September 2018

Population Health: The Translation of Research to Policy

Case Studies and Commentary

Robert Wood Johnson Foundation Health & Society Scholars

The Robert Wood Johnson Foundation Health & Society Scholars (HSS) program was designed to build the nation's capacity for research, leadership, and policy change, while addressing the multiple determinants of population health. One of its goals was to produce a cadre of scientific leaders who could contribute to this research and spearhead action to improve overall population health and eliminate health inequities.

This report, edited by Robert A. Hiatt, MD, PhD, University of California, San Francisco, takes a case study approach, using six diverse examples of science to policy translation generated by Scholars in the HSS program from 2003 to 2016. Because the HSS program was discontinued in 2017, the Milbank Memorial Fund published these case studies in 2018 in hopes that many audiences, including students, would use them to learn about the connections between research, decision making, and policy.

Case Study 1

Healthy and Unhealthy Food Sources in New York City

Tracing the generation, evolution, and dissemination of policy-relevant research on the food environment

Authors

Gina S. Lovasi, PhD, MPH
Dornsife Associate Professor
Urban Health
Co-Director, Urban Health Collaborative
Drexel University

Andrew Rundle, DrPH
Associate Professor
Department of Epidemiology
Mailman School of Public Health
Columbia University

Michael D.M. Bader, PhD
Assistant Professor
Department of Sociology
Center on Health, Risk, and Society
American University
Washington, DC

Kathryn M. Neckerman, PhD
Research Scientist
Columbia Population Research Center
Columbia University

Synopsis

This case study traces the generation, evolution, and dissemination of policy-relevant research on the food environment. The study was conducted by the Built Environment and Health (BEH) Research Group at Columbia University. This interdisciplinary research team includes epidemiologists, sociologists, urban planners, and geographers. The Robert Wood Johnson Foundation Health & Society Scholars (HSS) program played a vital role in the formation of this group by connecting researchers across the health and social sciences, providing seed funding for pilot research, and engaging scholars (including Lovasi at Columbia University and Bader at the University of Pennsylvania, their affiliations when they were HSS scholars) with a commitment to innovative, interdisciplinary research.

Learning Objectives

- Explain why the food environment is an attractive target for policy intervention.
- Describe and critically evaluate evidence for claims that either: (1) lowering the density of fast-food outlets or (2) increasing availability of supermarkets is likely to reduce obesity rates.
- Summarize the value of longitudinal data for understanding neighborhood effects on health.
- Specify ways that city-specific population health research on the food environment can inform local policies in zoning, economic development, and health.

Introduction

The BEH Research Group at Columbia University was formed at a moment when new currents in research intersected with a growing public concern to spark policy innovation. On the research side, population health approaches brought social science perspectives to public health problems, and the new availability of spatially referenced data allowed researchers to link human health data to detailed objective measures of the environments where people live,

work, play, and learn. At the same time—the early 2000s—the "obesity epidemic" became a prominent focus of public concern. For several years, we could hardly attend a public health conference without seeing the Centers for Disease Control and Prevention obesity slides, which mapped the dramatic rise in adult obesity rates after 1985 (http://www.cdc.gov/obesity/data/prevalence-maps.html). A problem among children as well as adults, the increase in obesity and excess caloric intake led to higher rates of type 2 diabetes and cardiovascular risk factors across the population.[1-3]

By now, it is well established that healthy diets can help prevent obesity, cardiovascular disease, and other chronic health conditions. The American Heart Association recently recommended "a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, nontropical vegetable oils and nuts."[4] Eating these foods, avoiding "red meat, full-fat dairy products, and foods and beverages high in added sugars" and limiting total energy intake promotes health by providing important nutrients and helping people maintain a healthy body mass index (BMI).[4-6] Yet most Americans' diets do not come close to this ideal. While nutrition advice can help individuals improve their dietary patterns,[7] the effect of advice alone is minimal, leading researchers and policymakers to look elsewhere for strategies that simultaneously improve population health, are scalable, and are cost-effective.

