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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 (1) proximity to chain fast food outlets and (2) proximity to full-service supermarkets on the frequency of meal-time 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 and Baltimore were geocoded. The count of fast food outlets and supermarkets within quarter-mile, half-mile, and one-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 if 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, 1 fast food outlet within a 1-mile buffer was an independent predictor of more fast food meals among point-of-purchase respondents. At ¼-mile distance, 1 supermarket was predictive of fewer fast food meals.

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Competing Interests

The authors have no competing interests to declare.

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Conclusions—Supermarket access was associated with less fast food dining among telephone respondents while 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.

BACKGROUND

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 thought 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 et al.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 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.¹⁷ 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, however, supermarket availability appears to be associated with lower 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 if 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 (“as the crow flies”) versus street network distances, which represent the pathways individuals would travel from home, school, or work to a fast food establishment. Fast food density (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 impact 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 impact on fast food dining frequency, this paper sought to test a series of hypotheses using different definitions of "access" to fast food outlets and supermarkets. Three hypotheses are tested: (1) proximity to fast food outlets increases fast food dining frequency; (2) proximity to full-service supermarkets decreases the frequency of meal-time dining at fast food outlets; and (3) presence of a supermarket reduces the association between fast food outlet access and fast food meal-time dining frequency.

METHODS

Data

Data for this analysis were originally collected to test the effect of calorie labeling on fast food purchasing among adults (age 18+) in Philadelphia, Pennsylvania, using Baltimore, Maryland as a comparison community.²² Data were collected via point-of-purchase surveys at fast food restaurants in Baltimore and Philadelphia in order to capture receipt level data on food purchases pre- and post-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/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, as food outlet data was only available for restaurants and supermarkets in the city limits. In all, 3,240 (60%) of observations had values for weekly fast food dining frequency and all predictor variables and were used in the analysis, 49.3% of these were telephone survey respondents and 50.7% point-of-purchase respondents.

Data on fast food outlets and supermarkets in 2011 were purchased from InfoUSA.²³ Though 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 composes 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 (SIC) 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 as 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 SIC code 541105 and restricted to those with sales volume greater than \$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).²⁸ Because InfoUSA data only included supermarket and fast food outlet locations within the cities of Baltimore and Philadelphia, the analysis data set 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 ¼ mile, ½ mile, and 1 mile distances, were then calculated. These distances were selected as reasonable walking distances for food shopping, ~0.5 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.²⁹

Models

Dependent variable—Weekly fast food dining frequency for meals was selected as the dependent variable (possible range: 0–21). 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 estimates for analysis. Visits to fast food outlets for snacks were omitted from the calculation, as the hypotheses were focused on fast food dining as a replacement for meals prepared at home.

Independent variables—The latitude and longitude of chain fast-food outlets and full-service supermarkets were plotted and fast food and supermarket access was calculated in three ways:

- Outlet density:³⁰ Count of outlets within ¼-mile, ½-mile, and 1-mile network buffers around respondent's intersection.
- Presence of outlet:³¹ Indicator variable represents 1 outlet within ¼-mile, ½-mile, and 1-mile network buffers. We dichotomized the outlet density measure to represent presence/absence of outlets at our three distances, because outlet density values were highly skewed.

- Street network distance to nearest outlet.³² Given a degree of skewness in this variable, it was also tested as a categorical variable, representing quintiles of distance to the nearest outlet.

Covariates—The following covariates were included in our models: time period (i.e., whether respondent was surveyed before or after calorie labeling was introduced in Philadelphia), gender, race (African-American, other), age (years, centered on age 18), education (≤ high school diploma, > high school), all of which have been shown to be associated with fast food dining frequency. Respondent intersections were also mapped to 2010 census tracts, and data on tract level poverty and population density were accessed from the 2010 Decennial Census.³³

Data analyses

Three sets of models were run, one for each approach to representing access to food outlets. In each set of models, the independent effects of fast food access and supermarket access were first tested, and their respective effects when both predictors were in the model. In the models using indicator variables to represent access, the models also included an interaction term to explore whether presence of both fast food outlets and supermarkets had a combined effect on fast food dining frequency.

