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Piloting a Spatial Mixed Method for Understanding Neighborhood Tobacco Use Disparities

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Abstract

The tobacco retail environment is where most advertising dollars are spent. However, most research on the retail environment has not methodologically situated tobacco retailers as part of a larger community, and few studies have incorporated community member perspectives of their own tobacco use in relation to their local environments. The purpose of this study is to describe and evaluate a multilevel, multimodal, mixed methods approach for understanding tobacco use in context. We combine quantitative data collected from tobacco retailer audits and geographically-explicit interviews with neighborhood residents to tell a more complete story of tobacco use behavior among adults in San Francisco's Marina district, and the Oakland Coliseum neighborhood in Alameda County, California. We find that while area-level and retail data provide a broad snapshot of two distinct communities with respect to sociodemographic characteristics and tobacco availability, interviews with community residents who use tobacco add important perspectives regarding how tobacco retailers are viewed and how residents interact with their neighborhood landscapes on a daily basis. The method we describe and critique has the potential to be scaled to incorporate a broader set of geographies, or tailored to address a multitude of

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health-related questions. Our approach further demonstrates the utility of including geolocated participant narratives as a means of understanding where researcher interpretations of urban environments diverge from those of community residents.

Keywords

health geography; neighborhoods & health; tobacco control; substance use; health policy

INTRODUCTION

While cigarette smoking in the United States is decreasing, this decline has not been consistent among all populations.[1] Disparities in tobacco use persist among people with lower socioeconomic status, as well as for young adults, nonwhite, and sexual and gender minority communities,[2–6] creating what some have referred to as “smoking islands” across geographies.[7] Furthermore, use of other tobacco products, such as e-cigarettes, as well as multiple tobacco product use, has increased among youth and young adults in recent years,[8–10] prompting some cities and states to pass new restrictions on flavored tobacco sales, set tobacco retail moratoria, raise taxes on tobacco, and raise the age of purchase to 21.[11–13]

As these policies and upward tobacco use trends are both contemporary phenomena, evidence on local and individual impact is relatively sparse. In 2016, the state of California passed Tobacco 21 and a $2.00 increase in the tobacco excise tax,[13] but local policies on flavored tobacco use are not consistent across the Bay Area. For example, in San Francisco County, a comprehensive policy prohibiting menthol and other flavored tobacco sales was enacted in July 2018, prior to federal sales restrictions. However, cities in neighboring Alameda County developed a patchwork of laws, wherein some exempted menthol, some applied only to areas in specific distance to schools, and some failed to pass any flavored tobacco policy.[12] It is therefore important to develop integrated methods that can investigate place-specific local perceptions and practical implementation of tobacco-related policies, and the potential impact on smoking, multiple product, and alternative tobacco use. To do this comprehensively, it is important to not only evaluate area-level trends, but also to engage with the experiences of people living in these places.

The tobacco control and health geography literatures have sought to address various aspects of tobacco use in context. The bulk of these studies can be categorized into four areas: (1) emerging tobacco geographies theory;[7,14–18] (2) tobacco point-of-sale (POS) studies, including those focused on both exposure and retail density;[19–32] (3) spatial concentrations of urban advertising and marketing in targeted communities;[33–41] and (4) disparities in neighborhood and area-level characteristics as they relate to individual tobacco use behavior, or tobacco retail clustering.[25,40,42–51] Collectively, this literature has confirmed the necessity of understanding local tobacco use dynamics for developing effective policy and public health interventions.

Specifically, greater exposure to tobacco retail outlets and marketing has been found in area-level studies, surveys, and ecological momentary assessment studies to be associated

with tobacco use initiation among adolescents[19–21] and with triggering tobacco use among multiple populations.[28,32] Tobacco advertising, such as on billboards, has also been repeatedly found to target communities that are poorer, or have higher proportions of Black or Latinx residents.[33,34,36,38] Finally, neighborhood disorder, area-level socioeconomic status, and permissive neighborhood smoking norms have all been associated with greater likelihood of tobacco use among residents.[43,44,48,52] While these studies have created a solid foundation for understanding the geographies of tobacco use, few have utilized mixed methods approaches and mobile technology tools that would allow for integrated analyses of multiple qualitative and quantitative data sources.

In particular, the social determinants of health are spatially experienced in real time. Utilizing participatory technology models, data visualization tools, community level local knowledge and conducting spatial analysis with experiential data can help researchers and practitioners better understand and address multilevel challenges to health and wellness, especially among diverse populations.[53–55] Publicly available geospatial data sources cannot provide insights into local phenomena or experiences of place in the same way as data provided by people living and working in those places. Combining findings from place-informed lived experiences of local residents with distal data on local trends, such as tobacco retail products and pricing, offers a more nuanced and layered perspective on community assets and challenges.

This study also capitalized on an opportune time for evaluating the effects of local and state policy on tobacco use behavior and consumer experiences. At the time the study was conducted (2018–2019), California had increased the state tobacco tax (effective April 2017) and raised the age of tobacco purchase to 21 (effective May 2016.) In addition, San Francisco County enacted a moratorium on new tobacco retail licenses in 2015,[11] and a comprehensive policy eliminating menthol and other flavored tobacco sales (effective July 2018). Most municipalities in Alameda County (e.g., Berkeley, Oakland, Hayward), as well as the County itself, have also passed flavored tobacco sales restrictions, though these differ from place to place within the county.

This pilot study combined novel mixed-methods, including the use of a mobile mapping platform,[56] to integrate area- and individual-level geospatial analysis with community knowledge and narratives. We adapted Pearce et al.'s[15] framework for evaluating pathways between place characteristics and tobacco use behavior to guide the study (Figure 1). In this formulation, interviews with participants informed the place-based practices dimension of the neighborhood landscapes, while recent local and state legislation in the Bay Area and California, along with tobacco retailer audits, informed the place-based regulation and policy arm.

We intend to address the following two questions in this study: (1) How might a study of tobacco use in local environments that integrates retail assessments and geographically-explicit interviews contribute to existing knowledge about place-based tobacco practices and policies? (2) How might this approach be improved and scaled?

METHODS

Study area

We selected two areas with different sociodemographic and tobacco use characteristics to describe participant lived experiences. To define the sample frame, we utilized data from our 2014 San Francisco Bay Area Young Adult Health Survey (BAYAHS),[57,58] a probabilistic household survey that had been conducted in Alameda and San Francisco Counties, and block group summary file, TIGER/Line block group and ZCTA shapefile data (2017), from the 2013–2017 American Community Survey (ACS). First, we created a point density surface from BAYAHS participant addresses, using ArcGIS 10.7.1, centered on cigarette smoking as the density variable. Because the BAYAHS data only included young adults, aged 18–26, we overlaid block group-level sociodemographic data from the ACS and performed cluster analyses to determine spatial concentrations by age, sex and race/ethnicity. We then randomly selected one ZCTA in which there was both higher concentrations of Black and Latinx residents at the aggregate block group level for the ZCTA, and higher than average tobacco use as determined by the BAYAHS data. The neighborhood largely encompassed within this ZCTA was “Oakland Coliseum (Coliseum).” We then selected a second ZCTA at random from the remaining ZCTAs in the two counties, which was generally correspondent with the Marina neighborhood in San Francisco (Figure 2). We selected the ZCTA level to have a broad enough recruitment area in each case, but not so broad that tobacco-related environments would vastly differ for participants within each ZCTA.

Study Participants

After selecting the study areas, we matched the ZCTAs to their corresponding ZIP codes and posted ads on Facebook targeting those ZIP codes. We also engaged in street recruitment within those ZIP codes. Potential participants completed a brief screening instrument via Qualtrics to determine eligibility; they had to be aged 18 or older, residing in one of the selected ZIP codes, and have used any form of tobacco in the past 30 days. Eligible individuals completed informed consent and a baseline questionnaire including their sociodemographic and tobacco use characteristics and information about their neighborhoods. Qualified participants (N=6) participated in semi-structured, in-depth interviews about their neighborhood activities and impressions, experiences in places that were associated with tobacco, whether positive or negative, and recent policy changes. The study was approved by the primary funding institution’s Human Research Protection Program in January 2018.

Semi-structured, in-depth interviews

The interview guide utilized Streetwyze, an online mapping platform that allows users to identify features of their neighborhoods as “good”, “bad”, or needing a “fix” by dropping corresponding placemarks on a base map, and adding narrative or imagery as appropriate[56,59] to place the interview discussion visually (Figure 3). Places marked as “bad stuff” were features of the area interviewees did not like, and did not wish to fix, while “fix stuff” placemarks were elements of the area that residents felt were not an asset currently but could be made so if specific problems were addressed. With the assistance of study

personnel, participants used a laptop or tablet during the interview to drop pins on the mapping platform and notate places where they smoked or observed tobacco use, and places where they did not smoke or that they considered 'anti-tobacco'. On the map in Figure 3, data point clusters signify features of the neighborhood that were mentioned by multiple interviewees wherein the number represents how many people mentioned that feature; single data points indicate features that only held significance for one interviewee. Streetwyze users are also able to "upvote" or "downvote" other users' contributions; the thumbs up and thumbs down icons in Figures 5–8 illustrate this.

The interview guide (Figure 4) further leveraged this pin dropping activity to elicit participants' accounts of their experiences and interactions with their neighborhood, including where and how they used tobacco, spatial norms and practices of tobacco use, and their perceptions of new tobacco policies (e.g., menthol/flavored tobacco sales restrictions).

