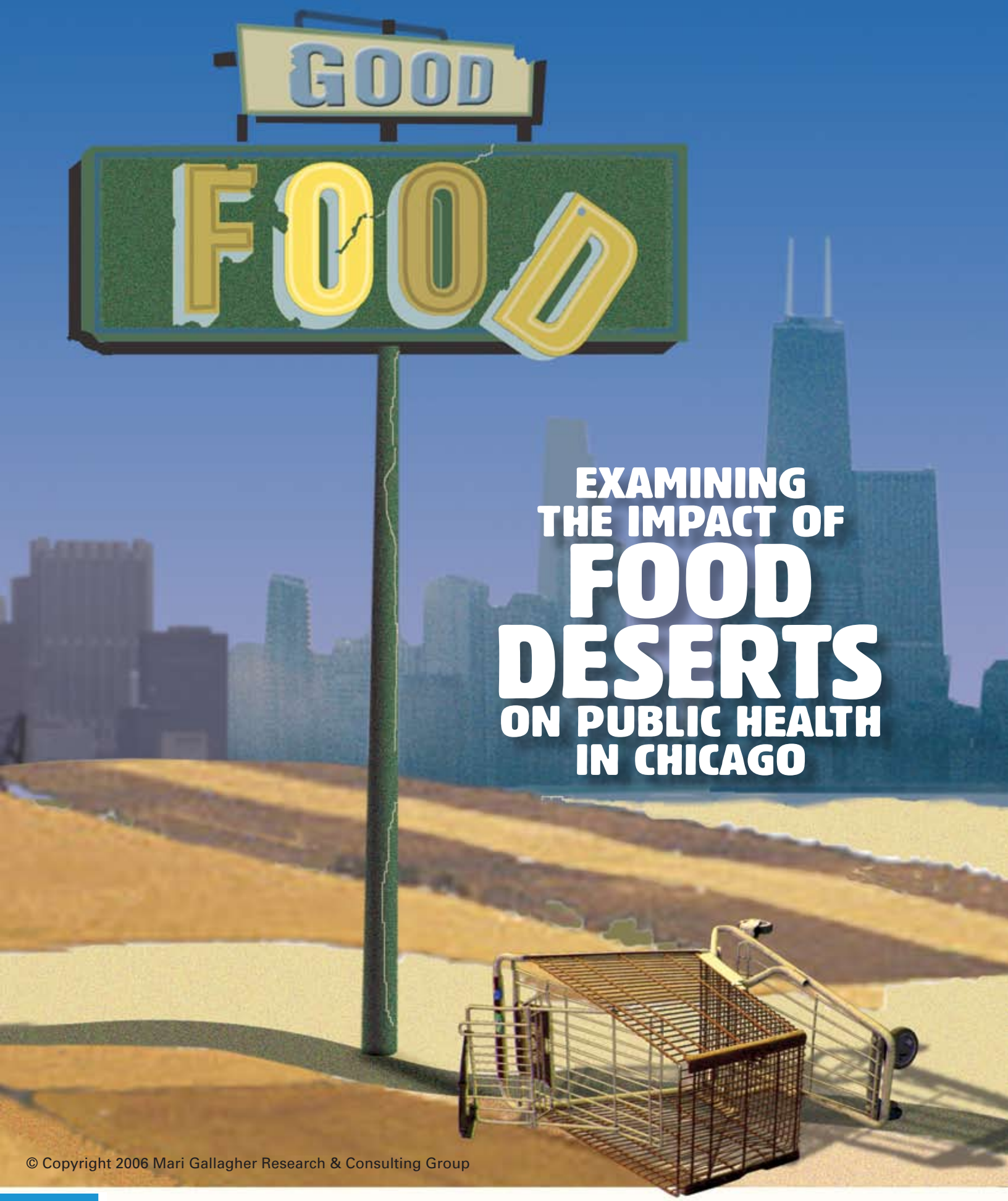

EXAMINING THE IMPACT OF FOOD DESERTS ON PUBLIC HEALTH IN CHICAGO

Mari Gallagher
Research & Consulting Group

Full Report

LaSalle Bank
ABN AMRO

LaSalle Bank Corporation
135 South LaSalle Street
Suite 2325
Chicago, Illinois 60603

Robert S. Grossinger
Senior Vice President
Community & Sustainable Development

Dear Colleague:

LaSalle Bank is committed to building sustainable communities by providing residents, small businesses and non-profit organizations with the resources and assistance necessary to be healthy and vibrant members of the community.

With deep roots in the Chicago community, LaSalle Bank understands that many of the city's neighborhoods are challenged by limited access to healthy food. It has been established that numerous areas of Chicago are considered "food deserts," neighborhoods with no or distant grocery stores but an abundance of fast food restaurants and other retail outlets offering little or no nutritious food. Similarly, public health officials and community advocates have been alarmed by statistics that reflect the growing prevalence of obesity, diabetes, cancer, cardiovascular disease and hypertension, particularly in these disadvantaged communities.

As rates of these and other chronic health problems continue to rise, researcher Mari Gallagher proposed, and LaSalle Bank commissioned, a report to explore the health consequences of food deserts. And, indeed, it appears that residents of food deserts experience higher rates of certain diet-related health conditions.

We hope that the findings herein and discussion at the *Stranded in the Food Desert* forum will reveal both the challenges and opportunities involved in providing equal access to healthy food to affected neighborhoods – and that it will inspire new understanding of this important community health issue, and action that begins to bring solutions. Thank you to Mari Gallagher, Local Initiative Support Corporation and the many organizations and individuals who contributed to this report.

Sincerely,

Robert Grossinger

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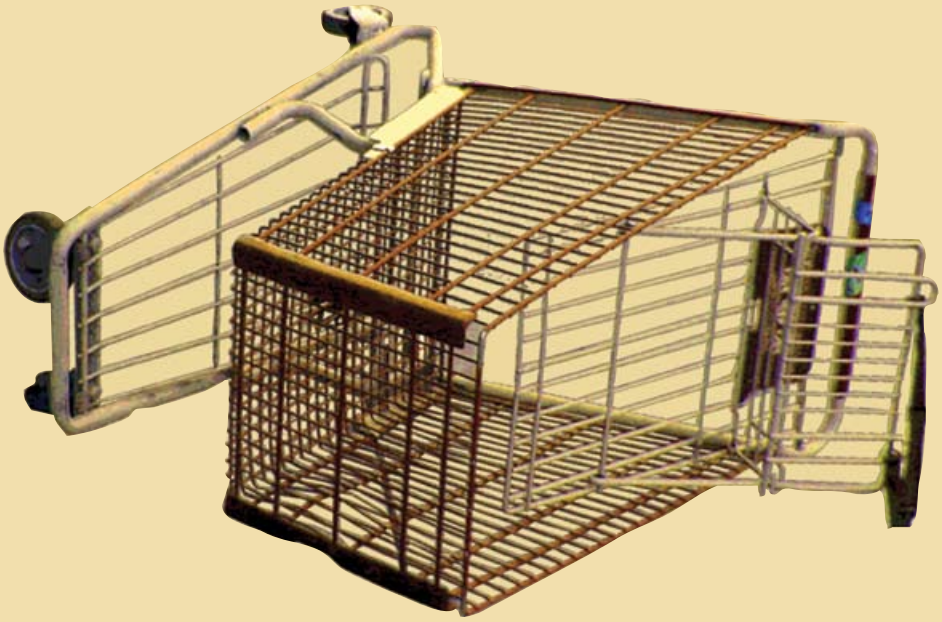


FOREWORD FROM GEORGE KAPLAN

"Location, location, location," is an expression that comes up a lot in conversations about the value of a piece of property. Whether we're talking about buying a new house or locating a business, everyone knows that location matters. But what about health? Is the location where you live also important for your health? Sure, we all know that living in an area with fouled water or air can affect our health, but are there other aspects of places that can make us sick or keep us well? The answer is most assuredly "yes," and it is not based on just real estate lore but on a solid foundation of facts that have been accumulated over the last quarter century or so. Researchers from epidemiology and other disciplines have consistently shown, for example, that those who live in disadvantaged neighborhoods have worse health outcomes. For a wide range of health problems across the age spectrum – from infant mortality to disability in the elderly, and specific conditions such as cardiovascular disease, diabetes, and asthma – where you live does make a difference. What's more, living in disadvantaged areas also is associated with more obesity, depression, and physical inactivity, all factors that increase your risk of getting sick.

