Locations of licensed and unlicensed cannabis retailers in California: A threat to health equity?

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ABSTRACT

This study examined whether unlicensed and licensed cannabis retailers in California are disproportionately located in neighborhoods with minority populations or populations living below the Federal Poverty Level. We mapped the locations of licensed and unlicensed cannabis retailers in California in October 2018, combining advertisements from cannabis websites with licensing data. Demographic characteristics of neighborhoods with and without licensed and/or unlicensed cannabis retailers were compared. We identified 1110 cannabis retailers in California (448 licensed and 662 unlicensed). Relative to neighborhoods without retailers, neighborhoods with retailers had higher proportions of Hispanics, African Americans, and residents living below the poverty level. Compared with neighborhoods with only licensed retailers, neighborhoods with only unlicensed retailers had higher proportions of Hispanics and African Americans, and lower proportions of non-Hispanic whites. Neighborhoods with both licensed and unlicensed retailers had higher proportions of African Americans, Asian Americans, and people living in poverty, relative to neighborhoods with only licensed retailers. Unlicensed retailers were disproportionately located in unincorporated areas and jurisdictions that allow cannabis retailers. Minority populations in California are disproportionately exposed to unlicensed cannabis retailers, potentially exacerbating health disparities by selling unregulated products or selling to minors.

1. Introduction

Cannabis is currently legal for adult use (also known as recreational use) in 11 US states, the District of Columbia, Canada, and several other countries, and retailer licensing laws vary widely (Lancione et al., 2019). California legalized cannabis for medicinal use in 1996 and for adult use in 2016 (Jones, 1996; Padilla, 2016). The 2016 Control, Regulate, and Tax Adult Use of Marijuana Act allows the state, counties, and cities to regulate commercial medicinal and adult-use retail cannabis sales. Effective January 1, 2018, cannabis retailers must obtain a state license from the California Bureau of Cannabis Control (BCC) as well as local authorization (California Board of Cannabis Control, 2019). State law grants cities and counties the right to allow, prohibit, or choose not to regulate cannabis businesses in their jurisdictions (California Legislative Analyst's Office, 2015). Incorporated cities may have their own local ordinances for regulating commercial cannabis activities that are separate from county regulations. The BCC began accepting applications for retail licenses in December 2017. To obtain a license, retailers must document acceptable procedures for

transportation, inventory, quality control, and security, provide the business formation and ownership documents, demonstrate compliance with environmental and labor laws, and prove that they own or lease a location that is not near schools or on Tribal land. Licensed retailers were allowed to open on January 1, 2018.

Washington State established a similar retailer licensing process in 2012. Individual counties and cities implemented various temporary and permanent restrictions on retail cannabis sales, resulting in a patchwork of local ordinances throughout the state. (Dilley et al., 2017) Furthermore, numerous unlicensed retailers appeared during the two years following legalization of adult-use cannabis, but prior to the issuance of cannabis retail licenses (Dilley et al., 2017).

This sequence of events appears to be repeating in California. Numerous unlicensed cannabis retailers opened throughout the state following the law's passage in November 2016 but before the licensing application process began in December 2017 (Hansen, 2019). Even after licensing began, the number of applications quickly outpaced the BCC's ability to review them, creating a backlog of pending applications. Enforcement efforts to close unlicensed retailers also lagged; local

regulators stated whenever they closed an unlicensed retailer, several more appeared (Fuller, 2019). Therefore, in 2018–2019, a combination of licensed and unlicensed retailers operated throughout California (Queally and McGreevy, 2019). This illustrates some of the challenges faced by state and local governments in regulating adult-use retail cannabis. The high prevalence of unlicensed cannabis retailers might thwart municipalities' efforts to prevent youth access to cannabis and cannabis-related health emergencies such as acute psychosis (Zamost and Lee, 2019). A comparison of 37 licensed and 92 unlicensed cannabis retailers in Los Angeles County (Nicholas et al., 2019) found that unlicensed dispensaries were more likely to sell high potency cannabis products, allow onsite consumption, sell products designed to be attractive to children, and sell products without child-resistant packaging.

As of 2019, only 108 (22%) of California's 485 municipalities allow any type of cannabis business to operate in their jurisdictions, and 18 of the 58 counties permit cannabis businesses in their unincorporated areas (i.e., geographic areas that are not within the jurisdiction of a city) (Staggs and Wheeler, 2019); these numbers have fluctuated throughout 2018 and 2019 as municipalities without regulations began to pass new ordinances (Schroyer and McVey, 2019). The licensing process has been slower than expected (Fuller, 2019) because of the high cost of establishing a cannabis business, as well as public safety concerns associated with cannabis operations in a community. Meanwhile, unlicensed retailers have proliferated (Zamost and Lee, 2019; Nicholas et al., 2019).

