

The Prevalence of Harmful Content on Outdoor Advertising in Los Angeles: Land Use, Community Characteristics, and the Spatial Inequality of a Public Health Nuisance

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Outdoor advertising provides an important perspective for understanding how land-use decisions impact community health. Although economic factors and zoning determine its placement, growing evidence suggests that harmful content can have adverse effects on neighborhood environments, residential quality of life, and human well-being. Outdoor advertising is an indicator of the ways social processes, land use, and the built environment interact to influence public health because of its connection to fundamental, intermediate, and proximate determinants of health promotion.¹

Although outdoor advertising represents a key moneymaker for landowners, as well as a tourist attraction for local businesses, accumulated evidence suggests that outdoor advertising with harmful content disadvantages particular communities, similarly to other studies documenting toxic facilities,² liquor stores,³ and food deserts.⁴ Given this evidence, the recent increase in billboards in many cities around the United States, and especially around the world,⁵ raises important public health concerns. In this way, billboards are part of the neighborhood effect⁶ that inhibits positive public health outcomes for vulnerable communities.

Studies demonstrating the adverse effects of outdoor advertising generally focus on a specific area of public health such as obesity, smoking cessation, or substance abuse; some are cross-sectional, and a number compare outdoor advertising in areas that are regulated by different zoning and land-use regulations. Developing a methodology that allows public health and planning professionals to examine the issue longitudinally, over neighborhoods governed by similar land-use regulations, aids in determining the extent to which land use and

Objectives. Our study sought to examine associations between the content of outdoor advertising and neighborhood ethnic/racial and socioeconomic composition to see whether particular communities disproportionately host harmful content.

Methods. We constructed a spatial database of photographs taken from June 2012 until December 2012 in 7 identically zoned communities in Los Angeles, California, to compare outdoor advertising area and content. We selected communities to contrast by ethnicity/race, income, education, and youth population.

Results. At-risk communities and communities of color hosted more outdoor advertising depicting harmful content than other communities. Among included neighborhoods, harmful content and the proportion of outdoor advertising overall were most prevalent in communities of Asian Americans and Latino Americans. In all communities, harmful content represented at least 24% of outdoor advertising space.

Conclusions. This study provides evidence of the potential for land-use decisions to result in spatially inequitable health impacts. Although dictating the placement of outdoor advertising through zoning may seem sensible, such a decision might have the unintended consequence of disadvantaging the well-being of local communities. Neighborhood factors require more contextually nuanced public health and land-use policy. (*Am J Public Health*. Published online ahead of print February 13, 2014: e1–e7. doi:10.2105/AJPH.2013.301694)

zoning contribute to outdoor advertising proliferation. A coding procedure that systematically examines the breadth of related public health concerns is critical to understanding how outdoor advertising functions collectively to create a nuisance and promote unhealthy behaviors.

Linkages between outdoor advertising and a range of public health issues include problem drinking,^{7–10} tobacco use,¹¹ environmental pollution caused by the intense light,^{12–14} and the obesity epidemic.^{15–17} Additionally, when used to promote alcohol, gambling, entertainment, and clothing, outdoor advertising also promotes the potential exclusion—or at least harassment—of women in public spaces.^{18,19} Repeated exposure to media, such as outdoor advertising that depicts guns and gun-related violence, may contribute to aggressive behavior,²⁰ tolerance of violence,²¹ and desensitization to weapons,²² thus reducing the perceived

risks associated with guns through their commonplace occurrence in public space. Outdoor advertising correlates to themes opposed to health promotion and harm reduction, essentially endorsing the misogynistic portrayals of women and promoting adverse health behaviors such as violence, smoking, excessive drinking, and unhealthy eating.

Furthermore, evidence suggests that disadvantaged and vulnerable communities experience the impacts of outdoor advertising disproportionately. Advertising presents a heightened nuisance in communities with lower educational attainment,²³ places dense with children²⁴ and minorities,^{23,24} as well as communities having a lower socioeconomic status, as defined by income and occupation.²⁵ Additionally, harmful advertising with portrayals of alcohol and tobacco appear to be disproportionately located in minority communities,^{26–30} often adjacent to child-serving

places, such as schools and playgrounds.^{30–33} And, research shows that more affluent neighborhoods tend to be protected against outdoor advertising, specifically advertising that promotes tobacco use^{23,34} and obesity.¹⁵

A few studies suggest that outdoor advertising may have positive health effects by communicating health information and projecting healthy perceptions of activity. In a particular study, outdoor advertisements about sun protection were found to complement other media, such as television and magazine advertisements, in promoting actions that guard against skin cancer.³⁵ In another study, outdoor advertising in a community correlated positively with physical activity and walking.³⁶ The researchers suggest that outdoor advertisements, like billboards, may serve to increase the perception that a place is a pleasant, thriving community of human activity.