A good example of this is a study that colleagues and I conducted 20 years ago in which we compared the risk of dying between residents of Oakland, California, who lived in federally designated poverty areas and those who did not. Groups of census tracts were gathered together and designated as a poverty area based on levels of income, unemployment, low education, substandard housing, unskilled male workers, and children in single parent homes. This resulted in a 10-mile-long strip divided by a freeway in which housing was interspersed with warehouses, manufacturing, and railways. We tracked the health experience of a group of individuals who lived in this area and other parts of Oakland for many years. After nine years, we discovered that those who lived in this poverty area had a 71% greater chance of dying during that period than those who lived in other parts of Oakland. Of course, the two groups of people differed in many ways, but when we took into account differences in income and education, health care access, race/ethnicity, smoking and other high risk behaviors, depression, and other factors by which they differed, those in the poverty area were still 50% more likely to die during those nine years! So there must have been something about the social and physical environment to which residents of poverty areas were exposed that made them sicker. Health – like politics – must be local, adding new meaning to the importance of location.

How could it be that merely living in a place could make you sick? The evolving perspective is that the areas in which people live can differ widely in their access to health-promoting factors and exposures to health-damaging factors. Furthermore, these different opportunities and risks may explain many of the health differences that we see

between residents of different places, as well as health disparities between racial, ethnic and socioeconomic groups.

This is where the present report, *Examining the Impact of Food Deserts on Public Health in Chicago*, makes a real contribution. By demonstrating that where you live makes a real difference to where you can buy food and, indirectly, the quality of that food, the report begins to explain exactly how opportunities and risks vary by neighborhood. But it doesn't stop there. It also shows important differences between neighborhoods in the "balance" of grocery stores to fast food outlets. That there are large differences in the nutritional choices available between grocery stores and fast food outlets is well known, but what was not known before this report is that for some neighborhoods the balance swings far to the fast food side. At first glance, we might only guess that these differences influence the health of those who live in the neighborhoods. The report provides evidence that suggests our guesses are correct. Cleverly combining information from the City health department, research studies, and driver's license records, the report illustrates that both access to markets and the balance of markets to fast food outlets are associated with important health outcomes. This conclusion applies generally to a broad swath of health outcomes, ranging from "premature mortality," to cardiovascular disease, diabetes, and cancer deaths to obesity and hypertension, lending support to the overall importance of the argument.

Finally, a word on language in the report. I find the use of the term "food desert" particularly interesting. A desert is, of course, a place distinguished by the absence of vegetation, rain, etc., which is the sense in which the word is used in this report. Food deserts are defined as "areas with no or distant grocery stores." But the word "desert" is also a verb – "to leave someone without help or in a difficult situation and not come back." This seems to me to capture an important dimension of food deserts not conveyed by the noun. The verb "desert" focuses on action and agency, emphasizing that the lack of access to good food in some areas is not a natural, accidental phenomenon but is instead the result of decisions made at multiple levels by multiple actors. By focusing on this latter meaning, we can find room for changes to be effected, for different decisions to be made in the future, for movement toward actions that can improve access to healthy food for those who have been deserted. In doing so, we can help in at least one way to improve uneven opportunities, and perhaps provide better health as well.

George A. Kaplan, Ph.D.
Thomas Francis Collegiate Professor of Public Health
Department of Epidemiology
University of Michigan School of Public Health and
Research Professor, Institute for Social Research
Director, Center for Social Epidemiology and Population Health

EXECUTIVE SUMMARY

African-American and White communities that have out-of-balance food environments will have higher rates of residents dying prematurely from diabetes.

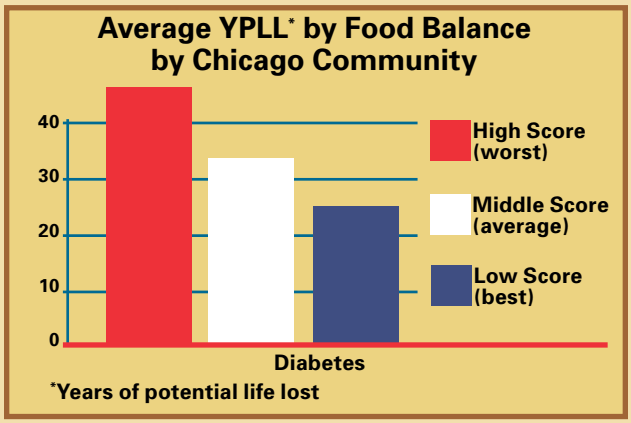


Fig. 1

Diabetes is also a serious health issue confronting Latino and diverse communities.

In 1923, long before the rise of McDonald's golden arches, an advertisement for beef made this proclamation in the *Bridgeport Telegraph*:

> *"Ninety percent of the diseases known to man are caused by cheap foodstuffs. You are what you eat."*

The phrase "you are what you eat" actually dates back to the 17th Century. Over time, science has repeatedly demonstrated that nutritional intake directly affects health outcomes. That we are what we eat is a medical fact. But to what degree does what we eat and, thus, our health, depend on where we live and the types of food we have access to?

Examining the Impact of Food Deserts on Public Health in Chicago probes this very question. Given our foundational premise that the health and vitality of urban communities is a block-by-block phenomenon, our first task is to measure the distance from every City of Chicago block to the nearest grocery store and fast food restaurant. Next, we develop an empirical score to quantify the balance of food choice available to residents. Finally, we compare food access and food balance directly to health outcomes, holding constant education, income, and race. Here is what we found:

- Residents of food deserts – large geographic areas with no or distant grocery stores – face nutritional challenges evident in diet-related community health outcomes. Those outcomes worsen when the food desert has high concentrations of nearby fast food alternatives. We call this the Food Balance Effect.
- Majority African-American and majority White communities that have out-of-balance food environments will have higher rates of residents dying prematurely from diabetes that are statistically significant. This statistical forecast takes into account income, education, and race. African-American communities will be the most likely to experience the greatest total years of life lost from diabetes as a result. To measure this effect, we developed a Food Balance Score: the distance to the closest grocer divided by the distance to the closest fast food restaurant for each block, tract, and Community Area in the City of Chicago. The chart in *Fig. 1* shows the average years of potential life lost (YPLL) for diabetes in 2003 by high, middle, and low Food Balance Scores by Chicago Community Area. The more out of balance the community, the higher the

life lost to diabetes. Diabetes is also a serious health issue confronting Latino and diverse communities. Our study suggests that food access and geographic food balance, however, are not the key contributors to those poor health outcomes.

