

A Cross-Sectional Prevalence Study of Ethnically Targeted and General Audience Outdoor Obesity-Related Advertising

ANTRONETTE K. YANCEY, BRIAN L. COLE,
ROCHELLE BROWN, JEROME D. WILLIAMS,
AMY HILLIER, RANDOLPH S. KLINE,
MARICE ASHE, SONYA A. GRIER,
DESIREE BACKMAN, and WILLIAM J. McCARTHY

University of California at Los Angeles; Johns Hopkins University; University of Texas at Austin; University of Pennsylvania; Public Health Institute; American University; State of California Department of Public Health

Context: Commercial marketing is a critical but understudied element of the sociocultural environment influencing Americans' food and beverage preferences and purchases. This marketing also likely influences the utilization of goods and services related to physical activity and sedentary behavior. A growing literature documents the targeting of racial/ethnic and income groups in commercial advertisements in magazines, on billboards, and on television that may contribute to sociodemographic disparities in obesity and chronic disease risk and protective behaviors. This article examines whether African Americans, Latinos, and people living in low-income neighborhoods are disproportionately exposed to advertisements for high-calorie, low nutrient–dense foods and beverages and for sedentary entertainment and transportation and are relatively underexposed to advertising for nutritious foods and beverages and goods and services promoting physical activities.

Methods: Outdoor advertising density and content were compared in zip code areas selected to offer contrasts by area income and ethnicity in four cities: Los Angeles, Austin, New York City, and Philadelphia.

Address correspondence to: Antronette (Toni) K. Yancey, 31-235 CHS, UCLA School of Public Health, 650 Charles Young Drive South, Los Angeles, CA 90095 (email: ayancey@ucla.edu).

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Findings: Large variations were observed in the amount, type, and value of advertising in the selected zip code areas. Living in an upper-income neighborhood, regardless of its residents' predominant ethnicity, is generally protective against exposure to most types of obesity-promoting outdoor advertising (food, fast food, sugary beverages, sedentary entertainment, and transportation). The density of advertising varied by zip code area race/ethnicity, with African American zip code areas having the highest advertising densities, Latino zip code areas having slightly lower densities, and white zip code areas having the lowest densities.

Conclusions: The potential health and economic implications of differential exposure to obesity-related advertising are substantial. Although substantive legal questions remain about the government's ability to regulate advertising, the success of limiting tobacco advertising offers lessons for reducing the marketing contribution to the obesigenicity of urban environments.

Keywords: Disparities, minority, African American, Latino, black, Hispanic, policy, marketing.

ENVIRONMENTAL INTERVENTION APPROACHES APPEAR TO BE necessary to stem the advancing obesity epidemic, as the environment is becoming increasingly "obesigenic," or obesity-producing, particularly in communities of color (Fontaine *et al.* 2003; French, Story, and Jeffery 2001; King *et al.* 1995; Kumanyika 2005; Marcus *et al.* 2006; Nestle and Jacobson 2000; Rigby, Kumanyika, and James 2004; Sloane *et al.* 2003, 2006; Swinburn, Egger, and Raza 1999; Swinburn, Gill, and Kumanyika 2005; Yancey, Ory, and Davis 2006; Yancey *et al.* 2005). Efforts to make changes on an individual level have demonstrated little sustainability (Jeffery *et al.* 2000; Kumanyika 2001; Kumanyika and Grier 2006; Yancey 2004; Yancey *et al.* 2004), but a similar shift toward environmental intervention is credited with accelerating declines in tobacco use (Forster, Widome, and Bernat 2007; Hopkins *et al.* 2001). Particularly in California, as the leader in this arena (Messer *et al.* 2007), the incidence of tobacco-related disease has declined significantly (Barnoya and Glantz 2004), so the history of tobacco control may have important lessons for emerging strategies in obesity control (Daynard 2003; Emery *et al.* 2007; Kersh and Morone 2002; Kline *et al.* 2006; Mercer *et al.* 2003).

Commercial marketing is a critical but understudied element of the sociocultural environment influencing both Americans' food and beverage preferences and purchases (Cawley 2006; Nestle et al. 1998) and their use of goods and services related to physical activity and sedentary behavior (Maibach 2007). The U.S. food, beverage, and restaurant industries, with total sales approaching \$900 billion, spent more than \$11 billion in 2004 on advertising alone, which was only 20 percent of the industries' total marketing expenditures (IOM et al. 2006). In 2006, the estimate of \$31.7 billion for food and beverage advertising was about 5 percent of the total U.S. food and beverage marketing expense estimate of \$633.4 billion in that year (Elitzak 2004, 2007). Together, these industries are the second largest advertiser in the American economy (Gallo 1999) and have led to a growing literature documenting racial/ethnic targeting in commercial advertisements in magazines, on billboards, and on television that may influence disparities both in the risk of obesity and obesity-related chronic disease morbidity and premature mortality and in protective behaviors (Byrd-Brenner and Grasso 2000; Hackbarth et al. 2001; Kumanyika et al. 2008; Lohmann and Kant 2000; Mitchell and Greenberg 1991; Powell, Szczypka, and Chaloupka 2007; Pratt and Pratt 1995; Story, Neumark-Sztainer, and French 2002; Tirodkar and Jain 2003; Wakefield et al. 2003; Wallack and Dorfman 1992). Some of these racial/ethnic groups' differences in mortality are linked to a higher risk of diabetes for Latinos than for whites (Delisle et al. 2008) and a higher risk of kidney failure, stroke, and congestive heart failure for African Americans than for whites (McClellan et al. 2007; Mensah et al. 2005).