There was a marked difference in fast food dining frequency between telephone survey and point-of-purchase survey respondents. As the survey samples represented two groups with distinct dining patterns, the relationship between the independent variables of interest—fast food and full-service supermarket access—and fast food dining frequency were done by method of collection: point-of-purchase versus telephone surveys.

Models included covariates as previously described. Tertiles of census tract population density and poverty were insignificant in multivariate analysis and were not used in the final models. Data analysis was completed in SAS version 9.3 using the GENMOD procedure.³⁴ The negative binomial distribution produced the best model fit, and was used in all final models.

RESULTS

Descriptive statistics

The samples resulting from the telephone survey and point-of-purchase survey were markedly different. Survey respondents identified at restaurant point-of-purchase were younger (39.5 vs. 45.3 years), had lower levels of education (19% vs. 11% without high school diploma), were overwhelmingly male (61% vs. 34%), and predominantly African-American (74% vs. 50%). Point-of-purchase survey respondents consumed, on average, 5.3 fast food meals a week, compared to 1.4 fast food meals among the telephone survey respondents. All differences were significant at the $p < 0.0001$ level (Table 1). It is unsurprising that respondents in the point-of-purchase survey had higher frequency of fast food dining, as they were identified exiting a fast food restaurant; frequent visitors to fast food chains were therefore likely to be over represented in our sample. The telephone

survey, designed to provide a population-level estimate of fast-food dining behaviors, appears to over represent female respondents.

Looking across data from both surveys, increasing age was associated with decreased frequency of dining at fast food; 18–24 year olds ate 1.6 more meals per week at fast food outlets compared to respondents aged 50 years and older (4.3 versus 2.7). Women dined at fast food outlets 2.5 times per week, compared to 4.2 fast food meals for men. Respondents with a high school diploma or less ate 1.6 more fast food meals per week compared to respondents with some education post-high school. African-American respondents ate 1.4 more meals per week at fast food outlets relative to other respondents. Baltimore respondents dined at fast food outlets more than Philadelphia residents and, finally, point-of-purchase survey respondents were much more likely to report dining at fast food restaurants, with 3.9 more meal-time visits to fast food outlets per week relative to telephone survey respondents. All these findings were statistically significant at the $p < 0.001$ (results not shown).

Telephone Survey Respondents

COUNT OF OUTLETS: For telephone survey respondents, only count of supermarkets was a significant predictor of fast food dining frequency. The number of supermarkets within a specified distance of the nearest intersection reduced the frequency of weekly fast food meals among these respondents, but the effect decreased as the distance increased. Each additional supermarket within a 1/4-mile buffer reduced fast food dining by 18%, or ~1 fewer fast food meals per month, on average. Within a 1/2-mile buffer, each additional supermarket reduced fast food meals by 11.2%, and in the 1-mile buffer, fast food meals declined by 4.6% for each supermarket. Once count of fast food outlets was controlled for, number of supermarkets was significant only in the 1/4-mile and 1/2-mile buffers (Table 2).

PRESENCE/ABSENCE OF OUTLETS: For telephone survey respondents, presence of a fast food outlet was not predictive of fast food dining frequency at any buffer size, and presence of a supermarket predicted weekly fast food dining only within the 1/2-mile buffer. Having a supermarket within a 1/2 mile distance of nearest residential intersection reduced fast food dining frequency by 17.3% among telephone respondents (~1 meal per month on average). When controlling for the presence of a fast food outlet, having at least one supermarket reduced fast food meals by 15.5%. Including an interaction term between our indicator variables for fast food and supermarket outlets resulted in non-significant coefficients for all three predictors (Table 3).