Studies in several states have found that both licensed and unlicensed cannabis retailers tend to locate in areas with more racial and ethnic minority residents, more poverty, and more alcohol outlets (Nicholas et al., 2019; Morrison et al., 2014; Shi et al., 2016; Tabb et al., 2018; Thomas and Freisthler, 2016). This is similar to alcohol and tobacco retailers, which are more concentrated in areas with more racial and ethnic minorities, more low-income households, and lower social capital (Fakunle et al., 2016; Gonzalez et al., 2019; Romley et al., 2007). A high concentration of unlicensed retailers in disadvantaged communities could exacerbate health disparities in chronic respiratory diseases, acute respiratory distress from contaminated THC, motor vehicle accidents, and unintentional overdoses of mislabeled products (Mair et al., 2015; Shih et al., 2019; Academies and of Sciences, Engineering, and Medicine, 2017; Schier et al., 2019). Research is needed to understand the disparities created by locations of unlicensed vs. licensed cannabis retailers.

This article extends research in other states by investigating the landscape of licensed and unlicensed cannabis retailers in California as of October 2018, providing a descriptive snapshot of California's cannabis retail landscape at one point in time. We hypothesized that neighborhoods with cannabis retailers—particularly unlicensed retailers—would show more socioeconomic disadvantage (i.e., higher concentrations of racial and ethnic minorities and people living below the poverty level) than communities without cannabis retailers. We also tested the hypotheses that unlicensed facilities would be more likely than licensed facilities to be in unincorporated areas (since they are not under the jurisdiction of a local city government and have fewer resources for enforcement).

2. Method

To describe the landscape of licensed and unlicensed facilities, we gathered data on existing cannabis retail facilities in California that advertised on the two most popular cannabis retailer websites and/or had a state license and compared their locations with demographic data from those locations. Data were collected from all sources on October 19, 2018.

2.1. Data sources

Addresses of all actively licensed cannabis retailers were obtained

from the California BCC. They included four license types: adult-use, medicinal, adult-use and medicinal, and microbusiness (a business that provides a combination of cultivation, manufacturing, distribution and/or retail). Addresses of unlicensed cannabis facilities in California were obtained from Weedmaps (www.weedmaps.com) and Leafly (www.leafly.com)–two websites with comprehensive listings of both licensed and unlicensed cannabis businesses throughout the US. A recent analysis of cannabis websites (Pedersen et al., 2018) found that Weedmaps had the most updated listings and correctly identified 95% of cannabis retailers in Los Angeles County, and the addition of Leafly brought the total coverage close to 99%. We obtained the names and addresses for facilities in California from these two platforms and then cleaned the data by eliminating duplicates and confirming incomplete street addresses with Google Street View. Locations that offered only cannabis home delivery services but did not have a retail location were omitted.

All facilities that advertised online but did not have a corresponding license on the BCC website were considered to be unlicensed. This produced a list of 1110 unique addresses corresponding to 448 licensed and 662 identified unlicensed facilities. The licensed retailers included four license types: adult-use and medicinal (N = 342), medicinal only (N = 47), microbusiness (N = 42), and adult-use only (N = 17). These addresses were geocoded using ArcGIS Pro.

2.2. Using retailer locations to create service areas and service area geographies

To analyze the demographic characteristics of the neighborhoods surrounding licensed and unlicensed facilities, we created service areas for each retail facility and service area geographies for the state of California. We then matched the spatial overlaps of the geographies with the census tracts in the American Community Survey (ACS) 2013–2017 5-year estimate (released in December 2018). To operationalize the construct of neighborhood, we focused on convenient accessibility of populations to each facility. Using ArcGIS, we created 2.5-mile service areas around each cannabis facility to represent a 5–10-minute drive. A service area is determined by starting from the facility address and following each road segment and adjoining road segments up to 2.5 miles in every direction. It is better than a geodesic buffer (i.e., straight line distance) because it accounts for barriers like freeways, waterways, or mountainous areas and the density of the road network. In urban areas with higher road network density, traffic congestion at various times of day could impede access, while in rural areas there may be greater willingness to drive long distances.

The service areas around each retail facility were joined using ArcGIS to produce geographies for different types of accessibility in the state of California. The area of the state of California that is outside of any service buffer area is called the no service geography. The area where the service area buffers for licensed facilities overlaps *only* with the service area buffers for other licensed facilities is called the licensed facility *only* service area geography. The area where the service area buffers for unlicensed facilities overlaps *only* with the service area buffers for other unlicensed facilities is called the unlicensed only service area geography. The area where the service area buffers for licensed facilities overlap with the service area buffers for unlicensed facilities is called the overlapping licensed and unlicensed service areas geography. No areas that are served by only licensed facilities or served by only unlicensed facilities are included in the overlapping licensed and unlicensed service areas geography. The area that combines the service area buffers for all the facilities is called the any service geography.

