Passages taken from the Methods, Results, and Discussion sections of the following article. Minor revisions (including the addition of paragraph numbers) have been made to the original:

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Methods

Dataset

1. We used pre-collected data from the Public Health Management Corporation (PHMC)'s 2004 Southeastern Pennsylvania Household Health Survey (HHS; Philadelphia Health Management Corporation 2004). The survey used a random-digit-dialing methodology to reach adult respondents (>18 years), in 4,434 households, in Philadelphia, PA, between June and September 2004. Stratified sampling helped ensure sufficient representation of socio-demographic subpopulations.

2. Many HHS questions come from longstanding national health surveys—e.g. the National Health Interview Survey (Centers for Disease Control and Prevention) and Behavior Risk Factor Surveillance System (Centers for Disease Control and Prevention). PHMC administers the HHS biennially. The 2004 administration included questions about dietary patterns and perceptions of the local food environment—questions not asked previously or since.

Survey variables of interest

3. Wishing to measure negative perceptions of the food environment, we created the following dichotomous variables from responses to HHS questions: Poor Produce Availability: How easy or difficult is it for you to find fruits and vegetables in your neighborhood? (difficult/very difficult vs. easy/very easy); Poor Supermarket Accessibility: Do you HAVE to travel outside of your neighborhood to go to a supermarket? (Yes vs. No); and Poor Grocery Quality: How would you rate the overall quality of groceries available in the stores in your neighborhood? (fair/poor/absent vs. good/excellent).

4. To measure dietary intake, we defined the following count variables: Fruit-and-Vegetable Intake: How many servings of fruits and vegetables do you eat on a typical day? (A serving of a fruit or vegetable is equal to a medium apple, half a cup of peas, or half a large banana), and Fast-Food Intake: In the past seven days, how many times did you eat food from a fast food restaurant such as McDonalds, Pizza Hut or Crown Fried Chicken?

Multivariable adjustment and weighting

5. We adjusted individual survey responses about perceptions of the food environment and dietary intake for conceptually relevant confounders using multivariable regression models. We used face validity (supported by past literature (Ball et al. 2006; Davis and Carpenter 2009; Dibsdall et al. 2003; Diez-Roux et al. 1999; Franco et al. 2009; Kamphuis et al. 2006; Morland et al. 2002; Pearson et al. 2005; Rolls et al. 1991; Turrell et al. 2004; Westenhoefer 2005)) to determine included confounders: age, gender, race/ethnicity (Black, White, Asian, Other; Hispanic or not), education (<high-school grad, high-school grad, some college, college grad, post-college), income (<100% Federal Poverty Level [FPL], 100-200% FPL, > 200% FPL), having children (any children in the home), marital status (any other adults in the home), and older adults (any adults >60 years old in the home).

6. In addition to adjusting for relevant confounders, we applied PHMC-provided balancing weights (using the *svy* command in STATA statistical software; StataCorp LP, "STATA Data Analysis and Statistical Software, Release 11", to take into account the stratified sampling design and to adjust for under- and overrepresented segments of the population. We used logistic regression for dichotomous variables (i.e. the three variables measuring perceptions of the food environment), and Poisson regression for count variables (i.e. the two variables measuring dietary intake). After fitting appropriate regression models, we used post-estimation to generate fitted (adjusted) values.

Unit of analysis: the neighborhood

7. The neighborhood was our unit of aggregation and analysis. To define neighborhoods we used census tracts (US Census Bureau, Geography Division 2000), following the lead of other researchers who have conducted small-area food-environment studies (Block et al. 2004; Franco et al. 2009; Moore et al. 2008b; Morland et al. 2002). The boundaries of census tracts may not perfectly align with those of established urban neighborhoods (Philadelphia City Planning Commission 2004), and census tracts are not intrinsically policy-relevant areas themselves. However, census tracts do comprise larger political districts—e.g., City Council, State Representative, State Senatorial, and US Congressional districts—although boundaries between census tracts and these larger policy-relevant areas do not always neatly overlap (Philadelphia City Planning Commission 2004). Philadelphia has 381 census tracts, which make up Philadelphia's 10 City Council, 28 State Representative, 8 State Senatorial, and 4 US Congressional districts (Philadelphia City Planning Commission 2004).

Results

Description of the sample

1. Table 1 shows means or percentages for study variables. Survey respondents ate few fruits and vegetables (5.6% of respondents typically ate none, and 88.8% ate fewer than five daily servings). Respondents consumed a fair amount of fast food (43% ate fast food at least one time in the past week). Only a minority of respondents had poor perceptions of their neighborhood food environments. Respondents were mostly middle aged, women, Black or White (as opposed to Asian or Other), non-Hispanic, high-school graduates, with incomes >200% Federal Poverty Level, and living with other adults but not children or older adults.