Interviews lasted 68 minutes, on average, and were conducted by research staff, including postdoctoral fellows and faculty members with interview expertise. Interviews were audio-recorded and professionally transcribed. Field notes were written after each interview. Participants received $45 for their participation.

Tobacco retailer data

To evaluate tobacco retail environments in the selected ZIP codes, we used tobacco retail licensing data provided by the Alameda and San Francisco County Departments of Public Health to map the locations of all tobacco retailers. Once each retailer was geolocated, we selected 100 percent of tobacco retailers that fell within the two Census ZCTA boundaries, as well as those that were located within 0.15 miles of the ZCTA boundaries (2–3-minute walk) in order to minimally account for edge effects. The resulting number of retailers included in the analysis was 46 out of 2,220 in the two counties overall (2.1%), which included 25 in Oakland Coliseum and 21 in the Marina. Tobacco retail assessment instruments included questions about tobacco product availability, tobacco prices, discounts, displays, and tobacco advertising.

Area-level sociodemographic characteristics were analyzed using 2013–2017 block group-level American Community Survey data to illustrate descriptive differences between the two neighborhoods in order to provide context (Table 1). These variables were all measured continuously as a percentage of the designated population. There were 28 block groups included in the Marina and 45 in Oakland Coliseum for a total of 73 (out of 1,626 in the two-county area).

Tobacco retailer characteristics evaluated in this analysis included: exterior store advertising; products sold; and prices and promotions. Exterior ads and cigarette promotions were classified as present (1) or not (0). Products were coded as currently sold (1) or not (0), and prices were measured continuously as currency.

Statistical analysis

Participant survey, tobacco retail, and aggregate block-group-level descriptive analyses were performed using Stata 16 and ArcGIS 10.7.1. Characteristics for variables included in this

analysis are shown in the Results section and means comparison tests were evaluated for each variable, comparing the Marina and Oakland Coliseum neighborhoods.

Qualitative analysis

Transcripts were grouped by neighborhood (Marina N = 2; Oakland Coliseum N = 4) and uploaded into Dedoose qualitative analysis software. Qualitative data analysis was designed to complement the quantitative findings[60] by providing grounded perspectives and community voices from people who smoke and live in each neighborhood. The aim was to understand how participants interacted with and experienced tobacco use and the local tobacco retail environment, as well as gain their perspectives on local tobacco policies. Accordingly, the second and fourth authors coded transcript content for three broad themes: (1) people and tobacco use, including tobacco-related norms and social practices; (2) tobacco retail, including stores, advertising, policy restrictions and products sold; and (3) experiences of the neighborhood environment. The coders met with the team and presented and discussed coded content to compare and synthesize findings across the three themes for each neighborhood.

RESULTS

Area-level Sociodemographic Characteristics

Table 1 shows aggregate block-group level characteristics for the Marina and Coliseum neighborhoods. The Marina had a significantly higher median household income, lower poverty, less public assistance income, lower rates of un-insurance, and higher educational attainment. Coliseum had a higher dependency ratio, or ratio of children and elders to working age adults, and more minoritized residents.

Participant Characteristics

Regarding the participants, the two living in the Marina were daily cigarette smokers, while the four in Coliseum smoked on an average of 26.5 days in the month prior to the survey. However, the Marina participants smoked fewer cigarettes per day (4.0) compared to those in Coliseum (7.0). Coliseum participants reported paying $4.80 more per cigarette pack, on average, compared to Marina participants, and used a greater variety of tobacco products, including little cigars, smokeless tobacco and e-cigarettes. The average age of participants in both neighborhoods was similar (Marina: 42; Oakland: 48.8), however three out of four Coliseum participants were male as was one of the two Marina participants. Participants from both neighborhoods represented the four largest racial/ethnic groups in the San Francisco Bay Area. Marina participants had higher educational attainment and reported substantially higher annual income than participants in Coliseum. Of the two Marina participants, MM09 (age=61) had resided there for 27 years, while MM01 (age=23) had resided there for two years. Two of the Oakland participants (MM03, age=45; MM12, age=59) reported residing in the neighborhood for one year, although MM03 had grown up in Oakland, moved away for several years, and had recently returned. MM13 (age=50) and MM15 (age=40) had lived there for 16 and 11 years respectively.

Place-Based Tobacco Practices

During interviews, participants discussed tobacco use norms and practices within their neighborhoods, including the places where they considered it appropriate or inappropriate to smoke, and ways that they mitigated the health and aesthetic impacts of tobacco on themselves, their loved ones, and other neighborhood residents. Coliseum participants described a variety of tobacco use norms and place-based practices of smoking, including indoor and outdoor smoking. One Coliseum participant (age 61, African American, female, MM12) had a landlord who tolerated her smoking menthol cigarettes inside her house, but she regularly wiped down the walls and emptied ashtrays for cleanliness. She smoked in the yard when her sons were inside the house to protect their health, only smoking in her room when they were gone.

Another Coliseum participant (age 47, African American, male, MM03) who smoked cigars described exclusively smoking outside a smoke shop, or while alone in his truck as a form of solitary relaxation: “I’m just kicking back, relaxing, and smoke me a Black & Mild.” This participant would never smoke inside his own or his grandmother’s house. His grandmother had a “breathing machine” and his daughter had asthma and was receiving chemotherapy; he did not want to endanger them by exposing them to tobacco. Moreover, he described himself and his wife as “neat fanatics” and did not want a tobacco smell inside his home, his truck, or on his body:

> I don’t like to smoke around my kids, and I don’t like my house smelling like no type of smoke period. I done been in so many people’s house, and their house just stink. They be so immune to it, they don’t smell it.
>
> (MM03)

For this reason, he always carried mouthwash, a toothbrush, and toothpaste in his truck, cleaned his truck regularly, and showered as soon as he got home.

The two Marina participants described exclusively smoking cigarettes outdoors, with more relaxed spatial norms for cannabis and electronic cigarette use. One participant (age 25, Latinx, male, MM01) illustrated the strong anti-cigarette smoking norms in the Marina by describing his landlord’s request for tenants to pick up cigarette butts outside the building. This participant ‘vaped’ inside and outside of his home and smoked “spliffs” (loose leaf tobacco with cannabis flower) outside the home. The other Marina participant (age 63, Non-Hispanic White, female, MM09) described strict rules against smoking tobacco inside her multiplex housing and identified the porch and garden as informally sanctioned smoking places where she and other tenants smoked. For example, MM09 described smoking at an outdoor recreational space that she calls the “Little Green Park”:

> There’s very few places to smoke anymore. So, I just feel like any place that’s outdoors where you’re going to have a lot of people, that would be an opportunity. Because you’re not gonna do it in a restaurant anymore or a bar.
>
> (MM09)

She also described people smoking around the Palace of Fine Arts, where tourists, picnickers, and neighborhood residents can relax outdoors and smoke (Figure 5). In contrast,

the other Marina participant (MM01) identified a public park, Fort Mason, with strict rules against smoking.

Marina participant MM01 smoked while walking to the bus stop. While he had not been reprimanded by others for doing this, he was vigilant and tried to avoid smoking around other people as much as possible (Figure 6).

Similarly, Coliseum participant MM03 says he had never been asked to put out his cigar because he is so conscientious of others around him when he smokes:

> If I'm smoking, and somebody walk up and we're talking, or if I walk up and I'm smoking, I'm always gonna ask them if it bothers them. If it bothers them, I'll put them out. […] I was raised with so much respect. So, like I said, nobody has ever asked me because I always ask people who's around me.

Neighborhood places that were viewed as inappropriate for smoking were discussed at length in both Coliseum as well as Marina participants' accounts. This was particularly true for locations that had children or people with health problems, as alluded to in MM03's account above. Another Coliseum participant (age 52, Non-Hispanic Multiracial, male, MM13) frequented the local library but would never smoke there due to the proximity of children:

> Never because there's a school right next door. I wait until I get to 69th, cross the street, and then uh, I'll light up. Walking from there.
>
> (MM13)

He enjoyed going to the library several times per month, experiencing it as an asset for "peace of mind":

> Peace of mind time as I call it, you know. And magazines and read a - you know, read a book. I never check out though. I just sit there and read. Just for the peace of mind, quietness.
>
> (MM13)

Marina participant MM09 also frequented her public library and obeyed posted signs that required smoking from a certain distance away from the entrance. She also listed grocery stores, movie theaters, and hardware stores as places where smoking was inappropriate.

In addition to the library, Coliseum participant MM13 avoided smoking near the neighborhood youth recreation center, which was run by a counselor who does not tolerate smoking at the center:

> It's no smoking on the facility, on the campus or whatever […]. It's for the community and it's well appreciated. Especially for the kids and stuff. You know, well needed.

He enjoyed spending time at the neighborhood youth recreation center sitting and watching the children play. He described the center's youth resources, and how he experienced it as a welcoming environment:

> It's called a recreation center now. It's basketball. They have an indoor court. Now from what I understand they finally have a computer room. They do like food drives for the neighborhood. It's good for the youngsters. You know, young kids, something for them to do. They have summer programs, and you know, lunches for the kids in the summer. They have everything.

Interviewer 1 So, they have lunches. Um, sports, computers. Is it an okay place for older people too? Is it really just for kids?

Yeah. We sit around and just watch them play. [laughs]

Interviewer 1 Okay. [laughs] But you would feel welcome in that space?