Published findings increasingly reveal that products associated with significant population-wide morbidity (e.g., sodas, candy, and alcoholic beverages) are advertised disproportionately in magazines and television shows targeting African Americans compared with general audiences. Conversely, ads for healthier food and beverage products (fruits, vegetables, low-fat meats, soy and dairy products) are disproportionately underrepresented (Grier and Kumanyika 2008; Outley and Taddese 2006; Pratt and Pratt 1995; Tirodkar and Jain 2003). On billboards in predominantly African American and Latino neighborhoods, alcohol products were advertised five times as frequently as in predominantly white areas (Hackbarth et al. 2001), with other studies showing similar findings (Alaniz and Wilkes 1998; Hackbarth, Silvestri, and Cospes 1995; Herd 2005; Kwate and Lee 2007; Moore, Williams, and Qualls

1996; Pasch et al. 2007; Wagenaar et al. 2000). Lewis and colleagues (2005) also identified substantially more point-of-sale advertising and promotion of unhealthful foods in restaurants in low-income African American and Latino communities than in more affluent white communities in Los Angeles County. These influences on individual preferences and behaviors may be mediated by creating familiarity with certain products, by depicting social norms supportive of their consumption or utilization, by addressing a void in positive and culturally grounded images of people of color, and by reinforcing cultural beliefs of inevitability regarding the development or maintenance of obesity (Kumanyika and Grier 2006; Yancey, Ory, and Davis 2006). To date, the only “successful” litigation addressing such inequities was General Foods’ settlement of a class action suit to redress its advertising of high-fat/high-sugar breakfast cereals with false claims of healthfulness that exploited low-income children of color (Hinkle 1997; Mello, Rimm, and Studdert 2003; Parloff 2003).

Commercial media messages also are likely to influence patterns of physical activity (Outley and Taddese 2006). Most of the scant scientific literature on this subject has addressed the media’s displacement of physical activity, especially in children (Maibach 2003, 2007). One exception is a constructive example of addressing disparities: the differential increases in physical activity among black girls produced by the VERB social marketing campaign (Berkowitz, Huhman, and Nolin 2008; Huhman et al. 2005). In addition, a high density of billboards is generally considered deleterious to neighborhood walkability (Ewing et al. 2005), an important issue in low-income African American and Latino communities, which typically have fewer leisure recreational facilities than other communities do (Day 2006; Estabrooks, Lee, and Gyurcsik 2003; Sloane et al. 2006; Wolch, Wilson, and Fehrenbach 2005).

Duerksen and colleagues (2005) noted a corollary finding: the greater frequency of health-diminishing, and the lesser frequency of health-promoting, advertising content in magazines targeting Latinos and African Americans, compared with those targeting whites. They also found that the products in advertisements featuring African American models were more likely to diminish health (Duerksen et al. 2005). Furthermore, Tirodkar and Jain (2003) documented a fourfold greater likelihood of observable overweight in television actors in black prime-time shows compared with general audience prime-time offerings.

Outley and Taddese (2006) documented fewer physical activity–related ads, fewer health-related ads, and more food and beverage ads in television programming for majority black audiences than in television programming for majority white audiences. The California Department of Public Health’s Network for a Healthy California commissioned the UCLA School of Public Health to determine whether predominantly ethnic minority and/or low-income communities were disproportionately targeted by advertising for high-calorie, low nutrient–dense foods and beverages and products promoting a sedentary lifestyle. The initial focus on outdoor advertising in California cities was expanded to include three more U.S. cities when researchers at other institutions volunteered to collect comparable data as a part of a University of Pennsylvania, NIH-funded EXPORT disparities center and a Robert Wood Johnson Foundation Clinical Scholars’ project at New York University. Outdoor advertising has increased substantially, and ads are now commonplace in many community locations, for example, on signs, murals, storefronts, and bus benches and shelters (Kumanyika and Grier 2006).

Content analyses of outdoor advertising of products and services related to food, beverages, and physical activity in Los Angeles, Philadelphia, Austin, and New York City were conducted to test the hypothesis that African Americans, Latinos, and people living in low-income neighborhoods are exposed more often than whites are to advertisements for unhealthful products and are exposed less often to advertisements for nutritious foods and beverages or physical activity–promoting goods and services. Examples of unhealthful products are high-calorie, low nutrient–dense foods and beverages and sedentary entertainment and transportation.

In this article we present findings from this study of the connection between outdoor advertising content and neighborhood characteristics. We also (1) describe variations in the prevalence of magazine ads and attributes of outdoor and magazine ad content targeting different racial/ethnic groups that may influence the purchase and consumption of obesity-promoting products; (2) examine weight-related body imagery in ads; and (3) document the geographical positioning of outdoor ads in relation to schools and other places frequented by children, to determine whether the concentration and content of ads near schools differ from those of ads farther from schools. These outcomes are reported elsewhere.

Methods

Overview

Our research staff used GPS receivers and digital cameras to create a record of outdoor advertising in select zip code areas, which were chosen to provide the contrasts of interest by race/ethnicity (predominantly African American, Latino, or white) and household income (relative median household income overall and by census tracts within these zip code areas). The staff collected data on the types of outdoor advertisements, numbers of advertisements, and size of each advertisement. Only English- and Spanish-language advertisements were included. Next, coders abstracted the product content and targeting of advertisements based on the photographs. A second person verified that the content coding matched the descriptive information and ad images. We analyzed the ad content to determine whether the ads' relative density or type varied systematically with the different demographic characteristics associated with the selected zip code areas.