This article reports on a study in Los Angeles, California, where in recent years the city has been considering revisions to its existing signage ordinance. These revisions were prompted by the sudden proliferation of outdoor advertising because of advancements in technology that allowed for vinyl supergraphics to be affixed to the façade of almost any structure and the conversion of 101 conventional billboards into digital billboards. Because these technologies were not explicitly addressed by past land-use regulation, the legality of such signs was vague. In response, the City of Los Angeles placed a moratorium on all new outdoor advertising and proposed legislation that would limit outdoor advertising to 21 commercially zoned sign districts in regional centers around the city. These areas cover 2.45 miles of Los Angeles or 0.4% of the total land area.

Outdoor advertising, or out-of-home advertising, is a term used to denote a category of signage that advertises goods or services that are not made or sold at the location of the sign. In legal and regulatory terms, these signs generally adhere to a different set of land-use regulations than signs that promote the business being conducted at the location of the sign. They are often referred to as off-premise³⁷ or off-site³⁸ advertising. In Los Angeles and other cities, off-site signs are represented by both conventional and digital billboards that come in a variety of sizes ranging in area from 7920

square feet to 96 786 square feet, as well as smaller posters that appear on bus benches and transit kiosks that range in size from 1856.25 square feet to 3082 square feet in area.

This research improves upon previous studies in 2 important ways. First, by selecting spatial sampling units from the proposed regional centers in Los Angeles, it addresses concerns regarding the complications of making land-use comparisons across municipalities because of differences in population density, urban form, and land-use regulations.²⁷ Second, the study employs multiple measures to capture how residents experience outdoor advertising along the sidewalks and streets in the community, street length,^{27,29} and number of intersections.³⁹

METHODS

We selected 7 sites from the 21 proposed sign districts using census tracts within 500 feet of each regional center. Following a process of landscape assessment,⁴⁰ ArcGIS version 10.1 (ESRI, Redlands, CA) and data from the 2010 US Census and the 2010 American Community Survey estimates were used to select sites based on previously identified indicators of outdoor advertising impact. Key indicators included race/ethnicity, formal education, poverty, and number of children.

Data

Data on race and ethnicity were derived from the United States Census 2010 Profile of General Population and Housing Characteristics (DP-1). Census tracts were coded to indicate areas of racial and ethnic homogeneity. Coding reflected areas in which 1 race or ethnicity served as a plurality of the total population.

Data on income were derived from the United States Census 2010 American Community Survey Five Year Estimates for Selected Economic Characteristics (DPO3). Census tracts were coded to indicate areas of concentrated poverty. Coding reflected areas where the percentage of families and people whose income in the last 12 months is below poverty level was greater than 25.40% – 1 standard deviation (11.94) from the population mean (13.46%).

Data on education were derived from the United States Census 2010 American

Community Survey Five Year Estimates for Selected Social Characteristics (DP02). Census tracts were coded to identify communities with less formal education. Coding indicated areas where the percentage of high school graduates or higher was less than 54.91% – 1 standard deviation (19.18) from the population mean (74.10%).

Data on age were derived from the United States Census 2010 Profile of General Population and Housing Characteristics (DP-1). Census tracts were coded to identify communities with greater number of youths. Coding indicated areas where the percentage of individuals older than 18 years was less than 68.62% – 1 standard deviation (7.40) from the population mean (76.02%).

Data on the area of each sign district, street length, and number of intersections were derived from street and land use shape files available from the City of Los Angeles Department of City Planning (<http://planning.lacity.org>).

Table 1 illustrates the population characteristics of all 21 regional centers and downtown Los Angeles. The selected regional centers include: 1 community of African American residents (Baldwin Hills); 4 Latino communities (1 with a concentration of youths [Boyle Heights North], 1 with an increased risk of poverty [City West], 1 with a concentration of youths and multiple other risks including increased risk of poverty and increased educational risk [Boyle Heights South], and 1 without distinguishing characteristics with regard to age, income, and education [Van Nuys]); 1 Asian American neighborhood (Chinatown); and 1 community of White residents (Encino).

