disease and disproportionate targeting by the tobacco industry, including low-income residents, rural residents, racial and ethnic minorities, and school-age children and young adults—are more likely to contain dollar stores. We then examine the price of the cheapest cigarette pack (regardless of brand) and the availability of cigarette price discounts as a function of store type (dollar stores, convenience stores, small markets, liquor stores, supermarkets, gas station booths, tobacco shops, drug stores/pharmacies, and other). Conducted in a statewide random sample of tobacco retailers in California, this study is the first to examine the socio-demographic characteristics of the communities where dollar stores that sell tobacco are located and to compare cigarette prices in dollar stores and other tobacco retailers. Understanding whether and where dollar stores increase the availability and accessibility of low-cost cigarettes among priority populations can inform the development of pro-equity tobacco control policies.

## Methods

Store-level data are from California's Healthy Stores for a Healthy Community (HSHC) campaign, a statewide collaboration between tobacco control, alcohol use prevention, nutrition, and sexual health partners.<sup>29</sup> The campaign's marketing surveillance is designed to monitor the availability and marketing of healthy and unhealthy products in the retail environment, inform the development of local healthy retail policies, and evaluate the campaign's impact over time. Data were collected between March and June 2019 by California's 61 county and municipal Local Lead Agencies (LLAs; designees from each of CA's 61 local health jurisdictions (58 counties and 3 cities) responsible for developing comprehensive tobacco control plans) and their local partners.

## Sample

The sampling frame was the California Department of Tax and Fee Administration's list of all tobacco retailers in California that had applied and paid for a state license as of October 2018 (n=31,100 retailers). The sample excluded stores that prohibited youth (e.g. bars, nightclubs), required paid membership or entry (e.g. Costco, state parks), or were restricted to the public (e.g. military bases). The state tobacco control program determined a target sample size for each LLA, based on total number of retailers, to achieve a margin of error ranging from 0.05 to 0.10. Zip codes were randomly sampled within each LLA jurisdiction (county or city) and all eligible tobacco retailers were included until the target was reached. For 5 LLAs, the target sample size to achieve the required margin of error was a census of tobacco retailers. In addition, to fulfill local programmatic needs, 26 LLAs opted to conduct a census of tobacco retailers and 19 LLAs elected to randomly select additional zip codes beyond their required sample, but did not complete a census.

## Data collection

Data were collected using the SurveyPocket application, which allows for offline, mobile data collection on handheld devices (e.g. iPod Touch, iPad, cell phones). A train-the-trainers model was used to train more than 700 data collectors statewide.<sup>27</sup> Leaders from each LLA attended in-person training and field practice, and then recruited and trained additional data collectors using standardized training materials. Data collectors were provided with

a pocket guide and access to a technical assistance hotline for questions that arose in the field. Data collectors completed surveys at 7,969 retailers (94% completion rate). Tobacco retailers that did not sell cigarettes (n=273, 3.4% of total) were excluded from this analysis as were tobacco retailers located in census tracts for which tract-level socio-demographic data were not available (n=18, 0.2% of total). The final analytic sample included 7,678 tobacco retailers.

## Measures

**Store type.**—Data collectors recorded the store type for each retailer visited, choosing from one of 11 categories: convenience store; drug store/pharmacy; small market/deli/produce market; supermarket/large grocery store; discount store/supercenter; liquor store; gas station booth; hookah bar/café; tobacco store/head shop; vaping product store; and other (specify). During training, data collectors were provided with standardized definitions for each store type. After data collection, all stores in the original “discount store/supercenter” category were reclassified. We created a new category for dollar stores by searching the store name variable for various text strings (e.g. “Dollar”; “99 Cents”) and extracting the identified retailers. Walmart (n=78) was reclassified into the supermarket category (renamed supermarket/large grocery store/supercenter), and the remaining 39 stores were reclassified using the store name variable and Google Images searches. We also reviewed the descriptions entered by data collectors in the “other” category and reclassified 77 stores where the description entered matched an existing store type. One author reclassified retailers and a second author reviewed all decisions; any disagreements were resolved through discussion. Finally, we combined tobacco specialty shops and head shops to create a single tobacco shop category. The final store type variable consisted of nine categories: dollar store; convenience store; drug store/pharmacy; small market/deli/produce market; supermarket/large grocery store/supercenter; liquor store; gas station booth; tobacco shop; and other (e.g., donut shops, water stores, and bait and tackle shops).