Yes, yes. I know the person that overlooks everything. He's a good gentleman and don't tolerate no mess from youngsters, you know. [laughs] (MM13)

In summary, participant accounts from both the Coliseum and Marina neighborhoods described strong anti-tobacco norms for indoor spaces, and a shared understanding of tobacco use as something that is harmful to health and should not be done around children or other sensitive adults. Participant narratives revealed that both Coliseum and Marina neighborhoods have micro-environments that encourage or discourage smoking, influenced by outdoor space, social norms, and the presence of children. They further underlined collective understanding of social spaces and aspects of the built environment that fostered socialization while also discouraging disruption from negative influences, including secondhand smoke exposure.

Place-based Policies & Regulations: Tobacco Retail Environment

As detailed above, tobacco retail exposure has been associated with tobacco use initiation and triggering among current smokers. From a neighborhood standpoint, tobacco retail outlet density has also been associated with neighborhood disinvestment,[61] which has direct impact on area residents, as discussed in their own words below. Table 5 shows sample characteristics of tobacco retailers in the Marina and Oakland Coliseum neighborhoods. Ultimately, 46 retailers in this area were successfully audited: 21 in the Marina and 25 in Coliseum. Coliseum retailers had greater exterior advertising intensity than those in Marina, especially with respect to tobacco products targeted to nonwhite populations (i.e., menthol, little cigars, cigars).[36,62–66] They were also statistically more likely to sell cigars. Coliseum stores additionally offered more cigarette price promotions. Marina stores, on the other hand, had statistically higher pack prices for both regular and Newport menthol cigarettes (the most popular brand of menthol cigarettes, which has been shown to be priced lower in neighborhoods with more Black residents)[67] than did Coliseum stores, which contradicts the experience of our participants who reported paying much higher pack prices in Coliseum on average (Table 2).

Participant interviews provided insight into how Coliseum and Marina residents interacted with and experienced tobacco retail in their neighborhood, and their opinions about local tobacco-related policies such as Tobacco 21 and flavored tobacco sales restrictions. When

discussing where they purchased tobacco, Coliseum participants spent more time discussing smoke shops, i.e., retailers whose primary stock is tobacco products, than did Marina participants, who mentioned purchasing tobacco at a local liquor store (MM01) and a nearby convenience store (MM09).

Two smoke shops which sit side-by-side featured in interviews with four Coliseum participants (MM12; MM13; MM03; MM15). Participants suggested that these smoke shops had varying social and practical significance for different neighborhood residents. For example, MM12, an older woman, chose to travel from her home by bus to one of these two smoke shops (Figure 7). This was because they sold her preferred brand of cigarette (soft pack Newport), but also because she liked that she did not see the shop owners selling tobacco to minors as they did at the smoke shop closer to her home. Despite her preference for this smoke shop, she 'gets in and out' as quickly as possible because she did not perceive the place as being safe:

> No, I don't hang out. Because um, well there with [that street] it's sort of like … well, they call it like a danger zone, and I guess a lot of people done got killed. They'd be standing out there smoking or smoking or whatever. But no, I never liked standing there.
>
> (MM12)

In contrast, two middle-aged men (MM13, MM03) went to one of the corner smoke shops because they experienced it as a place to connect with friends and engage with a community of people who had lived in the neighborhood for a long time (Figure 8). One of them described it as:

> My hangout spot… We all stand inside the smoke shop talking and friends that'll be outside.
>
> (MM03)

The other participant (MM13) added that, in addition to it being a social place, he felt safe around the smoke shop:

> You, you know, run into people, you know. I mean you meet a lot of people at the smoke shop. I mean a lot of people go to the smoke shop. And they're friendly and nice, and you know.

Interviewer Okay. So, you can meet a lot of people at this smoke shop.

Yeah. And the restaurants around it. And, you know, McDonalds up the street and --

Interviewer Okay. And the restaurants nearby. And you said they're friendly?

Yeah. I've never had any problems in the 16 years I've lived around there. (MM13)

He also liked the smoke shop because it had a wide variety of products in addition to tobacco that made it a convenient location for him to buy things that he would otherwise have to travel further to obtain:

> It has everything that I need in it. Snacks… Everything. Cords for computers and iPhones… It's like a one stop shop.
>
> (MM13)

Similarly, Oakland Coliseum participant MM12 emphasized the general need for better commercial assets in her neighborhood to provide more opportunities to purchase things, describing the main retail center, which she reached by bus, as inadequate:

> I started using it for business. Business. And to shop at a - two stores there. And then the grocery store. Then, other than that they don't have too many places to go.

Interviewer What would you like to be there if there was something else?

Let me see. Like more shopping places. More places where people can eat at. Eat at and buy more things. (MM12)

Another participant (age 42, Latinx, male, MM15) described a different kind of relationship with these smoke shops. He did not buy tobacco at the Oakland Coliseum smoke shops, choosing instead to purchase e-cigarette liquid online. However, he had a business relationship with the owner of one of the identified smoke shops and worked in the office above it.

Participants from both the Marina and Coliseum neighborhoods expressed strong opposition to tobacco sales to minors. Again, MM12 in the Coliseum chose to travel further to buy tobacco from a smoke shop that she did perceive as selling to minors:

> I don't prefer [that store].

Interviewer Why don't you prefer it?

The ones that sell [tobacco], they seem like they're really too young to be selling… their patrons are young. (MM12)

She did, however, trust the clerks at the smoke shop she frequented:

> They more wiser about it. They more know what - what the danger is about it too, you know. Things like that. And then they know that - that it's not right to sell to under - underage teenager because some of 'em I've done been to they have - took their license in stores because they done sold to a minor.

Interviewer Mm-hmm. So, you feel like the people at this smoke shop, they don't sell to underage people? Is that your feeling?

Right. I feel like they more - like they're more alert to who they're trying to sell it to, you know. Yeah.

Opinions about policies against sales of flavored tobacco in neighborhood retail outlets varied among participants. Marina participant, MM01, strongly supported eliminating sales of flavored tobacco and said that he voted for San Francisco's flavored sales restriction policy, citing scientific understandings of addiction and distinguishing between access to

flavored products versus restrictions on use of those products: “The laws passed don’t affect, you know, my ability to smoke or my freedom to. It just makes it a little bit more harder to access or inconvenient” (MM01). Nevertheless, he noted that some of his friends were against the policy. Coliseum participant MM03 also supported flavored tobacco sales restrictions in his neighborhood, but he felt they were ineffective because retailers still sold flavored tobacco. Instead, he was in favor of terminating tobacco sales altogether:

> I don’t think it helps because they still sell it, so it really didn’t do any good. I mean, if they’re gonna stop tobacco, they need to stop it altogether period. I mean, it wouldn’t bother me ‘cause, like I said, I’m not addicted. I just do it, I think, when, um, get around certain people or- It’d be great if they could just get rid of it, which I know some things they’ll never get rid of. It brings in too much money.
>
> (MM03)

In contrast, Coliseum participant MM13 felt that age restrictions on access to tobacco were important, but that flavored products should be available to people who were of age to buy tobacco:

> I think a smoke shop should be able to sell flavors and separate them like they’re doing it now. Menthol - I mean, menthols and flavors and hookahs and all that - sell them in a smoke shop. Which you should be 21 to be in.
>
> (MM13)

Participant MM15, who lived in an Oakland neighborhood to the west but spent a lot of time in Coliseum, was also against flavored tobacco sales restrictions, viewing them as part of a larger trend in restrictions on personal freedoms:

> I think these bans are just the start of us releasing way too many of our freedoms, you know? Because there should be nothing wrong with choosing to have a flavored cigarette versus not, and your choice to have that flavored something or other has no bearings on somebody else’s choice to do that… we’re taking all the responsibility of the parents in that instance to just do better parenting.
>
> (MM15)

Thus, while participants again tended to agree on the need to shield minors from tobacco exposure and initiation, there was less agreement that flavored tobacco needed to be regulated to accomplish this. Additionally, for participants in Coliseum, proximity to retailers was less important than tobacco product preference, opportunities for social interaction and preventing sales to minors.

DISCUSSION

Triangulating between area-level quantitative data and ground-level experiential data from these two neighborhoods offered a more complex picture of tobacco user interactions with, and expectations of, their neighborhood, the tobacco retail environments therein, and their views on local tobacco-related policies than could be obtained from either data set independently. For example, the quantitative data revealed higher tobacco advertising density in the Coliseum neighborhood as compared to the Marina neighborhood, implying

higher tobacco advertising exposure for Coliseum residents than for Marina residents. The qualitative data augmented our understanding of tobacco advertising exposure in these neighborhoods. Coliseum participants described using tobacco retail outlets, like the two adjacent smoke shops discussed by multiple participants, for the purpose of socializing with other community members, as well as for purchasing non-tobacco products not readily available in other nearby retail outlets, (e.g., phone chargers). This implies that Coliseum residents likely have greater exposure to tobacco retail – not only because of the higher density of advertising in their neighborhood, as suggested by the quantitative data – but also because of how they socially interact with and derive supplementary retail benefits from tobacco retail outlets in their neighborhoods. While our samples are small, the combination of survey, observational, and mapping-enhanced interview data nevertheless provide a rich set of integrated sources that offer insight into tobacco use experiences in context.