Borrowing from the social sciences, researchers began to use the science of neighborhood effects and new spatially referenced data to study the "food environment"—the mix of food outlets near an individual's home, school, or workplace. Some evidence suggested that low-income people were more likely to live in "food deserts," places conceptualized as lacking access to affordable, healthy food, and that food deserts were linked to obesity.[8,9] Investigators hypothesized that people who lived in neighborhoods with more supermarkets and other healthy food outlets would have better dietary patterns and lower rates of obesity and that exposure to unhealthy food might have the opposite effect.[10]

The idea had enormous appeal to policymakers as well as researchers. It suggested that city or state governments could promote health by using existing policy tools such as zoning, construction, loans, or tax incentives. Some policymakers have already sought to increase the number of healthy food outlets in identified neighborhoods, as with New York City's Green Carts and the Food Retail Expansion to Support Health (FRESH) initiative[11] and the federal Healthy Food Financing Incentive.[12] Others focused on unhealthy food outlets;[13] concerns were raised especially about the concentration of fast-food restaurants near schools[14] or in socially disadvantaged communities.[15] Los Angeles enacted a one-year moratorium on new fast-food restaurants in the South Central neighborhood.[16] In addition to limiting the number

of fast-food outlets, policies have sought to improve the nutrition environment within food outlets often considered unhealthy, either by providing consumers with more nutritional information, like New York City's calorie labeling law, which was subsequently applied nationally through the Affordable Care Act, or by changing the mix of foods sold in these outlets, e.g., New York City's Healthy Bodegas Initiative.

As is often the case, policy enthusiasm outpaced research: in the early 2000s, there was little systematic evidence linking the food environment to diet, BMI, and disease outcomes such as cardiovascular disease or diabetes. We did not know, for instance, whether access to healthy food or exposure to unhealthy food was more important for health. Moreover, discussions of the food environment often drew on simplistic assumptions—such as, larger stores were more likely to offer healthy food or people tend to shop at the supermarket nearest their homes—that were plausible but had been subjected to little empiric testing.

We organized the BEH group in 2004 when Andrew Rundle, an epidemiologist, and Kathryn Neckerman, a sociologist, obtained seed funding from the HSS program at Columbia University. Gina Lovasi, a Health & Society Scholar at Columbia University, joined in 2006, and Michael Bader, who went on to be a Cohort 7 HSS at the University of Pennsylvania, joined in 2008. Funding from the National Institutes of Health in 2005 allowed us to hire a geographer and geographic information systems (GIS) analyst—essential resources for the work we planned to do. In our research on the food environment, the primary goal was to develop new evidence about whether and how the food environment might shape health, with a focus on New York City. Even in this very dense city, many individuals have no or few healthy food sources near their homes. Historically disadvantaged communities, particularly African American neighborhoods, are especially likely to have low access to healthy food outlets.[17] We hoped to learn whether placing healthy food sources within closer reach or limiting unhealthy food outlets could improve dietary quality (e.g., more fresh produce, lower reliance on bulk-purchased nonperishable goods) and health. In addition, informed by our own and others' research and by our growing knowledge of the city's food landscape, we developed ancillary projects that addressed conceptual and methodological issues in study of the food environment. Our research program was shaped by continuing discussions with colleagues in city government, some of whom became our research collaborators.

Study Design and Execution

Like most researchers studying the food environment, we began by using cross-sectional study designs in which individual-level health data were linked to measures of the neighborhood food environment. We were fortunate in our location: there were many data collection efforts at Columbia University and in New York City government that we could leverage for our

research. Contacts with city government led to opportunities to use several large New York City data sets, including the Community Health Survey, an annual health surveillance survey of adults, and the NYC Fitnessgram, which collects objectively measured data on obesity and fitness among New York City schoolchildren. We were able to collaborate with the New York City Department of Health and Mental Hygiene on several research grants and analyses.

For our initial study of the New York City food environment, we used business micro-data (i.e., a list of businesses coded by location and type) to characterize the mix of food outlets in a neighborhood.[18] Based on previous research, we used detailed industry codes in the business data to classify food stores and restaurants as "BMI-healthy," "BMI-intermediate," or "BMI-unhealthy."[19] We defined healthy food outlets to include supermarkets, fruit and vegetable markets, and natural food stores. To identify "BMI-unhealthy" food sources, we also used industry codes but supplemented this strategy with name searches for local and national chain restaurants to make our classification more accurate.

Using GIS software, we defined neighborhoods for our study participants and measured the presence or density of different types of food outlets in these neighborhoods. We then examined how the distribution of food sources across neighborhoods was associated with obesity levels of neighborhood residents.

