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# Association between federal and California state policy violation among vape shops and neighbourhood composition in Southern California

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## ABSTRACT

**Introduction** Past studies have documented disparities in regulation compliance among tobacco retailers with respect to ethnic diversity in neighbourhoods. This study investigated the association between compliance with the Food and Drug Administration (FDA) and California state rules and neighbourhood ethnic composition of a vape shop location.

**Methods** We recruited 122 vape shops located in 'ethnic enclave' neighbourhoods in Southern California. Trained teams of data collectors visited each of the consented vape shops and coded items in the shops that were visible and on display. Location data for the percentages of ethnic composition for a given city were obtained from the U.S. Census Bureau, American FactFinder. Multilevel logistic regression models examined the relationship between the city-level neighbourhood ethnic composition and vape shop rule violation status: not displaying Ask4ID sign and offering free samples.

**Results** Vape shops located in neighbourhoods/communities with more white residents were significantly less likely to not display Ask4ID sign ( $p=0.03$ ) and less likely to offer free sampling ( $p=0.009$ ), controlling for other neighbourhood ethnic characteristics.

**Discussion** Greater enforcement for proper signage display is needed for vape shops located in racial/ethnic minority locations to ensure that minors are discouraged from purchasing e-products.

## INTRODUCTION

Vape shops are brick-and-mortar stores that specialise in the sales of electronic cigarette (e-cigarette) devices, e-liquids and related products. The proliferation of vape shops is a recent phenomenon that has accompanied the increasing popularity of e-cigarettes,<sup>1,2</sup> targeting users who prefer 'in-store' experiences.<sup>3</sup> The presence of vape shops in a neighbourhood could create an environment that normalises use of nicotine-containing products<sup>4</sup> and increases access to vaping products among youths.<sup>15</sup> Consistent with that assertion, the density of vape shops around schools and volume of advertisement exposure has been found to be positively associated with ever and past-month use of e-cigarettes among high school students in all ethnic/racial groups.<sup>5</sup> Vape shop retailers typically believe that e-cigarettes are safer than combustible tobacco products and often 'counsel' their customers to vape instead of smoke.<sup>6,7</sup> Vape shop retailers also use unique marketing strategies that appeal to youth.<sup>8</sup> Attributes of vape shop staff and physical

environments of vape shops (eg, 'bar like') are associated with shops' longevity.<sup>9</sup> Electronic nicotine delivery systems have rapidly evolved,<sup>10</sup> prompting a range of implementation of regulations on packaging, limits on nicotine content, health warnings and advertisements by the state of California and at the federal level.

Federal and state regulations and policies for vape shops and distribution of these products have been enacted. Effective 9 June 2016, California vape shops are required to post an age-of-sale warning sign that states that it is illegal to sell tobacco products to anyone under 21 years of age. Such signage must be posted at cash register, per California Penal Code Section 308 and Stop Tobacco Access to Kids Enforcement Act.<sup>11</sup> Further, FDA's authority specified in the 'Deeming Rule' prohibits vape shops from providing free samples (21 CFR 1140.16(d), effective 8 August 2016). However, it is unclear whether FDA or state regulation compliance by vape shops varies across neighbourhoods, and particularly in low-income racial/ethnic neighbourhoods.

Past studies have documented disparities in regulation compliance among tobacco retailers and showed an inverse relationship between regulation compliance by tobacco shops and ethnic diversity in neighbourhoods. In Florida, more tobacco sales to minors occurred in rural (vs urban) areas, in census blocks with higher proportions of Hispanic residents, and in neighbourhoods with lower per capita income.<sup>12</sup> Similar studies involving FDA inspection data across the USA have also shown that underage sales of tobacco were positively related to the proportion of residents with black and Latino ethnicities, adjusting for other neighbourhood variables.<sup>13</sup> Point-of-sale tobacco marketing is more prevalent in rural areas and in neighbourhoods with lower income and more black residents.<sup>14</sup> Recent studies on tobacco and vape shops in Colorado,<sup>15</sup> California,<sup>16</sup> Illinois, New York and Florida<sup>17</sup> documented violation of vape products sales to minors comparable to that of the combustible cigarettes. Although vape shops have been found to be disproportionately located in areas with higher concentration of racial/ethnic minorities, macrolevel factors such as neighbourhood characteristics have not been explicitly assessed with regards to regulation compliance among vape shops.<sup>18,19</sup>

This study investigated neighbourhood variation in compliance with two FDA and state regulations



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among Southern California vape shops. We hypothesised that compliance would be lower in racial/ethnic minority areas than in predominantly white areas.