While the calculation of years of potential life lost might be a new concept to some, almost everyone can relate to differentials among death rates. *Fig. 2* shows the numeric years of potential life lost outcomes from the previous chart along with 2003 death rates for diabetes. The diabetes death rate for the most out-of-balance Chicago communities is more than twice the rate for all other communities.

The map in *Fig. 3* shows Food Balance Scores by race for the tracts that scored in the worst third. These are areas that have no or distant grocery stores, but nearby fast food restaurants, where the greatest premature death from diabetes will likely continue to occur.

Premature death due to cancer and cardiovascular disease is also greater for African-American, White, and Latino communities where there is greater imbalance of food choices. While these effects are not statistically significant, the pattern repeats itself in nearly every instance of analysis: as communities become more out-of-balance in terms of food choices, diet-related deaths and premature death increase.

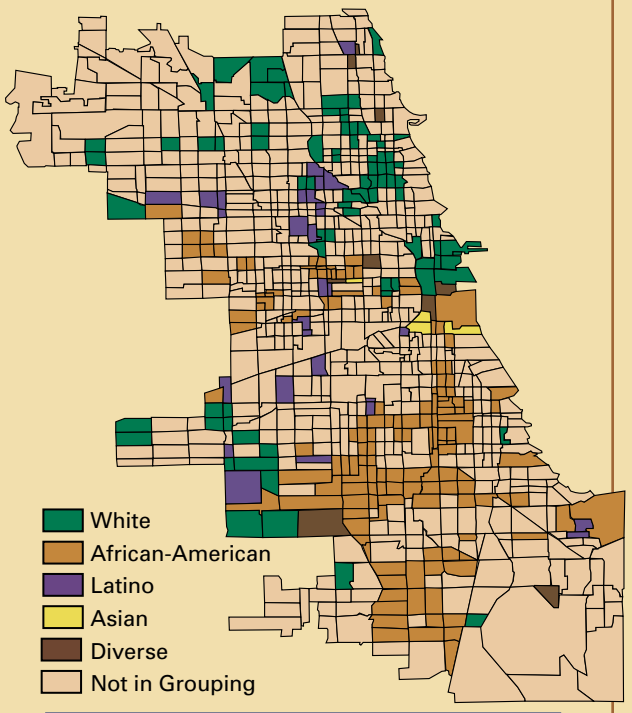
African-Americans are the most disadvantaged when it comes to balanced food choices, although other racial groups do suffer as well. African-Americans, on average, travel the farthest distance to any type of grocery store, and their low access communities cluster strikingly. Chicago's food deserts, for the most part, are exclusively African-American.

Diabetes by Chicago Community Areas by Food Balance Scores

Food Balance Groupings	YPLL	Death Rate Per 1,000 Population
Worst	45.48	1.27
Middle	33.48	1.11
Best	25.36	0.56

Fig. 2

Chicago's Most Out-of-Balance Tracts When It Comes to Food Access



The map shows the most out-of-balance tracts that have no or few grocers but nearby fast food restaurants shaded by that tract's majority race.

Fig. 3

Cancer and Cardiovascular Disease by Chicago Community Areas by Food Balance Scores

Food Balance Groupings	Cancer		Cardiovascular Disease		Food Balance Score
	YPLL	Death Rate	YPLL	Death Rate	
Worst	314	9.73	345	11.07	2.04
Middle	247	7.42	242	7.41	1.25
Best	204	6.68	185	5.72	0.87

Fig. 4

Average YPLL by Food Balance by Chicago Community

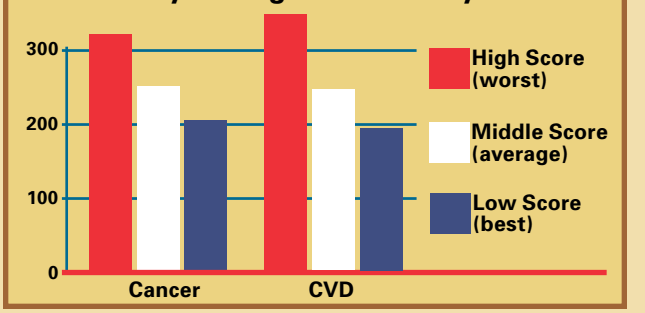
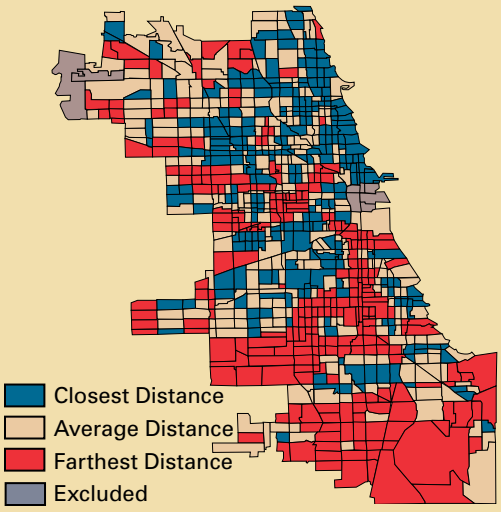


Fig. 5

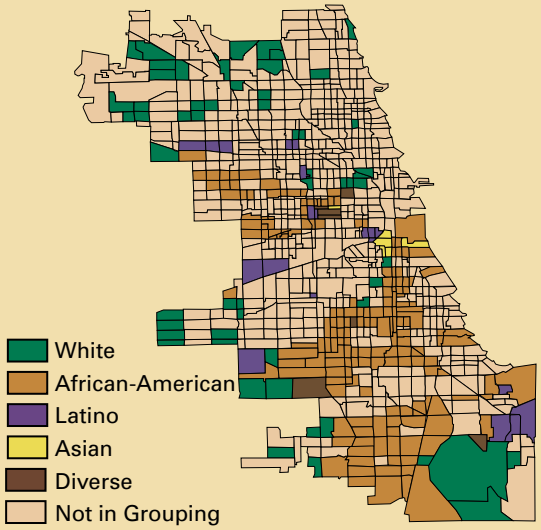
Distance to Grocers by Tract in Chicago



The map shows distance to all types of grocery stores at the tract level. Red colored tracts are the farthest distance from grocers; we see that they form three key food deserts on Chicago's West and South sides.

Fig. 6

Chicago's Food Deserts Are Nearly Exclusively African-American



The map shows only the tracts that are the farthest distance to grocers and shades them by race. We see that the three clusters of food deserts are primarily African-American, with the African-American majority tracts.