Our first research question asks: How might a study of tobacco use in local environments that integrates retail assessments and geographically-explicit interviews contribute to existing knowledge about place-based tobacco practices and policies? Our results suggest that the contribution could be quite substantial, especially if applied at a broader geographic scale and with more substantial participant enrollment. Most studies evaluating area- or retail-level characteristics and tobacco use behavior simply identify associations.[19,20,26,28,30] By pairing empirical participant and environmental data with in-depth, geolocated interview techniques, we found more nuance in the way neighborhood residents evaluated certain features of their neighborhoods, such as smoke shops.

Two of the Coliseum participants who frequented the same smoke shop viewed the smoke shop less as a transactional environment for tobacco purchase, and more as a venue for socializing with neighbors and friends. Furthermore, in an area offering scant retail amenities, tobacco retailers offered a one-stop-shop for a variety of needs in addition to tobacco, including groceries and electronics, which may explain why Coliseum residents rated local business accessibility higher in their survey responses than Marina residents. This offers a contrast to a common assumption in the public health literature of a zero-sum game wherein the presence of retailers that sell tobacco is a net deficit, and their absence is a net benefit.[20,22,68,69] Instead, there may be great utility, from health and economic perspectives, in instead working with retailers to gradually reduce tobacco sales while increasing shelf space for healthy foods and health-promoting products.[70]

Many tobacco retail studies have focused on distances to the nearest tobacco retailers,[21,71] or density of tobacco outlets in local areas,[19,69,72] and though these studies have yielded important findings, the qualitative data highlight meaningful nuances in the way these retailers are actually experienced by local patrons. For example, one of the Coliseum participants spoke in detail about how she went out of her way, taking a bus, to purchase her cigarettes at a retailer farther from her home even though a closer retail option was available. Her desire for specific product packaging, as well as to censure her local retailer for selling tobacco to minors, seemed to be her way of enacting her own “vote with your feet” policy. Given the concern all participants shared about protecting youth from the dangers of tobacco, this is a noteworthy deviation from expected purchasing behavior patterns.

This concern for youth may also inform local policy implementation, as do the qualitative stories of not using tobacco around families or children. Quantitative data highlighted differences in external advertising density and product sales that may indicate a need for policies limiting retailer density or flavored tobacco sales, while the interviews give insight to community-level perspectives on the support (or lack thereof) for such policies. Specifically, flavored tobacco has been shown to appeal to youth who are more likely to initiate tobacco use with flavored products.[73,74] Additionally, tobacco retailers in neighborhoods with large proportions of Black and Latino residents, such as Oakland Coliseum, have been shown to be more likely to sell cigars/little cigars as the tobacco industry targeted cigars for use by those populations,[75] as well as having more price promotions for tobacco and lower cigarette prices, again as a way to target these communities for tobacco use.[36,66] The universal concern among our participants for preventing youth tobacco initiation may be a productive approach to facilitate more effective implementation of tobacco sales restrictions, or age restrictions.

Our second research question asked how might our approach be improved and scaled? The richness of even our small dataset suggests that conducting a larger and more geographically diverse study has the potential to yield instructive results for both policies and practices related to tobacco use. However, we learned some lessons that would serve to make a future study of this type more productive. First, we decided to use ZIP Code Tabulation Areas as our original “neighborhood” boundary files for purposes of area-level data collection and participant recruitment, and we targeted our Facebook ads to these relatively small geographies. With our small pilot budget, this was a reasonable area level for the quantitative data collection, but it was not entirely successful for participant recruitment. Future studies of this type would do well to: (1) begin with a larger geographic recruitment area, which could be subdivided after data collection if appropriate; and (2) use multiple recruitment pathways, establishing and leveraging local public health networks, and community partnerships prior to beginning the study. Studies conducting local recruitment have been shown to be much more successful in enrolling participants when recognized community partners are involved.[76,77]

Additionally, the baseline survey was long, and may have discouraged some participants from completing that phase of the study, which precluded participation in interviews. We also initially inquired with participants whether they were comfortable engaging with the Streetwyze mapping platform on their own, followed by a later in-person interview, or if they preferred to use the platform in concert with research staff as the interview was conducted. While we had hoped for all participants to use Streetwyze on their own and then proceed to interview, most of the participants chose instead to have an interviewer present to transcribe for them within Streetwyze. Participant interaction with the platform was therefore facilitated by interviewers, which still yielded rich, contextually-engaged narrative, but also required additional time in interviewing and the presence of two interviewers, one to engage with the mapping platform, and the other to maintain interaction with the participant. Moreover, during the interview, text was entered into the platform by researchers, which may have influenced results. This was done in cases where the participant expressed preference for having the researcher do so and was necessary to facilitate study participation for individuals who were not comfortable using the Streetwyze mapping platform on a tablet

or laptop. The text entered into the platform was negotiated between and reviewed by the interviewee and researcher in real time. The researcher reviewed the text with the participant and worked with the participant to either confirm or edit the text so that the content reflected the participant's reflections/thoughts to the best of their ability. Larger scale data collection efforts must account for the additional training time required to bridge the digital divide for diverse populations in independently collecting data with digital platforms,[78] as well as the utility of providing larger incentives than the 45 dollars we were able to offer.

Second, our initial plan was to conduct the location-informed in-depth interviews prior to completing the design of our neighborhood-level assessment instrument so that participant feedback could help to inform its development. Because participant recruitment took longer than anticipated, we instead adapted a neighborhood data collection instrument we had piloted in an earlier study[79] and collected the neighborhood assessment data first. Thus, the neighborhood-level data we collected were not necessarily reflective of the perspectives on place offered in the interviews, nor did the actual data collection locations correspond well spatially to the areas highlighted by our participants. For these reasons, we did not include analysis of these data in this study.

Future studies would do well to glean insights from interviews and work with local community organizations to ensure the most relevant area-level measures are included on a neighborhood data collection instrument. In this way, the data can serve both the community and support scholarly publication. This is especially important as a means of seeing neighborhood opportunities rather than focusing exclusively on more typical disorder or deprivation measures.

CONCLUSION

This pilot study demonstrated the feasibility of a multilevel mixed-methods approach for understanding tobacco behavior, policy, and practices, while also offering lessons for improvement in future studies of this nature. While limited by a small number of cases, our study points to the level of richness that can be gained from evaluating health behavior through a variety of geographically related perspectives, including integrating population-level data with geographically explicit interviews of neighborhood residents. By pairing participant interviews with a comprehensive quantitative data collection effort and new technologies like Streetwyze, we were able to paint an area-level picture of sociodemographic, neighborhood and tobacco retail features, while also gaining insight into what those pictures mean to the participants who live within them. To fully eradicate persistent tobacco use requires a comprehensive approach that accounts for these community perspectives. For example, greater community investment can provide social networking and engagement opportunities that serve as alternatives to socializing at the local smoke shop. Local policymakers may find it productive to leverage the concern all our participants had about preventing youth tobacco use to bolster local tobacco sales restriction and smoke-free policies, as well as to support healthy stores initiatives like that already piloted in the Bay Area.[70]

This method has great potential not only for tobacco use, but for better understanding a variety of health behaviors and conditions. While our focus was hyperlocal given the pilot nature of this study, our method also has potential to be scaled to include multiple localities at once given appropriate resources. Finally, it provides insight into how we might propagate wellness in communities by engaging community members, who can better identify both obstacles to and opportunities for health promotion in their neighborhoods.

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REFERENCES

1. Office of the U.S. Surgeon General. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General, 2014. Washington D.C.: Department of Health and Human Services;2014.
2. King BA, Dube SR, Tynan MA. Current Tobacco Use Among Adults in the United States: Findings From the National Adult Tobacco Survey. American Journal of Public Health. 2012;102(11):e93–e100. [PubMed: 22994278]
3. Barbeau EM, Leavy-Sperounis A, Balbach ED. Smoking, social class, and gender: what can public health learn from the tobacco industry about disparities in smoking? Tobacco Control. 2004;13(2):115–120. [PubMed: 15175523]
4. Blosnich J, Lee JGL, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tobacco Control. 2013;22(2):66–73. [PubMed: 22170335]
5. Fagan P, Moolchan ET, Lawrence D, Fernander A, Ponder PK. Identifying health disparities across the tobacco continuum. Addiction. 2007;102:5–29.
6. Reid JL, Hammond D, Boudreau C, Fong GT, Siahpush M, ITC Collaboration. Socioeconomic Disparities in Quit Intentions, Quit Attempts, and Smoking Abstinence among Smokers in Four Western Countries: Findings from the International Tobacco Control Four Country Survey. Nicotine & Tobacco Research. 2010;12(suppl 1):S20–S33. [PubMed: 20889477]
7. Thompson L, Pearce J, Barnett JR. Moralising geographies: stigma, smoking islands and responsible subjects. Area. 2007;39(4):508–517.
8. Richardson A, Williams V, Rath J, Villanti AC, Vallone D. The Next Generation of Users: Prevalence and Longitudinal Patterns of Tobacco Use Among US Young Adults. American Journal of Public Health. 2014;104(8):1429–1436. [PubMed: 24922152]
9. Soneji S, Sargent J, Tanski S. Multiple tobacco product use among US adolescents and young adults. Tobacco Control. 2016;25(2):174–180. [PubMed: 25361744]
10. Lee YO, Hebert CJ, Nonnemaker JM, Kim AE. Multiple tobacco product use among adults in the United States: Cigarettes, cigars, electronic cigarettes, hookah, smokeless tobacco, and snus. Preventive Medicine. 2014;62:14–19. [PubMed: 24440684]
11. San Francisco Tobacco Free Project. San Francisco Tobacco Control Laws. San Francisco, CA: San Francisco Department of Public Health;2019.
12. Section TC. California Flavored Tobacco and Menthol Cigarette Policy Matrix. Sacramento, CA: California Department of Health Services;2017.
13. ChangeLab Solutions. Tobacco Laws Affecting California. Sacramento, CA: California Department of Public Health;2019.
14. Barnett R, Moon G, Pearce J, Thompson L, Twigg L. Smoking Geographies: Space, Place and Tobacco. Chichester, England: Wiley-Blackwell; 2016.
15. Pearce J, Barnett R, Moon G. Sociospatial Inequalities in Health-related Behaviours: Pathways Linking Place and Smoking. Progress in Human Geography. 2012;36(1):3–24.

