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Proximity to Fast-Food Outlets and Supermarkets as Predictors of Fast-Food Dining Frequency

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ABSTRACT

Background This study used cross-sectional data to test the independent relationship of proximity to chain fast-food outlets and proximity to full-service supermarkets on the frequency of mealtime dining at fast-food outlets in two major urban areas, using three approaches to define *access*. Interactions between presence of a supermarket and presence of fast-food outlets as predictors of fast-food dining were also tested.

Methods Residential intersections for respondents in point-of-purchase and random-digit-dial telephone surveys of adults in Philadelphia, PA, and Baltimore, MD, were geocoded. The count of fast-food outlets and supermarkets within quarter-mile, half-mile, and 1-mile street network buffers around each respondent's intersection was calculated, as well as distance to the nearest fast-food outlet and supermarket. These variables were regressed on weekly fast-food dining frequency to determine whether proximity to fast food and supermarkets had independent and joint effects on fast-food dining.

Results The effect of access to supermarkets and chain fast-food outlets varied by study population. Among telephone survey respondents, supermarket access was the only significant predictor of fast-food dining frequency. Point-of-purchase respondents were generally unaffected by proximity to either supermarkets or fast-food outlets. However, $\geq$1 fast-food outlet within a 1-mile buffer was an independent predictor of consuming more fast-food meals among point-of-purchase respondents. At the quarter-mile distance, $\geq$1 supermarket was predictive of fewer fast-food meals.

Conclusions Supermarket access was associated with less fast-food dining among telephone respondents, whereas access to fast-food outlets were associated with more fast-food visits among survey respondents identified at point-of-purchase. This study adds to the existing literature on geographic determinants of fast-food dining behavior among urban adults in the general population and those who regularly consume fast food.

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OBESITY PERSISTS AT EPIDEMIC LEVELS ACROSS THE United States and worldwide.[1,2] Obesity results from an energy imbalance that is largely determined by dietary intake, eating behaviors, and physical activity patterns.[3-8] Obesogenic behaviors (including eating behaviors) are believed to be affected by the environments in which people live and as such many research efforts have focused on the characteristics of the food environment—such as fast-food outlets and supermarkets—to understand more fully its role in food purchasing and consumption.[9-15]

Evidence on the relationship between fast-food dining and fast-food access has so far been equivocal. For instance, He and colleagues[16] found that closer proximity to the nearest fast-food outlet increased the likelihood of purchases at these establishments and that a higher density of fast-food outlets was associated with increased fast-food dining. Likewise, Burgoine and colleagues[17] found that people who have greater access to fast food or "take-away" restaurants near home, work, and along their commute are more likely to consume fast food for meals. Other researchers have found that fast-food restaurant density was not predictive of fast-food purchasing.[18-20]

As with fast-food restaurant availability and fast-food meals, the relationship between proximity to supermarkets and dietary behaviors is not consistent in the literature. On balance, supermarket availability appears to be associated with lower body mass index (BMI), due in part to increased intake of healthier food items such as fresh produce, whole grains, dairy, and unprocessed meats.[21] Supermarket access allows residents to more easily purchase ingredients for food preparation and may, therefore, prompt a shift away from fast-food dining toward home-prepared meals. However, little research has explored whether access to supermarkets has a direct effect on fast-food dining frequency, or whether supermarkets can attenuate the effect that proximity to

fast-food outlets appears to have in some cases on fast-food dining.

The inconsistencies in the literature on associations of food environments with obesity-related behaviors (including fast-food dining) may arise from different approaches to operationalizing geographic proximity, such as Euclidean (ie, as the crow flies) vs street network distances, which represent the pathways individuals would travel from home, school, or work to a fast-food establishment. Fast-food density (ie, number of outlets within a distance or area), diversity of fast-foods available within a select distance, and distance to nearest outlet are just a few of the ways in which access can be represented—but from the accumulated literature it is not clear which measure matters, and in what contexts.

Given the uncertain influence of fast-food access on fast-food dining, meaning meals (not snacks) consumed at or purchased from fast-food restaurants, and little evidence on supermarkets' direct or indirect influence on fast-food dining frequency, we sought to test a series of hypotheses using different definitions of *access* to fast-food outlets and supermarkets. Three hypotheses were tested: proximity to fast-food outlets increases fast-food dining frequency, proximity to full-service supermarkets decreases the frequency of mealtime dining at fast-food outlets, and presence of a supermarket reduces the association between fast-food outlet access and fast-food mealtime dining frequency.