In addition to these analyses, we conducted several ancillary studies. One used qualitative interviews to elicit perceptions of healthy food among Hispanic immigrants in the city. For another, we used the Nutrition Environment Measurement Study in Restaurants audit protocol[20] to compare nutrition environments in small corner stores (locally, "bodegas") and national chain fast-food restaurants.[21] We also conducted a mapping study to learn more about disparities in access to healthy and unhealthy food in New York City.

Results

Consistent with a core assumption of research and advocacy on the food environment, we found that obesity was less common among people who lived near supermarkets and other healthy food outlets such as produce markets and natural food stores.[19] We also found that the relative density of unhealthy compared with healthy food sources predicted higher BMI in New York City, while the absolute density of unhealthy food did not.[19,22] As reported in earlier studies of food deserts, this result could mean that unhealthy food sources are not themselves problematic as long as people can access healthy food sources. Alternatively, it may be that unhealthy food outlets are so prevalent in New York City that the slight variation in density seen across neighborhoods is not sufficient to influence diet.

Our study of adolescents, however, yielded a surprising result: adolescents with more neighborhood fast-food availability had lower odds of obesity.[23] This finding is counterintuitive in light of what we know about the nutritional content and portion size of offerings at national chain restaurants, as well as their pricing and marketing strategies.[1,15,24,25] However, our systematic review of the U.S. literature[17] also raised questions about the idea that unhealthy food density is a major determinant of obesity rates in the contemporary U.S. context. Indeed, a previous national study found no association between neighborhood fast-food restaurant availability and fast-food consumption,[26] an association that would seem to be necessary for unhealthy food outlets to influence weight and health. If fast food were completely absent from the environment, people would not eat it, but it may not follow that incrementally higher fast-food restaurant density always increases fast-food consumption. A ceiling effect could be in play, in which the availability of fast food does shape dietary patterns but, above some threshold, increases in fast-food density have little or no effect.[16]

We explored competing explanations for this unexpected result linking fast-food availability to lower adolescent obesity and noted that fast-food restaurants were related to commercial investment in general: neighborhoods with a higher density of banks also had lower obesity rates, even though there is no apparent reason why banks would be directly predictive of adolescent diet or weight. It may be that fast food, banks, and other retail businesses after "retail" are markers of economic context or other neighborhood qualities associated with lower obesity and better health.[23] The underlying economic forces leading to disinvestment of all kinds, reflected in our work by fewer fast-food outlets and fewer banks, might be an important factor affecting obesity. This analysis suggests that policymakers should be cautious about identifying solutions based on *correlations* without fully considering complex social forces that might be underlying *causes* of unequal health.

Other BEH studies refined and complicated our conceptions of a healthy food environment. Incorporating specific practices of ethnic groups provides a distinctive lens on the food environment. Our mixed-methods study found that many Latina immigrants did not consider supermarket food to be healthy; their conceptions of nutrition emphasized food that was fresh and local, such as produce from farmers markets or chickens from local slaughterhouses.[27] We also found that, among our Latina sample, residential neighborhood access to farmers markets was associated with higher reported consumption of fruits and vegetables, while residence near a supermarket was not associated with differences in diet. Furthermore, living in a co-ethnic Hispanic enclave was associated with healthier diets, and differences in dietary quality by neighborhood ethnic composition could not be explained by measured differences in the retail food environment.[28] This work suggests that the same kind of food environment could have different effects across communities defined by ethnicity or other social characteristics.

Our audit study measured the nutritional environments of fast-food restaurants and bodegas, both commonly considered unhealthy food sources.[21] We found that bodegas offered more healthy foods than fast-food restaurants, while fast-food restaurants were more likely than bodegas to provide nutritional information such as calorie counts. Both bodegas and fast-food restaurants located in high-poverty neighborhoods had poorer nutritional environment scores than their counterparts in low-poverty neighborhoods. Here, too, the reality of the food environment is more complex than the industry codes in our business micro-data suggest. If the nutritional environment is systematically poorer in high-poverty neighborhoods, we could be underestimating its effect on health when using standard measures.