These five geographies are shown in Fig. 1. The four colors noted in Fig. 1 show areas not served by any type of cannabis retail facility (gray), areas served only by licensed facilities (green), areas served by both licensed and unlicensed facilities (yellow), and areas served only by unlicensed facilities (orange). We also created a combined
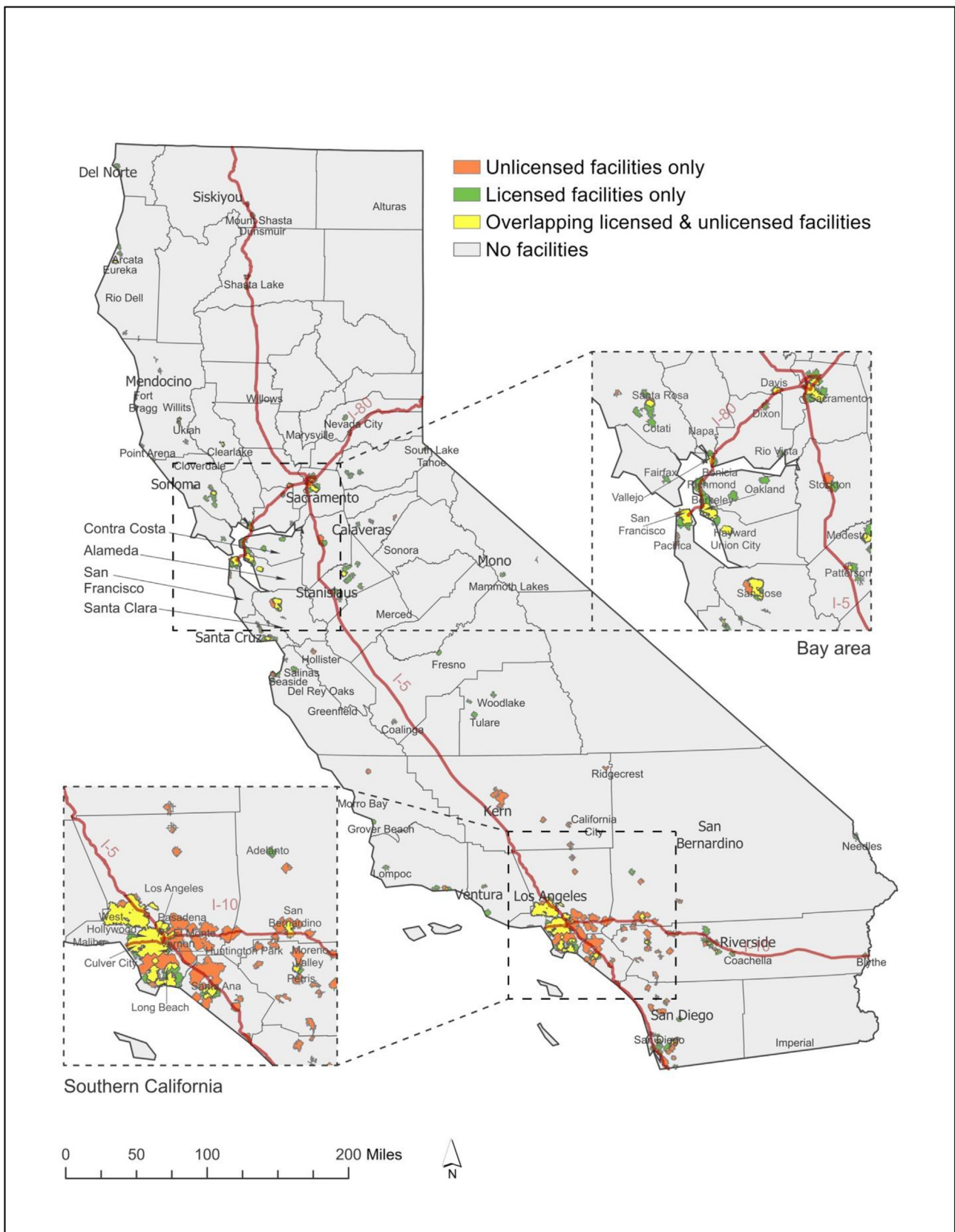
Fig. 1. Service area geographies of licensed and unlicensed facilities.

geography to represent areas served by any facilities (licensed or unlicensed or both), which can be seen in Fig. 1 by comparing the green, orange, or yellow colors as a group with the gray area.

2.3. Calculation of demographic characteristics of service areas

We linked demographic characteristics from the ACS to the cannabis retail geographies by area-weighting the estimates for all census tracts that are included in any part of each geography. For the population estimates, we weighted the influence of a census tract in each of the four geographies by the percent of the census tract included in a given geography and aggregated counts. For example, if 10% of a census tract was in the no facilities geography, 10% of that tract's population was included in the sum.

To calculate *race/ethnicity*, we calculated total population, percent non-Hispanic white, percent Hispanic (all races), percent African American, and percent Asian American. American Indian/Alaska Native and Native Hawaiian/Pacific Islander were not calculated because they represent less than 1% of the California population. *Income* was operationalized as the percent of residents below the Federal poverty level (% below FPL), which is based on household income and number of residents in the household. It is important to note that the poverty threshold applies to the entire United States. The percent of people living below the Federal poverty level appears low in California, where both the mean income and cost of living are higher than the national average.

2.4. Calculation of margins of error

Unlike the decadal census, the ACS five-year estimates are survey data, and thus each variable has a corresponding margin of error. We followed established methods to calculate new margins of error from the original margins of error for regionalized geographies, generally known to reduce the uncertainty in the data because of increasing sample size (Spielman and Folch, 2015). When aggregating population counts and population ratios, we used formulas provided in conjunction with the ACS to estimate new margins of error (U.S. Census Bureau, 2018; DerSimonian and Laird, 2015). All new estimates for margins of error were based on the original data for each census tract (i.e., unweighted) for counts or means, margins of error, and variance at the ACS standard 90% confidence interval.