**METHODS**

**Sample**

As described previously,<sup>20</sup> we combined vape shop locations from Google Maps and Yelp with data on neighbourhood composition from the U.S. Census. Our vape shops were those that specialised in e-cigarettes/e-liquids/devices and did not sell combustible tobacco products. From the exhaustive list of eligible vape shops generated from these sources, we reached out to 136 vape shops (refusal rate: 10.3%) until we reached the desired sample size from each of the stratified area (n=122)<sup>17</sup>: approximately 30 shops in each of 4 ethnic enclaves in the Greater Los Angeles area, Orange and San Bernardino Counties in Southern California (ie, areas with higher than average concentration of Hispanic/Latinos, African Americans, non-Hispanic Whites, and Koreans).<sup>21</sup>

**Data collection and measures**

Trained teams of two or three data collectors visited each of the vape shops for recruitment and consent between November 2017 and December 2018. After providing verbal consent, one employee per shop completed a 35 min anonymous interview. Simultaneously, another member of the research team conducted a store audit, by coding items in the shops that were visible and on display. Recorded shop observation data included a three-page checklist of print information (indoor and outdoor signage, advertisements), products offered (e-cigarettes, e-liquids, other items) and an assessment of the physical layout of the shop (area to socialise, description of shop, product selection size and size of shop).<sup>20</sup> Each vape shop’s built environment (characteristics of the physical environment surrounding the shop) and customers were also observed and coded. Each participating employee received a US\$50 prepaid gift card.

**Ethnic composition-vape shop location variable**

To systematically characterise macrolevel neighbourhood composition, we extracted census data for the percentages of ethnic composition for a given city where each vape shop is located by searching U.S. Census Bureau, American FactFinder,<sup>22</sup> unless the city contained an ethnic enclave. For vape shops located in an ethnic enclave (ie, a neighbourhood or a community known for heavy presence by a certain ethnicity), we used zip codes to better represent the direct population surrounding the shop, with the following exception (n=2). These two shops were located in a sparsely populated location (eg, industrial area) but within the 2 mile radius to ‘ethnic enclave’ neighbourhoods; therefore, we used the adjacent city information. We resorted to the city data rather than zip code in these cases because of the lack of permanent residents within the listed zip code of the business. The extremely

low permanent population would cause the racial/ethnic composition to be inaccurate according to census tract data. Thus, racial/ethnic composition of a city/zip code where a given vape shop is located (referred to as macrolevel neighbourhoods herein) was used as the main level-2 predictor as our vape shops were clustered within macrolevel neighbourhoods.

**Store compliance variables**

To assess store compliance status, we used two variables. From the store observation data, trained research assistants made observations as to whether the store displayed Ask4ID signs by/at the cash register. During store interviews, we asked how the sampling of juice was handled at the given shop; we used the variable that indicated whether the store offered free samples of vaping products. Reliability of store observation data had been established by having a second observer cocode a 15% sample of the shops (Kappa=0.81).

**Statistical methods**

A set of multilevel logistic regression models were used to examine the association between macrolevel neighbourhood racial/ethnic composition (level-2 predictor) and two level-1 outcomes: vape shop violating (1) state regulation of displaying Ask4ID sign (not displaying=1) and (2) FDA rule of not offering free samples (offering free samples=1). Level-1 unit of analysis was vape shop stores; level-2 cluster was the macrolevel neighbourhood in which a given vape shop was located. All racial/ethnic percentage variables were centred at their respective means. The analyses were performed in SAS V.9.4, using PROC GLIMMIX.

**RESULTS**

**Descriptive statistics**

Out of 122 vape shops, 23.8% (n=29) failed to display the Ask4ID sign. Of the 93 vape shops that displayed the Ask4ID sign, 52.7% (n=49) displayed it by the cash register, as specified by the California Penal Code. Out of 122 vape shops, 6.6% (n=8) offered free sampling of e-juice. On average, the racial/ethnic compositions of the neighbourhoods included in our sample were: 37.8% (range: 6.3%–94.8%) non-white Hispanic/Latinos, 35.5% (range: 3.1%–79.0%) of non-Hispanic whites, 6.2% (range: 0.3%–23.9%) African Americans and 3.1% (range: 0.1%–20.2%) Korean Americans. The bivariate association between the racial/ethnic percentages of residents in vape shop neighbourhood and compliance status is presented in table 1.