Lastly, we used a mapping study to see how our measures of food access might be affected by neighborhood characteristics that affect travel. Most studies, including our own, examine the food environment within a fixed buffer size—a half-mile or so—around the home, but neighborhood characteristics could moderate the effect of distance. In some neighborhoods, for instance, high crime or poor traffic safety may encourage residents to stay close to home. In others, excellent public transit or high rates of car ownership allow residents to take advantage of food outlets farther away.[29] Adjusting for these differences changes the patterns of disparities we observe.[30] For instance, car ownership rates tend to be lower in high-poverty neighborhoods. When we adjust for car ownership in our measures of supermarket access, the gap between poor and affluent neighborhoods grows wider.

Translating Research to Policy

Defining a public policy "takeaway" from these studies was not straightforward. We had found that access to both healthy food and unhealthy food seemed to be associated with lower obesity rates. In this case, however, what attracted mainstream media attention was the unexpected or counterintuitive results. For instance, our study of immigrant women's perceptions of supermarkets, in which we reported that Latina immigrants did not consider supermarkets to be "healthy," led to an interview for Andrew Rundle on "Latino USA," a National Public Radio show.[31] The study of fast food and adolescents' BMI was covered in Los Angeles, where city government had limited new fast-food outlets in specific neighborhoods, and in New York City, where Mayor Michael Bloomberg's recently proposed ban on the sale of large sodas had drawn controversy. Michael Bader, first author of that paper, sought to highlight the broader issues of economic disinvestment. He was quoted in the *Los Angeles Times* saying, "My research has found banning fast food misses the root cause of unhealthy communities," and in the *New York Post* stating, "Maybe the worst places for your health are where fast-food restaurants won't locate."[32,33] The *New York Post*, however, led with: "Nanny Bloomberg might want to reconsider his war on everything that tastes good."[33]

Our research on the food environment attracted notice from researchers and policymakers in the New York City Department of Health and Mental Hygiene and elsewhere in city government. Even as we were conducting our research, the city was launching a number of initiatives to increase availability of healthy food in underserved neighborhoods, including: (1) a program of Green Carts, sidewalk stands that sell fresh produce; (2) the FRESH program, which supports the establishment or retention of grocery stores; (3) the Healthy Bodegas Initiative, which promotes the sale of produce and other healthy items at corner stores; (4) the Shop Healthy NYC program, which promotes stocking and display of healthy foods in grocery stores in targeted zip codes; (5) the Health Bucks program, which provides a bonus to customers using food stamps to purchase fresh produce at farmers markets; and (6) efforts to promote the expansion of farmers markets in low-income neighborhoods and to equip these markets with terminals so customers can purchase food with their EBT (food stamps) cards. These initiatives, aimed at the food environment, complement other regulatory steps, voluntary standards, and public education campaigns. Similar initiatives were launched in other major cities.

It is notable that, by and large, these measures addressed the undersupply of healthy food, not the oversupply of unhealthy food. One reason for this is the ubiquity of unhealthy food.[19,34] In New York City, unhealthy food sources, including fast-food restaurants, pizzerias, and corner stores, are 10 times more prevalent than healthy food sources.[19] These counts don't even include the calorie-dense foods that are widely available from pharmacies, gas stations, newsstands, mobile vendors, and other businesses. In an environment that is so saturated with unhealthy food, restrictions on restaurants and stores would have to be Draconian to impact diets—and such policy measures are likely to be politically and legally challenging to enact. It may be more productive to focus on increasing the variety, value, and prominence of healthy options within fast-food restaurants, corner stores, and other "unhealthy" outlets.[35] New York City's Healthy Bodegas Initiative and Philadelphia's Healthy Corner Store Initiative have taken exactly that approach.

Although we cannot draw a straight line between our research and a specific food policy, our research was part of the context in which these policy measures were developed. At the request of Karen Lee at the New York City Department of Health and Mental Hygiene, Gina Lovasi led the development of a report on Built Environment Indicators for New York City and presented this report to a multiagency audience in 2008. Andrew Rundle provided testimony to the New York City Council and the New York City Planning Commission at 2009 hearings on healthy food access and the FRESH initiative and met several times with New York City's food policy coordinator ("food czar"), Ben Thomases.