DISTANCE TO NEAREST: Among telephone survey respondents, only distance to nearest supermarket was predictive of fast food dining: each mile increase in distance to a supermarket was associated with a 29.9% increase in fast food meals per week; on average < 0.5 meal per week (Table 4). When distance was converted to a categorical measure (quintiles), only the highest quintile (distance > 0.87 miles) had a significant coefficient, representing a 42% increase in fast food meals per week, relative to respondents living < 0.3 miles from a supermarket (Table 5). Although distance to nearest chain fast food restaurant was not predictive of fast food meals, it was significant when converted to quintiles. When

looking at quintiles of distance to the nearest chain fast food restaurant, respondents who lived 0.23–0.4 miles from a fast food outlet ate 23.2% fewer fast food meals relative to respondents living < 0.23 miles from a fast food outlet.

Point of Purchase Survey Respondents

PRESENCE/ABSENCE OF OUTLETS: For point-of-purchase respondents, neither the count of fast food outlets nor the count of supermarkets was significant at the $p = 0.05$ level across the three buffer sizes. However, having at least one chain fast food restaurant within a mile was associated with a 21.2% increase in frequency of fast food meals (~1 meal per week). After controlling for supermarkets, the presence of a fast food outlet predicted a 22.4% increase in fast food dining. Once the interaction term was included, none of the predictors were significant (Table 3).

In general, the interaction term between supermarkets and fast food restaurants had no effect on weekly fast food meals. However, when all three variables (1 supermarket, 1 fast food outlet, interaction term) were included in the 1/4-mile model for point-of-purchase respondents, the coefficients for supermarkets and their interaction with fast food were significantly associated with fast food meals. In this model, 1 supermarket was associated with an 18.2% decrease in fast food dining frequency, or almost 1 fewer meals per week on average. When there was also at least one fast food chain, there was a 37.9% increase in fast food dining frequency (~2 meals per week). Fast food outlets among this population have an antagonistic relationship with supermarkets as related to fast food dining frequency.

Among point-of-purchase respondents, distances to nearest supermarket or nearest fast food outlet were not associated with weekly fast food meals (results not shown).

DISCUSSION

The study found that, among a sample of urban adults in Philadelphia and Baltimore contacted via a random digit dial survey, access to supermarkets was associated with a minor reduction in fast food dining frequency. In this population, access to chain fast food outlets appeared to be insignificant as a predictor of weekly fast food meals. However, among point-of-purchase respondents—who tend to dine often at fast food places—neither number of outlets or distance to outlets (supermarkets or chain fast food) had a significant effect on fast food dining frequency. Once the explanatory variables were converted to indicator measures (presence/absence of an outlet), only the presence of a fast food chain outlet within a 1 mile buffer had an independent, positive association with weekly fast food meals among point-of-purchase survey respondents. Interestingly, within the smallest buffer (1/4 mile), supermarkets had a negative association with fast food dining frequency, when controlling for presence of fast food outlets and the interaction between supermarkets and fast food. The interaction term was also significant, leading to a net increase in fast food meals when respondents had both a supermarket and fast food outlet within a 1/4 mile from their home.

Changes in fast food dining frequency are of significance given the association between fast food dining and overweight/obesity. Wilcox and colleagues found that fast food dining was associated with increases in calorie consumption after controlling for socio-demographics

and physical activity, with a difference of more 600 calories between respondents who did not eat at fast food outlets and those who ate fast food 5 or more times a week.³⁵ These differences in intake translate directly to BMI outcomes. Using data from the longitudinal Coronary Artery Risk Development in Young Adults (CARDIA) study, Duffy et al. find that weekly frequency of fast food dining was positively associated with BMI in cross-sectional analysis (0.13 units increase in BMI per weekly fast food dining episode). Moreover, previous fast food dining behaviors were predictive of BMI in subsequent years.³⁶ Though the effects of access or proximity on telephone survey respondents was statistically significant, they did not appear clinically meaningful (0.25–0.5 meals per week). However, the statistically significant impact on fast food dining among point-of-purchase respondents in this study, an increase of 1–2 weekly meals, would equate to 0.13–0.26 BMI units in the CARDIA study.