Fig. 7

Chicago Communities

1 ROGERS PARK
2 WEST RIDGE
3 UPTOWN
4 LINCOLN SQUARE
5 NORTH CENTER
6 LAKE VIEW
7 LINCOLN PARK
8 NEAR NORTH SIDE
9 EDISON PARK
10 NORWOOD PARK
11 JEFFERSON PARK
12 FOREST GLEN
13 NORTH PARK
14 ALBANY PARK
15 PORTAGE PARK
16 IRVING PARK
17 DUNNING
18 MONTCLARE
19 BELMONT CRAGIN
20 HERMOSA
21 AVONDALE
22 LOGAN SQUARE
23 HUMBOLDT PARK
24 WEST TOWN
25 AUSTIN
26 WEST GARFIELD PARK
27 EAST GARFIELD PARK
28 NEAR WEST SIDE
29 NORTH LAWNDALE
30 SOUTH LAWNDALE
31 LOWER WEST SIDE
32 LOOP
33 NEAR SOUTH SIDE
34 ARMOUR SQUARE
35 DOUGLAS
36 OAKLAND
37 FULLER PARK
38 GRAND BOULEVARD
39 KENWOOD
40 WASHINGTON PARK
41 HYDE PARK
42 WOODLAWN
43 SOUTH SHORE
44 CHATHAM
45 AVALON PARK
46 SOUTH CHICAGO
47 BURNSIDE
48 CALUMET HEIGHTS
49 ROSELAND
50 PULLMAN
51 SOUTH DEERING
52 EAST SIDE
53 WEST PULLMAN
54 RIVERDALE
55 HEGEWISCH
56 GARFIELD RIDGE
57 ARCHER HEIGHTS
58 BRIGHTON PARK
59 MCKINLEY PARK
60 BRIDGEPORT
61 NEW CITY
62 WEST ELSDON
63 GAGE PARK
64 CLEARING
65 WEST LAWN
66 CHICAGO LAWN
67 WEST ENGLEWOOD
68 ENGLEWOOD
69 GREATER GRAND CROSSING
70 ASHBURN
71 AUBURN GRESHAM
72 BEVERLY
73 WASHINGTON HEIGHTS
74 MOUNT GREENWOOD
75 MORGAN PARK
76 O'HARE
77 EDGEWATER

Chicago's Food Deserts by Tract with Community Boundaries

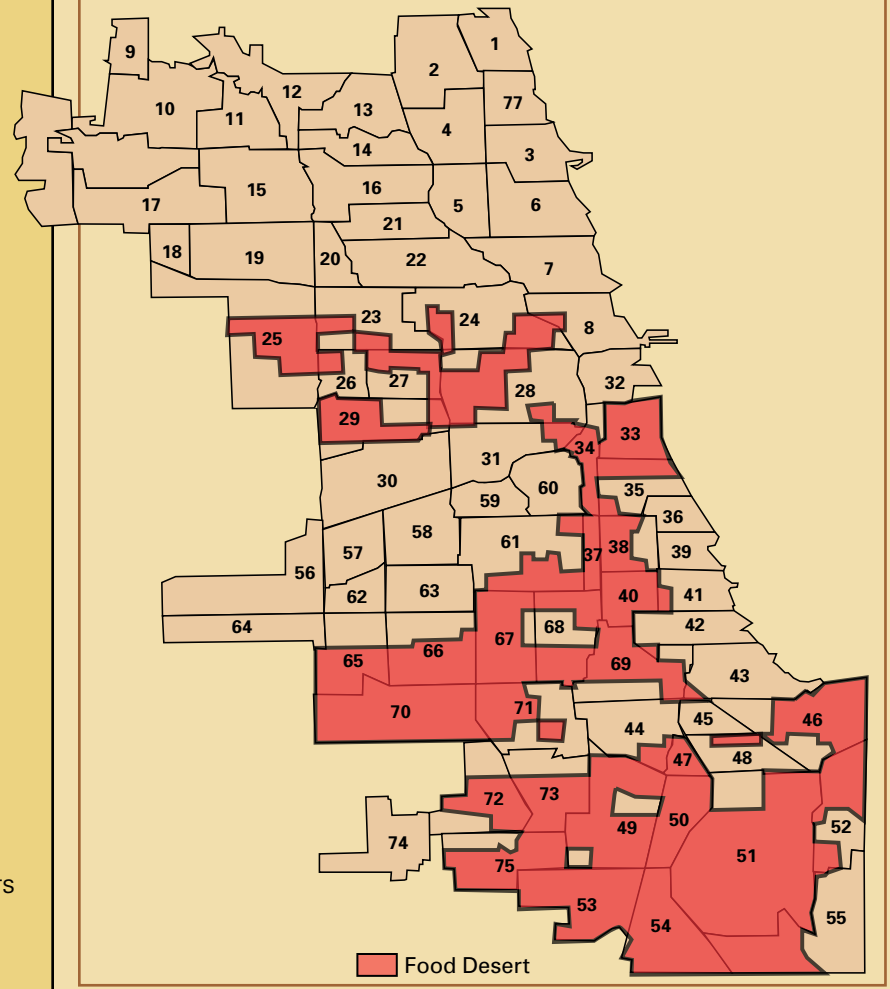


Fig. 8

In a typical African-American block, the nearest grocery store is roughly twice as distant as the nearest fast food restaurant. This means that, for African-Americans, it is much easier to access fast food than other types of food. Following a doctor's dietary recommendation is likely very difficult for the half million plus African-Americans who live in the 287 worst grocery-store-access tracts.

Food balance is a statistically significant contributor to increased rates of body mass index (obesity), but when we conduct the analysis separately by distinct food venues, we see that distance to a grocery store has an even greater impact on body mass index. As grocery store access decreases, obesity increases, holding education and income constant. Since obesity can fuel the onset of other diseases and chronic health conditions, the development of grocery stores in underserved areas likely would contribute positively to community health and wellness of African-Americans and other groups. Conversely, living in a food desert can mean greater rates of obesity, premature death, and lower quality of life, especially for mothers and children.

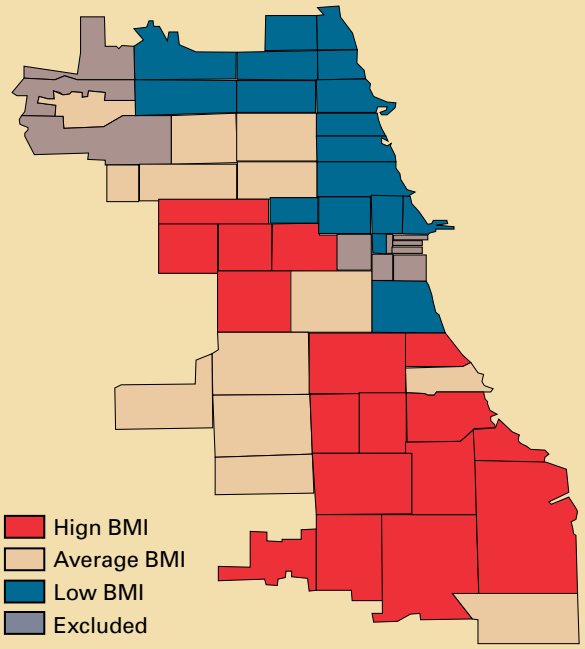
In Chicago, body mass index patterns cluster dramatically by race and by place: the North and Northwest sides have the lowest rates of obesity, while the West and South sides have the highest rates of obesity. The data is grouped into equal tertiles, not by empirical definitions of obesity as calculated by BMI.

All of these findings point to one conclusion: communities that have no or distant grocery stores, or have an imbalance of healthy food options, will likely have increased premature death and chronic health conditions, holding other influences constant. Although we must set our findings in the context of the challenges and limitations of linking cause and effect and of predicting, with certainty, the exact statistical magnitude of the relationship between food access and health, it is clear that food deserts, especially those with an abundance of fast food options, pose serious health and wellness challenges to the residents who live within them and to the City of Chicago as a whole.

The diet-related health outcomes that we focus on – cancer, cardiovascular disease, diabetes, obesity, and hypertension – steal time, resources, vitality, and productivity, and they reinforce each other. According to a recent report released by the Centers for Disease Control and Prevention, "obesity can increase the risk of (adult onset) type 2 diabetes by as much as 34 fold, and diabetes is a major risk factor for amputations, blindness, kidney failure, and heart disease." Obesity alone is estimated to cost the United States health care system $100 billion per year (Koplan and Fleming, 2000).

Communities that have no or distant grocery stores, or have an imbalance of healthy food options, will likely have increased premature death and chronic health conditions.