We were also engaged in policy formation at the national level. In 2009, the U.S. Department of Agriculture's (USDA's) Economic Research Service provided guidance to Congress on the measurement of food deserts. The BEH group took part in a conference organized by the University of Michigan's National Poverty Center to help the Economic Research Service formalize a definition of food deserts for the federal government. Our working paper was cited in the 2009 USDA food deserts report to Congress, which in turn was incorporated into the USDA Food Environment Atlas (http://www.ers.usda.gov/topics/food-choices-health/food-access.aspx) and into ongoing analyses on the extent and consequences of food deserts by the USDA and research groups throughout the United States.[36,37]

Successes and Challenges

BEH research on the food environment can count a number of successes. We contributed to a growing literature on the association between the food environment and health; documented disparities in healthy food access and unhealthy food exposure in New York City; highlighted conceptual and measurement questions in studies of the food environment; and engaged with the local and national policy conversation related to food and health. In an iterative fashion, our interactions with policymakers, community groups, and the press have fed back into our new research directions. Chief among these is a project that addresses a key methodologic challenge in the research on the food environment and health: the fact that most studies relating the food environment to health, including our own, measure cross-sectional correlations and do not evaluate whether the temporal sequence supports causality.

In the largely cross-sectional literature linking the food environment to health, common causes such as lifestyle preferences and poverty may confound observed environment–health associations. Although longitudinal research is often recommended as a strategy to enhance the relevance of future research on local environments and health, many studies have incorporated change only on the health side, while assuming that the environment is fixed. Use of longitudinal data is a substantial advance in work on neighborhoods and health, yet lifestyle preferences and other common causes could still confound the association between baseline environment and changing health during follow-up. For example, someone who prefers to eat fresh foods might choose to live near a supermarket or farmers market and might also have a healthier dietary pattern over subsequent years. In addition, those areas with high resident demand for healthy foods would be expected to attract and sustain businesses that sell healthy foods. These patterns of neighborhood selection would tend to inflate the association between local availability of healthy food outlets and health at any time, making the observed correlation an overestimate of the causal effect of healthy food outlets on changes in health

over time. The status quo of cross-sectional research also typically neglects how local policies such as zoning or investment affect the location of residents and businesses; this factor needs further academic research to help policymakers understand how they influence the patterns we study.

These limitations have motivated longitudinal research efforts to strengthen our understanding of whether living in a healthy environment influences diet or vice versa. Two strategies are often used to clarify the sequence of cause and effect in place-based studies using longitudinal data. The first strategy is to study people who move. Mobility experiments such as Moving to Opportunity for Fair Housing[38] observe what happens when randomly selected families are given vouchers to move to a different neighborhood with less concentrated poverty. Such experiments are intriguing in that they can capture responses to a new environment, although they may not be generalizable to residential moves that occur over the life course for a variety of reasons. In addition, the relocation-focused experiments are best suited to inform housing voucher policies, rather than policies that would focus on making neighborhood food environments more health-supportive. Thus, a second strategy is to study neighborhoods that change. Studies in this vein often leverage "natural experiments" such as policy changes. For instance, several such studies have considered a major change to the local context, such as a new supermarket, transit infrastructure expansion, or housing development.[39,40] However, if these studies fail to support the original hypothesis, the result is often explained away based on lack of fidelity to the research question or to idiosyncratic barriers to population use of the new resource. Research using natural experiments in multiple sites is less vulnerable to these kinds of limitations.

The next phase of our research builds on both of these research strategies. In a project led by Gina Lovasi, "Communities Designed to Support Cardiovascular Health for Older Adults" (1R01AG049970-01A1 from the National Institute on Aging), we will analyze two population-based cohorts of older adults. We will take advantage of self-reported information on residential moves,[41] supplemented with commercially available residential history data,[42] providing unprecedented richness of information on residential stability and change in later life. With detailed survey data as well as linked profile information from LexisNexis (e.g., property ownership, vehicle registration, bankruptcy), we can explore changes in health and financial circumstances that might precipitate moves to a new neighborhood. These data on residential locations and health over time will be linked to a 25-year census of local businesses from the National Establishment Time-Series,[43] capturing key dynamics in the food environment.

Given their spatial and temporal scope, these data are likely to offer a number of natural experiments. In particular, supermarket openings or broader zoning changes are attractive because they are outside the control of any one study participant and thus likely to be independent of their preferences. With residential location data over time we can also examine whether participants appear to relocate in anticipation of, or in response to, shifts in the local food environment.