METHODS

Data

Data for this analysis were originally collected to test the effect of calorie labeling on fast-food purchasing among adults (aged 18 years and older) in Philadelphia, PA, using Baltimore, MD, as a comparison community.[22] Data were collected via point-of-purchase surveys at fast-food restaurants in Baltimore and Philadelphia to capture receipt-level data on food purchases before and after labeling. A second, random-digit-dial telephone survey of Baltimore and Philadelphia residents was also completed to estimate population-based fast-food consumption patterns. In both surveys, respondents reported how frequently they dined at fast-food outlets for meals and snacks; demographic information such as age, sex, race and ethnicity; and the cross streets nearest their home address. Information on study design and survey development is reported elsewhere.[22] The first wave of data collection was in December 2009; the second was completed in June 2010, after calorie labeling was implemented in Philadelphia. The New York University School of Medicine Institutional Review Board approved the study protocol and all participants provided written informed consent at the point of purchase for the in-person interview. Participants contacted during the random-digit-dial telephone surveys provided verbal informed consent at the outset of the telephone call.

Over the course of the study, responses were collected from 5,361 respondents: 2,435 (45%) were point-of-purchase surveys and 2,926 (54.6%) were telephone surveys. Of these, 4,203 (78.4%) had viable intersections for geocoding and 3,335 (62.2%) were located within the city limits of Philadelphia or Baltimore. Our analyses were constrained to respondents within city boundaries because food outlet data were only available for restaurants and supermarkets in the city limits. In all, 3,240 observations (60%) had values for weekly fast-food dining frequency and all predictor variables and were used in the analysis. Of these, 49.3% were telephone survey respondents and 50.7% were point-of-purchase respondents.

Data on fast-food outlets and supermarkets in 2011 were purchased from InfoUSA.[23] Although survey collection preceded the dates of fast-food outlet and supermarket data, this analysis is restricted to large fast-food chains that typically have lower rates of turnover; supermarkets, likewise, are less likely to turn over quickly. Therefore, the InfoUSA data compose a reasonable picture of the food environment at the time of the surveys. Fast-food outlets were initially defined as the top-20 quick-service restaurants in 2010, based on data reported by Technomic, a food industry research and consulting firm.[24] Of the top 20, we selected those that had the following Standard Industrial Classification codes as their primary industry classification: 581208 (restaurant), 581206 (carry-out), and 581222 (pizza), resulting in a list of 16 large-chain fast-food outlets. Of these, two did not have outlets in Baltimore or Philadelphia, resulting in a total of 14 chains represented in our analyses: McDonald's, Subway, Burger King, Wendy's, Taco Bell, Pizza Hut, KFC, Arby's, Chick-Fil-A, Domino's Pizza, Papa John's Pizza, Quizno's, Hardee's, and Popeye's Louisiana Kitchen.

The analyses focus on chain-style fast-food restaurants because the survey question in both point-of-purchase and telephone questionnaires specifically asked about these kinds of establishments: "In the past 7 days, how many times did you eat [breakfast/lunch/dinner/snack] that came from any of the big chain fast-food restaurants?" Supermarkets were identified by Standard Industrial Classification code 541105 and restricted to those with sales volume >$2,000,000 annually to exclude small, specialty, or bodega-style supermarkets.[25-27] Any outlet that was designated as a distribution center or headquarters was also excluded.

Geocoding

Home intersections were geocoded with ArcGIS (version 9.3, 2012, ESRI). Because InfoUSA data only included supermarket and fast-food outlet locations within the cities of Baltimore and Philadelphia, the analysis dataset included only respondents whose intersections fell within the city limits. Network distances to the nearest fast-food outlets and supermarkets, as well as network buffers at one-quarter mile, half-mile, and 1-mile distances, were then calculated. These distances were selected as reasonable walking distances for food shopping, approximately one-half mile approximating the mean distance walked for food shopping per the 2009 National Household Transportation Survey. In line with previous research, a distance of 1 mile was included as the maximum probable walking distance for food shopping.[28]

Models

Dependent Variable. Weekly fast-food dining frequency for meals was selected as the dependent variable (possible range=0 to 21). Data were collected via an in-person or telephone survey, and respondents were asked how frequently they dined at fast-food outlets for breakfast, lunch, dinner, and snacks. Frequency was reported as daily, weekly, or monthly by respondents, but was converted to weekly