**Price of the cheapest single pack of cigarettes.**—Data collectors recorded the price of the cheapest single pack of cigarettes, regardless of brand, and indicated whether sales tax was included in the price. Data collectors were instructed to ask the store clerk “What’s the cheapest single pack of cigarettes? How much is it?”. If the store clerk refused to answer, data collectors were instructed to compare advertised prices to find the lowest price. Data collectors then indicated whether sales tax was included in the price, selecting “yes”, “no”, or “unable to verify”. Following procedures in other research, we geocoded retailers to jurisdiction, obtained jurisdiction-specific sales tax rates,<sup>30</sup> and analyzed price before sales tax as sales tax rates in California vary by jurisdiction.<sup>31</sup> We removed outliers where price excluding sales tax was less than \$3.89 (sum of state and federal excise tax=\$3.88). Valid data for price (with sales tax information) were available for 7,211 retailers (94% of total). While we did not assess inter-rater reliability in the present study, the training and data collection protocols described above are similar to those used in prior publications, with intraclass correlation coefficients ranging from 0.81<sup>32</sup> to 0.88.<sup>33</sup>

**Cigarette price discounts.**—Data collectors recorded whether any price discounts for cigarettes were advertised inside the store (yes/no). These were defined as temporary

“special” or “sale” prices and multi-pack discounts (e.g., buy 2 packs, get 1 pack free). Advertisements with general statements about price (e.g. “everyday low price”) and promotions for cigarette cartons were not considered price discounts.

**Census tract socio-demographics.**—We geocoded retailers to census tracts and obtained tract-level socio-demographic data from the American Community Survey 2013–2017 5-year estimates. Although zip codes were the sampling unit, we examined neighborhood characteristics of interest at the census tract-level because zip codes can be large and generally poor representations of the local neighborhoods within which retailers are located.<sup>34</sup> Socio-demographic characteristics included: race/ethnicity (% non-Hispanic (NH) African American; % NH white; % NH Asian/Pacific Islander; % NH multiple races/American Indian and Alaska Native (AIAN)/other races; % Hispanic of any race); age (% school-age youth (ages 5–17 years); % young adults (ages 18–24 years)); and median household income. All variables were standardized based on the sample data (n=2,317 unique census tracts) to allow for easier interpretation.

**Census tract rural/urban classification.**—We used 2010 Rural-Urban Commuting Area (RUCA) codes to classify census tracts into one of three categories: urban; large rural city/town; or small and isolated small rural town. We used primary and secondary RUCA codes to classify census tracts according to the Rural Health Research Center’s categorization scheme B.

## Analysis

We used the California Department of Tax and Fee Administration’s (CDTFA) list of all tobacco retailers in California (n=31,100) to test whether census tracts with higher proportions of residents that belong to priority populations were more likely to contain dollar stores. To do this, we fit logistic regression models at the census tract-level to examine the association between tract socio-demographic characteristics and odds of at least one dollar store being located in the tract. We removed census tracts for which tract-level socio-demographic data were not available (n=30, 0.4% of total) resulting in a final analytic sample of 6,716 census tracts. First, we assessed bivariate associations with each socio-demographic characteristic and then fit a final model adjusting for all socio-demographic characteristics.