Selection of Geographical Sampling Units

Our research staff ranked the neighborhoods (defined by zip code) in each metropolitan area by median household income and then identified those zip codes where residents were predominantly (> 50 percent) African American, Latino, or white at the top and the bottom of the income ranking, for a total of up to six neighborhoods in each city (table 1). If no neighborhood met the 50 percent threshold, our protocol allowed for selecting a neighborhood with slightly less than 50 percent of the specified ethnicity if it was the largest ethnic group in that zip code area. Neither Austin nor Philadelphia had upper-income Latino neighborhoods that met this criterion. Austin also lacked an upper-income African American neighborhood. Although an upper-income white neighborhood in Los Angeles was included, it did not have any billboards aimed at a weight-related lifestyle. Table 1 describes each zip code area's ethnic composition and income/poverty level. Because zip code areas, unlike census tracts, may encompass demographically disparate areas, the majority of residents in a relatively low-income zip code might not be poor by federal standards. For instance, poverty is fairly homogeneously distributed throughout the low-income Latino

TABLE 1
Demographic Characteristics of Sampled Zip Codes

City	Zip Code	Category Ethnicity (Income)	Pop. ^a	Race/Ethnicity ^a (%)			Household Income ^b		
				Afr. Am.	Latino	White	Median (\$/Year)	% Under 185% FPL	% ≥ \$100,000/Year
Aus	78702	Latino (low)	22,534	24.5	67.7	7.4	23,348	57.1	3.3
Aus	78751	white (low)	14,005	1.9	21.6	67.3	29,779	42.2	8.0
Aus	78727	white (high)	22,212	6.1	14.9	69.3	62,648	12.3	19.1
LA	90008	Afr. Am. (low)	30,840	77.6	14.3	1.8	30,472	41.0	9.7
LA	90056	Afr. Am. (high)	8,108	71.4	3.9	16.8	72,193	8.1	37.3
LA	90033	Latino (low)	49,418	1.2	92.3	2.1	22,429	69.1	2.2
LA	90240	Latino (high)	24,891	1.6	53.0	32.8	55,492	20.5	18.3
LA	90027	white (low)	48,715	3.6	24.4	52.1	31,820	42.0	11.6
LA	90272	white (high)	22,708	0.8	3.6	88.9	122,877	6.2	58.9
NYC	10039	Afr. Am. (low)	21,737	75.9	10.9	0.8	17,370	37.1	2.8
NYC	11411	Afr. Am. (high)	21,282	89.7	4.1	2.3	62,071	9.2	21.8
NYC	10454	Latino (low)	34,976	24.1	73.2	1.3	14,271	46.1	2.3
NYC	11372	Latino (high)	71,308	2.0	56.4	21.3	39,084	15.3	8.3
NYC	11211	white (low)	85,089	3.3	36.2	51.6	23,567	37.2	4.1
NYC	10022	white (high)	30,642	1.2	4.8	85.9	80,406	1.6	40.7
Phil	19132	Afr. Am. (low)	41,709	96.1	0.7	1.3	18,777	60.1	3.0
Phil	19150	Afr. Am. (high)	25,274	94.3	0.8	2.2	42,342	22.2	8.6
Phil	19133	Latino (low)	27,971	45.5	54.8	2.3	13,828	73.5	1.9
Phil	19148	white (low)	48,573	10.0	4.1	72.6	27,097	42.2	3.3
Phil	19128	white (high)	36,420	7.2	1.9	87.4	43,629	19.6	9.8

Notes: ^aPopulation and ethnicity from 2000 U.S. Census, <http://factfinder.census.gov> (accessed December 7, 2007).

^bMedian household income and percentage of households earning ≥ \$100,000. Federal Poverty Level (FPL) data are for families. 2000 U.S. Census, 1999 income, <http://factfinder.census.gov> (accessed December 7, 2007).

zip code in Los Angeles (90033), with 69 percent of families earning below 185 percent of the federal poverty level (FPL) and a majority of individuals in every census tract living in families earning below this threshold. Poverty, however, is more clustered in the low-income white zip code (90027), in which 42 percent of families earn below 185 percent; fewer than half the census tracts have majorities living in families below this threshold; and 12 percent of households have annual earnings in excess of \$100,000 per year.

Field Surveys

Our research staff used GPS receivers and digital cameras to create a record of outdoor advertising images and locations in zip code areas that were selected to provide the contrasts of interest by ethnicity (predominantly African American, Latino, or white) and household income (relative median household income). We included commercial-grade outdoor advertisements visible from the street or sidewalk that conveyed thematic content through either words or pictures. The types of outdoor advertisements represented in the analysis were billboards, bus bench and shelter advertisements, sidewalk “sandwich” signs, murals painted on the sides of buildings, and some large store window posters (table 2).

We identified zip code area boundaries on maps using the U.S. Environmental Protection Agency’s EnviroMapper website (<http://www.epa.gov/enviro/html/em/index.html>). Within these boundaries, we found the streets on which restaurants and grocery stores were located (i.e., streets with a high probability of having billboards) using Yahoo maps (<http://maps.yahoo.com>). Two research staff members trained in the data collection methodology were sent to each zip code area to conduct a comprehensive assessment of all outdoor advertising on selected streets of the zip code area meeting the inclusion criteria shown in table 2. Starting with streets identified as being likely locations of billboards, the research staff first surveyed all publicly accessible streets in the zip code area to identify outdoor ad locations and then collected data at each location that had one or more billboards. For each ad that met the weight-related lifestyle criteria shown in table 2, the researchers (1) completed a data log form recording the product/service name, ad category, size of the poster/billboard, photo number, and GPS

TABLE 2
Inclusion Criteria

Included as an outdoor advertisement

Virtually all billboards, bus shelter ads, bus bench ads, some store window posters:

