



## Original article

## Can the introduction of a full-service supermarket in a food desert improve residents' economic status and health?



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## ABSTRACT

**Purpose:** To estimate the impacts of a new supermarket in a low-income desert, on residents' economic status and health.

**Methods:** We surveyed a randomly selected cohort in two low-income Pittsburgh neighborhoods before and about 1 year following the opening of a supermarket. We used difference-in-difference approach to test changes across the two neighborhoods in residents' food security, United States Department of Agriculture Supplemental Nutrition Assistance Program and Special Supplemental Nutrition Program for Women Infant and Children participation, employment, income, and self-reported health/chronic disease diagnoses.

**Results:** We observed declines in food insecurity (−11.8%,  $P < .01$ ), Supplemental Nutrition Assistance Program participation (−12.2%,  $P < .01$ ), and fewer new diagnoses of high cholesterol (−9.6%,  $P = .01$ ) and arthritis (−7.4%,  $P = .02$ ) in the neighborhood with the new supermarket relative to residents of the comparison neighborhood. We also found suggestive evidence that residents' incomes increased more (\$1550,  $P = .09$ ) and prevalence of diabetes increased less in the neighborhood with the supermarket than in the comparison neighborhood (−3.6%,  $P = .10$ ).

**Conclusions:** Locating a new supermarket in a low-income neighborhood may improve residents' economic well-being and health. Policymakers should consider broad impacts of neighborhood investment that could translate into improved health for residents of underserved neighborhoods.

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### Background

Research examining associations between poverty and poor health has largely focused on individuals' economic status. Recent work identified links between neighborhood economics and health (e.g., mortality) [1,2]. Neighborhood characteristics that have been tied to health include educational quality, access to social and economic services, and access to healthy foods [3]. Yet, the evidence is not fully consistent with respect to cardiometabolic health (e.g., obesity) [4–7], and we have limited understanding of why these neighborhood factors are associated with health and have causal influence.

Establishing causal evidence for neighborhood effects on individuals is difficult. Residential selection (i.e., individuals typically choose their neighborhoods) limits our ability to disentangle the individual from context. Factors affecting preferences (or

constraints) regarding where to live may also play a role in individual health and wealth. Most research on neighborhood health effects [8] is based on cross-sectional or aggregate data that cannot account for residential selection.

One approach to reduce residential selection bias is randomly assigned residence. Moving to Opportunity for Fair Housing (MTO) Demonstration Program randomized low-income families to receive no rental assistance housing vouchers, unrestricted housing vouchers, or vouchers to use in higher income neighborhoods. MTO aimed to isolate causal neighborhood effects net of unmeasured background differences [9] on “employment, income, education, and well-being” [10]. Since MTO's implementation, findings suggest that moving to economically improved areas has both positive and negative impacts on health and economic outcomes [9,11–13]. Inconsistent findings could relate to length of follow-up, relocation timing, or the act of moving itself. Few randomized studies have been able to assess resident well-being in association with neighborhood improvement or decline (vs. moving into a socio-economically different neighborhood) [14].

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However, advocacy efforts to increase access to food retailers with healthy food options motivated the federal government to incentivize full-service supermarkets (FSSs) to locate in low-income areas with limited access to fresh products and foods. The Healthy Food Financing Initiative (HFFI) (S.1926, H.R. 3525), launched in 2010 was inspired, in part, by the Pennsylvania Fresh Food Financing Initiative (PFFFI). The PFFFI was a state-level public-private partnership that financed supermarket development projects; job creation and local tax revenue were some of the economic advantages that resulted from the PFFFI [15]. In addition to affecting food access, opening a FSSs may foster community economic development by introducing employment opportunities, generating tax revenues, and increasing foot traffic to support additional stores [16]. An analysis of economic impacts on communities where new supermarkets opened in low-income communities found increases in home values [17]. The grocery industry and PolicyLink reported that opening new supermarkets in underserved areas provides jobs to local residents [18]. If a new FSS improves neighborhood or resident socioeconomic status, it might influence residents' health by increasing residents' means (e.g., employment) [18,19] to make healthier lifestyle choices. Studies of FSS investments provide an opportunity to explore possible causal effects of improved neighborhood economics on health.