This work will also provide a strong platform for informing policy and understanding effect heterogeneity—in other words, when, where, and for whom the food environment matters most. Our research strategy, which relies on time-varying measures of both residential address and environment characteristics, will also allow us to consider the food environment as part of a broader context. Other aspects of the environment, including housing characteristics,[44] pollution sources,[45] daily stressors,[46] and physical activity opportunities, may all have effects on obesity that are not entirely explained by associated dietary behaviors. As research on the built environment continues, it will be important to assess how the multiple associations with health are related to each other and whether those associations are contingent upon each other.

Conclusions

Research on the environmental determinants of health and health behavior has successfully shifted attention from individual risk factors to the broader contexts that shape risk factors and related behaviors. Although the evidence linking the local food environment to dietary intake and health is not drawn from studies with traditional experimental randomization, this evidence has nonetheless reached an audience among policymakers and other stakeholders. As new data and computational resources become available, the policy-relevant evidence base will expand and enrich this evolving story. Government agencies, community groups, and business entities make decisions that have lasting impact on the homes, neighborhoods, lifestyles, and health of populations; evidence can both inform and help assess these decisions.

More remains to be done. Questions remain as to whether built environments can be effectively designed to improve health and how different populations would react to such changes. The population health research community has an opportunity to articulate both the importance of health for successful communities and the potential for policies and infrastructure investments to support healthy behaviors alongside economic, ecological, and equity goals. As decisions are made that have lasting structural and system-level implications for populations, the best currently available evidence should be shared, with attention to limitations

and remaining uncertainty, and leveraged to limit harmful effects and optimize health benefits. Partnerships within and beyond the health sciences can generate and help to disseminate this evidence. The BEH group will continue to build on a decade of research innovation and translation in the context of growing policy interest to improve the urban food environment.

Discussion Questions

1. What has been the role of your own environment in shaping lifestyle patterns? Do you see ways that the opportunities for healthy or unhealthy eating have influenced your diet?

2. Self-selection of people into neighborhoods that match their lifestyles was discussed as one source of bias in neighborhood health research. How have you made decisions about where to live? Do your health-related preferences and resources such as supermarkets factor prominently into your decisions?

3. In considering policy on the food environment, research to date offers some guidance, and yet the evidence continues to evolve. How should the research community balance the interests of news media and policymakers, who would like a clear and simple message about what works, with the desire of researchers to accurately convey the state of existing scientific knowledge?

Assignment

Choose one or two commercial blocks near your home or school and list the food outlets (stores and restaurants) on these blocks. Include all stores that sell food, even if they are not grocery stores or restaurants. If there are food trucks or sidewalk stands that sell food regularly, include these as well. Which outlets should be considered "healthy" or "unhealthy" and why? Based on the research described in the case study, what local policies (if any) would you recommend to make this micro-food environment more supportive of healthy eating? How would you know whether your proposed change provided the anticipated health benefits? Defend your policy and research recommendation.

References

1. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *Lancet.* 2002;360(9331):473-482.

2. Hayman LL, Williams CL, Daniels SR, et al; Committee on Atherosclerosis, Hypertension, and Obesity in Youth (AHOY) of the Council on Cardiovascular Disease in the Young, American Heart Association. Cardiovascular health promotion in the schools: a statement for health and education professionals and child health advocates from the Committee on Atherosclerosis, Hypertension, and Obesity in Youth (AHOY) of the Council on Cardiovascular Disease in the Young. *Circulation.* 2004;110(15):2266-2275.

3. Poirier P, Giles TD, Bray GA, et al; American Heart Association, Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss: an update of the 1997 American Heart Association Scientific Statement on Obesity and Heart Disease from the Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. *Circulation.* 2006;113(6):898-918.

4. Eckel RH, Jakicic JM, Ard JD, et al; American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol.* 2014;63(25 Pt B):2960-2984.

5. Eyre H, Kahn R, Robertson RM, et al; American Cancer Society; American Diabetes Association; American Heart Association. Preventing cancer, cardiovascular disease, and diabetes: a common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Circulation.* 2004;109(25):3244-3255. Epub June 15, 2004.

6. Batch JA, Baur LA. Management and prevention of obesity and its complications in children and adolescents. *Med J Aust.* 2005;182(3):130-135.

7. Rees K, Dyakova M, Wilson N, Ward K, Thorogood M, Brunner E. Dietary advice for reducing cardiovascular risk. *Cochrane Database Syst Rev.* 2013;12:CD002128.