2.5. Unincorporated areas and policies

We also analyzed the locations of licensed and unlicensed facilities relative to whether medicinal, adult-use, or both types of cannabis retail businesses are allowed or not allowed in all unincorporated and incorporated jurisdictions throughout California. We obtained data on local cannabis ordinances as of October 2018 from local news stories and the websites of local jurisdictions (Fig. 2) (Staggs and Wheeler, 2019). We took state data on population by jurisdiction (California Department of Finance, 2019) and calculated the proportion of the state population living in incorporated areas versus unincorporated areas and the proportion living in localities that allow (a combination of cities that allow and unincorporated areas of counties that allow) versus localities do not allow adult-use retail (a combination of cities that do not allow and unincorporated areas of counties that do not allow). The populations for these four types of jurisdictions were summed and then proportions were taken. We estimated the expected values of facility locations by apportioning the total number of licensed or unlicensed facilities according to the population, and then used chi-square statistics to test whether facility locations varied significantly from the expected values.

3. Results

3.1. Analyses of any retailers vs. no retailers

Table 1 shows the population characteristics of the neighborhoods with retailers (including licensed and/or unlicensed) and neighborhoods without retailers. Neighborhoods served by any facility represented 42% of the California population. Relative to neighborhoods without retailers, neighborhoods with retailers had significantly higher proportions of Hispanic residents (46% vs. 33%), significantly higher proportions of African American residents (8% vs. 4%), significantly lower proportions of non-Hispanic whites (29% vs. 44%), and significantly higher proportions of residents living below the poverty level (18% vs. 13%–indicating that neighborhoods with retailers have higher poverty rates). The proportion of Asian Americans did not differ significantly between the areas served by any facility vs. areas served by no facilities.

3.2. Analyses of licensed vs. unlicensed retailers

Table 1 also compares select demographics across neighborhoods with: only licensed retailers, only unlicensed retailers, and both licensed and unlicensed retailers. Neighborhoods with only licensed retailers represented 8% of the California population, neighborhoods with only unlicensed retailers represented 17% of the California population, and neighborhoods with both licensed/unlicensed retailers represented 18% of the California population. Of all neighborhood types, neighborhoods with only unlicensed retailers had the lowest proportion of non-Hispanic whites (25%) and the highest proportion of Hispanics (52%). However, the highest proportions of African Americans (9%), Asian Americans (15%), and individuals living in poverty (19%) were in neighborhoods with both licensed/unlicensed retailers.

3.3. Unincorporated areas and policies

Table 2 shows that of the 1110 cannabis retail facilities in California, a higher than expected proportion of the unlicensed facilities was located in unincorporated areas of California (chi-square = 14.26, p = .0008) while a higher than expected proportion of licensed facilities was located in incorporated areas (chi-square = 6.03, p = .049). There were more unlicensed facilities in localities that allow retail sales (408) than in localities that do not allow it (254), and there was a higher than expected proportion of unlicensed facilities in areas that allow retail sales (chi-square = 119.24, p = .00001). There were no licensed facilities in localities that do not allow facilities.

4. Discussion

Licensed retailers can benefit public health by ensuring that cannabis products are uncontaminated, accurately labeled, and sold only to adults (Nicholas et al., 2019). Our findings show that neighborhoods with only licensed retailers contain a disproportionately high proportion of non-Hispanic whites, compared to neighborhoods with unlicensed retailers or a mix of licensed and unlicensed retailers.