Data for the store-level outcome models are conceptualized as forming two, two-level hierarchies: stores within census tracts (M=3.3 stores/tract, SD=2.5, range=1–17) and stores within zip codes (M=10.6 stores/zip code, SD=11.6, range=1–71). Because stores are clustered within census tracts and zip codes, and census tracts do not form a hierarchy with zip codes, we used cross-classified linear and generalized linear mixed models to examine price of the cheapest single pack of cigarettes and the availability of in-store price discounts for cigarettes, respectively, as a function of store type. We fit multilevel models specifying two random intercepts (one for tract and one for zip code) for each price outcome: 1) unadjusted models including the level one store type predictor (reference=dollar store), and 2) adjusted models including store type plus level two covariates (i.e. tract-level socio-demographic characteristics).

**Sensitivity analyses.**—We conducted two sensitivity analyses to determine whether the findings were unique to the: 1) major chain dollar stores and (2) price of cigarettes. First, we replicated all analyses restricting the dollar store category to the two major chains, Family Dollar and Dollar General (n=128; 73.1% of all dollar stores in the analytic sample; n=341; 57.2% of all dollar stores on the CDTFA list). For store-level analyses, non-chain dollar stores were recategorized as “other”. Second, to assess whether pricing in dollar stores was unique to cigarettes, we replicated the linear mixed model examining price of the cheapest single pack of cigarettes using price (per unit) of the least expensive pack of condoms as the outcome. This item was added by sexual health partners and was the only other price measure available in the dataset. Data collectors recorded the price of the least expensive pack of condoms and the number of condoms in the pack, which was used to calculate price per unit. Data collectors did not indicate whether price was inclusive of sales tax. We assume that the vast majority of recorded prices for condoms did not include sales tax, as was true for cigarettes. The analysis was restricted to retailers that sold condoms and for which data collectors were able to obtain information on price and pack size (86% of stores were verified to sell condoms; of those, 95% had price and pack size available; final analytic n=6,250, or 81% of full HSHC analytic sample).

We did not use weighting variables because the analytic sample was restricted to the subset of stores that sold cigarettes (or subset of stores that also sold condoms for the sensitivity analysis). We assessed all models for collinearity and did not identify any issues (i.e. all VIF < 3). All analyses were conducted using SAS software, Version 9.4 (Copyright © 2016 by SAS Institute Inc., Cary, NC, USA).

## Results

Table 1 summarizes retailer and census tract characteristics for the analytic sample. Convenience stores were the most prevalent store type (n=3,332; 43.4%) in the sample, followed by small markets (n=1,003; 13.1%) and liquor stores (n=936; 12.2%). The least common store types were pharmacies (n=350; 4.6%), dollar stores (n=175; 2.3%), and other store types (n=146; 1.9%). The majority of dollar stores (n=128; 73.1%) were either Dollar General or Family Dollar stores.

### Census tract correlates of dollar store locations

There were 596 dollar stores on the CDTFA list, and there was at least one dollar store present in 524 of the 6,716 census tracts. The first two columns in Table 2 present descriptive statistics for census tracts containing at least one dollar store and census tracts without a dollar store, respectively. Census tracts in which dollar stores were located had higher percentages of Hispanic residents and school-age youth, were more frequently classified as large or small rural towns and less frequently classified as urban, and had lower median household income, and lower percentages of non-Hispanic White and non-Hispanic Asian/Pacific Islander residents than census tracts without a dollar store.

In adjusted models (Table 2), there were lower odds of a census tract containing at least one dollar for each SD increase in the proportion of Asian/Pacific Islander residents (aOR=0.62, 95% CI=0.52, 0.75); residents who identified as multiple races, AIAN, or other races

(aOR=0.79, 95% CI=0.69, 0.92); and median household income (aOR=0.31, 95% CI=0.25, 0.38). In contrast, odds of a census tract containing at least one dollar store were 51% higher (aOR=1.51, 95% CI=1.33, 1.72) for each SD increase in the proportion of school-age youth; 75% higher for census tracts classified as large rural versus urban (aOR=1.75, 95% CI=1.18, 2.61); and more than 3.6 times higher for census tracts classified as small rural versus urban (aOR=3.61, 95% CI=2.39, 5.46).