**Multilevel logistic regression model**

The results of multilevel logistic regression model are presented in table 2. Vape shops located in neighbourhoods/communities with more white residents were significantly less likely to violate the Ask4ID sign display regulation (OR=0.96; 95%CI 0.92 to

**Table 1** Ethnic composition of vape shop neighbourhood by violation status

	Ask4ID sign displayed			Ask4ID posted by cash register			Offer free samples		
	Yes (n=93)		No (n=29)	Yes (n=49)		No (n=73)	Yes (n=8)		No (n=113)
	M (SD)	M (SD)	P value	M (SD)	M (SD)	P value	M (SD)	M (SD)	P value
% Hispanic residents	37.4 (22.1)	39.1 (17.3)	0.70	41.3 (22.0)	35.5 (20.2)	0.14	37.7 (18.4)	38.1 (21.2)	0.96
% White residents	37.5 (22.2)	29.1 (18.5)	0.07	32.8 (20.0)	37.3 (22.5)	0.26	21.5 (12.4)	36.23 (21.7)	0.06
% African American residents	6.2 (6.2)	6.0 (5.4)	0.83	6.4 (6.5)	6.0 (5.7)	0.71	3.8 (4.2)	6.4 (6.1)	0.24
% Korean residents	3.2 (4.4)	2.8 (3.7)	0.66	3.3 (4.3)	3.0 (4.2)	0.75	2.0 (2.8)	3.2 (4.3)	0.44

\*p<0.05; \*\*p<0.01.

**Table 2** Neighbourhood ethnic composition predicting log odds of rule violation status

	Not displaying Ask4ID sign		Ask4ID sign not posted by cash register		Offer free samples	
	b (SE)	P value	b (SE)	P value	b (SE)	P value
Intercept	-1.40 (0.40)	<0.001	0.47 (0.23)	0.05	2.00 (1.47)	0.18
% Hispanic residents	-0.03 (0.02)	0.14	-0.02 (0.02)	0.23	-0.04 (0.02)	0.06
% White residents	-0.04 (0.02)*	0.03	-0.01 (0.01)	0.75	-0.06 (0.02)**	0.009
% African American residents	-0.05 (0.05)	0.34	-0.02 (0.04)	0.68	-0.11 (0.08)	0.16
% Korean residents	-0.08 (0.08)	0.32	-0.05 (0.07)	0.42	-0.19 (0.14)	0.19

\*p<0.05, \*\*p<0.01.

0.99; p=0.03). However, Ask4ID sign being displayed by the cash register as specified by California Penal Code was not associated with neighbourhood ethnic composition (p>0.23). The vape shops in neighbourhoods with more white residents were significantly less likely to violate the FDA rule by offering free sampling (OR=0.942; 95% CI 0.90 to 0.99, p=0.009); the same pattern of results was found in neighbourhoods with more Hispanic/Latino residents but was not significant.

## DISCUSSION

The current study showed that vape shop federal and state policy compliance in California was greater in neighbourhoods with higher proportions of white residents, consistent with the findings in other types of tobacco retailer shops (eg, tobacco shops, non-franchised shops, convenience stores) that sold combustible tobacco products.<sup>12-14</sup> While vape shops claim to offer a means of harm reduction, in contrast to the tobacco industry,<sup>23</sup> their patterns of non-compliance suggest that they may be exacerbating health disparities by exposing minority communities to greater risk. The presence of legal age signage was a notable finding. Greater enforcement regarding signage display is needed within such locations to discourage minors from purchasing e-products. Still, misposting of signage in the shop did not differ by locations of retailers with varying racial/ethnic compositions. Since only eight shops offered free samples, those results need replication and are limited in interpretability. However, it is plausible that increased education about monitoring, and enforcement of multiple types of FDA tobacco regulation is needed in urbanised minority areas. We opted to use city-level ethnic composition percentages, rather than zip code level, because zip codes of many of our participating vape shops in large cities would have resulted in inaccurate neighbourhood representation. Our study contributes to the recent literature that explores the vape shop retail environment in diverse racial/ethnic communities. More such research is needed to reduce tobacco-related disparities among all populations.

### What this paper adds

- We contribute to the current literature by addressing the extent of potential regulation disparity among Southern California vape shop retailers.
- To our knowledge, no previous study has examined policy violations at vape shops with respect to neighbourhood compositions.

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