1. Advertisement for a product or service
2. Visible from publicly accessible street or sidewalk within the selected zip code
3. Minimum of 8 × 12 inches commercial grade (i.e., not handwritten flyer)
4. Posted on paid commercial space
5. Not an advertisement for a product or service specific to the premises on which the ad was located
6. Not merely the name of the establishment
7. Not targeted exclusively to drivers on high-speed thoroughfares that passed through the selected zip code, e.g., interstate highways
8. Convey thematic content, through words, pictures, or both

Weight-related lifestyle (full content and image recorded)

Advertised content in one of the following categories:

1. Food
 2. Nonalcoholic beverages
 3. Alcoholic beverages
 4. Physical activity
 5. Sporting goods (not clothing)
 6. Sporting goods (clothing)
 7. Screen entertainment (i.e., movies, television, video games)
 8. Other health-related topics (e.g., obesity prevention public service announcements)
-

“waypoint”; (2) took a digital photograph for each data log form entry; and (3) recorded the latitude and longitude (keyed to a “waypoint” on the GPS receiver).

For other outdoor advertising that met the general inclusion criteria but was not relevant to obesity, the investigators recorded only the location, name of the ad, and its size.

Data Entry and Coding

We entered these ad descriptions, street addresses, and ad size information into a Microsoft Excel database, downloaded the GPS coordinates, and merged them into the data file software. Digital photographs were downloaded and linked to the data file by identification number.

Together with all the sites' research teams, we developed an abstraction form and pretested it with small samples of advertisements to assess interrater reliability. Student research assistants, trained in the content analysis of the ads, coded the type of product or service and the themes and populations targeted based on the photographs and entered this information into a Microsoft Access database. The principal content categories that we analyzed for this study included food (fast food, fruits and vegetables, and other), sugary beverages, alcohol, other beverages, tobacco, screen entertainment (movies, videos, computer games, television), automobiles, and physical activity (sports, walking, etc.). The content coding was based not only on the type of product or service being advertised but also on other visual or text information. For example, a fast-food ad that featured two young men playing soccer would have been coded as both "fast food" and "physical activity." The advertisements' gender and racial/ethnic and cultural cues or targeting also were coded but are not presented in this analysis. Two other research assistants each recoded 10 percent of the assessed ads to verify interrater reliability. None of the coders knew the zip code area in which the ads were located. A master database was created by merging the content coding information with the log data. Our coding strategies were similar to those reported in previous research on advertising (Taras and Gage 1995).

Analysis

Quantifying the Frequency and Coverage of Outdoor Advertising

We used two different measures to assess outdoor ad coverage in the sampled zip code areas: number of ads and sheetspace. We compared these across areas of analysis (cities and zip code area groupings) for the totals, percentage of total advertising, and ad density of different types of ads (e.g., fast food, sugary beverage).

The simplest measure of outdoor advertising, number of ads, gives a gross estimate of the total amount of outdoor advertising in the sampled area, but this representation may be skewed by several factors. That is, a count of all outdoor advertising treats all types of ads in the same way, regardless of their size and location. For instance, a poster in a store

window is treated in the same way as a large billboard. Advertisers, however, are willing to pay more for a large billboard than for a small window poster because they know that large billboards are likely to reach more people. But this value given to the size of the ad is ignored when the measure of density is simply the total number of ads.

Because the advertisements varied greatly in size, from large billboards measuring more than 600 square feet to storefront posters measuring 6 square feet, the researchers assessed the coverage of the neighborhood advertisements in terms of sheetspace. Sheets, a common measure of size in the advertising industry, are equivalent to about 9 square feet. A neighborhood's sheetspace of advertisements, then, is simply the sum of the number of sheets of all the advertisements in that neighborhood.

Comparison of Relative Distribution

We used three different measures to estimate advertising density. Although the numerator of all three measures is sheetspace, their denominators differ: number of residents, number of employees, and land area (table 3). Each of these density measures has strengths and weaknesses. Because we were concerned with individuals' exposure to outdoor advertising, advertising space per capita (i.e., counts of residents from U.S. Census data) may have been an appropriate density measure in some circumstances, but often those areas with the most residents are zoned exclusively for residences. Consequently, these areas are unlikely to have outdoor advertising, which is usually found in commercial and retail areas. The number of residents also does not account for the number of people who travel through or work in an area and are exposed to outdoor ads.

Data on the number of employees working in an area are available from U.S. Department of Labor employment surveys. Besides accounting for individuals who are exposed to advertising during the workday, employee numbers also serve as a useful proxy for the area's commercial activity. Problems with employee data are the smaller, less stable numbers compared with population data, mistaken attribution of location (i.e., business addresses do not necessarily reflect where workers are actually located), discrepancies between the demographic characteristics of employees and those of residents (zip code areas were categorized by the residents' demographics, not the employees'), and questions of how to combine population and employee counts.

TABLE 3
Total Population and Land Area of Sampled Zip Codes Grouped by Median Household Income and Ethnicity