Unlicensed dispensaries are problematic because they have been reported to engage in illegal business practices that can compromise public health and encourage underage use, including selling products that exceed the legal THC limit, selling counterfeit products that contain pesticides, allowing consumption of cannabis in retail stores, not imposing daily limits on purchases, staying open late at night, and selling products that are attractive to youth and lack child-resistant packaging (Zamost and Lee, 2019; Nicholas et al., 2019. Residents of neighborhoods containing only unlicensed retailers experience a public health inequity because the only retail cannabis available to them may be more likely to be contaminated, inaccurately labeled, or inadequately packaged. Our findings show that this situation—access to
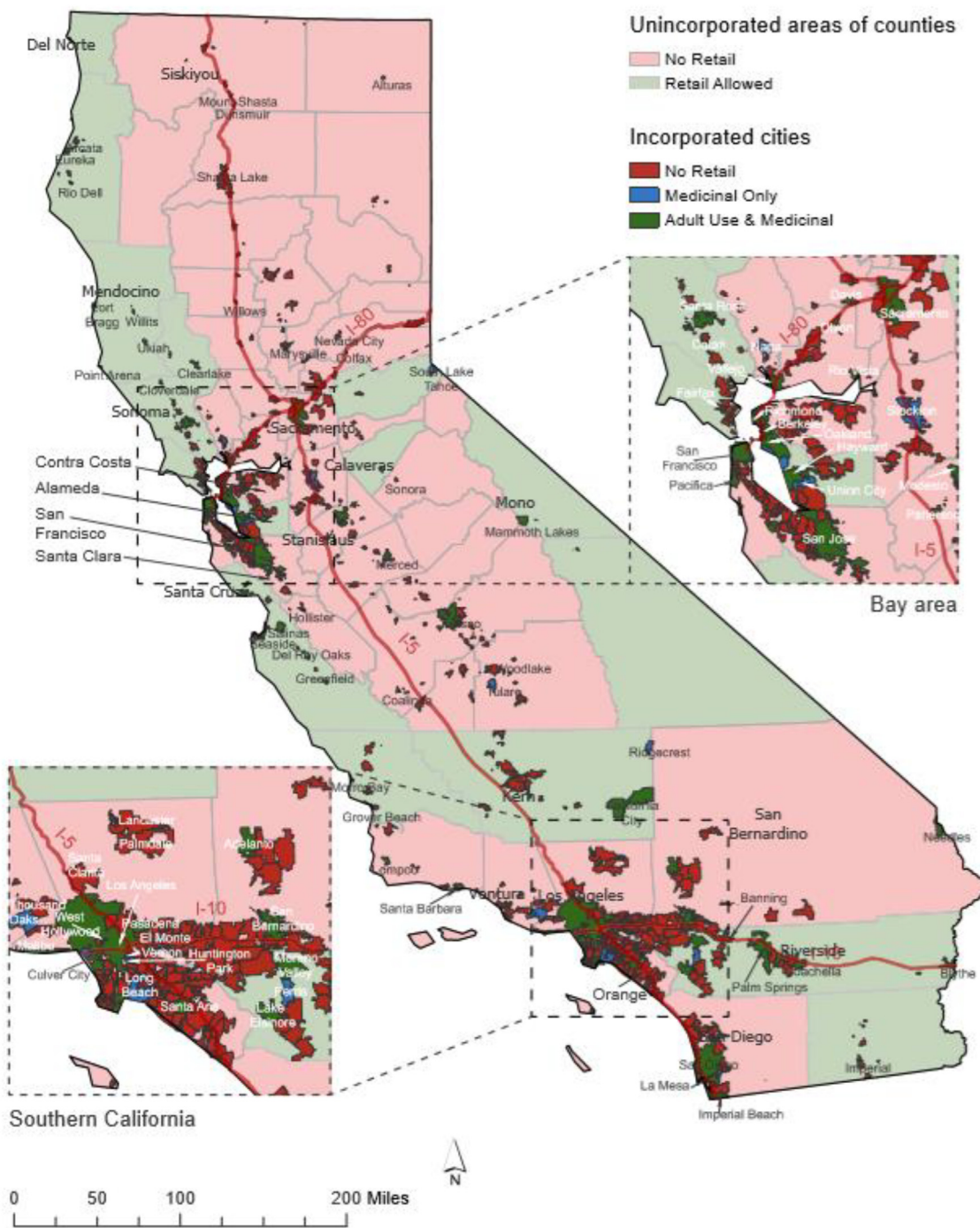
Fig. 2. Local jurisdictions that allow and do not allow cannabis retail.

only unlicensed retailers—is more likely to exist in neighborhoods with more Hispanics and fewer non-Hispanic whites. Fortunately, only 17% of Californians live in neighborhoods with only unlicensed retailers.

Residents of neighborhoods containing both licensed and unlicensed retailers are also at risk because the unlicensed retailers can compete against the licensed retailers. Conversely, proximity to licensed retailers might put pressure on unlicensed retailers to sell higher-quality products. The finding that a larger than expected number of unlicensed facilities are in areas that allow retail suggests that unlicensed retailers are competing with licensed retailers, potentially undercutting the sales of the licensed retailers and reducing the taxes paid to the state. Neighborhoods with both licensed and unlicensed retailers had disproportionately high proportions of residents living below the Federal

poverty level. Residents below the Federal Poverty Level might be especially price-sensitive and might be more likely to choose the low prices of an unlicensed retailer over the regulation and standardization of a licensed retailer, making it easier for the unlicensed retailers to undercut the sales of a licensed retailer.

Neighborhoods with both licensed and unlicensed retailers also contained disproportionately high proportions of African American residents. Historically, African Americans have been four times more likely than non-Hispanic whites to be arrested for cannabis possession, despite a similar prevalence of cannabis use (American Civil Liberties Union, 2013; Koch et al., 2016). From a social justice perspective, it is important that African American communities now benefit from the safety precautions, employment opportunities, and revenue afforded by

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Table 1
Population characteristics of the neighborhoods surrounding cannabis facilities, California, 2018.

	No service geography (n = 5,434)	Any service geography (licensed, unlicensed, or both) (n = 4,796)	Licensed Facilities Only (n = 1,601)	Unlicensed Facilities Only (n = 2,317)	Licensed and Unlicensed Facilities (n = 2,189)
	Est. (MOE)	Est. (MOE)	Est. (MOE)	Est. (MOE)	Est. (MOE)
% of California Population	57.82% (0.06%)	42.18% (0.07%)**	7.83% (0.05%)	16.55% (0.05%)**	17.81% (0.05%)**
% Non-Hispanic White	44.49% (0.09%)	28.89% (0.11%)**	37.71% (0.35%)	25.13% (0.20%)**	28.49% (0.15%)**
% Hispanic (all races)	33.22% (0.12%)	46.33% (0.14%)**	37.49% (0.44%)	51.99% (0.26%)**	44.95% (0.21%)**
% African American	4.38% (0.06%)	7.76% (0.08%)	7.42% (0.22%)	6.66% (0.14%)**	8.92% (0.12%)
% Asian	14.09% (0.07%)	14.16% (0.09%)ns	13.41% (0.28%)	13.84% (0.16%)*	14.79% (0.14%)**
% Below Federal Poverty Level	12.90% (0.11%)	18.09% (0.14%)**	17.34% (0.44%)	17.00% (0.26%)ns	19.43% (0.21%)**

*p < .05, **p < .001, ns = nonsignificant (z-tests).