16. Frohlich KL, Potvin L, Chabot P, Corin E. A theoretical and empirical analysis of context:: neighbourhoods, smoking and youth. Social Science & Medicine. 2002;54(9):1401–1417. [PubMed: 12058856]
17. Haines-Saah RJ, Oliffe JL, White CF, Bottorff JL. “It is just not part of the culture here”: Young adults’ photo-narratives about smoking, quitting, and healthy lifestyles in Vancouver, Canada. Health & Place. 2013;22:19–28. [PubMed: 23542328]
18. McQuoid J, Keamy-Minor E, Ling PM. A practice theory approach to understanding poly-tobacco use in the United States. Critical Public Health. 2020;30(2):204–219. [PubMed: 32982073]
19. Abdel Magid HS, Halpern-Felsher B, Ling PM, Bradshaw PT, Mujahid MS, Henriksen L. Tobacco Retail Density and Initiation of Alternative Tobacco Product Use Among Teens. Journal of Adolescent Health. 2020;66(4):423–430.
20. Cantrell J, Pearson JL, Anesetti-Rothermel A, Xiao H, Kirchner TR, Vallone D. Tobacco Retail Outlet Density and Young Adult Tobacco Initiation. Nicotine & Tobacco Research. 2016;18(2):130–137. [PubMed: 25666816]
21. Henriksen L, Feighery EC, Schleicher NC, Cowling DW, Kline RS, Fortmann SP. Is adolescent smoking related to the density and proximity of tobacco outlets and retail cigarette advertising near schools? Preventive Medicine. 2008;47(2):210–214. [PubMed: 18544462]
22. Novak SP, Reardon SF, Raudenbush SW, Buka SL. Retail Tobacco Outlet Density and Youth Cigarette Smoking: A Propensity-Modeling Approach. American Journal of Public Health. 2006;96(4):670–676. [PubMed: 16507726]
23. Ogneva-Himmelberger Y, Ross L, Burdick W, Simpson S-A. Using geographic information systems to compare the density of stores selling tobacco and alcohol: youth making an argument for increased regulation of the tobacco permitting process in Worcester, Massachusetts, USA. Tobacco Control. 2010;19(6):475–480. [PubMed: 20817715]
24. Tucker-Seeley RD, Bezold CP, James P, Miller M, Wallington SF. Retail Pharmacy Policy to End the Sale of Tobacco Products: What Is the Impact on Disparity in Neighborhood Density of Tobacco Outlets? Cancer Epidemiology Biomarkers & Prevention. 2016;25(9):1305–1310.
25. Anesetti-Rothermel A, Herman P, Bennett M, et al. Sociodemographic Disparities in the Tobacco Retail Environment in Washington, DC: A Spatial Perspective. Ethnicity & Disease. 2020;30(3):479–488. [PubMed: 32742153]
26. Golden SD, Kuo T-M, Kong AY, Baggett CD, Henriksen L, Ribisl KM. County-level associations between tobacco retailer density and smoking prevalence in the USA, 2012. Preventive Medicine Reports. 2020;17:101005. [PubMed: 31934535]
27. Yu D, Peterson NA, Sheffer MA, Reid RJ, Schnieder JE. Tobacco outlet density and demographics: Analysing the relationships with a spatial regression approach. Public Health. 2010;124(7):412–416. [PubMed: 20541232]
28. Kirchner TR, Cantrell J, Anesetti-Rothermel A, Ganz O, Vallone DM, Abrams DB. Geospatial Exposure to Point-of-Sale Tobacco: Real-Time Craving and Smoking-Cessation Outcomes. American Journal of Preventive Medicine. 2013;45(4):379–385. [PubMed: 24050412]
29. Kirchner TR, Gao H, Lewis DJ, Anesetti-Rothermel A, Carlos HA, House B. Individual Mobility and Uncertain Geographic Context: Real-time Versus Neighborhood Approximated Exposure to Retail Tobacco Outlets Across the US. Journal of Healthcare Informatics Research. 2019;3(1):70–85.
30. Pearce J, Hiscock R, Moon G, Barnett R. The Neighbourhood Effects of Geographical Access to Tobacco Retailers on Individual Smoking Behaviour. Journal of Epidemiology and Community Health. 2009;63(1):69–77. [PubMed: 18628269]
31. Pearce J, Rind E, Shortt N, Tisch C, Mitchell R. Tobacco Retail Environments and Social Inequalities in Individual-Level Smoking and Cessation Among Scottish Adults. Nicotine & Tobacco Research. 2016;18(2):138–146. [PubMed: 25895953]
32. Watkins KL, Regan SD, Nguyen N, et al. Advancing Cessation Research by Integrating EMA and Geospatial Methodologies: Associations Between Tobacco Retail Outlets and Real-time Smoking Urges During a Quit Attempt. Nicotine & Tobacco Research. 2013;16(Suppl_2):S93–S101. [PubMed: 24057995]

33. Giovenco DP, Spillane TE, Merizier JM. Neighborhood Differences in Alternative Tobacco Product Availability and Advertising in New York City: Implications for Health Disparities. Nicotine & Tobacco Research. 2018;21(7):896–902.
34. Hackbarth DP, Silvestri B, Cosper W. Tobacco and Alcohol Billboards in 50 Chicago Neighborhoods: Market Segmentation to Sell Dangerous Products to the Poor. Journal of Public Health Policy. 1995;16(2):213–230. [PubMed: 7560056]
35. Lee JGL, Henriksen L, Rose SW, Moreland-Russell S, Ribisl KM. A Systematic Review of Neighborhood Disparities in Point-of-Sale Tobacco Marketing. American Journal of Public Health. 2015;105(9):e8–e18.
36. Ribisl KM, D'Angelo H, Feld AL, et al. Disparities in tobacco marketing and product availability at the point of sale: results of a national study. Preventive Medicine. 2017;105:381–388. [PubMed: 28392252]
37. Robertson L, McGee R, Marsh L, Hoek J. A Systematic Review on the Impact of Pointof-Sale Tobacco Promotion on Smoking. Nicotine & Tobacco Research. 2014;17(1):217.
38. Stoddard JL, Johnson CA, Sussman S, Dent C, Boley-Cruz T. Tailoring Outdoor Tobacco Advertising to Minorities in Los Angeles County. Journal of Health Communication. 1998;3(2):137–146. [PubMed: 10977250]
39. Vardavas CI, Connolly GN, Kafatos AG. Geographical information systems as a tool for monitoring tobacco industry advertising. Tobacco Control. 2009;18(3):190–196. [PubMed: 19188209]
40. Yerger VB, Przewoznik J, Malone RE. Racialized Geography, Corporate Activity, and Health Disparities: Tobacco Industry Targeting of Inner Cities. Journal of Health Care for the Poor and Underserved. 2007;18(4):10–38. [PubMed: 18065850]
41. Henriksen L, Schleicher NC, Johnson TO, Roeseler A, Zhu S-H. Retail Tobacco Marketing in Rural Versus Nonrural Counties: Product Availability, Discounts, and Prices. Health Promotion Practice. 2020;21(1_suppl):27S–36S. [PubMed: 31908200]
42. Duncan DT, Rienti M, Kulldorff M, et al. Local spatial clustering in youths' use of tobacco, alcohol, and marijuana in Boston. The American Journal of Drug and Alcohol Abuse. 2016;42(4):412–421. [PubMed: 27096932]
43. Fakunle DO, Curriero FC, Leaf PJ, Furr-Holden DM, Thorpe RJ. Black, white, or green? The effects of racial composition and socioeconomic status on neighborhood-level tobacco outlet density. Ethnicity & Health. 2019:1–16.
44. Farley SM, Maroko AR, Suglia SF, Thorpe LE. The Influence of Tobacco Retailer Density and Poverty on Tobacco Use in a Densely Populated Urban Environment. Public Health Reports. 2019;134(2):164–171. [PubMed: 30763150]
45. Holmes LM, Llamas JD, Smith D, Ling PM. Drifting Tobacco Smoke Exposure among Young Adults in Multiunit Housing. Journal of Community Health. 2020;45(2):319–328. [PubMed: 31535264]
46. Galea S, Ahern J, Tracy M, Vlahov D. Neighborhood Income and Income Distribution and the Use of Cigarettes, Alcohol, and Marijuana. American Journal of Preventive Medicine. 2007;32(6, Supplement):S195–S202. [PubMed: 17543711]
47. Galea S, Ahern J, Vlahov D. Neighborhood education inequality and use of cigarettes, alcohol, and marijuana. Annals of Epidemiology. 2004;14(8):623.
48. Kong AY, Myers AE, Isgett LF, Ribisl KM. Neighborhood racial, ethnic, and income disparities in accessibility to multiple tobacco retailers: Mecklenburg County, North Carolina, 2015. Preventive Medicine Reports. 2019;17:101031–101031. [PubMed: 32021758]
49. Patterson F, Seravalli L, Hanlon A, Nelson DB. Neighborhood safety as a correlate of tobacco use in a sample of urban, pregnant women. Addictive Behaviors. 2012;37(10):1132–1137. [PubMed: 22688344]
50. Wilson N, Syme SL, Boyce WT, Battistich VA, Selvin S. Adolescent Alcohol, Tobacco, and Marijuana Use: The Influence of Neighborhood Disorder and Hope. American Journal of Health Promotion. 2005;20(1):11–19. [PubMed: 16171156]