Ethnicity	Low Income				High Income			
	City (Zip)	Population		Area Mi. ^a	City (Zip)	Population		Area Mi. ^a
		Resident ^a	Employee ^b			Resident ^a	Employee ^b	
African American	Austin (-)	-	-	-	Austin (-)	-	-	-
	LA (90008)	30,840	4,058	3.7	LA (90056)	8,108	2,369	1.6
	NYC (10039)	21,737	973	0.3	NYC (11411)	21,282	964	1.2
	Phil (19132)	41,709	4,360	2.1	Phil (19150)	25,274	2,204	1.5
	Total (3 zips)	94,286	9,391	6.1	Total (3 zips)	54,664	5,537	4.3
Latino	Austin (78702)	22,534	8,081	5.0	Austin (-)	-	-	-
	LA (90033)	49,418	17,415	3.1	LA (90240)	24,891	5,187	3.3
	NYC (10454)	34,976	7,963	1.0	NYC (11372)	71,308	7,262	0.7
	Phil (19133)	27,971	3,275	1.3	Phil (-)	-	-	-
	Total (4 zips)	134,899	36,734	10.46	Total (2 zips)	96,199	12,449	4.0
White	Austin (78751)	14,005	8,440	2.4	Austin (78727)	22,212	7,468	7.9
	LA (90027)	48,715	20,098	8.2	LA (90272)	22,708	5,003	22.9
	NYC (11211)	85,089	27,818	1.9	NYC (10022)	30,642	133,066	0.4
	Phil (19148)	48,573	20,822	4.3	Phil (19128)	36,420	6,606	7.0
	Total (4 zips)	196,382	77,178	16.8	Total (4 zips)	111,982	152,143	38.2

Notes: ^aResident and land area data from the U.S. Census (2000) (<http://factfinder.census.gov>; accessed December 7, 2007).

^bEmployee data from the U.S. Census (2003) (<http://censtats.census.gov/cbpnaic/cbpnaic.shtml>; accessed December 7, 2007).

Expressing density in terms of land area provides a good picture of the coverage of ads in a geographic area, but some of the zip code areas in our study had large swaths of uninhabited land without potential outdoor advertising space or exposure. Ad density per land area is particularly problematic for making comparisons across cities (or when intercity differences affect comparisons of interest), since patterns of development (and potential for outdoor advertising) between more suburban, automobile-centric cities and high-density, pedestrian-oriented cities are so different. An ideal denominator for measuring advertising density would be linear feet of streets through areas zoned retail or commercial (i.e., areas where outdoor advertising is typically located). Even more ideal would be including information about the height of office and residential buildings on streets as a proxy for representing the denominator of potential billboard consumers. Such data were not readily available, however, and estimating such data using zoning maps, GIS methods, and surveys of building dimensions was beyond the scope of this project.

Results

Differences by City in the Prevalence and Type of Outdoor Advertising

We observed a number of notable differences in the types of advertising in the four cities (table 4). While Austin, New York, and Philadelphia had remarkably similar amounts of total outdoor advertising sheetspace (3,179, 3,501, and 3,031 sheets, respectively), Los Angeles had more than double the amount, 8,198 sheets of outdoor advertising in its sampled zip code areas. Although Austin and Philadelphia might be expected to have fewer ads, since they did not have all the combinations of ethnicity and income for a full complement of six zip code areas assessed per city (see Methods section), the total for Los Angeles did not include any ads from one of the zip code areas (high-income white), where we found virtually no outdoor advertising, probably because of zoning restrictions.

The average size of outdoor advertising in Austin (where its urban sprawl and low population density necessarily make its built environment more automobile oriented than those of the other cities

TABLE 4
Outdoor Advertisements and Sheetspace by Ad Topic and City

	Food	Fast Food	Sugary Bev.	Alcohol	Screen Ent.	Cars	Other	Total
Austin	ad count	3	0	11	7	1	68	93
	% ads	3.2%	0.0%	11.8%	7.5%	1.1%	73.1%	100.0%
	sheets	90	0	398	300	60	2,241	3,179
	% sheets	2.8%	2.8%	12.5%	9.4%	1.9%	70.5%	100%
Los Angeles	ad count	83	50	82	168	30	342	816
	% ads	10.2%	7.5%	10.0%	20.6%	3.7%	41.9%	100.0%
	sheets	644	382	781	1,745	576	3,767	8,198
	% sheets	7.9%	4.7%	9.5%	21.3%	7.0%	46.0%	100%
New York	ad count	88	0	131	71	3	391	685
	% ads	12.8%	0.0%	19.1%	10.4%	0.4%	57.1%	100.0%
	sheets	331	0	623	370	122	2,053	3,501
	% sheets	9.5%	0.0%	17.8%	10.6%	3.5%	58.6%	100%
Philadelphia	ad count	8	1	99	18	1	472	639
	% ads	1.3%	0.2%	15.5%	2.8%	0.2%	73.9%	100.0%
	sheets	124	30	532	155	30	1,944	3,031
	% sheets	4.1%	1.0%	17.6%	5.1%	1.0%	64.1%	100%
All cities	ad count	183	59	322	264	35	1,279	2,233
	% ads	8.2%	2.6%	14.4%	11.8%	1.6%	57.3%	100.0%
	sheets	1,190	405	521	2,333	788	10,102	17,909
	% sheets	6.6%	2.3%	2.9%	13.0%	4.4%	56.4%	100%

in this study) was 34 sheets per ad (about 12×25 feet), compared with 10 sheets per ad in Los Angeles and about 5 sheets per ad in New York and Philadelphia (about 6×8 feet). These size differences explain why the total sheetspace in Austin was similar to that in New York and Philadelphia, despite having relatively few ads (93) compared with 685 in New York and 639 in Philadelphia.

Advertising content also varied considerably in these cities. Although alcohol ads comprised at least 10 percent of all outdoor advertising in each city, they were particularly prevalent in New York and Philadelphia, accounting for about 17 percent of sheetspace in both cities. Sugary beverage ads made up about 4 percent of the sheetspace in Los Angeles and 7 percent of the sheetspace in Philadelphia, but they were absent from the sampled zip code areas in Austin and in New York, where we found only one such ad. The sampled zip code areas in New York also did not have any fast-food ads, but such ads constituted 4.7 percent of the sheetspace in Los Angeles and 2.8 percent of the sheetspace in Austin. Perhaps fulfilling the stereotypical view of Los Angeles as home to Hollywood and an autocratic culture, advertising for cars and screen entertainment (e.g., movies and video games) was much higher in Los Angeles than in the other cities, comprising 7 percent and 21 percent, respectively, of advertising sheetspace. This was two to seven times higher than the level in any other city.