Analysis

To determine if harmful content is differentially situated in the communities in this study, we employed urban tomography,⁴¹ using a longitudinal sample of 3416 photographs representing the location and changing content of approximately 585 outdoor advertisements found in the 7 selected regional centers. Because people living within 500 feet of a regional center may be exposed to outdoor advertising outside the district, a second 500-foot buffer was included to ensure full representation of the outdoor advertisements experienced by local residents. Outdoor

TABLE 1—Descriptive Statistics for Population Variables in Census Tracts within 500 feet of Los Angeles, CA, Regional Centers: 2010 US Census

City	Tracts, No.	Total Pop.	African American, %	Asian American, %	Latino American, %	White, %	Fell Below Poverty in Last Year, %	Youths, %	≥ High School Diploma, %
Baldwin Hills ^a	4	17 368	81	4	11	5	14	20	89
Ballona	2	13 641	5	10	20	77	5	8	98
Beverly Center	5	15 516	3	7	8	84	< 1	8	95
Boyle Hts. North ^a	6	21 263	1	3	94	48	27	32	48
Boyle Hts. South ^a	5	18 603	1	2	95	51	37	32	39
Century City	6	25 520	2	10	5	83	3	16	97
Chinatown ^a	7	23 954	15	43	31	26	28	13	51
City West ^a	17	60 329	6	16	68	34	36	22	49
Downtown ^b	19	65 250	16	25	38	36	23	13	65
Encino ^a	6	29 802	4	6	9	83	3	19	97
Hollywood ^b	16	53 792	6	7	26	70	15	9	87
Hughes	5	28 877	34	10	12	45	5	< 1	96
Koreatown	21	69 527	5	37	49	27	23	20	66
Los Angeles International Airport	6	16 939	14	3	76	37	19	29	61
Miracle Mile	11	38 722	8	18	9	67	7	16	95
Northridge	5	20 257	4	15	40	58	12	23	79
Panorama City	9	33 745	3	11	78	39	24	31	54
San Pedro	3	10 248	11	6	61	46	30	23	60
Universal City	5	15 815	5	8	10	80	1	13	97
Van Nuys ^a	6	25 448	5	5	63	53	19	26	63
Warner Center	9	34 881	6	15	26	62	7	19	88
Westwood	5	15 715	4	25	7	63	19	7	96

^aCase study site.

^bPreviously existing sign district.

advertisements found within 1000 feet of each of these proposed sign districts were included in the analysis. Photographs were taken monthly, during the last week of each month from June 2012 until December 2012.

For this study, we coded harmful content into 5 categories. We guided categorization by applying an analytical construct derived from

previous research regarding risk associated with specific types of harmful advertising content, as well as a focus on at-risk and sensitive populations such as children, women, individuals prone to addiction and substance abuse, and those inclined toward violent or antisocial behavior. Categories included outdoor advertisements that encourage (1) addictive

behaviors such as alcohol use, tobacco use, and gambling; (2) violence through the depiction of weapons or crime; (3) unhealthy eating by promoting high-calorie, low-nutrition food; (4) unsafe environments for women through misogynistic portrayals and advertisements for strip clubs; and (5) content that has been deemed inappropriate for young children such

TABLE 2—Descriptive Statistics for Environmental Variables of Selected Los Angeles Regional Centers: California, December 2012

Race/Ethnicity (Location)	Total Ads, No.	Total Area of Ads, Sq Ft	Area of Sign District, Sq. Miles	Street Length, Lane Miles	Total Intersections, No.
African American (Baldwin Hills)	59	5963.85	1.93	16.06	25
Asian American (Chinatown)	106	8363.06	3.00	34.61	67
White (Encino)	114	17 235.63	7.45	31.98	48
Latino American (Van Nuys)	64	11 581.08	1.82	12.90	25
Latino American Youths (Boyle Heights North)	29	2764.64	1.32	8.46	30
Latino American Poverty Risk (City West)	190	14 936.70	2.49	40.43	87
Latino American Multiple Risks (Boyle Heights South)	26	4785.66	1.92	9.46	23
Total average	84	9392.97	2.85	21.99	44