8. Wrigley N, Warm D, Margetts B. Deprivation, diet and food retail access: findings from the Leeds 'food deserts' study. *Environ Plann* A. 2003;35(1):151-188.

9. Cummins S, Macintyre S. "Food deserts"—evidence and assumption in health policy making. *BMJ.* 2002;325(7361):436-438.

10. Babey SH, Diamant A, Hastert T, et al. Designed for disease: the link between local food environments and obesity and diabetes. 2008. https://www.escholarship.org/uc/item/9zc7p54b. Accessed February 5, 2018.

11. Cohen N, Obadia J. Greening the food supply in New York. In: Slavin MI, ed. *Sustainability in America's Cities.* Springer; 2011:205-229.

12. Mozaffarian D, Afshin A, Benowitz NL, et al; American Heart Association Council on Epidemiology and Prevention, Council on Nutrition, Physical Activity and Metabolism, Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on the Kidney in Cardiovasc. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. *Circulation.* 2012;126(12):1514-1563.

13. Ashe M, Jernigan D, Kline R, Galaz R. Land use planning and the control of alcohol, tobacco, firearms, and fast food restaurants. *Am J Public Health.* 2003;93(9):1404-1408.

14. Davis B, Carpenter C. Proximity of fast-food restaurants to schools and adolescent obesity. *Am J Public Health.* 2009;99(3):505-510.

15. Grier SA, Kumanyika SK. The context for choice: health implications of targeted food and beverage marketing to African Americans. *Am J Public Health.* 2008;98(9):1616-1629.

16. Sturm R, Cohen DA. Zoning for health? The year-old ban on new fast-food restaurants in South LA. *Health Aff (Millwood).* 2009;28(6):w1088-1097.

17. Lovasi GS, Hutson MA, Guerra M, Neckerman KM. Built environments and obesity in disadvantaged populations. *Epidemiol Rev.* 2009;31:7-20.

18. Bader MD, Ailshire JA, Morenoff JD, House JS. Measurement of the local food environment: a comparison of existing data sources. *Am J Epidemiol.* 2010;171(5):609-617.

19. Rundle A, Neckerman KM, Freeman L, et al. Neighborhood food environment and walkability predict obesity in New York City. *Environ Health Perspect.* 2009;117(3):442-447.

20. Saelens BE, Glanz K, Sallis JF, Frank LD. Nutrition Environment Measures Study in restaurants (NEMS-R): development and evaluation. *Am J Prev Med.* 2007;32(4):273-281.

21. Neckerman KM, Lovasi L, Yousefzadeh P, et al. Comparing nutrition environments in bodegas and fast-food restaurants. *J Acad Nutr Diet.* 2013;114(4):595-602.

22. Stark JH, Neckerman K, Lovasi GS, et al. Neighbourhood food environments and body mass index among New York City adults. *J Epidemiol Community Health.* 2013;67(9):736-742.

23. Bader MD, Schwartz-Soicher O, Jack D, et al. More neighborhood retail associated with lower obesity among New York City public high school students. *Health Place.* 2013;23:104-110.

24. Grier SA, Mensinger J, Huang SH, Kumanyika SK, Stettler N. Fast-food marketing and children's fast-food consumption: exploring parents' influences in an ethnically diverse sample. *J Public Policy Market.* 2007;26(2):221-235.

25. Drewnowski A, Darmon N. The economics of obesity: dietary energy density and energy cost. *Am J Clin Nutr.* 2005;82(supp 1):265S-273S.

26. Richardson AS, Boone-Heinonen J, Popkin BM, Gordon-Larsen P. Neighborhood fast food restaurants and fast food consumption: a national study. *BMC Public Health.* 2011;11:543.

27. Park Y, Quinn J, Florez K, Jacobson J, Neckerman K, Rundle A. Hispanic immigrant women's perspective on healthy foods and the New York City retail food environment: a mixed-method study. *Soc Sci Med.* 2011;73(1):13-21.

28. Park Y, Neckerman K, Quinn J, Weiss C, Jacobson J, Rundle A. Neighborhood immigrant acculturation and diet among Hispanic female residents of NYC. *Public Health Nutr.* 2011;14(9):1593-1600.

29. Inagami S, Cohen DA, Finch BK, Asch SM. You are where you shop: grocery store locations, weight, and neighborhoods. *Am J Prev Med.* 2006;31(1):10-17.

