The Availability of Fast-Food and Full-Service Restaurants in the United States
Associations with Neighborhood Characteristics

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Background: Parallel to the rising obesity epidemic, food consumption patterns and household expenditures show a marked upward trend in total energy intake derived from away-from-home sources.

Methods: This study conducted cross-sectional multivariate analyses to examine associations between local-area racial, ethnic, and income characteristics and the availability of full-service and fast-food restaurants. Based on a U.S. national census of 28,050 ZIP codes that cover a population of 280,675,874 people, restaurant outlet data were linked to 2000 Census Bureau data based on ZIP code tabulation areas and analyses were undertaken using negative binomial count models and ordinary least squares regression analyses.

Results: Study results showed that higher- versus lower-income, predominantly black and racially mixed versus predominantly white and Hispanic versus non-Hispanic neighborhoods had fewer available full-service and fast-food restaurants. Near-low- and middle-income neighborhoods had the highest number of available restaurants with 1.24 and 1.22 times number of full-service restaurants and 1.34 and 1.28 times the number of fast-food restaurants compared to high-income neighborhoods. Predominantly black neighborhoods were found to have 58.2% and 59.3% of the number of full-service and fast-food restaurants available in predominantly white neighborhoods. No statistically significant differences were found in the relative availability of fast-food versus full-service restaurants by income, race, or ethnicity in the national sample used. However, across urban areas, near-low-, middle-, and near-high- versus high-income neighborhoods and predominantly black versus white neighborhoods were found to have moderately higher proportions of fast-food among total restaurants.

Conclusions: In urban areas, higher proportions of available fast-food restaurants out of total restaurants in predominantly black versus predominantly white neighborhoods may contribute to racial differences in obesity rates.
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Introduction

Recent estimates from the National Health and Nutrition Examination Survey (NHANES) 2003–2004 reveal that 66.3% of the United States adult population is overweight and close to one third are obese.[1] The prevalence of overweight among children and adolescents (age- and gender-specific body mass index [BMI] ≥95th percentile) has reached 11.5%, 17.7%, and 17.3% among children aged 2–5 years, 6–11 years, and 12–19 years, respectively.[1] The data also show that overweight and obesity do not affect all populations equally, with higher rates generally found for non-Hispanic black persons and Mexican Americans compared to whites.

Parallel to the rising obesity epidemic, data based on nationwide surveys of food consumption patterns and household expenditures show a marked upward trend in total energy intake derived from away-from-home sources, in particular fast-food outlets.[2–4] Several studies have shown that fast-food consumption is associated with higher total energy intake and higher intake of fat, saturated fat, carbohydrates, sugar, and carbonated soft drinks, and lower intake of micronutrients and fruits and vegetables.[5–12] Further, studies have found significant associations between fast-food consumption and increased BMI,[6] increased body weight,[7] and a higher probability of being overweight.[11] However, the relationship between fast-food restaurant availability and weight outcomes is mixed.[13–15]

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An emerging body of literature suggests that the availability of local-area restaurants and fast-food restaurants is associated with the racial and socioeconomic composition of the neighborhood, but there is no consensus in terms of reported findings. Based on a sample drawn across four states, Morland et al.[16] found that full-service restaurants were 2.4 times as prevalent in predominantly white neighborhoods and 3.4 times more prevalent in racially mixed neighborhoods compared to predominantly black neighborhoods. Fast-food restaurants were found to be 1.5 times as prevalent in white neighborhoods and 2.3 times as prevalent in racially mixed neighborhoods compared to predominantly black neighborhoods. Block et al.[17] examined fast-food restaurant density for 156 census tracts within the city limits of New Orleans LA and found that larger numbers of fast-food restaurants were available in census tracts with higher proportions of black residents.

By income, Morland et al.[16] found fast-food restaurants to be more prevalent in neighborhoods that fell into the second- and middle-income quintiles. Lewis et al.[18] found that, in South Los Angeles, less affluent neighborhoods had significantly higher proportions of fast-food restaurants (25.6%) compared to more affluent areas (11.2%). Their results also showed that the availability of healthy options both in terms of preparation methods and by menu choice was significantly higher in more affluent areas compared to their less affluent counterparts. Reidpath et al.[19] found that across four income categories, persons living in Australia in postal districts with the lowest individual median weekly incomes had 2.5 times the exposure to fast-food restaurants compared to those living in districts with the highest incomes. However, in a recent study based on data from Glasgow Scotland, Macintyre et al.[20] found that the likelihood of the presence of an out-of-home eating outlet was lower in deprived neighborhoods.