Fundamentally, the results show that fast food dining behaviors in different populations may respond to different stimuli in the built environment. Telephone survey respondents, considered a population-based sample, are less likely to dine at fast food and that likelihood is reduced only by proximity to supermarkets, and not affected by fast food outlets. Among the point-of-purchase respondents, fast food dining frequency was responsive only to presence of a fast food outlet. Presence of a supermarket was negatively associated with fast food dining in the ¼ mile buffer when an interaction between presence of supermarket and presence of fast food outlet was also included in the model. This interaction term reversed the effect of a supermarket on fast food dining, increasing the frequency of fast food dining by 20%. Though the coefficient for fast food itself was not significant, fast food access appeared to exert an upward influence on fast food dining through the interaction term.

Previous studies of proximity to fast food outlets, supermarkets and their association with fast food dining have been heterogeneous in their findings. For instance, He et al.¹⁶ found that as distance to the nearest fast food outlet increased, the likelihood of purchases at these establishments decreased and that a higher density of fast food outlets was associated with increased fast food dining. Likewise, Burgoine and colleagues found that people who have greater access to fast food or “take-away” restaurants (count of outlets) near home, work, and along their commute are more likely to consume fast food for meals.¹⁷ Laska and Thornton, however, found that fast food restaurant density was not predictive of fast food purchasing.^{18–20} Overall, the results presented here indicate that supermarket density (count of outlets within a specified distance) and distance to nearest supermarket were the most significant predictors of fast food dining frequency among telephone survey respondents. Whereas supermarkets exerted a negative influence on fast food dining among a population-based sample, only the presence of at least one fast food outlet within a mile determined fast food dining frequency among those surveyed at fast food outlets (and thus, by definition, more likely to consume fast foods).

The following issues arise given these study results. First, the findings do not resolve the contradictory findings in previous literature regarding the impact of fast food access (however measured) on fast food consumption. If anything, they highlight different response patterns in the population at large, represented by the telephone survey respondents, and among survey respondents recruited at fast food outlets. If the response of the two surveyed

groups were consistent with each other across operational definitions of “access,” these results would be more easily actionable. For example, the Centers for Disease Control and Prevention recommend leveraging zoning policies to promote healthy eating, but identifying the ideal zoning strategies remains difficult.³⁷

A fundamental cause of the heterogeneity of effect of fast food access remains to be explored, however. A recent review by Gorden-Larsen on the associations between food access and obesity notes that most research studies lack information on the decision-making processes that individuals engage in related to fast food consumption.³⁸ As an extension of that, little is known about how decision-making process is affected by geographic proximity to different types of food outlets. A better understanding of the ways in which consumers’ food purchasing and consumption patterns develop would clarify (1) what, if any, impact the location of a supermarket or fast food restaurant has on fast food consumption and (2) what the appropriate policy levers to address this consumption should be.

Study Strengths and Limitations

This study contributes to the food-environment literature and demonstrates a number of strengths: (1) testing three different definitions of “access,” as well as (2) three different thresholds to determine proximity, and (3) using street network distances to represent traveled distance to supermarket and restaurant outlets, rather than Euclidean distance. Finally, the paper considers the joint impact of proximity to supermarkets and fast food outlets on fast food meal-time dining frequency, rather than consider the effect of proximity to these food sources independently.