2. Potential confounders (selected a priori and listed in Table 1) were generally associated with variables of interest at $p<0.001$ (data not shown). Greater fast-food intake and/or lesser fruit-and-vegetable intake were associated with being younger, male, non-White, Hispanic, living with children or other adults, and having less schooling, lower income, and more-negative perceptions of the food environment. Having more negative perceptions of the food environment was associated with being younger, female, non-white, Hispanic, living with children or other adults, and having more schooling but less income.

Statistical correlations by neighborhood

3. Table 2 shows results of Spearman correlations between multivariable-adjusted neighborhood-level variables. Each negative food-environment perception (poor produce availability, poor supermarket accessibility, and poor grocery quality) was inversely correlated with fruit-and-vegetable intake and directly correlated with fast-food intake. Additionally, all negative food-environment perceptions were near perfectly correlated with each other. Scatter plots of all correlations suggested linear relationships. Correlation results were substantively unchanged in sensitivity analyses.

Mapping variables by neighborhood

4. Maps of neighborhood-level variables for Philadelphia provided visual corroboration of statistical associations and are shown in Fig. 1. When there were direct correlations between neighborhood-level variables, gray-scale quintile gradations for neighborhoods on one map were similar to the gray-scale quintile gradations on the other. When there were inverse correlations, corresponding neighborhoods between maps had opposite-appearing gray-scale gradations.

5. Maps also gave neighborhood-specific information with geographic context. Clustering of lightly shaded or darkly shaded neighborhoods revealed larger regions of Philadelphia with similar food-environment perceptions and dietary intake. Neighborhoods in the central, south, and south-west regions of Philadelphia generally had the worst perceptions of produce availability, supermarket accessibility, and grocery quality. Neighborhoods in these regions also showed relatively low fruit-and-vegetable intake and relatively high fast-food intake. Conversely, neighborhoods in the northeast, north-west, and eastern south-central regions of the city showed the opposite for both food-environment perceptions and dietary intake. Such geographical variation is perhaps

most obvious in the consolidated map showing our food-environment- and-dietary-intake index (Fig. 2). This map represents a single composite "mashup" of the five component maps in Fig. 1.

Discussion

1. Our study used pre-collected community health data to demonstrate an innovative method for statistical correlation and GIS mapping based on aggregation with multivariable adjustment. Specifically, we used our method to show strong associations between neighborhood perceptions of the food environment and dietary intake. Negative food-environment perceptions (poor produce availability, poor grocery quality, and having to travel outside of one's neighborhood to get to a supermarket) were each correlated with less-healthy dietary intake (i.e. greater intake of fast foods and lesser intake of fruits and vegetables). Also, three measures of the food environment were almost perfectly correlated with each other. Maps visually corroborated statistical associations, and further provided neighborhood-specific information with geographic context.

2. Other studies have demonstrated relationships between the perceived food environment and dietary intake (Caldwell et al. 2009; Dibsdall et al. 2003; Giskes et al. 2009; Inglis et al. 2008; Moore et al. 2009; 2008b; Zenk et al. 2009, 2005a). Despite some inconsistencies, taken together, these studies suggest that more-positive perceptions of healthy-food availability (Caldwell et al. 2009; Giskes et al. 2009; Inglis et al. 2008; Moore et al. 2008b; Zenk et al. 2005a) and/or quality (Giskes et al. 2009; Moore et al. 2008b; Zenk et al. 2005a) are associated with greater intake of fruits and vegetables (Caldwell et al. 2009; Giskes et al. 2009; Inglis et al. 2008; Moore et al. 2008b; Zenk et al. 2005a) and lesser intake of unhealthy items like fast-foods (Inglis et al. 2008; Moore et al. 2008b). Several of these studies considered area-level effects (Caldwell et al. 2009; Giskes et al. 2009; Moore et al. 2009, 2008b; Zenk et al. 2009), yet none provided specific results by area or geographic context.

3. We provide specific results by area and geographic context through neighborhood maps. Such maps may be useful for bringing political attention to neighborhood situations. While cartographic data alone probably will not sway policy-makers, neighborhood maps may be a concise, visually compelling way to make research findings accessible, understandable, and pertinent to those in a position to affect local change. Indeed, similar food-environment maps helped lead to the passage of the Fresh Food Financing Initiative (the nation's first statewide program aimed at supermarket development), suggesting to Philadelphia City Council members and Pennsylvania State Representatives how supermarket shortages within the city may impact public health (Giang et al. 2008). The Fresh Food Financing Initiative has since been adopted by the Obama Administration, and has been expanded to include not only resource-intensive strategies like supermarket development in disadvantaged neighborhoods but also redesign of existing neighborhood convenience stores and other workable strategies to make healthy food more available to communities most in need (US Department of Health and Human Services 2010).