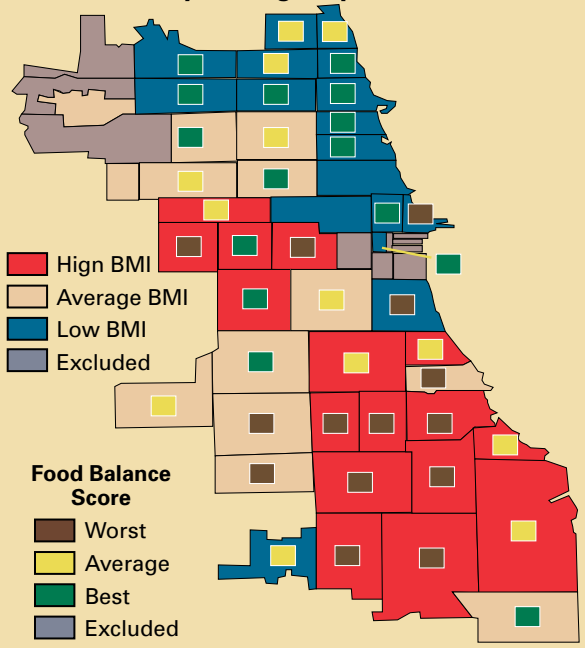
Average Body Mass Index by Tertiles by Chicago Zip Code



The map shows the starkness of obesity patterns by Chicago Zip Code. Red-colored Zip Codes have the highest obesity.

Fig. 9

Average Body Mass Index by Tertiles by Chicago Zip Code



This is the BMI map by Zip Code with the addition of our Food Balance Scores. Brown dots indicate areas that are the most out-of-balance; they have no or distant grocers but nearby fast food.

Fig. 10

Six out of every 10 adult Americans are overweight, nearly one in three is obese, and half of all meals are eaten outside the home, mostly at fast food restaurants (UMN News). And according to a study by Lisa Young and Marion Nestle of New York University, food portions, calories, and fat content have increased dramatically over the last few decades, not just at fast food locations, but everywhere. For example, a muffin today is typically 333% larger than what the USDA recommends. In these times, choosing healthy foods on a regular basis is a difficult challenge for anyone, but for residents of out-of-balance food deserts, it is nearly impossible.

The costs associated with the Food Balance Effect will be borne directly by communities and their residents as it relates to the quality and length of life, and indirectly by the health care industry, by employers, by government agencies and by others who take on the financial burden of pre-death treatments. To simply demonize the fast food industry for the negative health outcomes associated with the Food Balance Effect would be to miss several key points that we discuss in the section titled *Author's Comments, Conclusions, and Acknowledgements*. Less important now is what the fast food industry has been. More important are what it is becoming, what it could become, the best way to monitor the Food Balance Effect moving forward, and how to stand behind and support African-American and, indeed, all community leaders who struggle to secure quality and sustainable food venues in their neighborhoods.

As we all need to eat to live, food might not only be our most common denominator as people, but also our most uniting call for collective, strategic action that transcends race, place, class, and outdated development models that just don't work in these underserved communities. Identifying market as well as needs-based solutions that promote access to nutritious foods and healthy food choices will require input and support from the food desert residents themselves as well as from grocers, banks, brokers, developers, planners, health advocates, educators, government, and foundations – ultimately everyone – to achieve even a modest level of success.

We hope that this study provides one small step in the direction of understanding the complex relationship between food balance and community health.

We invite your comments and participation moving forward.

METHODOLOGY AND DATA DEVELOPMENT

Our methodology begins with a very simple premise: that the vitality and health of any urban community is a block-by-block phenomenon. When we think of concepts such as "home" and "community," we typically think of the very block where we live, and whether or not it is a well-balanced, life-supporting environment. We begin our study of food access and health outcomes at the block level for this reason. We also analyze patterns by census tract, official City of Chicago Community Areas, and by Zip Codes. Our research objective is to compare food access and diet-related health outcomes, holding other influencers such as income, education, and race constant to the degree possible given time and resource constraints. We test the theory that a balanced food environment is an important key to community health. In other words, do food deserts (areas with no or distant grocery stores) face nutritional challenges evident in diet-related health outcomes, and do those outcomes worsen when the food desert has high concentrations of nearby fast food alternatives? The health outcomes that we study are cancer, diet-related cardiovascular diseases (heart disease, hypertension, and stroke), diabetes, and rates of obesity and hypertension.

The City of Chicago has 18,888 census-defined blocks with non-zero populations. Approximately 7,000 are majority White, 7,300 are majority African-American, 3,400 are majority Latino, and 900 are majority diverse, meaning that no one race has 50% or more of the population.

City of Chicago Blocks By Majority Race	Number of Blocks	Percent
White	7,099	37.62
African-American	7,397	39.10
Latino	3,473	18.40
Diverse	919	4.87
Total	18,888	100.00

Fig. 11

To calculate the average distance to a food venue (such as a grocery store or fast food restaurant), we measured the distance between the geographic centers of each block and the locations of each food venue in the Chicago vicinity. The distance from the center of each block to each food venue was calculated using the latitude and the longitude of each food venue and of each block center. Of these distances, the minimum distance was calculated for each block, representing the distance from that block to the nearest food venue by category: chain grocers, small grocers, all grocers, and fast food. To control for population density, for each block a weight was created to reflect the share of the city's population living in that block. The average distance is the weighted average of the distance from each block to the nearest food venue, with greater weights given to blocks with larger numbers of residents. The distance score, calculated in miles, is the distance the average person from that block would need to travel to reach a food venue.

This same methodology was used to calculate distances for census tracts, official City of Chicago Community Areas, and for Zip Codes, building up each time from the block level so as to not lose the true pattern by looking solely at one average across a larger geography.

Similar to blocks, we excluded tracts with very small or zero populations. There are 77 Community Areas in the city; we excluded the Loop and O'Hare, as they are major destination centers, and would skew the findings. In our data

collection of fast food venues, we excluded those located at Midway Airport, but not those in its surrounding environs. As such, the entire Community Area that includes Midway was not excluded.

To test our core theory that food venue balance matters for health outcomes, we developed a ratio score: the distance to any grocer divided by the distance to any fast food venue. The average ratio for the entire city, a Zip Code, a Community Area, or a census tract, is the weighted average of the ratios for each block, with greater weight given to blocks with larger numbers of residents, controlling for density. We call this ratio the Food Balance Score, and the Food Balance Effect.

Food Balance Theory

Food Balance Scores	Examples
Far Above 1: high score "worst outcomes" – closer to fast food, farther from grocers	Grocery store is 1 mile away, and a fast food restaurant is .5 miles away **1/.5 = 2**
Around 1: average score "average of balanced outcomes" – equal access to grocers and fast food	Grocery store is 1 mile away, and a fast food restaurant is 1 mile away **1/1 = 1**
Far Below 1: low score "best outcomes" – closer to grocer, farther from fast food	Grocery store is .5 miles away, and a fast food restaurant is 1 mile away **.5/1 = .5**

Fig. 12

Food venue data was collected for Chicago, suburbs immediately outside Chicago, and areas immediately outside the Southeastern section of Chicago in nearby Indiana. This allowed us to calculate the actual distance to the nearest food venue, rather than be constrained by artificial boundaries such as concentric rings, Community Areas, and so on, that might not reflect the realities of food purchasing.