The loss of respondents due to incomplete data is the most notable limitation in this study. By excluding observations without complete data, the risk of bias in our findings is greater. Errors in geo-coding of participants are also a risk, and because participants’ nearest intersection was used, this may have introduced location misclassification and spatial overlap in the sample. Location misclassification can produce biased estimates and reduce the statistical power to detect true associations. Though there is still a risk of spatial misclassification from errors in geo-coding, the effect of using intersections on this type of misclassification is likely small, given our focus on study participants within the city limits of Philadelphia and Baltimore. These cities generally have dense street networks with small block sizes, making the distance between the exact address and the intersection minimal.³⁹

Errors in identifying fast food outlets and full-service supermarkets could also affect the results, as business list data are not optimal for describing the food environment.⁴⁰ Additionally, “access” to food outlets can be operationalized in multiple ways, including nearest five retailers, food environment diversity, and density of outlets;^{41–42} however, this study used 3 different approaches that have been used previously and provide a more nuanced view of food environments. There is a temporal mismatch of 1–2 years between our independent and dependent variables; the opening and closing of stores or restaurants between the time of the survey and dates of the food outlet data could result in spurious findings. However, in an analysis of food retail outlet stability over five years in a densely populated urban community (Brooklyn, NY), more than two-thirds of supermarkets were open for the full 5-year period. Of the ~20% of supermarkets that closed in that time frame,

18% were replaced by a new supermarket in the same location. Though store ownership shifted, 85% of supermarket locations remained consistent over 5 years.⁴³ Similar analyses have not been conducted for fast food outlets, but focusing on chain fast food restaurants, which tend to have slower turnover, should mitigate the risk of temporal mismatch.

Finally, unobserved confounding, including residential selection bias or land use mix, poses a limitation to this study. Adjusting for variables (e.g., education and income) that may be associated with neighborhood selection—as done in these analyses—may reduce residential selection bias. Results from this study might only be generalizable to adults in similar urban locations.

CONCLUSION

These findings suggest that the effect of type of food outlet varies across populations. Among a random sample of adults in Philadelphia and Baltimore, who tended to eat fewer than 2 meals per week at fast food chains, supermarket access was the only significant predictor of fast food dining frequency, with a negative effect on fast food meals. Point-of-purchase respondents ate more frequently at fast food outlets (>5 meals per week on average). This frequency was generally unaffected by proximity to either supermarkets or fast food outlets. Further studies that consider the decision-making process among fast food consumers will better elucidate how significant a role, if any, fast food and supermarket locations play in fast food consumption.

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Table 1

Demographic Characteristics of Adult Survey Respondents in Baltimore and Philadelphia, Food Outlet Access Measures, and Fast Food Dining Frequency by Survey Source

Variable	Telephone Survey	Point-of-Purchase Survey
Sample Size	1,598	1,642
<i>Demographic Variables</i>		
Mean Age (SD) **	45.3 (13.6)	39.5 (14.2)
Gender: % Male **	33.6%	60.5%
Education **		
< High school diploma	11.3%	18.8%
High school dipl./GED	31.3%	24.8%
Some college	29.9%	12.9%
4-year college degree	27.5%	8.8%
Race **		
African-American	50.8%	74.2%
Hispanic/Latino	35.6%	16.6%
White	12.4%	8.3%
Other	1.1%	0.9%
Location: Philadelphia (vs. Baltimore)	61.4%	59%
Post-calorie labeling period (6/2010) ^{†a}	45.5%	49.2%
<i>Food Outlet Access Measures</i>		
Fast food outlet density		
Within ¼ mile **	0.3 (0.7)	0.5 (0.9)
Within ½ mile ^	1.1 (1.6)	1.3 (1.6)
Within 1 mile *	4.3 (4.0)	4.5 (3.3)
Supermarket outlet density		
Within ¼ mile	0.2 (0.5)	0.2 (0.4)
Within ½ mile ^	0.7 (0.8)	0.6 (0.7)
Within 1 mile	2.5 (1.9)	2.4 (1.7)
Presence/absence of fast food outlet		
Respondents with 1 outlet within ¼ mile **	24.7%	29.7%
Respondents with 1 outlet within ½ mile *	53.5%	58.6%
Respondents with 1 outlet within 1 mile *	92.0%	95.1%
Presence/absence of supermarket		
Respondents with 1 outlet within ¼ mile	17.8%	16.2%
Respondents with 1 outlet within ½ mile	50.2%	47.5%
Respondents with 1 outlet within 1 mile	89.0%	89.7%