Est = Estimate; MOE = margin of error; n = the number census tracts in each geography.

the retailer licensing process. For this to occur, it is important to prevent unlicensed retailers from competing with licensed retailers in African American and Hispanic neighborhoods.

Retailers in unincorporated areas were more likely to be unlicensed, relative to retailers in incorporated areas. Enforcement could be difficult in unincorporated areas because these areas lack the representation of a centralized local government, which can provide local control over community services such as law enforcement and regulatory oversight for cannabis retail stores. Increased county-level enforcement resources are needed to eliminate unlicensed cannabis retailers in areas that are outside the jurisdictions of city governments.

California currently has more unlicensed cannabis retailers than it can control with existing enforcement resources (Schroyer, 2019). Enforcement by the state has been hampered by a lack of resources and a decision to give new businesses time to comply with complex regulations. At the same time, lack of enforcement has created an environment for a thriving unregulated 'underground market.'

5. Limitations

These findings are subject to several limitations. First, the retailer data might have been incomplete. The data on unlicensed retailers are limited to those that advertised on Weedmaps and Leafly. It is possible that this analysis missed additional retailers that did not advertise on these websites. The data presented on California cannabis retailers represent a descriptive snapshot of California's cannabis retail landscape at one point in time, less than one year after state retail licensure began. The total number of retailers is changing as new retailers open and existing retailers close. As the cannabis market matures, it is unclear whether the number of unlicensed retailers will increase or decrease relative to the number of licensed retailers. If unlicensed retailers proliferate, accurate data on their locations will be needed to conduct updated analyses in the future. Such longitudinal analyses of changes in retailer locations over time would advance the field. However, such analyses will be difficult because Weedmaps and Leafly have changed their policies and now include only licensed retailers, so new data on unlicensed retailers could be difficult to obtain. In addition, this study did not include cannabis home delivery and shipping services, which currently can deliver cannabis to any address in California. Cannabis was available on the black market in California before legalization, and medical cannabis cards are relatively easy to obtain from dispensaries or physicians affiliated with dispensaries. Thus, availability was already quite high before legalization, limiting generalization of findings to other states.

Second, characteristics of neighborhoods are often intercorrelated, including racial/ethnic composition, socioeconomic status, resources for local policy enactment and enforcement, and zoning laws. Longitudinal, multivariate analyses would be necessary to disentangle the complex co-evolution of these neighborhood characteristics. Our sophisticated geographic analyses provide a descriptive snapshot of the residents living in geographies with diverse cannabis retail landscapes, but multivariate analyses would be necessary to understand the complex demographic and economic forces that produced these patterns.

5.1. Public health implications

This paper uncovers important geographic disparities in the presence of unlicensed retailers in California which are disproportionately located in Hispanic and lower-income areas throughout the state. These are the same communities impacted negatively by disproportionate incarceration of racial and ethnic minorities during the War on Drugs (American Civil Liberties Union, 2013; Koch et al., 2016; Adinoff and Reiman, 2019). Also, as is readily apparent in comparing the two inset maps in Fig. 1, there is a notable geographic concentration of neighborhoods with access to unlicensed retailers only or a mix of licensed and unlicensed retailers in Southern California versus the Bay Area. The

Table 2
Types of cannabis facilities by types of legal jurisdictions, California, 2018.

Facility type	Jurisdiction type	Number of facilities (n = 1,110)	Expected value	Chi-Square	P Value
Unlicensed (n = 662)	Incorporated areas	516 (78%)	552 (83%)	14.26	0.0008
	Unincorporated areas	146 (22%)	110 (17%)		
Licensed (n = 448)	Incorporated areas	393 (88%)	374 (83%)	6.03	0.049
	Unincorporated areas	55 (12%)	74 (17%)		
Unlicensed (n = 662)	Allowed locality	408 (62%)	270 (41%)	119.24	less than0.00001
	Not allowed locality	254 (38%)	392 (59%)		

overrepresentation of unlicensed retailers in broad regions of the state as well as in unincorporated areas suggests pervasive problems with enforcement.