The data are from the following sources and years, unless otherwise noted in the report. Some of our tables and charts compare several variables and have lengthy titles. We therefore do not repeat core information each time, such as the year and the source, unless it is needed for clarity. **We are grateful to many colleagues for their generous contributions of data**. We acknowledge them and other contributors in more detail in the section titled *Author's Comments, Conclusions, and Acknowledgements*. And while their contributions of data and insights were tremendously important, the accuracy of the analysis and the interpretation of the findings were strictly the responsibility of the author.

Food venue data sources include:

- Daniel Block, Chicago State University and The Northeastern Illinois Food Security Assessment (data collected through a past project funded by The Chicago Community Trust)
- City of Chicago Department of Planning and Development
- Reference USA
- Mari Gallagher Research and Consulting Group

Health data sources include:

- Cook County, Illinois death records
- Office of Epidemiology, Chicago Department of Public Health
- Siim Sööt, University of Illinois
- University of Michigan School of Public Health (from The Chicago Study)

Food venue data consists of grocery stores and fast food restaurants. It was developed and released by different sources at different points in time over the past five years, was merged into one file, cleaned, and made current by additional data development and field checks. No data set can provide a complete and fully accurate picture of the locations of commercial venues across large, diverse, and dynamic urban geographies. Nonetheless, we believe that our overall patterns are accurate and that they reflect the current realities of food access in Chicago today. There are three types of grocer categories that we study:

1) Chain grocery stores. Examples include Jewel, Whole Foods, Dominick's Finer Foods, Trader Joe's, etc.

2) Smaller and/or independent grocers, including those that focus on fruits and vegetables, such as Delray Farms and Pete's Produce. This category also includes various-sized Latino-focused supermarkets as well as larger independent supermarkets such as the Hyde Park Co-Op and Happy Foods. We shorten the label for this category as "smaller" stores, but it does not mean to imply that they are all "small" in terms of square footage or shelf space. "Convenience" and "corner" grocery stores were excluded.

3) Large and smaller/independent stores combined, labeled "all grocers."

Fast food venues were collected in one category and include chains as well as smaller, independent outlets. Generally, the definition of fast food is take-out or self-carry to tables within the restaurant. Primarily we focused on burger, chicken, taco, and hot dog places. Sit-down restaurants with wait staff, coffee houses, gas stations, and convenience stores that might serve ready-made "fast food" items were excluded. Deli-type take-out restaurants were excluded with the exception of Subway and Mr. Submarine because of their ubiquity in most markets. We are not suggesting that deli food is inherently bad or good, or that traditional fast food alone or in moderation directly causes poor health. Our focus is on what we consider a balance of food options in testing our hypothesis that it impacts health outcomes. We posit that communities with no or distant grocery stores and nearby fast food restaurants and perhaps a submarine sandwich shop are out of balance.

Cardiovascular disease rates and deaths were segregated by those that are diet-related, namely: essential hypertension, hypertensive heart disease, hypertensive renal disease, hypertensive heart and renal disease, acute myocardial infarction, subsequent myocardial infarction, certain current complications following acute myocardial infarction, other acute ischaemic heart diseases, chronic ischaemic heart disease, all cerebrovascular diseases (stroke) and artheroscelorosis. Excluded were cardiovascular disease rates and deaths: acute rheumatic fever, chronic rheumatic heart diseases, pulmonary

heart disease and diseases of pulmonary circulation and other forms of heart disease not linked to diet-related deaths, such as ones caused by viruses.

We calculate years of potential life lost (YPLL) for 2003 for cancer, cardiovascular disease, diabetes, and chronic liver disease and cirrhosis, and for total diet-related diseases excluding chronic liver disease and cirrhosis for YPLL aggregations by Community Area. For chronic liver disease and cirrhosis we analyzed food access impact using grocer-to-fast-food distance ratio scores through a regression analysis. Access to alcohol would also be a useful measure. We began that analysis through the lens of liquor license data, but more work needs to be done to isolate and understand potential impacts from the types of alcohol access. Alcohol is purchased and consumed in many venues, including small liquor stores, chain grocery stores, pharmacies, and sit-down restaurants. Our focus on alcohol access was not deep enough to draw any conclusions.

YPLL is a statistic that measures the total number of life years lost due to premature death in a population from a certain cause. Premature death is usually defined as death at the age of less than 65 or 75 years, or less than the average life expectancy (McDonnell, 1998, and www.musc.edu/bmt737/Spr_1999/pj/ypll.html).

In our calculations, the YPLL rate is the total years of life lost due to a specific disease in persons under 65 divided by the persons in that Community Area who are under 65. Each death is weighted based on its distance from age 65.

2005 driver's license data, which reports height and weight, was used to construct measures of body mass index, which is an accepted measure for obesity. BMI calculations were at the Zip Code level. Zip Codes in high destination areas, namely the Loop and O'Hare, were excluded so as not to skew the findings.

We use regression analysis to compare food ratio scores and their impact on YPLL and BMI outcomes, holding education, income, and race constant.

We recognize the "time factor" challenge in studying food access to health outcomes. How much time needs to pass for the lack of nutritious food access to have an effect on community health? For example, lack of adequate nutrition in childhood might not be evident until later in life. Or it could be evident in childhood obesity patterns. This is not a challenge we can control for in this study, nor do we speculate on the theoretical possibilities of time factors on health impacts. We primarily compare 2006 food access patterns to 2003 City of Chicago death data, 2005 Chicago Study by the University of Michigan obesity and hypertension data, and 2005 driver's licenses data to construct body mass index scores, as they are the most current data available to us. We believe these are valid comparisons. Health conditions do not develop overnight, nor do new grocery stores or fast food restaurants.

A bigger challenge in correlating neighborhood characteristics and health is that neighborhood effects are, by definition, endogenous to the compositional characteristics of neighborhoods. The project recognizes the many complex methodological challenges in isolating cause and effect and holding constant potential statistical confounders, such as income, race, genetics, culture, food preferences, and self-selection into specific types of communities. We utilize

national and local best methodological practices, taking deliberate measures to maximize the robustness and accuracy of our data and models, and exercise caution and care in stating our findings. We are particularly mindful of what has been called the "Ecological Fallacy."

Here we present a scenario, not based on actual individual level data, but one that should be kept in mind when describing outcomes and findings. Within each community of our scenario, the relationship between access to grocery stores and health is positive (better access ➤ better health). The relationship is also positive across the entire population (if we pool observations from all three communities, the regression line would coincide with the Community 2 regression line).

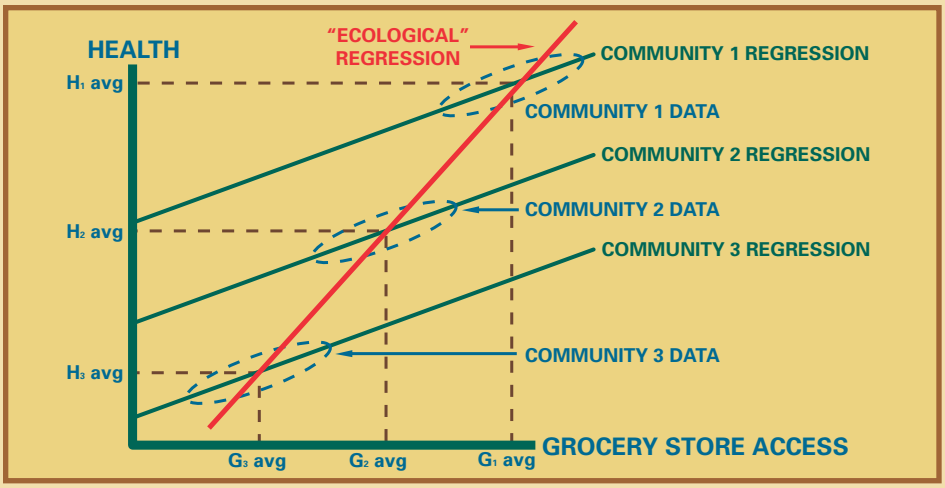


Fig. 13

If we only have averages by community, we could still conclude that the relationship is positive: the ecological regression line that best fits the average values for the three communities – (H1avg, G1avg), (H2avg, G2avg), (H3avg, G3avg) – slopes upward. But the relationship is stronger when we use community averages than when we use data on individuals (either analyzing all individuals pooled or analyzing individuals separately by community). This is because the communities have very different compositions (Community 1: high health/high access; Community 2: moderate health/ moderate access; Community 3: low health/low access).