### Differences in cheapest cigarette pack price and price discount availability by store type

The observed price of the cheapest pack of cigarettes (regardless of brand) was lowest in tobacco shops (M=\$6.29, SD=1.08) and dollar stores (M=\$6.44, SD=0.76) and most expensive in small markets (M=\$7.56, SD=1.50) and stores categorized as “other” (M=\$8.64, SD=2.18) (Table 3). As shown in Table 3, price differences by store type persisted in adjusted models that controlled for tract demographics. Compared to dollar stores, the cheapest cigarette pack cost more in nearly all store types. Estimated price differences ranged from \$0.32 (95% CI: 0.14, 0.51) more in liquor stores and \$0.39 (95% CI: 0.22, 0.57) more in convenience stores, to \$0.82 (95% CI: 0.64, 1.01) more in small markets and \$1.86 (95% CI: 1.61, 2.11) more in stores classified as other. Only in tobacco shops did the cheapest cigarette pack cost less than in dollar stores (b= -\$0.32, 95% CI: -0.52, -0.11).

As shown in Table 4, price discounts were available in 31.4% of dollar stores. In adjusted models, compared to dollar stores, the odds of in-store price discounts for cigarettes were higher in tobacco shops (aOR=1.59, 95% CI=1.04, 2.43), convenience stores (aOR=2.03, 95% CI=1.41, 2.92), and pharmacies (aOR=1.59, 95% CI=1.04, 2.43), and lower in small markets (aOR=0.57, 95% CI=0.38, 0.84).

### Sensitivity analyses

Overall, results were similar when we restricted the dollar store category to major chains only. Again, in adjusted analyses, the cheapest cigarette pack cost more in all store types except tobacco shops, ranging from \$0.47 (95% CI: 0.26, 0.69) more in liquor stores, to \$1.64 (95% CI: 1.38, 1.89) more in stores classified as other. However, the estimated price difference between tobacco shops and dollar stores was no longer significant (b= -\$0.17, 95% CI: -0.40, 0.06) (Appendix Table 1). Interpretations and overall conclusions from analyses examining the availability of in-store price discounts (Appendix Table 3) did not differ from those of the primary analyses. In analyses examining census tract correlates of dollar store locations (Appendix Table 2), there were lower odds of a census tract containing at least one dollar store for each standard deviation increase in the proportion of non-Hispanic African American and Hispanic residents.

To assess whether lower pricing in dollar stores was unique to cigarettes, we replicated the analyses presented in Table 3 using price of the least expensive pack of condoms as the outcome. The observed price per unit for the least expensive pack of condoms was lowest in dollar stores (M=\$0.78, SD=0.25) and most expensive in pharmacies (M=\$1.97, SD=0.33). In adjusted models, compared to dollar stores, condoms (price per unit) cost more in all

other store types, ranging from \$0.30 (95% CI: 0.24, 0.36) more in supermarkets to \$1.13 (95% CI: 1.06, 1.19) more in pharmacies (Appendix Table 4).

## Discussion

In a statewide sample of California tobacco retailers, census tracts with lower median household income, rural status, and higher proportions of school-age youth were more likely to contain dollar stores. Further, the price of the cheapest pack of cigarettes was significantly lower in dollar stores compared to all other tobacco retailers except tobacco shops. Dollar stores were not more likely than other store types to offer price discounts on cigarettes, which suggests that their lower cigarette prices are not attributable to temporary discounts. Our findings suggest that dollar stores contribute to the availability of cheap cigarettes among tobacco-related priority populations, including people who are low-income, residents of less densely populated areas, and youth.