Systematic differences by race, ethnicity, or income levels in the local-area availability of full-service and fast-food restaurant options may put different groups at different levels of risk for sustaining a healthy diet. Based on a national sample (full census excluding ZIP codes that are P.O. boxes and those with a population of less than 300) of 28,050 ZIP codes in the U.S. that cover a population of 280,675,874 people, this study used multivariate analyses that controlled for population, urbanization, and region to examine associations between local-area racial, ethnic, and income characteristics and the availability of full-service and fast-food restaurants. This study also examined the extent to which the proportion of available fast-food restaurants out of the total number of available restaurants differed by community characteristics.

Methods

Restaurant Outlet Measures

Data on full-service and fast-food restaurant outlets were drawn from a national business list developed by Dun and Bradstreet (D&B).[21] This list was obtained through the use of D&B MarketPlace software. MarketPlace contains information on more than 14 million businesses in the U.S. and uses the following sources to help update its database quarterly: telecenters to update and verify their data; Yellow Page directories that are matched against its database to identify new businesses; news and media sources that are monitored daily to identify businesses that have merged, been acquired, closed, or claimed bankruptcy; government registries to identify business registration information; and, websites, including its own where businesses have the ability to review and update their own information. D&B utilizes "match grade" technology to consolidate multiple business listings into one complete record. This matching technology ensures that there are no duplicate entries of the same business and that data are not matched to the wrong business. D&B also assigns each business a unique numerical identifier to ensure validity of its data over time. This nine-digit number is never recycled and allows D&B to easily track changes and updates for all businesses contained in its database. MarketPlace allows sorting by multiple criteria such as ZIP code and Standard Industry Classification (SIC) codes with SIC code searches for specific types of businesses available at varying levels of specificity. This study drew on the primary SIC code listing in creating the list of outlets used for this analysis.

Restaurant outlet data for the year 2000 available from D&B under the 4-digit classification of "Eating Places" were used. Fast-food restaurants were defined by the full set of 8-digit SIC codes (excluding coffee shops) that fell under "fast-food restaurants and stands" plus the two 8-digit SIC codes for chain and independent pizzerias. Nonfast–food restaurants, referred to as full-service restaurants, were defined as the total number of "Eating Places" minus fast-food restaurants and excluding coffee shops; ice cream, soft drink and soda fountain stands; caterers; and contract food services. A total of 259,182 full-service restaurants and 69,219 fast-food restaurants were retrieved from the D&B database.

Across the 28,050 ZIP codes in the sample, approximately 78% of ZIP codes had at least one restaurant. The sample of 21,976 ZIP codes with at least one restaurant was used in the analyses that examined fast-food restaurant availability as a proportion of total restaurants. Table 1 shows that ZIP codes had, on average, 12.9 restaurants of which 2.5 (or 19.1%) were fast-food restaurants and 10.4 were full-service restaurants.

Census Bureau Population, Socioeconomic Status (SES), and Control Measures

Census Bureau neighborhood population and socioeconomic data along with measures of urbanization and region were matched to the outlet density data for each of the 28,050 ZIP codes based on census ZIP code tabulation areas.[22,23] The ZIP code sample represented in this study was the full census of ZIP codes excluding postal office box addresses and ZIP codes that had a population of fewer than 300 people (the sample of 28,050 ZIP codes accounted for 99.8% of the U.S.

Table 1. Summary statistics: outcome variables

	Mean number of outlets		
	Total restaurants	**Full-service restaurants**	**Fast-food restaurants**
Full sample (N=28,050)	12.9046 (21.0710)	10.4369 (17.4011)	2.4677 (4.2141)

	Proportion of fast-food restaurants out of total restaurants	
	All ZIP codes (N=21,976)	**Urban areas ZIP codes (N=4,272)**
Sample of ZIP codes that have at least one restaurant	0.1550 (0.1827)	0.1931 (0.1187)

Notes: Standard deviations are shown in parentheses.

population). The following variables were drawn from the 2000 Census.

Race/ethnicity. Racial composition of the ZIP code was defined by three categories: predominantly white (population of 70% or greater white), predominantly black (population of 70% or greater black), or racially mixed (population less than 70% white and less than 70% black). Ethnicity was defined by a dichotomous variable of predominantly Hispanic if the ZIP code had a Hispanic population of ≥70%. In the ZIP codes used in this study, the majority (75%) of the U.S. population base was white, while African Americans made up about 12% of the population. On average, 12.5% of the population was Hispanic. Table 2 shows that approximately 69% of ZIP codes had a predominantly white population, 4% had a predominantly black population and 28% were racially mixed. Among all ZIP codes, 3% were predominantly Hispanic.