Differences by Zip Code Demographics

Prevalence and Density (All Types of Ads). We found large variations in the amount, type, and value of advertising in the twenty zip code areas we surveyed in the four cities. First, substantial differences were based on zip code income categories. Table 5 (All Ads) shows that low-income zip code areas in aggregate had twice as many ads as did high-income zip code areas (1,481 versus 782 ads) and three times more advertising sheetspace (13,363 versus 4,546 sheets). Depending on the measure used, the density of outdoor advertising was approximately two to four times higher in low-income zip code areas as a whole compared with high-income zip code areas. While the amount of outdoor advertising, measured in terms of the number of ads and sheetspace, varied little among zip code areas aggregated by ethnicity, the density of advertising

TABLE 5
 Number, Sheets, and Density of Outdoor Advertisements by Type of Ad and Demographic Category of Sampled Zip Code

All Ads					
	Count	Sheets	Density		
			Sheets/ 1,000 Pop.	Sheets/ 100 Empl.	Sheets/ Sq. Mi.
Afr. Am. low	406	3,105	32.93	33.06	509.85
Afr. Am. high	227	2,050	37.50	37.02	476.74
Latino low	532	5,789	42.91	15.76	553.44
Latino high	208	882	9.17	7.08	218.86
White low	543	4,469	22.76	5.79	266.01
White high	317	1,614	14.41	1.06	42.23
All low income	1,481	13,363	31.40	10.84	400.69
All high income	752	4,546	17.30	2.67	97.66
All Afr. Am.	633	5,155	34.61	34.53	496.15
All Latino	740	6,671	28.87	13.56	460.39
All white	860	6,083	19.73	2.65	110.56

Ads for High-Calorie/Low-Nutrient Products (e.g., fast food, sugary beverages, alcohol)					
	Count	Sheets	Density		
			Sheets/ 1,000 Pop.	Sheets/ 100 Empl.	Sheets/ Sq. Mi.
Afr. Am. low	94	720	7.64	7.67	118.23
Afr. Am. high	24	154	2.82	2.78	35.81
Latino low	170	1,490	11.05	4.06	142.45
Latino high	73	300	3.12	2.41	74.44
White low	61	555	2.83	0.72	33.04
White high	57	138	1.23	0.09	3.61
All low income	325	2,765	6.50	2.24	82.91
All high income	154	592	2.25	0.35	12.72
All Afr. Am.	118	874	5.87	5.85	84.12
All Latino	243	1,790	7.75	3.64	123.53
All white	118	693	2.25	0.30	12.60

(Continued)

TABLE 5—Continued

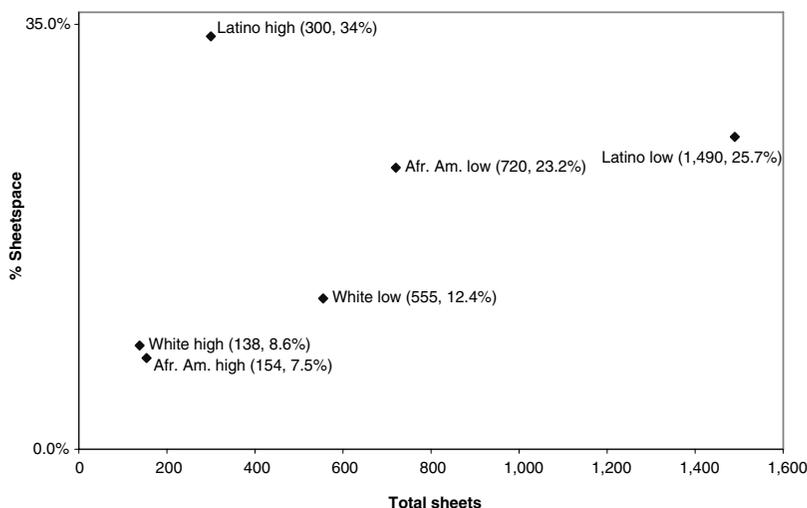
Ads Related to Sedentary Behaviors (e.g., video games, television, automobiles)					
	Count	Sheets	Density		
			Sheets/ 1,000 Pop.	Sheets/ 100 Empl.	Sheets/ Sq. Mi.
Afr. Am. low	21	373	3.96	3.97	61.25
Afr. Am. high	13	139	2.54	2.51	32.33
Latino low	89	1,260	9.34	3.43	120.46
Latino high	7	14	0.15	0.11	3.47
White low	124	1,340	6.82	1.74	79.76
White high	45	232	2.07	0.15	6.07
All low income	234	2,973	6.99	2.41	89.15
All high income	65	385	1.46	0.23	8.27
All Afr. Am.	34	512	3.44	3.43	49.28
All Latino	96	1,274	5.51	2.59	87.92
All white	169	1,572	5.10	0.69	28.57
Ads Featuring Physical Activity					
	Count	Sheets	Density		
			Sheets/ 1,000 Pop.	Sheets/ 100 Empl.	Sheets/ Sq. Mi.
Afr. Am. low	5	40	0.42	0.43	6.57
Afr. Am. high	3	10	0.18	0.18	2.33
Latino low	12	80	0.59	0.22	7.65
Latino high	1	2	0.02	0.02	0.50
White low	3	18	0.09	0.02	1.07
White high	14	85	0.76	0.06	2.22
All low income	20	138	0.32	0.11	4.14
All high income	18	97	0.37	0.06	2.08
All Afr. Am.	8	50	0.34	0.33	4.81
All Latino	13	82	0.35	0.17	5.66
All white	17	103	0.33	0.04	1.87

varied by zip code area ethnicity, with African American zip code areas having the highest advertising densities, Latino zip code areas having slightly lower densities, and white zip code areas having the lowest, for all three of the density measures used: sheets per 1,000 residents, sheets per 100 employees, and sheets per square mile.