30. Bader MD, Purciel M, Yousefzadeh P, Neckerman KM. Disparities in neighborhood food environments: implications of measurement strategies. *Econ Geogr.* 2010;86(4):409-430.

31. Cereijido A. Latina immigrant women might not trust supermarkets. *Latino USA.* November 28, 2014. http://latinousa.org/2014/11/28/latina-immigrant-women-might-trust-supermarkets/. Accessed February 5, 2018.

32. Jennings A, Smith D. South L.A. ban on new fast-food restaurants has little effect. *Los Angeles Times.* May 9, 2015. http://www.latimes.com/local/california/la-me-0510-south-la-food-20150510-story.html. Accessed February 5, 2018.

33. Buiso G. More fast food, fewer fat teens. *New York Post.* June 30, 2013. https://nypost.com/2013/06/30/more-fast-food-fewer-fat-teens/. Accessed February 5, 2018.

34. Neckerman KM, Bader MD, Richards CA, et al. Disparities in the food environments of New York City public schools. *Am J Prev Med.* 2010;39(3):195-202.

35. Neckerman KM. Takeaway food and health: change the menu, not the venue. *BMJ.* 2014;348:g1817.

36. Neckerman KM, Bader, M, Parcel M, Yousefzadeh P. Measuring food access in urban areas. National Poverty Center working paper. 2009.

37. Ver Ploeg M, ed. Access to affordable and nutritious food: measuring and understanding food deserts and their consequences. Report to Congress. Economic Research Service, U.S. Department of Agriculture. https://www.ers.usda.gov/webdocs/publications/42711/12716_ap036_1_.pdf?v=41055. Pubished June 2009. Accessed February 5, 2018.

38. Liebman JB, Katz LF, Kling JR. Beyond treatment effects: estimating the relationship between neighborhood poverty and individual outcomes in the MTO experiment. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=630803. KSG working paper RWP04-036. Published August 2004. Accessed February 5, 2018.

39. Knuiman MW, Christian HE, Divitini ML, et al. A longitudinal analysis of the influence of the neighborhood built environment on walking for transportation: the RESIDE study. *Am J Epidemiol.* 2014;180(5):453-461.

40. Lovasi GS, Goldsmith J. Invited commentary: taking advantage of time-varying neighborhood environments. *Am J Epidemiol.* 2014;180(5):462-466.

41. Lovasi GS, Richardson JM, Rodriguez CJ, et al. Residential relocation by older adults in response to incident cardiovascular health events: a case-crossover analysis. *J Environ Public Health.* 2014: article ID 951971.

42. Jacquez GM, Slotnick MJ, Meliker JR, AvRuskin G, Copeland G, Nriagu J. Accuracy of commercially available residential histories for epidemiologic studies. *Am J Epidemiol.* 2010;173(2):236-243.

43. Neumark D, Wall B, Zhang J. Do small businesses create more jobs? New evidence for the United States from the National Establishment Time Series. http://ftp.iza.org/dp3888.pdf. Institute for the Study of Labor (IZA) discussion paper 3888. Published December 2008. Accessed February 4, 2018.

44. Saegert SC, Klitzman S, Freudenberg N, Cooperman-Mroczek J, Nassar S. Healthy housing: a structured review of published evaluations of US interventions to improve health by modifying housing in the United States, 1990–2001. *Am J Public Health.* 2003;93(9):1471-1477.

45. Rundle A, Hoepner L, Hassoun A, et al. Association of childhood obesity with maternal exposure to ambient air polycyclic aromatic hydrocarbons during pregnancy. *Am J Epidemiol.* 2012;175(11):1163-1172.

46. Evans GW. The built environment and mental health. *J Urban Health.* 2003;80(4):536-555.

About the Milbank Memorial Fund

The Milbank Memorial Fund is an endowed operating foundation that works to improve the health of populations by connecting leaders and decision makers with the best available evidence and experience. Founded in 1905, the Fund engages in nonpartisan analysis, collaboration, and communication on significant issues in health policy. It does this work by publishing high-quality, evidence-based reports, books, and *The Milbank Quarterly*, a peer-reviewed journal of population health and health policy; convening state health policy decision makers on issues they identify as important to population health; and building communities of health policymakers to enhance their effectiveness.

Milbank Memorial Fund
645 Madison Avenue
New York, NY 10022
www.milbank.org