Income. The income variable was defined by median household income. Dichotomous indicators were created for each

income quintile category. Table 2 shows that median household income averaged about $45,000 across ZIP codes. Across the 28,050 ZIP codes, the income quintiles had the following income cut-offs: low income (less that $29,066), near-low income (≥$29,066 and <$34,291), middle income (≥$34,291 and <$40,049), near-high income (≥$40,049 and <$49,905), and high income (≥$49,905). Note that the income quintile cut-off values differed for the subsample of ZIP codes with a positive number of restaurants.

Control variables. For each ZIP code, total population size was included. ZIP codes were populated, on average, by about 10,000 people. In addition, for each ZIP code, a variable was added to describe its degree of urbanization. In the Census 2000, urban areas were defined by two types—urbanized areas and urban clusters. Urbanized areas were defined by an urban nucleus of 50,000 or more people with a population density of 1000 persons per square mile. Urban clusters consisted of densely settled areas with a population of at least 2500 but less than 50,000 persons. The remaining non-urban areas were defined as rural nonfarm and rural farm per the census farm definition. In this paper, these definitions were used to create four urbanization categories: urban (urbanized area), suburban (urban cluster), rural (rural nonfarm), and farm (rural farm). These variables were defined by the percentage of the ZIP code's population that fell into each category based on aggregations of block groups and census blocks. Finally, region (South, West, Midwest, and Northeast) was also controlled.

Analysis

Multivariate analyses were used to examine the availability of full-service and fast-food restaurants and associations with neighborhood characteristics on race, ethnicity, and income, with additional controls for population size, urbanization, and region. Given the count nature of the outlet density

Table 2. Summary statistics of census variables

		Sample of ZIP codes that have at least one restaurant	
Variables	**Full sample**	**All ZIP codes**	**Urban area ZIP codes**
Median household income[a] (in $1,000)	44.83 (17.12)	44.99 (17.14)	45.52 (18.42)
Race[a] %			
Predominantly white	69.0	68.7	50.8
Predominantly black	3.5	3.6	7.5
Racially mixed	27.5	27.7	41.8
Ethnicity[a] (predominantly Hispanic) %	2.8	2.9	4.5
Population	10,006.27 (13,423.91)	12,391.94 (14,231.46)	25,046.53 (17,205.68)
Urbanization %			
Urban	29.9	36.8	—
Suburban	9.7	11.6	—
Rural	56.1	48.3	—
Farm	4.3	3.3	—
Region %			
Northeast	18.3	19.5	29.9
Midwest	30.7	29.8	20.9
South	35.2	34.0	29.0
West	15.9	16.6	20.2
Number of ZIP codes (N)	28,050	21,976	4,272

Notes: Standard deviations are shown in parentheses.
[a]Variables are population weighted.

dependent variables, negative binomial count models were estimated to examine the association between the number of available restaurant outlets and the racial, ethnic, and SES composition of the ZIP code, including the additional control variables. All variables were included in the regression models simultaneously. Poisson models were also estimated, but due to the overdispersion of the data, the negative binomial models were more appropriate. Next, a multivariate ordinary least squares (OLS) regression model was estimated to examine similar associations with the proportion of fast-food restaurants out of total restaurants in the ZIP code. These latter OLS models were estimated for the full sample and the urban subsample. To further assess the findings, simulations of the relative availability of fast-food restaurants based on the significant OLS regression results were performed for communities with different racial compositions and income levels.

Results

The results from the multivariate analyses on the availability of full-service and fast-food restaurants are presented in Table 3. The results show that compared to high-income neighborhoods, ZIP codes falling into lower-income quintiles had more restaurants, in particular for near-low- and middle-income neighborhoods. Compared to high-income neighborhoods, full-service restaurants were 1.24 and 1.22 times more readily available in near-low- and middle-income neighborhoods, respectively. Similar patterns were found for fast-food restaurants. The number of available fast-food restaurants was 1.19, 1.28, 1.34, and 1.24 times greater

in near-high-, middle-, near-low- and low-income neighborhoods compared to their high-income counterparts. These results are consistent with findings from earlier studies for limited geographic areas.[16,18,19]

Controlling for all other variables, there were significant differences in restaurant availability by the racial composition of the neighborhood. The availability of full-service and fast-food restaurants in predominantly black neighborhoods was 58.2% and 59.3%, respectively, of that in predominantly white neighborhoods. Racially mixed neighborhoods also had significantly fewer restaurants of both types, but to a lesser degree than predominantly black neighborhoods. These results are similar to the findings by Morland et al.[16] who found fewer available full-service and fast-food restaurants in predominantly black versus predominantly white neighborhoods. However, the results in the present study differ from the findings by Block et al.[17] who found greater availability of fast-food restaurants in census tracts with higher proportions of black residents. However, the mean percentage of black residents in the census tracts examined in the Block et al.[17] study was 60.6%, almost five times the national average and while their geographic sample was restricted to reflect an urban and residential area, their regression model did not explicitly account for population size.