The propensity of dollar stores to locate in low-income and rural areas has been widely discussed in the popular media and documented by non-profit organizations such as the Institute for Local Self-Reliance (ILSR).<sup>22,35</sup> Our study confirms these findings and provides an important foundation for researchers and practitioners seeking to examine geographic patterns in other states and localities. That tracts with a higher proportion of school-age youth were more likely to contain dollar stores has important implications for youth smoking prevention efforts. It highlights the need to investigate additional ways in which dollar stores may facilitate youth access to tobacco, such as underage sales violations. In 2019, the FDA sent a warning letter to the CEO of Family Dollar identifying the chain as having one of the highest rates of illegal sales to minors (~23%).<sup>36</sup> Additional research on how dollar stores may contribute to rural-urban disparities in tobacco retailer density is also needed. While dollar stores were more likely to be located in less densely populated areas, we did not directly measure rurality. A recent study by Hall et al. suggests that this may be an important avenue for future research: following CVS' decision to discontinue tobacco sales in 2014 and the decisions of Family Dollar and Dollar General to begin selling tobacco in 2012 and 2013, respectively, the authors observed much larger net increases in the number of tobacco retailers per 10,000 adults in rural counties compared to urban counties in the southeastern US.<sup>37</sup>

Notably, in this sample, we did not find evidence that tracts with higher proportions of racial/ethnicity minority populations were more likely to contain dollar stores. Maps produced by ILSR in 2019 showed a greater number of dollar stores in neighborhoods with a higher proportion of Black or African American residents.<sup>38</sup> These findings may reflect the socio-demographic composition of the cities examined, including Atlanta, Georgia, Newark, New Jersey, and Washington, D.C., which have substantially larger African American populations than California, where African Americans comprised 6.5% of the state population in 2019.<sup>39</sup>

Our findings highlight dollar stores as a burgeoning source of low-cost cigarettes in lower-income, rural, and communities with higher proportions of youth. It is notable that the estimated price of the cheapest pack of cigarettes was significantly lower in dollar stores



compared to convenience stores and pharmacies, as prior research has identified the latter store types as among the cheapest retail sources for cigarettes.<sup>25–27</sup> Further, when we restricted the dollar store category to major chains, the estimated price of the cheapest cigarette pack was as low in dollar as tobacco shops. As price is a key determinant of smoking initiation, consumption, and quitting behaviors, particularly among lower-income and younger consumers,<sup>11,12</sup> action is warranted to address the potential for dollar stores to exacerbate smoking-related inequities. Explicitly pro-equity strategies may include product-focused policies, such as minimum price laws,<sup>12</sup> eliminating price discounts or coupon redemption, and place-based policies, such as limitations on the issuance of tobacco sales licenses<sup>40</sup> or other density reduction policies that restrict where dollar stores can locate.<sup>20</sup>

Given the dollar store business model of offering deep price discounts on all merchandise, we were not surprised to find that the price of the least expensive pack of condoms was lowest in dollar stores. Still, this finding highlights the complicated role that dollar stores may play in underserved areas: some argue that they bring affordable goods, such as groceries, to otherwise neglected communities,<sup>41</sup> while others contend that dollar stores harm local economies by putting small, independently-owned retailers out of business.<sup>35</sup> Several cities, such as Tulsa, Oklahoma, Kansas City, Kansas, and New Orleans, Louisiana, have adopted dispersal policies, requiring new dollar stores to be located a minimum distance from other dollar stores, that also include provisions to increase access to healthy foods.<sup>42</sup> For example, Birmingham, Alabama's dollar store dispersal policy includes incentives for grocery stores, mobile grocers, and farmers' markets to operate in areas where dollar stores are restricted.<sup>43</sup> Collaboration among tobacco and food researchers and practitioners may help prevent unintended consequences resulting from siloed policy proposals, and increase the likelihood of policy adoption and implementation.