Given the various geographical disparities uncovered in this paper, efforts are needed to encourage compliance with retailer licensing requirements to ensure uniformity of enforcement of the law across the state. State policymakers should provide additional enforcement resources to jurisdictions where enforcement is lagging. This could include effort from state investigators, state funding, and sharing of best practices from localities that have successfully blocked unlicensed facilities. However, the experiences of other states demonstrate that establishing an adequately regulated legal cannabis infrastructure can take several years (Lancione et al., 2019; Dilley et al., 2017). HYPER-LINK "SPS:refid::bib1_bib6"

It is important to note that the presence of licensed retailers in minority areas and areas below the FPL does not necessarily indicate that the industry is preying on disadvantaged populations. California recently enacted SB1294, which allocates grant funding to assist minority-owned cannabis businesses (Adinoff and Reiman, 2019). This is a restorative justice initiative to allow racial and ethnic minorities, who have been disproportionately adversely affected by anti-cannabis policies in the past, to benefit from participation in the legal cannabis market. These minority-owned businesses are likely to locate in minority neighborhoods and provide employment and tax revenue for minority communities. However, our data do not reflect the effects of these equity programs because this law passed only several weeks before our data were collected. Future research should evaluate the effects of these equity programs on the locations of licensed retailers.

A recent report from Los Angeles County (Nicholas et al., 2019) provides a comprehensive list of recommendations to prevent unlicensed cannabis retailers from threatening health equity. These include continually monitoring the geographic distribution of licensed and unlicensed retailers, shutting down unlicensed retailers quickly by turning off their utilities and padlocking their entrances, implementing an emblem program to identify licensed retailers who are in compliance with all regulations, and educating consumers about how to select licensed retailers. These recommendations, along with adequate resources to regulate compliance, may help to bring more uniform enforcement of the law, and thus mitigate potential adverse effects of unlicensed cannabis retailers throughout California.

CRediT authorship contribution statement

Jennifer B. Unger: Conceptualization, Funding acquisition, Methodology, Writing - original draft, Writing - review & editing. **Robert O. Vos:** Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Jasmine Siyu Wu:** Methodology, Investigation, Software, Writing - review & editing. **Kimberly Hardaway:** Methodology, Investigation, Software, Writing - review & editing. **Ada Y. Li Sarain:** Methodology, Investigation, Software, Writing - review & editing. **Daniel W. Soto:** Conceptualization, Supervision, Writing - review & editing. **Christopher Rogers:** Methodology, Investigation, Software, Writing - review & editing. **Jane Steinberg:** Conceptualization, Writing - original draft, Writing - review & editing.

References

Adinoff, B., Reiman, A., 2019. Implementing social justice in the transition from illicit to legal cannabis. Am. J. Drug Alcohol Abuse 45 (6), 673–688.

American Civil Liberties Union. The war on marijuana in black and white. 2013; https://www.aclu.org/sites/default/files/field_document/1114413-mj-report-rfs-rel1.pdf. Accessed 9-16-19.

California Board of Cannabis Control. License Search Tool. https://aca5.accela.com/bcc/customization/bcc/cap/licenseSearch.aspx, Accessed 9-16-19.

California Department of Finance, E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2018 and 2019. Sacramento, California, May 2019.

California Legislative Analyst's Office. Analysis of A.G. File No. 2015-103, December 22, 2015 https://lao.ca.gov/BallotAnalysis/Initiative/2015-103.

DerSimonian, R., Laird, N., 2015. Meta-analysis in clinical trials revisited. Contemp. Clin. Trials 45, 139–145. https://doi.org/10.1016/j.cct.2015.09.002.

Dilley, J.A., Hitchcock, L., McGroder, N., Greto, L.A., Richardson, S.M., 2017. Community-level policy responses to state marijuana legalization in Washington State. Int. J. Drug Policy 42, 102–108. https://doi.org/10.1016/j.drugpo.2017.02.010.

Fakunle, D.O., Milam, A.J., Furr-Holden, C.D., Butler 3rd, J., Thorpe Jr, R.J., LaVeist, T.A., 2016. The inequitable distribution of tobacco outlet density: the role of income in two Black Mid-Atlantic geopolitical areas. Public Health 136, 35–40.

Fuller, T. 'Getting worse, not better'; Illegal pot market booming in California despite legislation. New York Times, April 27, 2019; https://www.nytimes.com/2019/04/27/us/marijuana-california-legalization.html. Accessed 9-16-19.

Gonzalez, M., Sanders-Jackson, A., Henriksen, L., 2019. Social capital and tobacco retail outlet density: an empirical test of the relationship. Am. J. Health Promot. 33 (7), 1020–1027.

Hansen, C., Illegal pot still plagues states where weed is legal. US. News and World Report. 2019; https://www.usnews.com/news/national-news/articles/2019-07-23/illegal-pot-still-plagues-states-where-weed-is-legal. Accessed 9-16-19.

Jones B. Statement of Vote, November 5, 1996. https://elections.cdn.sos.ca.gov/sov/1996-general/sov-complete.pdf.

Koch, D.W., Lee, J., Lee, K., 2016. Coloring the war on drugs: arrest disparities in black, brown, and white. Race Social Problems 8, 313–325.

Lancione, S., Wade, K., Windle, S.B., Filion, K.B., Thombs, B.D., Eisenberg, M.J., 2019. Non-medical cannabis in North America: an overview of regulatory approaches. Public Health 178, 7–14.

Mair, C., Freisthler, B., Ponicki, W.R., Gaidus, A., 2015. The impacts of marijuana dispensary density and neighborhood ecology on marijuana abuse and dependence. Drug Alcohol Depend. 154, 111–116.