TABLE 3—Square Foot Area of All Outdoor Advertising Within 1000 Feet by Content for Selected Community Population Characteristics: Los Angeles, CA, June 2012–December 2012

	Total Area of Outdoor Advertising, Sq Ft	Addictive Behavior, No. (%)	Violence, No. (%)	Unhealthy Eating, No. (%)	Unsafe for Women, No. (%)	Not Appropriate for Children, No. (%)	All Unhealthy Ads, No. (%)	Community Service, No. (%)	Other, No. (%)	Available/For Rent
African American	69 486	1273 (3.6)	870 (2.4)	6619 (18.6)	236 (0.7)	1766 (5.0)	10 764 (30.2)	3292 (9.2)	21 067 (59.2)	592 (1.1)
Asian American	49 792	11 220 (22.5)	1716 (3.4)	3520 (7.1)	2021 (4.1)	3805 (7.6)	22 283 (44.8)	7526 (15.1)	18 698 (37.6)	988 (2.0)
White	103 126	6433 (6.2)	3558 (3.4)	9266 (9.0)	5654 (5.5)	5486 (5.3)	30 397 (29.5)	3843 (3.7)	67 065 (65.0)	1821 (1.8)
Latino American	69 486	1602 (2.3)	1227 (1.8)	8102 (11.7)	1841 (2.6)	3915 (5.6)	16 686 (24.0)	8654 (12.5)	40 957 (58.9)	3189 (4.6)
Youths	16 368	2994 (18.3)	13 (0.1)	2080 (12.7)	0 (0)	167 (1.0)	5254 (32.1)	2582 (15.8)	8060 (49.2)	472 (2.9)
Poverty Risk	88 924	5088 (5.7)	2412 (2.7)	9282 (10.4)	2803 (3.2)	5459 (6.1)	25 044 (28.2)	17 639 (19.8)	43 491 (48.9)	2751 (3.1)
Multiple Risks	28 714	7815 (27.2)	43 (0.1)	1715 (6.0)	236 (0.8)	352 (1.2)	10 160 (35.4)	2597 (9.0)	15 816 (55.1)	141 (0.5)

as the mature themes of R-rated movies and television programming aired after 10:00 PM during “safe harbor” hours.⁴² These categories are adversely related to community well-being, creating potentially harmful environments for those who encounter this type of content as part of their experience of community.

In addition, we categorized positive and seemingly benign advertisements into 3 categories. In some cases, advertisements were either (1) empty or available to rent; (2) used to promote a community event, public service, or nonprofit organization; or (3) used to advertise other movies, television and Web series, clothing, material goods, real estate, tourist destinations, local attractions, and businesses that are not linked to potentially negative public health outcomes.

Table 2 illustrates data for generating areal comparisons across districts. We derived values for sign-district area, street length, and number of intersections from calculations taken from ESRI ArcMap 10.1. Measurements were taken from roadways within 500 feet of each sign district including residential and commercial roadways that intersected the sign district. To confirm these measurements, we conducted field observations to estimate roadway volume. To do this, we divided each roadway into block segments and coded each segment according to the number of 24-hour dedicated through lanes. Values, indicated in lane miles, indicate the total number of lanes per segment multiplied by segment length.

RESULTS

Table 3 provides a generalized account of the quantity of each content type within 1000 feet of each of the selected sign districts by community population characteristic. Here, we aggregated monthly data from each site: the sum of the area over time for each type of advertising divided by the total area of all outdoor advertising in that district multiplied by the number of months.

The percentage of outdoor advertising space dedicated to unhealthy forms of advertising was greatest (44.8%) in the neighborhood where a majority of residents identified as Asian American. The community facing multiple risks—income insecurity, educational risk, rich in youths—was exposed to slightly fewer

(35.4%) unhealthy ads. This was followed by the community with a greater proportion of residents younger than 18 years, where (32.1%) of advertising space contained harmful content. The prevalence of harmful outdoor advertising in the other communities ranged from 24.0% in the Latino American community to 30.2% in the community of African American residents.