Prevalence patterns appeared somewhat mixed when comparing zip code areas categorized by both income and ethnicity. Low-income white zip code areas had the largest number of ads (543), slightly more than low-income Latinos (532). Low-income Latino neighborhoods had the most sheetspace (5,789 sheets), the highest density of sheetspace per resident (43 sheets/1,000 residents), and the highest density per area (553 sheets/square mile). High- and low-income African American neighborhoods had the highest density per employee (37 and 33 sheets/100 employees, respectively). Since the number of employees is a proxy for commercial activity, this may be due in large part to relatively little commercial activity in African American zip code areas. The lowest density of advertising in terms of sheets per employee and area was found in the high-income white neighborhoods. These low densities reflect both small numerators (e.g., an almost total absence of outdoor advertising in the high-income white zip code in Los Angeles) and large denominators (e.g., large numbers of employees working in the high-income white zip code in New York and large land areas, as in the high-income zip code area in Los Angeles, which encompasses large tracts of undeveloped land).

Advertising Devoted to High-Calorie/Low-Nutrient Products. Low-income Latino zip code areas had the highest prevalence of advertisements featuring high-calorie/low-nutrient products, which included ads for fast foods, alcoholic beverages, and sugary beverages like sodas and sweetened juices (table 5, Ads for High-Calorie/Low-Nutrient Products, and figure 1). The amount of such advertising is relatively high, even when considering that low-income Latino zip code areas had a greater total amount of outdoor advertising space than did other zip code areas. Indeed, the low-income Latino zip code areas had three times more total advertising space than the high-income white zip code areas, but the amount of sheetspace devoted to high-calorie/low-nutrient products was nine times higher (see table 5). The densities of such ads were correspondingly higher in the low-income Latino zip code areas with eleven sheets per 1,000 residents, compared to one sheet per 1,000 residents in the high-income white neighborhoods.

Advertising Related to Sedentary Behaviors. Included in the ads related to sedentary behaviors were those for screen entertainment (e.g., movies, television shows, and video games) and automobiles (table 5, Ads Related to Sedentary Behaviors). Generally such ads were most common in the low-income Latino and low-income white neighborhoods (1,260 and



Note: Products categorized as high-calorie/low-nutrient include fast food, sugary beverages, and alcohol.

FIGURE 1. Aggregate Sheetspace with High-Calorie/Low-Nutrient Product Advertisements by Percentage of Sheetspace in the Specified Area and by Zip Code Demographic Category: Austin, Los Angeles, New York, and Philadelphia

1,340 sheets, respectively). Given that such ads were far more common in Los Angeles than in other cities, the patterns of such advertising in Los Angeles can be seen as driving most of the differences among demographic groups in the prevalence and density of such ads. Although there were some modest differences among the aggregated ethnicity categories in the amount and density of sedentary behavior–related ads, the sharpest contrasts were by income, with the densities of such ads being five to eleven times higher in low-income zip code areas than in high-income zip code areas.

Advertising Featuring Physical Activity. In all zip codes, advertisements featuring physical activity made up less than 5 percent of all outdoor advertising sheetspace (table 5, Ads Featuring Physical Activity). Included in this category were not just ads promoting physical activity (e.g., gym memberships) but also ads in which physical activity was used as a theme to sell a product, such as soccer players shown in a beer ad and soft drink ads showing children playing. The total sheetspace of ads featuring physical activity was highest in high-income white zip code areas (85 sheets), with low-income Latino zip code areas following

closely with 80 sheets. Overall, high-income white zip code areas had 36 percent of physical activity ad sheets but only 4 percent of total advertising sheetspace.

Advertising Featuring Fresh Fruits and Vegetables. Unprocessed fruits or vegetables were rarely featured in outdoor advertisements in the zip code areas that we observed. Only one ad specifically promoted a fresh fruit, an ad for avocados sponsored by the California Avocado Commission. In other cases, the fresh fruits and vegetables may have been used symbolically. Salads were pictured in eight fast-food advertisements seen in various zip code areas in Los Angeles, and fresh fruits and vegetables were shown in ads for a grocery delivery service in New York City (all in the high-income white zip code).

Discussion

Summary

Living in an upper-income neighborhood, regardless of the residents' predominant ethnicity, is generally protective against exposure to most types of obesity-promoting outdoor advertising (food, fast-food, sugary beverage, sedentary entertainment, and transportation ads). Food advertising coverage was greatest in low-income Latino neighborhoods, and fast-food advertisement coverage differed by neighborhood income but not ethnicity. The most ads for sugary beverages were found in low-income African American neighborhoods. Even though there was less advertising coverage in upper-income than in low-income African American neighborhoods, it was similar to the coverage levels in low-income white and Latino neighborhoods. There was a paucity of advertising of fruits and vegetables and physical activity in all neighborhoods.