Based on the ecological regression, the most we can say is "communities with better average access to grocery stores have better average health" – we cannot say that "an individual person who has better access to grocery stores will have better health" (i.e. we need to limit our generalizations to the unit of observation – the community in this case – that we are using, and not generalize to smaller units of observation – the individual).

Therefore, while we demonstrate in this study the positive association between access to better foods and better diet-related health outcomes and conditions, particularly concerning certain diseases and races, we must set our findings in the context of the challenges and limitations of linking cause and effect and of predicting, with certainty, the exact statistical magnitude of the relationship. Nonetheless, we stand by our conclusion that food deserts – particularly those with high concentrations of fast food restaurants – pose serious health and wellness challenges to the residents who live within them and to Chicago as a whole.

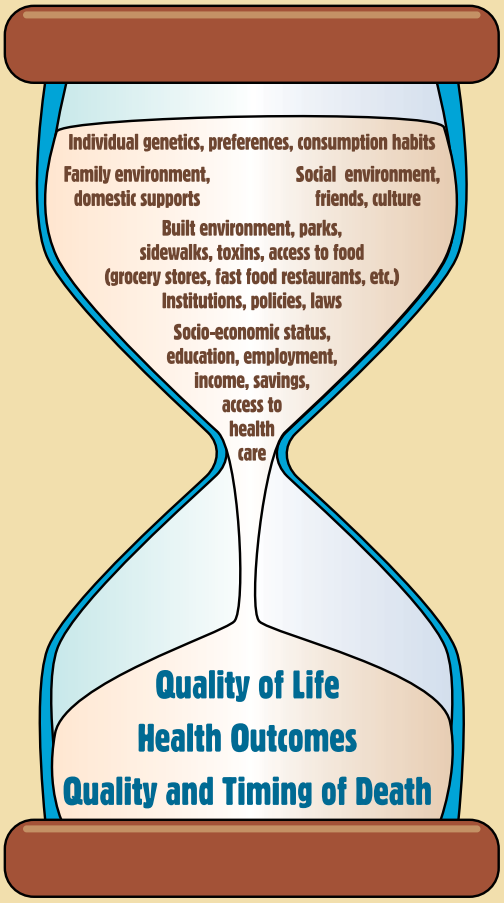


Fig. 14

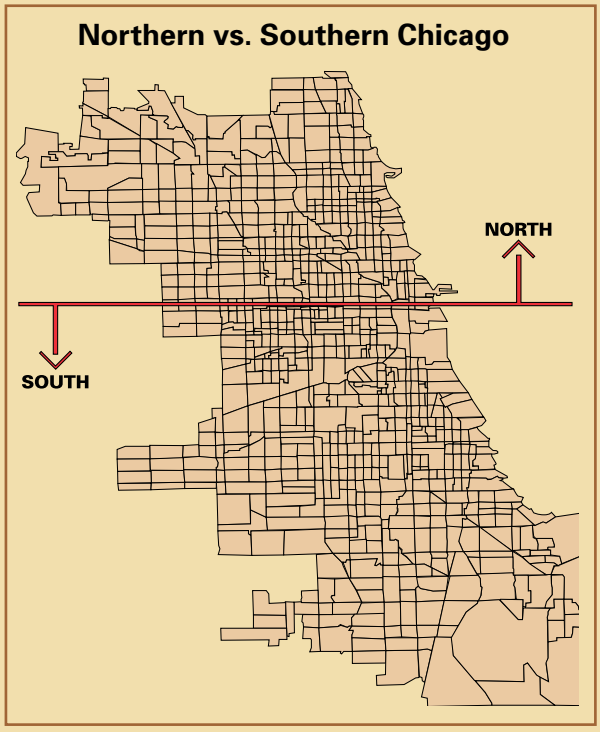


Fig. 15

FINDINGS

Overview

Examining the Impact of Food Deserts on Public Health in Chicago quantifies different types of food access at the lowest geographies possible then tests the theory that a balanced food environment – shorter distances to purveyors of a wide variety of healthy foods such as grocers, and longer distances to less healthy options such as fast food – is directly linked to better community health outcomes. The focus on the connections between the built environment and community health is only beginning to emerge as a professional field, but its foundational theory is not completely novel. Yen and Kaplan (1999) demonstrated the impact of the presence of local commercial stores on mortality: deaths were more likely in places with fewer stores, even after controlling for a variety of individual-level characteristics associated with a higher mortality risk. In our study, we developed what we call the Sand Glass Theory to understand and place into context the dynamic and complex relationships and conditions that impact health outcomes over a lifetime, food access and food balance being only one strand of many influencing factors. Our built environment data includes the locations of chain grocers, small or independent grocers, and all grocers, as well as a range of fast food outlets. The diet-related health outcomes that we study are cancer, specific cardiovascular diseases (such as heart disease, hypertension, and stroke), diabetes, and obesity. Because we posit that the health and vitality of any urban community is a block-by-block phenomenon, we begin our analysis at the block level, moving up to an analysis by census tract, official City of Chicago Community Areas, and Zip Codes. We also analyze the results of direct measurements of obesity and hypertension and compare those results to our Food Balance Scores. Our findings are organized into 4 sections: Quantifying Food Access Patterns, Food Balance Score, Food Balance and Community Health, and a very brief Summary of Findings.

Quantifying Food Access Patterns

The City of Chicago has 18,888 census-defined blocks with non-zero populations. Approximately 7,000 are majority White, 7,300 are majority African-American, 3,400 are majority Latino, and 900 are majority diverse, meaning that no one race has 50% or more of the population.

When we analyze food access by race at the block level, we find that majority African-American communities have the lowest access to 1) chain grocery stores,

2) independent and smaller grocery stores, and 3) all grocery stores, but about roughly equal access to fast food restaurants compared to other racial groupings. For example, from an average African-American block, one would need to travel about one-third of a mile (roughly 3 blocks) to reach a fast food restaurant, but an additional one-third of a mile farther (a total of 6 blocks) to reach some type of grocery store and slightly farther yet to reach a chain grocery store, which typically offers more variety of health-sensitive food items, from no- and low-fat and -salt products to lactose-reduced milk. Looking at transit patterns in majority African-American areas, we see that car ownership is comparatively low. Reliance on public transportation, rides from friends, and walking are often cited as methods to reach food venues, so small differences in distance could make for large differences in dietary choices available, and potentially large differences in health outcomes.