Results suggest that various types of harmful advertising were more prevalent in different types of communities. Images portraying addictive behaviors, like drinking and gambling, appeared with greater frequency in the Asian American community in Chinatown (22.5%), as well as the Latino American communities with multiple risks in the southern section of Boyle Heights (27.2%) and with a concentration of youths in the northern section of Boyle Heights (18.3%). Notably, none of the advertising surveyed contained advertisements for tobacco because of the 1997 Tobacco Master Settlement Agreement. Although much less prevalent overall, outdoor advertising that featured guns or violence, typically to promote movies, television, video games, or other media content, was more prevalent in the Asian American community in Chinatown (3.4%) and the White community in Encino (3.4%).

Advertisements featuring unhealthy food options, depicting foods that are high-calorie and of questionable nutritional value, were most prevalent in the African American community in Baldwin Hills (18.6%) and the Latino community more dense with young people (12.7%). Most frequent among these were advertisements that promoted fast food options (e.g. hamburgers, fried foods) and advertisements for soft drinks, flavored beverages, and candy.

In addition, images that create an unsafe environment for women and children were observed with greater frequency in specific neighborhoods. The Asian American community in Chinatown (7.6%) and the Latino community at increased risk for poverty (6.1%) saw more advertising for content that is not appropriate for children, including R-rated movies and adult-themed television programming that is aired after 10:00 PM, than did residents of other communities. Misogynistic content was observed in greater concentration in the Asian American community within

TABLE 4—Square Foot Area of All Outdoor Advertising by Population and Content for Selected Population Characteristics: Los Angeles, CA, June 2012–December 2012

Race/Ethnicity (Location)	Sq Ft of Unhealthy Ads			Sq Ft of Community Service Ads			Sq Ft of Other Ads		
	Per Sq Mile	Per Lane Mile	Per Intersection	Per Sq Mile	Per Lane Mile	Per Intersection	Per Sq Mile	Per Lane Mile	Per Intersection
African American (Baldwin Hills)	5586	670	431	1359	163	105	10 946	1313	844
Asian American (Chinatown)	7440	644	333	2722	522	421	6243	540	279
White (Encino)	4080	951	633	538	145	105	9002	2097	1397
Latino American (Van Nuys)	9188	1293	667	4775	691	367	22 553	3175	1638
Latino American Youths (Boyle Heights North)	3989	621	175	2054	646	460	6120	953	269
Latino American Poverty Risk (City West)	10 058	619	288	9380	4179	3996	17 466	1076	500
Latino American Multiple Risks (Boyle Heights South)	5295	1074	442	1446	447	297	8242	1672	688
Total average	6519	839	424	3182	970	822	11 510	1547	802

Chinatown (4.1%), as well as the White community in Encino (5.5%).

Results from areal analysis appear in Table 4. We summed monthly data from each sign district and calculated unit per area measurements for each of the suggested measures of urban form (area of the sign district, lane miles of the sign district, and number of intersections). Here, the difference in urban form between communities became apparent when looking at Encino (a large sign district along a single corridor with few intersections) and Chinatown (a relatively small but dense sign district with many intersections).

Findings indicate that the Latino American community in Van Nuys, without distinguishing characteristics with regard to age, income, and education, ranked either first or second for all types of advertisements under each of the 3 dependent variables, except for square foot of community service advertisements by intersection. Members of this community were exposed to a greater amount of outdoor advertising regardless of areal unit.

Table 4 also suggests that the neighborhoods of Latino Americans at increased risk for poverty and Latino Americans facing multiple risks were exposed to a greater proportion of unhealthy advertisements than the other communities when using area of the sign district and lane miles as the denominator, respectively, whereas the White community experienced greater exposure per intersection to harmful advertising. Notably, the Latino American community in the northern part of Boyle Heights with a higher percentage of youth residents ranked last in terms of total

unhealthy advertisements under all areal units except lane miles.

Advertisements that promote community service, such as nonprofit and for-profit health and human services organizations and charities, appeared in greater proportions in a particular Latino American community. The Latino American community at risk for poverty in City West experienced notably more of these advertisements per area regardless of areal unit. The African American community in Baldwin Hills and the White community in Encino were ranked last or second to last under all 3 dependent variables for total number of public service advertisements.

DISCUSSION

We found harmful content on outdoor advertising is inequitably distributed among a diverse set of Los Angeles neighborhoods. Although these communities are all regulated by the same land-use zoning and regulations, which are intended to protect residents from nuisances, we observed a disproportionate number of advertisements promoting negative messages in non-White, lower-income communities. Thus, advertisements with harmful content are more likely to be present in non-White communities where residents confront a wide range of other challenges, including heightened financial, educational, and health risks.