Limitations

Our findings must be interpreted in the context of historical covenants, with fewer ads traditionally found in unincorporated areas of Los Angeles County and moratoria on new billboards in the cities of Los Angeles and Austin. In addition, we did not intend the few zip code areas that we sampled to be representative of all sociodemographically similar areas within the cities or across different cities or communities. A more nuanced understanding of the role of income, immigration status, and

ethnic heritage characterizing different zip codes would require the application of study methods to many more zip codes than we considered here. Generalizations about nonbillboard ads must be conditioned by the fact that they were evaluated only on those streets that had billboards. With respect to the coding procedures used in this study, we acknowledge that although what constitutes “fast food” is not clear, the restaurant brands we coded as “fast food” also have been identified by others as “fast food” (Burdette and Whitaker 2004). Despite this imprecision in coding, the relationship between exposure to fast-food restaurants or fast-food advertising and obesity risk appears to be consistent (Burdette and Whitaker 2004; Emery et al. 2007). Although we did not design our study to reconfirm the relationship between ethnicity and obesity risk, the causal chain between exposure to fast-food advertising and obesity risk would have been stronger if the prevalence of obesity in the average neighborhood had been available to include in the analyses.

Policy Implications

The potential implications of our study for policy advocacy at the local and state levels are substantive. As we noted earlier, however, the scientific literature linking specific elements of the sociocultural environment to obesity-related outcomes is at a very early stage. Consequently, we discuss the policy implications in light of the potential commercial advertising influences on such intervening exposure variables as product demand and subsequent supply, local norms, and consumer risk or protective behaviors, and not directly on obesity rates.

Policy and legal intervention to prevent and control obesity is an active and burgeoning area of investigation (Alderman et al. 2007; Ashe et al. 2007; Gostin 2007; Kersh and Morone 2002; Schwartz and Brownell 2007; Spengler, Young, and Linton 2007). At least two categories of potential policy intervention are relevant to our findings: (1) ad-targeted intervention (e.g., policies that directly target advertising) and (2) effect-targeted intervention (e.g., policies that counteract the *effect* of advertising). Generally speaking, effect-targeted policies are on a sounder legal footing than ad-targeted policies are (Ashe et al. 2007).

Because advertising is a form of commercial speech that receives limited First Amendment protections, public policy approaches to reduce outdoor advertising directly—ad-targeted policies—are limited

and must be carefully crafted to withstand First Amendment scrutiny (e.g., *Central Hudson Gas & Electric Corporation v. Public Service Commission of New York*, 447 U.S. 557, 1980; Kline et al. 2006). Examples of regulatory and legislative legal actions directly targeting outdoor advertising that might be prompted or supported by the findings here include the following:

1. Limiting the amount of all outdoor advertising, regardless of content, thereby reducing the volume of ads in poorer neighborhoods. Care must be taken in how terms such as “outdoor advertising” are defined because loopholes abound. For instance, despite the moratorium by the city of Los Angeles on new billboards, we found on building exteriors in the low-income Latino neighborhood many large new ads framed to look like billboards.
2. Prohibiting or regulating the use and location of specific *types* of outdoor advertising, regardless of content, such as billboards, window signs, storefront signage, “A” frame/sandwich board signs, and pole signs.
3. Reducing the amount of all advertising, regardless of content, in or near residentially zoned areas.
4. Reaching litigation settlements or other agreements with the food industry restricting outdoor ad placement modeled on the tobacco settlement (Master Settlement Agreement § III, <http://ag.ca.gov/tobacco/pdf/1msa.pdf>).

Policy advocates also could consider a range of effect-targeted interventions that do not directly regulate commercial speech but nonetheless could serve to decrease the amount of advertising of unhealthy foods and beverages in a neighborhood. Communities have a wide array of policy tools at their disposal to regulate advertising indirectly by limiting the location and conduct of business operations. For example, each of the following policy options indirectly regulates advertising (so should not invoke First Amendment scrutiny) and is likely to withstand a legal challenge (Ashe et al. 2007):

1. Requiring restaurants to provide nutritional information next to menu items.
2. Using counteradvertising to expose the food industries’ targeting of vulnerable populations.

3. Using land-use planning to limit or eliminate specific uses of real estate, such as fast-food restaurants.
4. Levying taxes or fees on certain businesses that sell high-calorie, low nutrient–dense foods and/or beverages or on the high-calorie, low nutrient–dense products themselves to fund mitigation programs like counteradvertising campaigns, education campaigns, economic incentives for operating a healthy restaurant or grocery store in poorer neighborhoods, subsidizing parks and recreational facilities to increase opportunities for physical activity, banning the sale of high-calorie, low nutrient–dense foods and/or beverages at public facilities and other specified locations, restricting the sale of high-calorie, low nutrient–dense foods and/or beverages generally, and prohibiting nonspeech promotional activity, such as prohibiting “toy-with-purchase” giveaways with high-calorie, low nutrient–dense foods and/or beverages.

Conclusions

The findings from this study provide proof-of-concept evidence that outdoor advertising may contribute to disparities in obesity-related risk and protective behaviors and, consequently, to obesity and obesity-related chronic disease incidence and progression. They add to the growing evidence base pointing to inequities in food and beverage marketing based on the target audience’s race/ethnicity and income (e.g., Grier and Kumanyika 2008). These data are among the first to document the disproportionate exposure of low-income and ethnic minority communities to obesigenic outdoor advertising. The marketing of physical activity and sedentary goods and services, as well as its influence on consumer behavior, is strikingly understudied compared with the marketing of foods and beverages. Therefore, considerably more research is needed to fully appreciate the influence of ads on the public’s health and to identify policy and environmental intervention strategies to mitigate it. Both the replication of these cross-sectional observations and the longitudinal analyses of natural experiments arising from local policy changes increasing or decreasing obesity-related advertising exposure would be helpful in directing future research efforts. These efforts are aimed at informing candidate regulatory and legislative policy changes designed to address the contribution of marketing to racial/ethnic and

income disparities in obesity and obesity-related chronic disease risk and burden.

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