In 2013, a low-income predominantly African-American Pittsburgh neighborhood received a new FSS. Capitalizing on this natural experiment opportunity, we enrolled randomly selected households from the neighborhood that was to receive the new supermarket (intervention) and from a sociodemographically similar neighborhood (comparison), before the FSS opening [20]. Relative to the comparison neighborhood, we found that selected dietary behaviors and neighborhood satisfaction significantly improved among residents in the intervention neighborhood after the FSS opening. However, the use of the FSS was not related to either the dietary changes or to the improvements in neighborhood satisfaction [20]. This left the question open—exactly how did the FSS influence diet?

One possibility is that the FSS represented an investment in the neighborhood, improving neighborhood economic status, spurring additional neighborhood upgrades (e.g., housing conditions improved), and perhaps also improvements in residents' individual economics [21]. If so, these changes may have wrought broader changes in residents' health, beyond the improved diet we previously observed [22,23]. In this article, we examine this possibility, testing for changes in resident economic status and health in the intervention neighborhood (where the FSS opened) relative to the sociodemographically similar comparison neighborhood, over the same period. We drew on multiple economic and health indicators present in the FSS evaluation study data set.

## Methods

### *Study design and participants*

Pittsburgh Hill/Homewood Research on Eating, Shopping and Health (PHRESH) study used a quasi-experimental pretest design to investigate the effects of opening a HFFI (S.1926, H.R. 3525) supported FSS. We compared two neighborhoods, Hill District (intervention neighborhood) and Homewood (comparison neighborhood). The two neighborhoods were chosen to match in terms of (1) proportion of the neighborhood that is African-American (about 95 percent of the population in each categorized themselves as African-American), (2) physical proximity to food retail including full-service grocery stores (prior to the opening of the FSS in the Hill), and (3) neighborhood socioeconomic status (median household income was <\$15,000/household in both). In addition, both neighborhoods lie in the same broad geographic area, but

Homewood is approximately 6 miles from the Hill District, which limited the possibility of contamination of the control group. The Hill District experienced the FSS (October 2013) opening after baseline data collection (May through December, 2011) and before our follow-up survey (May through December, 2014). Interviewers administered surveys to a randomly selected cohort of residents in both neighborhoods. Our sampling approach, recruitment, and eligibility have been described in detail [20,24]. Briefly, we used a parcel-level property information system managed by the University of Pittsburgh Center for Social and Urban Research to sample nonvacant residences. In total, the primary food shopper from each of 831 households completed a baseline and a follow-up assessment. All study protocols were approved by the institution's Institutional Review Board.

### *Measures*

Economic indicators included employment (full-time, part-time, not employed [looking for work; volunteer; student; retired; disabled; and other], don't know/refused), total household income for the prior year and number of persons it supported, participation in Supplemental Nutrition Assistance Program (SNAP) and in Women, Infants, and Children (WIC) program within the last 12 months (yes, no, don't know/refused), and food security. The latter was measured using self-reported responses to 10-item Adult Food Security Survey Module [25,26] that incorporates questions about conditions and behaviors that characterize households when they are having difficulty meeting basic food needs. Based on standard coding procedures, we classified household food security status as high, marginal, low, or very low. We classified residents as having income below the federal poverty line (FPL) if, based on their income and household size, their income fell below that year's Census published threshold [27].

Health indicators included self-reported health (excellent, very good, good, fair, or poor), ever been told by a doctor or health professional that they have heart disease, high cholesterol, hypertension, high blood sugar, arthritis, or diabetes (yes, no, don't know/refused). Each of these conditions can be affected by changes in behavior or circumstance over a relatively short time period, and thus might be affected within the time frame of our follow up survey.

Sociodemographics included race/ethnicity (African-American/black vs. other), age, gender, marital status (married/living with partner, never married, widowed/divorced/separated), educational attainment (less than high school, high school diploma, some college/technical school, college degree), and any children in household.

### *Statistical analyses*

To conduct analysis with the full sample of participants with baseline and follow-up assessments, we used multiple imputations to impute values for respondents with missing outcome data, at either baseline or follow-up. Multiple imputation for missing data reduces measurement error [28] and bias [29] compared to complete-case analyses. Our sample was missing data on self-reported health (0.1%), employment (0.4%), hypertension (0.6%), -heart disease (0.6%), -diabetes (0.7%), -high blood sugar (0.7%), -arthritis (1%), -high cholesterol (1.4%), WIC vouchers (2.8%), SNAP (4%), and income (11%). To compare groups with no data ( $n = 680$ ) to those with any imputed data ( $n = 151$ ), we used linear regression for continuous outcomes with an imputed data indicator variable as the predictor to assess statistically significant differences between those with and without missing data. We conducted a Pearson  $\chi^2$  tests for categorical outcomes. The

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