51. Hatzenbuehler ML, Jun H-J, Corliss HL, Austin SB. Structural stigma and cigarette smoking in a prospective cohort study of sexual minority and heterosexual youth. Annals of Behavioral Medicine. 2014;47(1):48–56. [PubMed: 24136092]
52. Holmes LM, Marcelli EA. Neighborhood social cohesion and smoking among legal and unauthorized Brazilian migrants in metropolitan Boston. J Urban Health. 2014;91(6):1175–1188. [PubMed: 25331821]
53. Akom AA, Shah A, Nakai A. Kids, kale, and concrete: Using participatory technology to transform an urban American food desert. In: Race, equity, and education. Springer; 2016:75–102.
54. Lyles CR, Schillinger D, Piette JD. Applying Interactive Mobile Health (mHealth) Technologies for Vulnerable Populations. King TE, Wheeler MB, Bindman AB, Fernandez A, Grumbach K, Schillinger D, Villela TJ Medical Management of Vulnerable and Underserved Patients New York: McGraw-Hill. 2007.
55. Nguyen KH, Fields JD, Cemballi AG, et al. The Role of Community-Based Organizations in Improving Chronic Care for Safety-Net Populations. The Journal of the American Board of Family Medicine. 2021;34(4):698–708. [PubMed: 34312263]
56. Akom A, Shah A, Cruz T. Streetwyze: Mapping 2 Mobilize & People Powered PlaceMaking Toolkit. Oakland, CA: Streetwyze, Inc.;2017.
57. Holmes LM, Ling PM. Workplace secondhand smoke exposure: a lingering hazard for young adults in California. Tobacco Control. 2016;26(E1):e79–384. [PubMed: 27417380]
58. Holmes LM, Popova L, Ling PM. State of transition: Marijuana use among young adults in the San Francisco Bay Area. Preventive Medicine. 2016;90:11–16. [PubMed: 27346757]
59. OpenStreetMap contributors. In: OpenStreetMap.
60. Onwuegbuzie AJ, Teddlie CB. A framework for analyzing data in mixed methods research. In: Tashakkori AM, Teddlie CB, eds. Handbook Of Mixed Methods In Social And Behavioral Research. Thousand Oaks, CA: SAGE; 2003:351–383.
61. Wheeler DC, Do EK, Hayes RB, et al. Neighborhood Disadvantage and Tobacco Retail Outlet and Vape Shop Outlet Rates. International Journal of Environmental Research and Public Health. 2020;17(8):2864.
62. Lowery BC, Sloane DC. The prevalence of harmful content on outdoor advertising in Los Angeles: land use, community characteristics, and the spatial inequality of a public health nuisance. American Journal of Public Health. 2014;104(4):658–664. [PubMed: 24524512]
63. Cruz TB, Wright LT, Crawford G. The menthol marketing mix: targeted promotions for focus communities in the United States. Nicotine & Tobacco Research. 2010;12(suppl_2):S147–S153. [PubMed: 21177371]
64. Richardson A, Ganz O, Pearson J, Celcis N, Vallone D, Villanti AC. How the industry is marketing menthol cigarettes: the audience, the message and the medium. Tobacco Control. 2015;24(6):594–600. [PubMed: 25178275]
65. Moreland-Russell S, Harris J, Snider D, Walsh H, Cyr J, Barnoya J. Disparities and menthol marketing: additional evidence in support of point of sale policies. International Journal of Environmental Research and Public Health. 2013;10(10):4571–4583. [PubMed: 24071922]
66. Lee JG, Henriksen L, Rose SW, Moreland-Russell S, Ribisl KM. A systematic review of neighborhood disparities in point-of-sale tobacco marketing. American Journal of Public Health. 2015;105(9):e8–e18.
67. Henriksen L, Ribisl KM, Rogers T, et al. Standardized Tobacco Assessment for Retail Settings (STARS): dissemination and implementation research. Tobacco Control. 2016;25(Suppl 1):i67–i74. [PubMed: 27697950]
68. Fakunle DO, Milam AJ, Furr-Holden CD, Butler J III, Thorpe RJ Jr., LaVeist TA. The inequitable distribution of tobacco outlet density: the role of income in two Black MidAtlantic geopolitical areas. Public Health. 2016;136:35–40. [PubMed: 27076440]
69. Lee JGL, Sun DL, Schleicher NM, Ribisl KM, Luke DA, Henriksen L. Inequalities in tobacco outlet density by race, ethnicity and socioeconomic status, 2012, USA: results from the ASPiRE Study. Journal of Epidemiology and Community Health. 2017;71(5):487–492. [PubMed: 28249990]

70. Minkler M, Estrada J, Thayer R, Juachon L, Wakimoto P, Falbe J. Bringing Healthy Retail to Urban “Food Swamps”: a Case Study of CBPR-Informed Policy and Neighborhood Change in San Francisco. J Urban Health. 2018;95(6):850–858. [PubMed: 29633226]

71. Schensul JJ, Nair S, Bilgi S, et al. Availability, accessibility and promotion of smokeless tobacco in a low-income area of Mumbai. Tobacco Control. 2012.

72. Mennis J, Mason M, Way T, Zaharakis N. The role of tobacco outlet density in a smoking cessation intervention for urban youth. Health & Place. 2016;38:39–47. [PubMed: 26798960]

73. Courtemanche CJ, Palmer MK, Pesko MF. Influence of the flavored cigarette ban on adolescent tobacco use. American Journal of Preventive Medicine. 2017;52(5):e139–e146. [PubMed: 28081999]

74. Liber A, Cahn Z, Larsen A, Drope J. Flavored e-cigarette sales in the United States under self-regulation from January 2015 through October 2019. American Journal of Public Health. 2020;110(6):785–787. [PubMed: 32298169]

75. Kong AY, Queen TL, Golden SD, Ribisl KM. Neighborhood Disparities in the Availability, Advertising, Promotion, and Youth Appeal of Little Cigars and Cigarillos, United States, 2015. Nicotine & Tobacco Research. 2020;22(12):2170–2177. [PubMed: 31917833]

76. Horowitz CR, Brenner BL, Lachapelle S, Amara DA, Arniella G. Effective recruitment of minority populations through community-led strategies. American Journal of Preventive Medicine. 2009;37(6):S195–S200. [PubMed: 19896019]

77. Greiner KA, Friedman DB, Adams SA, et al. Effective recruitment strategies and community-based participatory research: community networks program centers’ recruitment in cancer prevention studies. Cancer Epidemiology and Prevention Biomarkers. 2014;23(3):416–423.

78. Chang BL, Bakken S, Brown SS, et al. Bridging the digital divide: reaching vulnerable populations. Journal of the American Medical Informatics Association. 2004;11(6):448457.

79. Holmes LM. Geospatial Approaches to Modeling Tobacco-Related Health Disparities among Young Adults. NCI Geospatial Approaches to Cancer Control and Population Sciences Conference; September 12, 2016; Bethesda, MD.

- Tobacco retail environments differ markedly even across proximate neighborhoods
- Geographically-explicit interviewing yields important behavioral health insight
- Combining quantitative, geospatial and qualitative techniques has broad application
- Local residents engage with their environments in nuanced ways