Variable	Telephone Survey	Point-of-Purchase Survey
Distance to nearest fast food (miles) **	0.6 (0.3)	0.5 (0.3)
Distance to nearest supermarket (miles) **	0.6 (0.4)	0.6 (0.4)
Weekly fast food dining frequency ** (times per week)	1.4 (2.2)	5.3 (4.1)

[†]
p < .05

[^]
p < .01,

^{*}
p < .001,

^{**}
p < .0001

^a The percent of respondents from each survey (telephone vs. point-of-purchase) who were interviewed in June 2010, after calorie labeling was introduced in Philadelphia.

Percent Change in Fast Food Dining Frequency per Food Outlet within ¼-, ½- and 1-Mile Buffers: Telephone Survey Respondents

Table 2

Model	Number of outlets in ¼ mile buffer		Number of outlets in ½ mile buffer		Number of outlets in 1 mile buffer	
	Supermarkets	Chain fast food outlets	Supermarkets	Chain fast food outlets	Supermarkets	Chain fast food outlets
A	-18.1 [‡] (-31.7, -1.8)	--	-11.2 [‡] (-19.6, -1.9)	--	-4.6 [‡] (-8.9, -0.1)	--
B	--	6.5 (-4.0, 18.1)	--	-3.2 (-8.0, 1.8)	--	-1.7 (-3.8, 0.4)
C	-19.5 [‡] (-32.9, -3.3)	8.0 (-2.7, 20.0)	-10.4 [‡] (-19.1, -0.7)	-1.9 (-6.9, 3.4)	-3.7 (-8.6, 1.6)	-0.9 (-3.3, 1.6)

All models control for age, gender, race/ethnicity, level of education, period of data collection (pre- vs. post-calorie labeling), and city (Baltimore versus Philadelphia). Model (A) includes only count of supermarkets, (B) includes only count of chain fast food stores, and model (C) includes both supermarkets and chain fast food stores.

[‡] p-value < 0.05

Percent Change in Fast Food Dining Frequency with Presence of 1 Food Outlet within ¼-, ½- and 1-Mile Buffers among Telephone Survey Respondents and Point-of-purchase Survey Respondents

Model	1 outlet in ¼ mile buffer			1 outlet in ½ mile buffer			1 outlet in 1 mile buffer		
	Supermarkets	Chain fast food outlets	Supermarkets * Chain fast food outlets	Supermarkets	Chain fast food outlets	Supermarkets * Chain fast food outlets	Supermarkets	Chain fast food outlets	Supermarkets * Chain fast food outlets
Telephone Survey Respondents (n = 1,598)									
A	-16.0 (-31.9, 3.5)	--	--	-17.3 [†] (-29.4, -3.2)	--	--	-20.6 (-37.7, 1.3)	--	--
B	--	9.7 (-9.7, 33.4)	--	--	-11.8 (-24.4, 3.0)	--	--	-12.7 (-34.3, 15.9)	--
C	-17.9 (-33.6, 1.5)	13.1 (-7.2, 37.8)	--	-15.5 [†] (-28.2, -0.4)	-7.7 (-21.4, 8.5)	--	-19.3 (-37.3, 3.8)	-6.7 (-30.5, 25.1)	--
D	-9.4 (-30.0, 17.3)	22.2 (-2.9, 53.8)	-26.8 (-53.6, 15.5)	-16.2 (-34.1, 6.6)	-8.4 (-26.6, 14.3)	1.7 (-26.6, 40.9)	-6.8 (-46.1, 61.2)	4.8 (-35.9, 71.5)	-16.6 (-54.8, 54.1)
Point-of-Purchase Survey Respondents (n = 1,642)									
A	-3.2 (-12.7, 7.4)	--	--	-2.9 (-10.1, 4.8)	--	--	2.1 (-9.9, 15.7)	--	--
B	--	5.0 (-3.3, 14.1)	--	--	3.3 (-4.3, 11.6)	--	--	21.2 [†] (1.3, 45.0)	--
C	-4.8 (-14.4, 5.9)	6.0 (-2.7, 15.4)	--	-3.9 (-11.2, 4.0)	4.3 (-3.6, 12.9)	--	-2.2 (-14.2, 11.5)	22.4 [†] (1.4, 47.8)	--
D	-18.2 [^] (-29.2, -5.5)	-0.5 (-9.5, 9.3)	37.9 [^] (11.5, 70.5)	-1.5 (-13.2, 11.8)	6.1 (-4.5, 17.8)	-3.9 (-18.2, 13.0)	-15.0 (-40.2, 20.9)	12.3 (-14.9, 48.1)	17.6 (-19.4, 71.7)