Morrison, C., Gruenewald, P.J., Freisthler, B., Ponicki, W.R., Remer, L.G., 2014. The economic geography of medical cannabis dispensaries in California. Int. J. Drug Policy 25 (3), 508–515.

National Academies of Sciences, Engineering, and Medicine, 2017. The health effects of cannabis and cannabinoids: Current state of evidence and recommendations for research. The National Academies Press, Washington, DC.

Nicholas, W., Greenwell, L., Washburn, F., Caesar, E., Lee, G., Loprieno, D., Vidyanti, I., Stroud, L., Jan, M., July 2019. Health Equity Implications of Retail Cannabis Regulation In LA County. Los Angeles County Department of Public Health, Center for Health Impact Evaluation.

Padilla A. Statement of Vote, November 8, 2016 general election. https://elections.cdn.sos.ca.gov/sov/2016-general/sov/2016-complete-sov.pdf.

Pedersen, E.R., Zander-Cotugno, M., Shih, R.A., Tucker, J.S., Dunbar, M.S., D'Amico, E.J., 2018. Online methods for locating medical marijuana dispensaries: practical considerations for future research. Cannabis 1 (2), 22–35. https://doi.org/10.26828/cannabis.2018.02.003.

Queally, J., McGreevy, P. Nearly 3,000 illegal marijuana businesses found in California audit, dwarfing legal trade. Los Angeles Times, -11-1, https://www.latimes.com/california/story/201-0-11/california-marijuana-black-market-dwarfs-legal-pot-industry. Accessed-16-1.

Romley, J.A., Cohen, D., Ringel, J., Sturm, R., 2007. Alcohol and environmental justice:

the density of liquor stores and bars in urban neighborhoods in the United States. J. Stud. Alcohol Drugs 68 (1), 48–55.

Schier, J.G., Meiman, J.G., Layden, J., Mikosz, C.A., VanFrank, B., King, B.A., Salvatore, P.P., Weissman, D.N., Thomas, J., Melstrom, P.C., Baldwin, G.T., Parker, E.M., Courtney-Long, E.A., Krishnasamy, V.P., Pickens, C.M., Evans, M.E., Tsay, S.V., Powell, K.M., Kiernan, E.A., Marynak, K.L., Adjemian, J., Holton, K., Armour, B.S., England, L.J., Briss, P.A., Houry, D., Hacker, K.A., Reagan-Steiner, S., Zaki, S., Meaney-Delman, D., 2019. Severe pulmonary disease associated with electronic-cigarette–product use — interim guidance. MMWR Morb. Mortal. Wkly. Rep. 68 (36), 787–790. https://doi.org/10.15585/mmwr.mm6836e2.

Schroyer, J., McVey, E. Chart: Most California municipalities ban commercial cannabis activity. Marijuana Business Daily 2019, https://mjbizdaily.com/chart-most-of-california-municipalities-ban-commercial-cannabis-activity/.

Schroyer, J. California cannabis trade group threatens to sue L.A. over lack of enforcement against legal shops. Marijuana Business Daily, June 5, 2019. https://mjbizdaily.com/california-cannabis-trade-group-threatens-to-sue-l-a-over-lack-of-enforcement-against-illegal-shops/, Accessed 9-16-19.

Shi, Y., Meseck, K., Jankowska, M.M., 2016. Availability of medical and recreational marijuana stores and neighborhood characteristics in Colorado. J Addict. 2016, 7193740. https://doi.org/10.1155/2016/7193740.

Shih, R.A., Rodriguez, A., Parast, L., Pedersen, E.R., Tucker, J.S., Troxel, W.M., Kraus, L., Davis, J.P., D'Amico, E.J., 2019. Associations between young adult marijuana

outcomes and availability of medical marijuana dispensaries and storefront signage. Addiction 114 (12), 2162–2170. https://doi.org/10.1111/add.v114.1210.1111/add.14711.

Spielman, S.E., Folch, D.C., 2015. Reducing uncertainty in the American community survey through data-driven regionalization. PLOS One 10 (2). https://doi.org/10.1371/journal.pone.0115626. e0115626.

Staggs, B., Wheeler, I. Marijuana laws for every city and county? Our database shows California slow to accept Prop. 64. 2019, https://www.ocregister.com/2018/04/09/database-of-marijuana-rules-from-every-city-and-county-in-california-shows-slow-acceptance-of-prop-64/. Accessed 9-16-19.

Tabb, L.P., Fillmore, C., Melly, S., 2018. Location, location, location: assessing the spatial patterning between marijuana licenses, alcohol outlets and neighborhood characteristics within Washington state. Drug Alcohol Depend. 185, 214–218.

Thomas, C., Freisthler, B., 2016. Examining the locations of medical marijuana dispensaries in Los Angeles. Drug Alcohol Rev. 35 (3), 334–337.

U.S. Census Bureau. Understanding and using American Community Survey data: What all data users need to know. 2018, https://www.census.gov/programs-surveys/acs/guidance/handbooks/general.html.

Zamost, S., Lee, M., Schlesinger, J. A look inside the black market for weed shows the huge threat to legal businesses. https://www.cnbc.com/2019/07/11/las-black-market-for-weed-threatens-the-growth-of-its-legal-business.html.