### Strengths and Limitations

To our knowledge, this study is first to assess the socio-demographic characteristics of communities in which dollar stores are located and to compare cigarette prices in dollar stores and other tobacco retailers. Although the data represent a large, statewide sample of licensed tobacco retailers, the results may not generalize to states outside of California, particularly where there are large differences in socio-demographic composition and tobacco-related policy landscapes, and the concentration of dollar stores. Other limitations include a lack of brand-specific cigarette prices; future studies should explore whether findings are consistent across premium and discount brands particularly as dollar stores may be more likely to carry discount brands. Finally, although census tracts are widely used to define store neighborhoods, administratively-defined areal units are subject to several limitations, including the assumption that populations are uniformly distributed throughout the unit. Future research may wish to assess whether the use of alternate definitions of neighborhoods or assessments of racial segregation impact findings.

### Conclusion

By contributing to the availability of low-cost cigarettes in lower-income, rural, and communities with higher proportions of youth, the expanding presence of dollar stores is poised to exacerbate inequities in tobacco use. Future research should examine additional

features of the retail environment for tobacco in dollar stores in the US and globally, such as the availability and pricing of e-cigarettes and other flavored tobacco products, point-of-sale advertising, underage sales violations, and compliance with other retail policies. Ultimately, pro-equity policies, designed in collaboration with other public health sectors, are needed to mitigate the health consequences of dollar stores' rapid expansion and support the development of healthy communities.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**What this paper adds**

**What is already known on this subject?**

- In the U.S., dollar store chains now outnumber Walmart locations five to one.
- Two of the three largest chains, Family Dollar and Dollar General, began selling tobacco products in 2012 and 2013, respectively, and now operate more than 24,000 stores across the U.S.

**What important gaps in knowledge exist on this topic**

- Although popular media reports indicate that dollar stores typically locate in low-income, rural, suburban, and predominantly racial and ethnic minority communities, these associations have received almost no attention in the scientific literature.
- Price is a key determinant of smoking-related behaviors, yet it is unknown whether dollar stores charge less for cigarettes than other tobacco retailers.
- Understanding if and how dollar stores increase the availability of low-cost cigarettes among priority populations can inform the development of pro-equity tobacco control policies.

**What this study adds**

- Dollar stores that sell tobacco are located in neighborhoods that are lower-income, rural, and have greater proportions of youth.
- The cheapest pack of cigarettes costs less in dollar stores compared to all other tobacco retailers except tobacco shops.

**Table 1.**

Retailer and census tract characteristics for tobacco retailers in California, 2019

Store type	Full HSHC analytic sample (n=7,678)		Stores with cheapest pack price (n=7,211)	
	<i>n</i>	%	<i>n</i>	%
Dollar store	175	2.3	154	2.1
Convenience store	3332	43.4	3186	44.2
Small market	1003	13.1	918	12.7
Liquor store	936	12.2	867	12.0
Supermarket/large grocery store/supercenter	697	9.1	654	9.1
Gas station booth	663	8.6	623	8.6
Tobacco shop	376	4.9	351	4.9
Drug store/pharmacy	350	4.6	323	4.5
Other	146	1.9	135	1.9

  

Census tract characteristics	Census tracts containing an HSHC sample store (n=2,317)		All CA census tracts containing a licensed tobacco retailer (n=6,716)	
	M	SD	M	SD
Race/ethnicity				
% NH African American	4.9	7.3	5.7	8.9
% Hispanic (any race)	33.6	24.7	39.6	26.8
% NH Asian/Pacific Islander	14.7	16.9	13.2	15.1
% NH Multiple races/AIAN/other	4.0	2.9	3.5	2.8
% NH White	42.8	26.3	38.1	26.3
Age				
% School-age youth (ages 5–17)	16.3	5.4	16.5	5.5
% Young adults (ages 18–24)	9.5	6.3	9.78	5.7
Median household income	\$73,264	\$35,499	\$69,252	\$32,706
Urban-rural classification (RUCA code)				
Urban	2047	88.4	6320	94.1
Large rural	144	6.2	222	3.3
Small rural	126	5.4	174	2.6

Notes. NH=non-Hispanic; AIAN=American Indian and Alaska Native; RUCA=Rural-Urban Commuting Area.