4. Our maps of Philadelphia suggest that even after controlling for socio-demographic factors (a methodological advance for this kind of mapping), perceptions of the food environment and healthy-food intake both appear to be worst in the central, south, and south-west neighborhoods of Philadelphia. These neighborhoods may be areas for community stakeholders and legislators to target. Conversely, perceptions and dietary intake appear to be best in the far northeast, northwest, and eastern south-central regions of the city. These neighborhoods may be areas to learn from.

5. Our method, using multivariable adjustment, improves on prior work. The method may be useful prospectively to aid in policy planning (e.g. for planning supermarket development in needy areas, for siting locations for new farmers' markets, for focusing redesign of neighborhood convenience marts, or for improving transportation to existing but distant grocery stores). The method could also be used retrospectively to assess changes that occur over time with the passage of policy to gauge success (e.g. to assess the impact of supermarket development, new farmers' markets, convenience-mart changes, or improved transportation, considering changes in both neighborhood perceptions and dietary intake). Our method is not limited to the study of the food environment though, and may be applied to other health-related issues: for instance, how perceptions of the built environment (e.g. parks, streets, sidewalks) relate to people's reported physical activity, how perceptions of neighborhood violent crime relate to individuals' self- ratings of personal mental health, or how perceptions of clinic availability relate to people's stated follow up with physicians for chronic-disease management.

6. Regarding future applications of our method to assess neighborhood food environments specifically, it is worthwhile to note that all food-environment perceptions in our study were directly and near-perfectly correlated with each other. Such high correlation is noteworthy given that the three measures assessed three different aspects of the food environment: i.e. availability, accessibility, and quality. Given such high correlation, it is possible that the perception of any of these aspects might perform independently as a reasonable and efficient single measure of people's broader perceptions in future assessments. Having to support only a single item on an existing community-health survey could be welcomed news to cash-strapped public agencies, community groups, or physician practices wishing to conduct neighborhood assessments (especially as an alternative to the costly and resource-intensive primary data collections such groups might otherwise use to produce similar information). The index we created to generate our consolidated map could easily be modified to include only single measures for both food-environment perceptions and dietary intake.

7. Our approach has several strengths. We explored relationships among and between three separate measures of the food environment and two separate measures of dietary intake. We used a large, city-wide dataset to demonstrate findings specific to Philadelphia, and employed a method that could be transportable to other municipalities having similar community-health surveys, both domestically (Los Angeles County Department of Public Health 2007; New York City Department of Health and Mental

Hygiene 2008) and internationally (Health Canada 2010, National Institute for Health Research Biomedical Research Centre 2010). We calculated correlations at the level of the census tract—a smaller unit of area than used in many prior studies (Cheadle et al. 1991; Jeffery et al. 2006; Kamphuis et al. 2006), and one that may provide greater understanding of local situations, community experience, and neighborhood needs. We adjusted our results for potentially important confounders neglected in prior research, and we conducted various sensitivity analyses to reassure ourselves about the robustness of our findings. Finally, we used GIS mapping to display multivariable-adjusted neighborhood-specific results within geographic context. As discussed, our findings may have particular policy relevance.

8. Our approach also has limitations. For instance, we used census tracts to delineate neighborhoods. Other researchers have taken a similar approach (Block et al. 2004; Franco et al. 2009; Moore et al. 2008b; Morland et al. 2002); however, census boundaries may not precisely align with residents' neighborhood conceptualizations. Fortunately in Philadelphia, there is often perfect overlap between census tracts and established neighborhoods (Philadelphia City Planning Commission 2004). When there is not, census tracts tend to be smaller than established neighborhoods so, putatively, residents of smaller census tracts would have similar perceptions of the larger neighborhoods these tracts comprise. Other issues with using census tracts as the unit of analysis have to do with ecological and individualistic fallacies (i.e. assuming everyone in the neighborhood holds the average perception for that neighborhood, and assuming outcomes like dietary intake can be explained exclusively in terms of individual-level characteristics; Subramanian et al. 2009). Reassuringly, our associations have generally held up to multi-level analyses performed by our group that account for both individual-level and neighborhood-level variability (Lucan and Mitra 2011).

9. Other limitations we should consider relate to the use of a telephone survey. . .