For example, outdoor advertising that depicts sexualized portrayals of women and violence was seen with greater frequency in the Asian American neighborhood in Chinatown, whereas outdoor advertising promoting

addictive behaviors such as alcohol consumption and gambling were disproportionately situated along a commercial boulevard in the African American community of Baldwin Hills. These findings suggest that current models of outdoor advertising regulation, most importantly land-use zoning, may not be supportive of efforts to promote community health and well-being, and that new models are needed.

Limitations

Several limitations offer opportunities to improve upon the methods and empirical evidence presented here. First, because of its relatively small sample size and focused geographical scope, researchers need to take care in comparing these findings to other municipalities. To suggest otherwise contradicts a primary conclusion of this study: that context matters. Researchers in other locales should consider how the methods applied here might be employed in other socioeconomic and political contexts to understand the localized impact of outdoor advertising.

As with all spatial analysis, this study relies on proximity as a measure of impact. Although employed commonly in the literature, the use of spatial buffers to investigate impact cannot be employed nonchalantly. In this case, a key difficulty was isolating the range of locations from which each outdoor advertisement is visible—either from the front as intended or from the back as it might appear from an adjacent residential yard. Understanding the risk associated with exposure to outdoor advertising may or may not necessitate consideration of a risk viewed.

Finally, incorporating the changing nature of community and the built environment over time is difficult in an analysis such as this. Though longitudinal, this study does not look historically at those who lived in these places and what the landscape looked like at various points in time. Even though the evidence suggests that here and now a spatial inequality exists in the content and placement of outdoor advertising, this inequality may not have been the case previously or may not be the case in the future. With advances in technology, researchers someday will be able to look at stored images of the landscape over time; at that point, they may be able to investigate whether these patterns are chronic or acute.

Conclusions

These findings suggest that public health professionals and planners need to consider the ramifications of the potential adverse impacts of outdoor advertising. Given the rising economic value of outdoor advertising to developers and property owners, the new digital technologies that give advertisers the ability to continuously present new ads, and the belief among many public officials that outdoor advertising enlivens public spaces in a cosmopolitan city,⁴³ the proliferation of outdoor advertising likely will increase. If, as we found here, the current reliance on land-use zoning as a determinant for the location of outdoor advertising results in an inequitable distribution of harmful content, the current approach to regulating the placement of outdoor advertising has the potential to disadvantage the well-being of poorer, minority, and at-risk communities.

A growing number of researchers believe that the built environment is capable of collectively constituting a cumulative barrier to healthy living. Individuals who are continually confined—physically, financially, or socially—to harmful environments are at increased risk for functional decline and accelerated mortality.⁴⁴ In this way, outdoor advertising becomes a component of a localized environmental riskscape,⁴⁵ a factor among many that adversely impacts human health and well-being. For non-White, low-income residents, repeated and continued exposure to junk-strewn vacant lots,⁴⁶ liquor outlets,⁴⁷

unhealthy food options,⁴⁸ and harmful advertising inhibits the attainment of personal and collective health and well-being.

Traditional zoning practice that segregates land into discrete, functionally homogenous districts seemingly fails to contribute to positive health outcomes for all communities, suggesting necessary reformation. Some researchers suggest that form-based codes and conditional-use permits provide an avenue for reducing the health risks confronting communities.⁴⁹ An alternative approach treats outdoor advertising around sensitive populations much like tobacco-free and drug-free schools zones, creating a buffer where either outdoor advertising in general or specific types of outdoor advertising are not permitted.³² Of course, as in places like Hawaii and Maine, a more dramatic approach bans outdoor advertising altogether, which means forgoing any potential economic benefits generated by off-site advertising. In support of the development of new models, researchers need to conduct further studies to reveal how the current system of outdoor advertising adversely or positively impacts at-risk and vulnerable communities. ■

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Contributors

B. C. Lowery guided the study design, collected and analyzed the data, and contributed to the data interpretation and article preparation. D. C. Sloane contributed to the data interpretation and article preparation.

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Human Participant Protection

The dissertation from which this research is derived complies with the Principles of the Ethical Practice of Public Health and received approval from the affiliated university institutional review board.

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