**Table 2.**

Odds of census tract containing 1 dollar store that sells tobacco (yes/no) as a function of census tract characteristics, California, 2019 (n=6,716)

	Characteristics of census tracts with 1 dollar store (n=524)		Characteristics of census tracts with no dollar stores (n=6,192)		Unadjusted models			Adjusted models		
	Mean	SD	Mean	SD	OR	95% CI	aOR	95% CI		
<b>Census tract characteristics</b>										
Intercept								0.07	0.05	0.09
Race/ethnicity										
% NH African American	7.25	11.32	5.56	8.61	1.16	1.08	1.25	1.02	0.93	1.12
% Hispanic (any race)	56.39	26.91	38.19	26.26	1.57	1.40	1.76	0.88	0.75	1.03
% NH Asian/Pacific Islander	5.79	8.92	13.80	15.34	0.42	0.34	0.52	0.62	0.52	0.75
% NH Multiple races/AIAN/other	2.56	2.41	3.52	2.76	0.97	0.84	1.12	0.79	0.69	0.92
% NH White	28.01	26.91	38.92	26.09	-	-	-	-	-	-
Age										
% School-age youth (5–17)	19.57	5.03	16.23	5.43	2.00	1.81	2.22	1.51	1.33	1.72
% Young adults (ages 18–24)	10.70	3.97	9.68	5.81	1.15	1.07	1.24	1.02	0.90	1.15
Median household income	\$45,602	\$15,752	\$71,253	\$32,984	0.23	0.20	0.28	0.31	0.25	0.38
Urban-rural classification (RUCA code)										
	<i>n</i>	%	<i>n</i>	%						
Urban	438	83.59	5882	94.99	Ref	Ref	Ref	Ref	Ref	Ref
Large rural	40	7.63	182	2.94	2.95	2.07	4.21	1.75	1.18	2.61
Small rural	46	8.78	128	2.07	4.83	3.40	6.85	3.61	2.39	5.46

*Notes.* Intercepts not presented for bivariate models; Estimates denote change in odds of 1 dollar store in census tract for each one standard deviation increase in the census tract characteristic; NH=non-Hispanic; AIAN=American Indian and Alaska Native; RUCA=Rural-Urban Commuting Area.

**Table 3.**

Price of cheapest single pack of cigarettes pack (before sales tax) as a function of store type, California, 2019

	Unadjusted models			Adjusted models					
	Mean (\$)	SD	b	95% CI		b	95% CI		
<b>Level 1</b> (store characteristics; n=7211)									
Intercept						6.69	6.52	6.87	
Store type									
Dollar store	6.44	0.76	Ref	Ref	Ref	Ref	Ref	Ref	
Convenience store	7.05	1.02	0.39	0.22	0.56	0.39	0.22	0.57	
Small market	7.56	1.50	0.82	0.64	1.01	0.82	0.64	1.01	
Liquor store	7.01	1.00	0.32	0.14	0.51	0.32	0.14	0.51	
Supermarket/large grocery store/supercenter	7.37	1.37	0.68	0.49	0.87	0.67	0.48	0.86	
Gas station booth	7.36	1.11	0.67	0.48	0.86	0.65	0.46	0.85	
Tobacco shop	6.29	1.08	-0.33	-0.53	-0.12	-0.32	-0.52	-0.11	
Drug store/pharmacy	7.12	0.44	0.54	0.34	0.75	0.53	0.33	0.74	
Other	8.64	2.18	1.87	1.62	2.12	1.86	1.61	2.11	
<b>Level 2</b> (census tract characteristics; n=2317)									
Race/ethnicity									
% NH African American			-0.04	-0.09	0.003	-0.001	-0.04	0.04	
% Hispanic (any race)			-0.19	-0.24	-0.15	-0.002	-0.06	0.06	
% NH Asian/Pacific Islander			-0.04	-0.08	0.01	-0.02	-0.07	0.02	
% NH Multiple races/AIAN/other			-0.02	-0.06	0.02	-0.01	-0.04	0.03	
Age									
% School-age youth (5–17)			-0.20	-0.24	-0.16	-0.19	-0.23	-0.14	
% Young adults (ages 18–24)			-0.07	-0.11	-0.04	-0.04	-0.08	-0.005	
Median household income			0.12	0.07	0.16	0.12	0.07	0.17	
Urban-rural classification (RUCA code)									
Urban			Ref	Ref	Ref	Ref	Ref	Ref	
Large rural			-0.03	-0.22	0.15	0.04	-0.13	0.20	
Small rural			0.37	0.22	0.53	0.34	0.19	0.49	