All models control for age, gender, race/ethnicity, level of education, wave of data collection, and city (Baltimore versus Philadelphia). Model (A) includes only presence of supermarkets, (B) includes only presence of chain fast food stores, (C) includes both presence of supermarkets and chain fast food stores, and (D) includes presence of supermarkets, chain fast food stores, and an interaction term for supermarkets and chain fast food stores.

[†] p < .05

[^] p < .01

Percent Change in Fast Food Dining Frequency by Distance (in miles) to Nearest Food Outlet: Telephone Survey Respondents

Table 4

Model	Supermarkets	Chain fast food outlets	Supermarkets * Chain fast food outlets
A	29.9 [*] (7.1, 57.5)	--	--
B	--	15.9 (−7.7, 45.5)	--
C	28.4 [‡] (4.4, 58.0)	3.7 (−18.9, 32.4)	--
D	39.5 (−3.9, 102.5)	12.8 (−24.3, 68.0)	−11.0 (−42.4, 37.4)

Percent Change in Fast Food Dining Frequency by Distance to Nearest Food Outlet in Quintiles: Telephone Survey Respondents

Table 5

MODEL	Quintile: Distance	Supermarkets	Chain fast food outlets
A	Q1: < 0.3 miles (ref.)	--	--
	Q2: 0.3–0.45 miles	6.4 (–17, 36.2)	--
	Q3: 0.46–0.62 miles	19.2 (–7.1, 52.8)	--
	Q4: 0.63–0.86 miles	20.9 (–6, 55.5)	--
	Q5: 0.87–3.5 miles	42.7 [†] (11.8, 80.5)	--
B	Q1: < 0.23 miles (ref.)	--	--
	Q2: 0.23–0.4 miles	--	–23.2 [†] (–40.5, –0.7)
	Q3: 0.41–0.56 miles	--	–20.3 (–38.4, 3.1)
	Q4: 0.57–0.78 miles	--	–9.1 (–29.9, 17.7)
	Q5: 0.79–2.1 miles	--	2.6 (–20.2, 32)
C	Q1 (ref.)	--	--
	Q2	9.7 (–14.4, 40.7)	–23.9 [†] (–41.2, –1.6)
	Q3	22.3 (–4.9, 57.2)	–22.4 (–40.1, 0.6)
	Q4	22.5 (–5.3, 58.4)	–13 (–33.2, 13.2)
	Q5	38.7 [†] (7.8, 78.5)	–7.7 (–29, 20.1)

All models control for age, gender, race/ethnicity, level of education, wave of data collection, and city (Baltimore versus Philadelphia). Model (A) includes only distance to nearest supermarket, (B) includes only distance to nearest chain fast food store, (C) includes distance to both nearest supermarket and nearest chain fast food store, and (D) includes distance to nearest supermarket, chain fast food, and an interaction term between distance to nearest supermarket and distance to nearest chain fast food store.

[†]
p < .05

[^]
p < .01