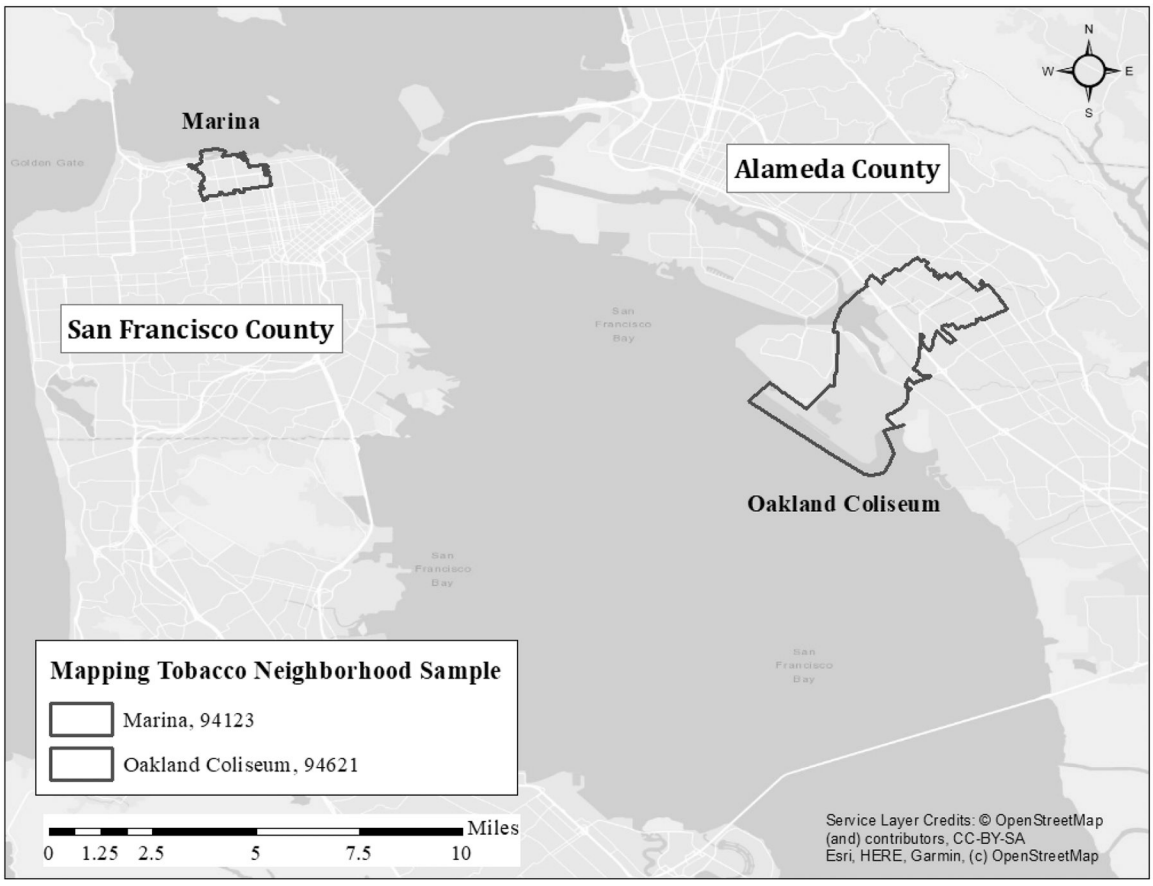

Figure 1.
Theoretical framework of the mixed methods study, adapted from Pearce et al.[15]

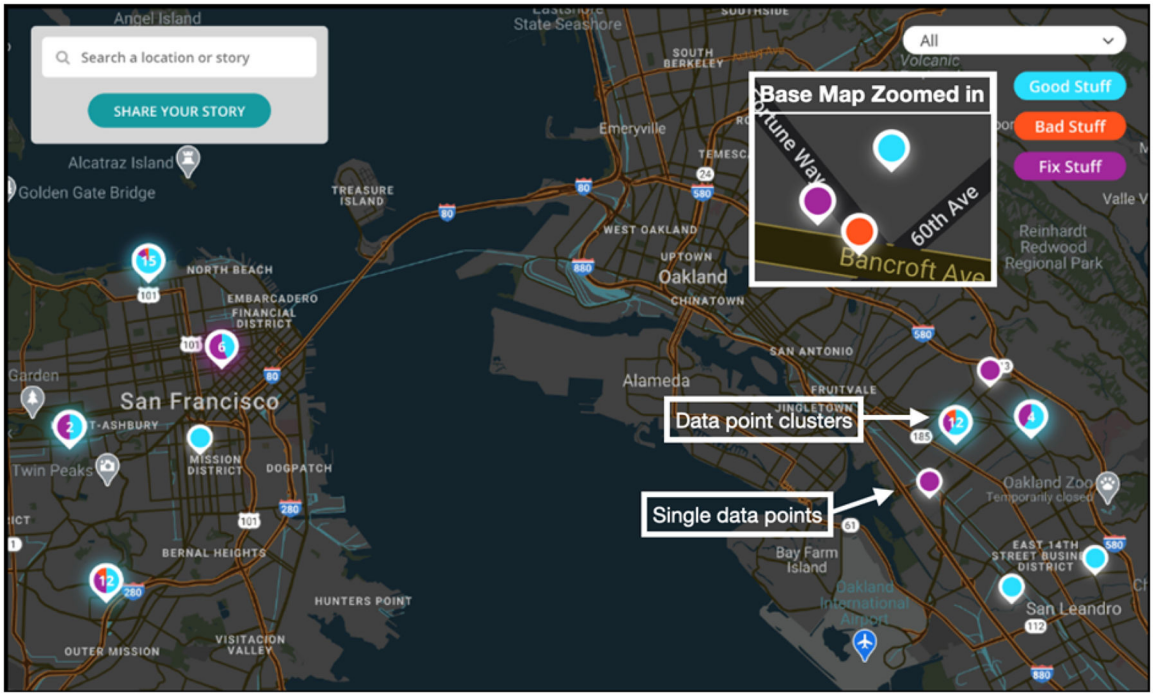

Figure 2.
"Mapping Tobacco" Selected Zip Code Tabulation Areas

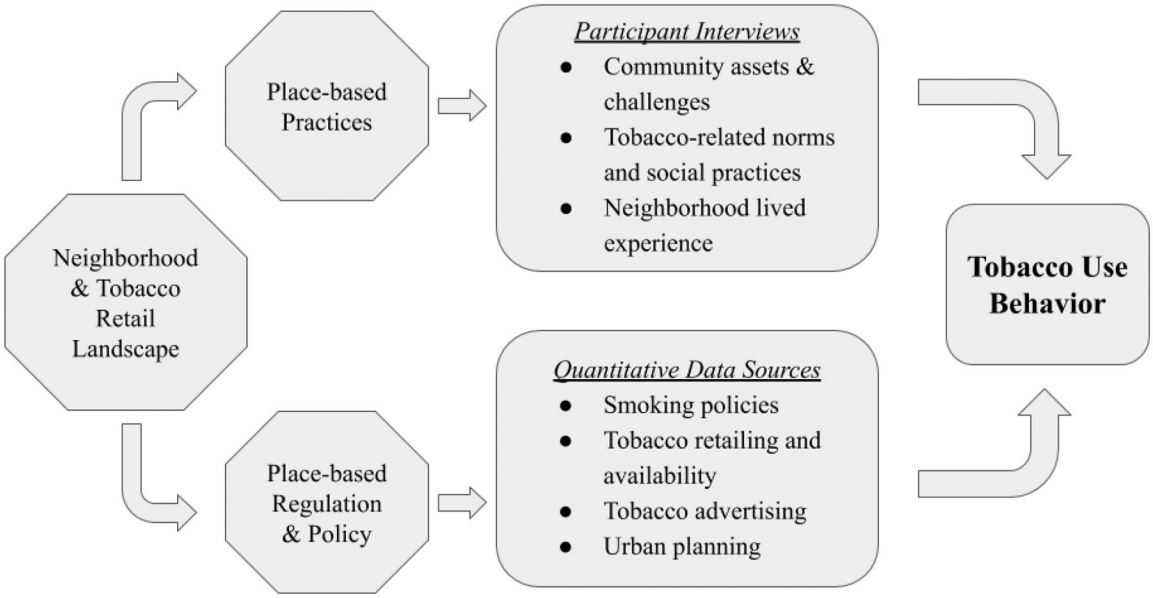

Figure 3.
Streetwyze Bay Area Basemap and Map Key

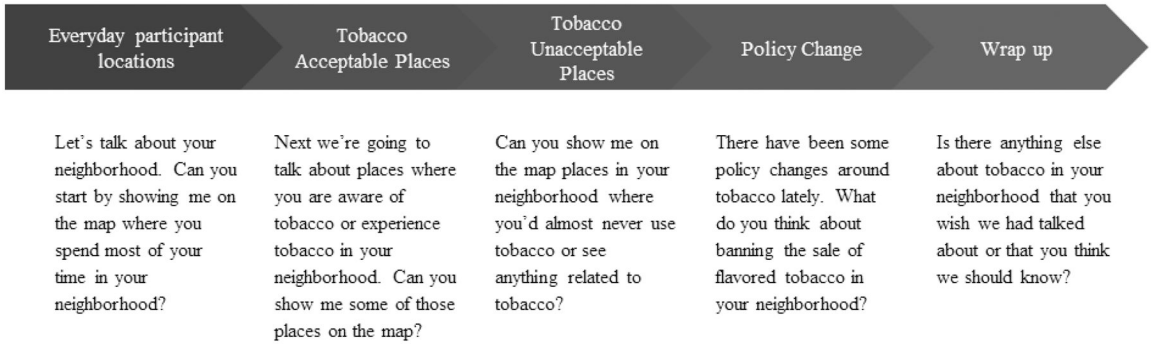

Figure 4.
Interview guide domains and examples of guiding questions

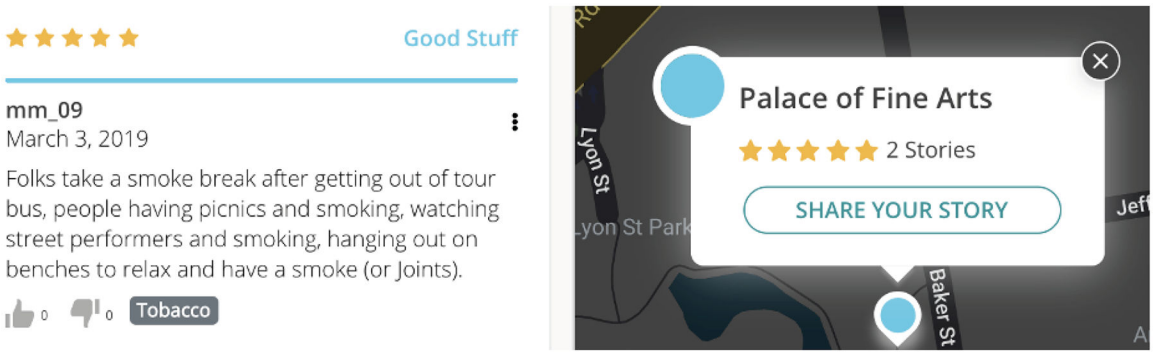

Figure 5.
MM09 described the acceptability of smoking in outdoor public places in her neighborhood, visualized using Streetwyze