By ethnicity, there were significantly fewer restaurants available in predominantly Hispanic neighborhoods, which had 60.9% the number of available

Table 3. Availability of full-service and fast-food restaurants

	Negative binomial regression: incidence-rate ratios (95% CI)		OLS regression: proportion of fast-food restaurants out of total restaurants (SE)	
	Full-service restaurants	Fast-food restaurants	All ZIP codes	Urban area ZIP codes
Income				
Low	1.1203** (1.076, 1.167)	1.235** (1.175, 1.297)	0.006 (0.004)	0.010 (0.006)
Near low	1.236** (1.189, 1.284)	1.336** (1.275, 1.399)	0.004 (0.004)	0.023** (0.006)
Middle	1.223** (1.178, 1.269)	1.278** (1.224, 1.335)	0.002 (0.004)	0.020** (0.006)
Near high	1.145** (1.105, 1.186)	1.194** (1.147, 1.243)	0.005 (0.004)	0.012* (0.006)
Race				
Predominantly black	0.582** (0.535, 0.632)	0.593** (0.541, 0.650)	0.010 (0.009)	0.028** (0.008)
Mixed races	0.899** (0.870, 0.929)	0.891** (0.859, 0.925)	0.005 (0.004)	−0.004 (0.004)
Ethnicity (predominantly Hispanic)	0.609** (0.553, 0.671)	0.558** (0.501, 0.622)	−0.015 (0.010)	0.001 (0.011)
Population (in 1000s)	1.049** (1.047, 1.050)	1.047** (1.046, 1.048)	0.001** (0.0001)	0.0001 (0.0001)
Urbanization				
Suburban	1.344** (1.282, 1.409)	1.768** (1.679, 1.862)	0.040** (0.005)	—
Rural	0.215** (0.207, 0.224)	0.142** (0.135, 0.150)	−0.074** (0.004)	—
Farm	0.004** (0.003, 0.005)	0.0003** (0.0002, 0.0006)	−0.318** (0.025)	—
Region				
Midwest	0.979 (0.945, 1.014)	1.284** (1.230, 1.341)	0.036** (0.004)	0.066** (0.005)
South	0.986 (0.955, 1.019)	1.434** (1.378, 1.492)	0.042** (0.004)	0.060** (0.005)
West	1.052 (1.013, 1.093)	1.069** (1.021, 1.119)	0.007 (0.004)	0.020** (0.005)
Constant	—	—	0.155** (0.004)	0.143** (0.005)
Number of observations	28,050	28,050	21,976	4,272

Note: For the negative binomial regressions, this table reports estimated coefficients (β_i) transformed to incidence-rate ratios (e^{β_i}).
*statistical significance at the 5% level; **statistical significance at the 1% level.
CI, confidence interval; OLS, ordinary least squares; SE, significant error.

full-service restaurants and 55.8% the number of fast-food restaurants compared to non-Hispanic neighborhoods. Suburban neighborhoods had 1.34 times the number of full-service-restaurants and 1.77 times the number of fast-food restaurants compared to urban areas. As expected, rural and farm areas had substantially fewer available restaurants compared to urban areas.

Turning to the relative availability of fast-food restaurants, the results from the OLS regressions on the proportion of fast-food restaurants among total restaurants for the full sample and for the subsample of ZIP codes in urban areas are presented in the last two columns of Table 3. Focusing first on the full sample, the regression estimates revealed no significant differences in the relative availability of full-service and fast-food restaurants by income, race, or ethnicity. However, turning to the results for ZIP codes in urban areas only, the regression estimates showed significant differences in the relative availability of fast-food restaurants by the racial and SES composition of the neighborhood. The results showed that near-low-, middle-, and near-high-income neighborhoods had a statistically significantly higher proportion of fast-food restaurants compared to their high-income counterparts. By race, while predominantly black neighborhoods were found to have significantly fewer restaurants of all types in urban areas (not shown in the tables for the urban sample), such predominantly black urban neighborhoods had a statistically significantly higher proportion of fast-food restaurants among all available restaurants compared to predominantly white urban neighborhoods. The relative availability of fast-food restaurants, however, was not found to differ statistically significantly across racially mixed versus white neighborhoods or predominantly Hispanic versus nonpredominantly Hispanic neighborhoods.