Notes. Intercepts not presented for bivariate models; Level 2 estimates denote change in price for each one standard deviation increase in the census tract characteristic; NH=non-Hispanic; AIAN=American Indian and Alaska Native; RUCA=Rural-Urban Commuting Area.



**Table 4.**

Availability of in-store price discounts for cigarettes (yes/no) as a function of store type, California, 2019

			Unadjusted models			Adjusted models		
	<i>n</i> <sup>a</sup>	% <sup>a</sup>	OR	95% CI		aOR	95% CI	
<b>Level 1</b> (retailer characteristics; n=7678)								
Intercept						0.37	0.26	0.69
Store type								
Dollar store	55	31.4	Ref	Ref	Ref	Ref	Ref	Ref
Convenience store	1487	44.6	2.05	1.43	2.94	2.03	1.41	2.92
Small market	190	18.9	0.57	0.39	0.84	0.57	0.38	0.84
Liquor store	323	34.5	1.21	0.83	1.78	1.21	0.82	1.78
Supermarket/large grocery store/supercenter	229	32.9	1.05	0.71	1.55	1.02	0.68	1.51
Gas station booth	240	36.2	1.40	0.94	2.08	1.39	0.93	2.07
Tobacco shop	159	42.3	1.65	1.08	2.51	1.63	1.07	2.49
Drug store/pharmacy	150	42.9	1.62	1.06	2.47	1.59	1.04	2.43
Other	3	2.1	0.06	0.02	0.19	0.06	0.02	0.19
<b>Level 2</b> (census tract characteristics; n=2317)								
Race/ethnicity								
% NH African American			1.01	0.93	1.11	1.02	0.927	1.11
% Hispanic (any race)			0.92	0.85	1.01	0.84	0.739	0.95
% NH Asian/Pacific Islander			1.05	0.96	1.15	1.04	0.947	1.15
% NH Multiple races/AIAN/other			1.00	0.93	1.08	0.98	0.907	1.05
Age								
% School-age youth (5–17)			1.04	0.97	1.12	1.12	1.024	1.23
% Young adults (ages 18–24)			1.06	0.99	1.13	1.07	0.991	1.15
Median household income			1.04	0.96	1.13	0.99	0.887	1.10
Urban-rural classification (RUCA code)								
Urban			Ref	Ref	Ref	Ref	Ref	Ref
Large rural			1.59	1.15	2.20	1.69	1.19	2.42
Small rural			0.80	0.60	1.06	0.84	0.61	1.16

<sup>a</sup>*n*, % of stores with an in-store price discount for cigarettes

*Notes.* Intercepts not presented for bivariate models; Level 2 estimates denote change in odds of in-store price discount availability for each one standard deviation increase in the census tract characteristic; NH=non-Hispanic; AIAN=American Indian and Alaska Native; RUCA=Rural-Urban Commuting Area.