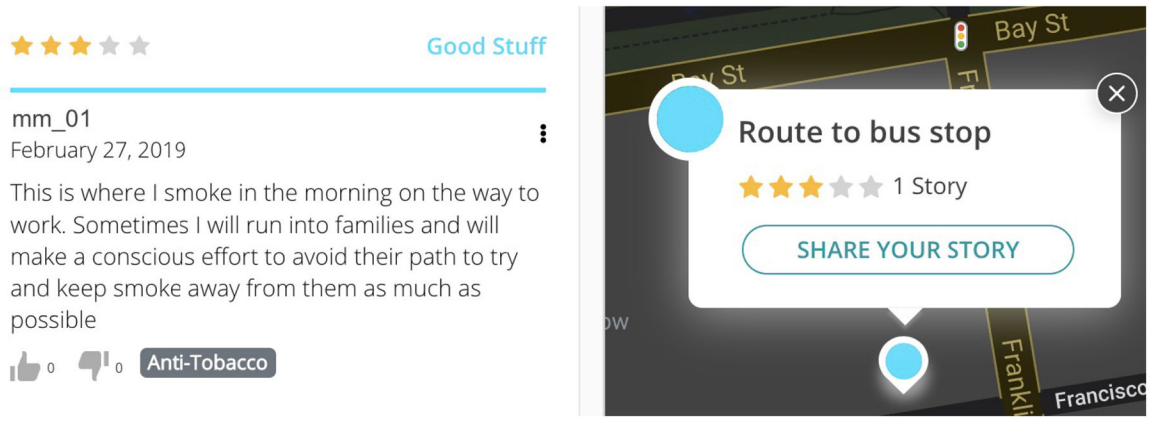

Figure 6.
MM01 smokes while walking to the bus stop but avoids exposing others to the smoke

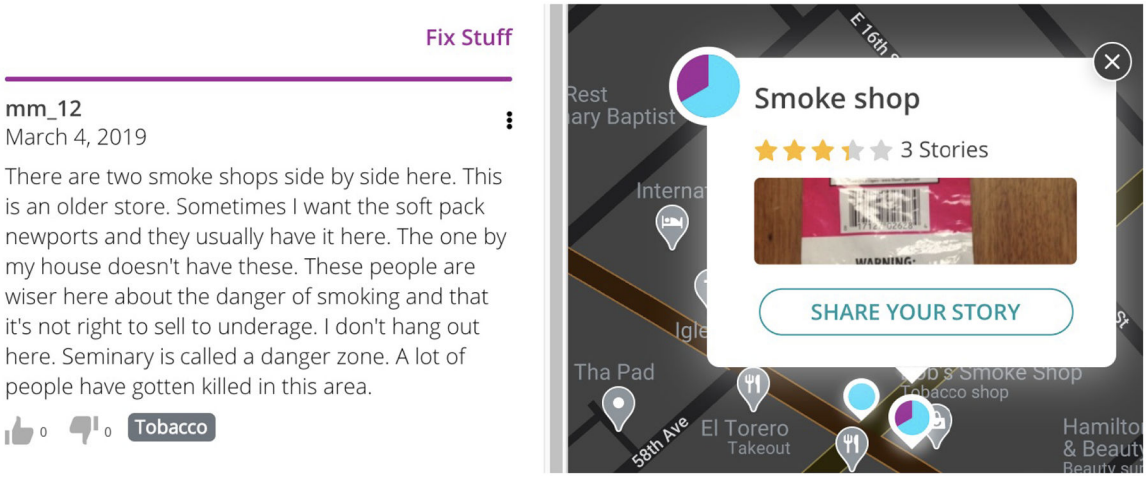

Figure 7.
MM12 explains why she shops at a particular smoke shop but does not stay long

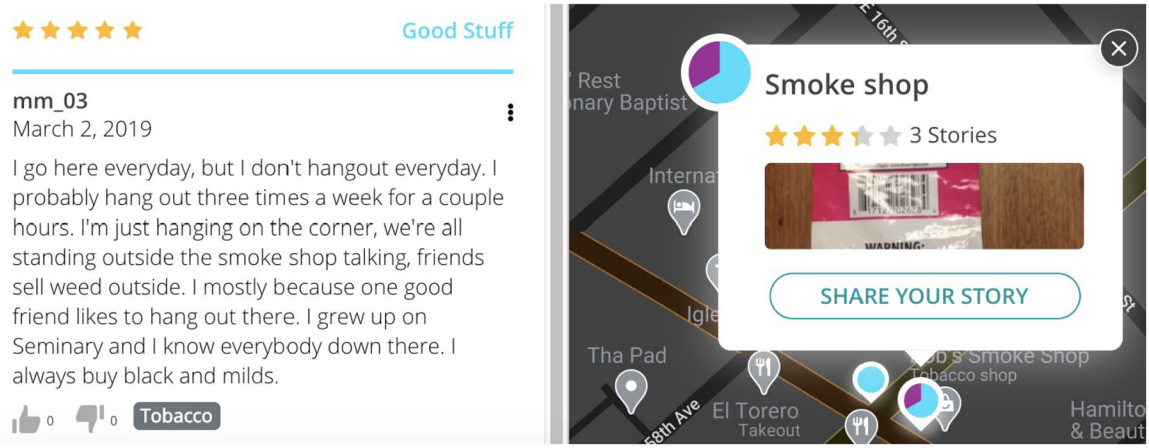

Figure 8.
Participant MM03 describes the social relevance of a local smoke shop

Table 1.

Block Group-level sociodemographic characteristics for Marina and Oakland Coliseum, ACS 2013–2017

SOURCE	STUDY ZCTA	
2013–2017 American Community Survey	Marina	Oakland Coliseum
	μ / Median	
	N=28 block groups	N=45 block groups
Household-Level		
Median household income	$147,151.20	$42,462.82 *
% of Households with public assistance income in prior year	2.4	7.4 *
% Vacant household units	10.1	8.5
% Occupied buildings with 2 or more units	73.5	42.4 *
Population-Level		
Median age	26.9	28.0
Dependency ratio	37.4	60.2 *
% Residents aged 17 and younger	11.5	30.0 *
% Residents aged 65 and older	14.4	8.1 *
% of Residents lacking any form of health insurance	2.0	16.8 *
% of Residents below 125% of the poverty threshold	6.0	31.7 *
% Latinx residents	6.4	49.8 *
% Non-Hispanic Black residents	2.0	30.0 *
% Non-Hispanic White residents	77.0	6.0 *
% Non-Hispanic Asian residents	11.1	7.0
% of residents with a BA degree or higher	82.4	11.0 *

* Significant difference in means/median

Table 2.

Tobacco retailer characteristics for Marina and Oakland Coliseum stores

SOURCE	STUDY ZCTA	
Mapping Tobacco Retail Audits	**Marina (94123)**	**Oakland (94621)**
	μ (% / $)	
	N=21 retailers	**N=25 retailers**
Exterior advertising		
Cigarettes	33.3	56.0
Non-menthol cigarettes	33.3	56.0
Cigarillos/Little cigars	23.8	44.0
Cigars	9.5	36.0 *
Chew, moist or dry snuff, dip or snus	4.8	20.0
E-cigarettes	28.6	24.0
Products sold		
Cigarettes	100.0	100.0
Newport menthol cigarettes	95.0	100.0
Cigarillos/Little cigars (regular and flavored)	81.0	92.3
Cigars (regular and flavored)	19.0	53.8 *
Chew, moist or dry snuff, dip or snus (regular and flavored)	57.1	38.5
E-cigarettes (regular and flavored)	52.4	30.8
Blu e-cigarettes	50.0	42.9
Prices and Promotions		
Cheapest cigarette pack price	$11.85	$9.01 *
Cigarette price promotions	10.0	28.0
Newport cigarette pack price	$14.94	$11.04 *
Blue-ciaarette price	$19.08	$15.96

* Significant difference in means

Table 5.

Tobacco retailer characteristics for Marina and Oakland Coliseum stores

SOURCE	STUDY ZCTA	
Mapping Tobacco Retail Audits	**Marina (94123)**	**Oakland (94621)**
	μ	
	N=21 retailers	**N=25 retailers**
Exterior advertising		
Cigarettes	33.3	56.0
Non-menthol cigarettes	33.3	56.0
Cigarillos/Little cigars	23.8	44.0
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E-cigarettes	28.6	24.0
Products sold		
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Newport cigarettes	95.0	100.0
Cigarillos/Little cigars (regular and flavored)	81.0	92.3
Cigars (regular and flavored)	19.0	53.8*
Chew, moist or dry snuff, dip or snus (regular and flavored)	57.1	38.5
E-cigarettes (regular and flavored)	52.4	30.8
Blu e-cigarettes	50.0	42.9
Prices and Promotions		
Cheapest cigarette pack price	$11.85	$9.01*
Cigarette price promotions	10.0	28.0
Newport cigarette pack price	$14.94	$11.04*
Blu e-cigarette price	$19.08	$15.96

*Significant difference in means