On the basis of the significant regression coefficient estimates in the urban sample, a series of simulations were undertaken in which differences in the proportion of fast-food restaurants among total restaurants were examined according to different neighborhood income and racial characteristics. Evaluated at the mean, the model predicted the relative availability of fast-food restaurants among total restaurants to be 19.31%. Examining differences across income, the relative availability of fast-food restaurants among total restaurants increased moderately by 12.6% when moving from a high-income neighborhood (18.00%) to a near-low-income (20.27%) community. The proportion of fast-food restaurants out of total restaurants increased by 14.3% when moving from a predominantly white neighborhood (19.27%) to a predominantly black neighborhood (22.03%). Simulations of moving from a high-income and predominantly white neighborhood to a near-low-income and predominantly black neighborhood showed that the proportion of

fast-food restaurants increased by 28.0% (from 17.96 to 22.99%).

Discussion

Based on the national analysis of restaurant availability in all ZIP codes with a population greater than 300, this study found that high-income neighborhoods had fewer numbers of available full-service and fast-food restaurants compared to all other lower income categories. Near-low- and middle-income neighborhoods were found to have the highest number of available restaurants with 1.24 and 1.22 times the number of full-service restaurants and 1.34 and 1.28 times the number of fast-food restaurants compared to high-income neighborhoods. By race and ethnicity, predominantly black neighborhoods and racially mixed versus white and Hispanic versus non-Hispanic neighborhoods were found to have significantly fewer restaurants of all restaurant types. In particular, predominantly black neighborhoods were found to have only 58.2% and 59.3%, respectively, of the number of available full-service and fast-food restaurants in predominantly white neighborhoods. Predominantly Hispanic neighborhoods had 60.9% and 55.8% the number of available full-service and fast-food restaurants compared to non-Hispanic neighborhoods. No statistically significant differences were found in the relative availability of fast-food versus full-service restaurants by income, race, or ethnicity in the national sample.

However, moderate differences were found to exist in the relative availability of fast-food versus full-service restaurants in the subsample of urban ZIP codes; near-low, middle-, and near-high- versus high-income neighborhoods and predominantly black versus white neighborhoods were found to have higher proportions of fast-food restaurants among total restaurants. The latter findings based on the urban subsample that predominantly black neighborhoods have a higher proportion of fast-food restaurants may compound barriers shown to exist in accessing healthful foods due to the differential availability of food stores by race. Several studies have found that neighborhoods with higher proportions of black residents had fewer available supermarkets,[16,24–26] which, compared to smaller grocery stores and convenience stores, have been shown to offer more healthful foods.[27,28]

The study is subject to several limitations: First, it is cross-sectional, and the reported associations do not account for potential selection effects. Second, the reported associations do not account for potential differences in zoning across ZIP codes. Third, the study is subject to measurement error due to potential inaccuracies in the commercial outlet density data. And fourth, ZIP code area outlet density data were matched with census-derived ZIP code tabula-
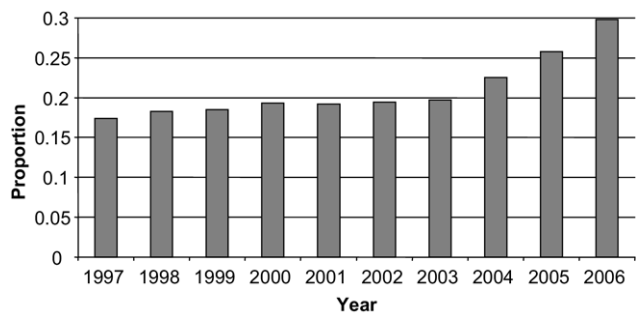
Figure 1. Proportion of fast-food restaurants out of total restaurants, 1997–2006. Data Source: D&B Marketplace 1997–2006. Authors' calculations based on restaurant definitions used in this study.

tion area data which may result in potential spatio-temporal mismatches.[29]

Based on the restaurant definitions used in the study, the number of fast-food restaurants in the U.S. doubled over the last decade while the number of full-service restaurants remained relatively constant. Figure 1 shows the related increase in the proportion of fast-food restaurants among total restaurants based on D&B outlet density data from 1997 to 2006. Nationally, in 2006, fast-food restaurants made up roughly 30% of all restaurants, up from 17% in 1997, an increase of 71%. Most of this increase has occurred in the last 3 years. This dramatic increase in the absolute and relative availability of fast-food restaurants may be associated with increased fast-food consumption and lower-quality diets for the population as a whole. The extent to which recent increases in the availability of fast-food restaurants differ by income and race warrants continued investigation. Further, the question of causality in the association between access to fast-food restaurants and diet and weight outcomes remains an important area for future research.

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