These same food access patterns are found at the tract level. On average:

- People who live in majority White, Latino, and Diverse tracts travel the shortest distance to any type of grocery store (about .39 miles).
- Peoplewho live in majority African-American tracts travel the farthest distance to any type of grocery store (.59 miles).
- In African-American tracts, the distance to a small or independent grocer is the farthest (.81 miles) and the distance to a chain grocer is slightly less (.77 miles). This dispels the myth that smaller and/or independent grocers are more likely than chain grocers to locate in African-American communities.
- The distance to fast food is slightly farther in African-American tracts than other tracts, but a grocery store is nearly twice as far. This means that, for African-American, it is much easier to access fast food than other types of food.

City of Chicago Blocks by Majority Race	Number of Blocks	Percent
White	7,099	37.62
African-American	7,397	39.10
Latino	3,473	18.40
Diverse	919	4.87
Total	18,888	100.00

Fig. 16

Food Access by Avg. Distance in Miles by City of Chicago Block

Majority Race	Chain Grocers	Small Grocers	All Grocers	Fast Food
White	.57	.54	.39	.35
Afr.-Am.	.77	.86	.59	.34
Latino	.62	.42	.36	.34
Diverse	.52	.53	.36	.30
Chicago	.65	.62	.45	.34

Fig. 17

Relative Access to Grocers and Fast Food in Chicago by Race

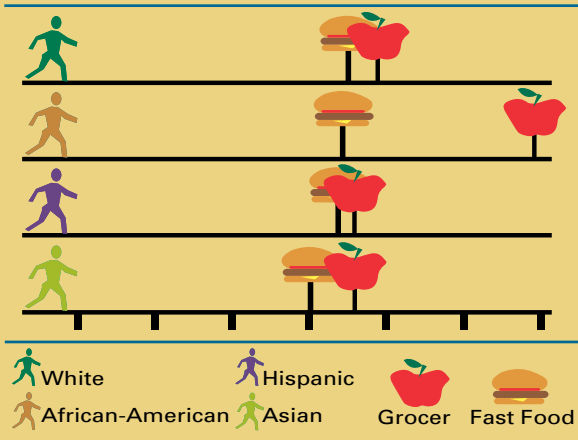


Fig. 18

Food Access by Avg. Distance in Miles by City of Chicago Tract

Majority Race	Chain Grocers	Small Grocers	All Grocers	Fast Food	Total Pop. (rounded)	Avg. Income
White	.57	.52	.39	.28	1,099K	$52,334
Afr.-Am.	.77	.81	.58	.32	985K	$27,485
Latino	.57	.52	.39	.28	1,099K	$33,437
Diverse	.60	.53	.38	.26	167K	$33,340

There are 8 majority Asian tracts in the City of Chicago which are not included in this table.

Fig. 19

Distance to Chain Grocer by Tract

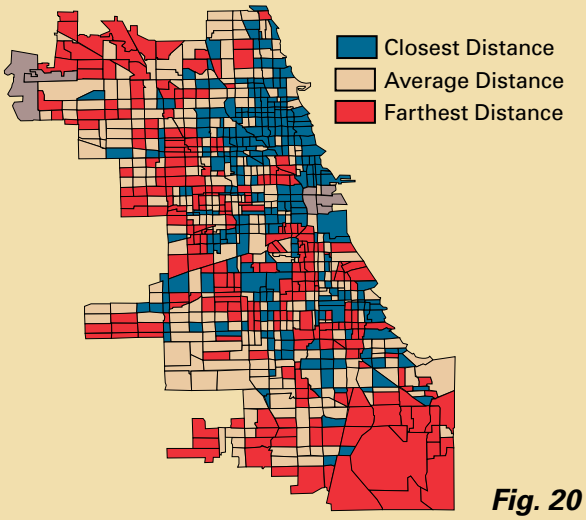


Fig. 20

Distance to Small Grocer by Tract

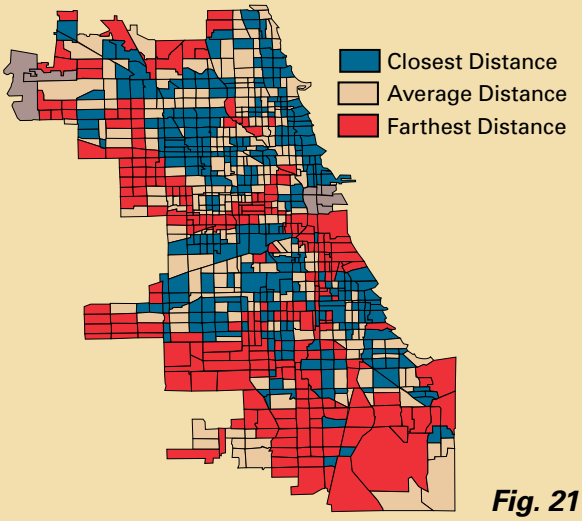


Fig. 21

Distance to Any Grocer by Tract

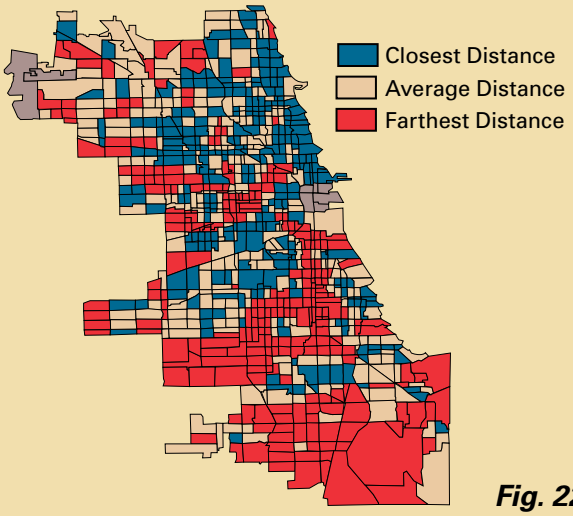


Fig. 22

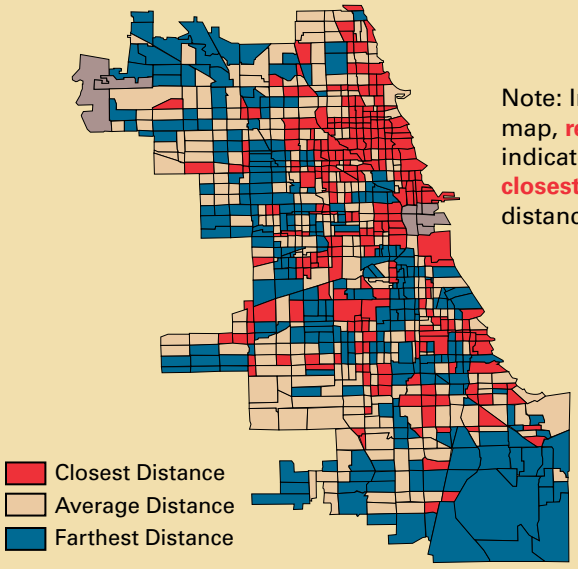
Because Chicago's blocks, tracts, and communities tend to be segregated by race, we see the impact of these patterns geographically in the following series of maps. The North side of the city tends to have greater access to all types of grocers, while the West and South sides tend to have less access. Low access tracts on the South side tend to cluster, forming food deserts. Food deserts are large geographic areas with no, few, or distant grocery stores (Lang and Rayner 1998; Whitehead 1998; Furey et al. 2001; Lang and Rayner 2002; Wright et al. 2005, Gallagher 2006).

In non-African-American tracts and on the North side of Chicago generally, there is a greater concentration of fast food.

However, much of the concentration of fast food on the North Side is in "destination" entertainment and eating areas, where there is heavy visitor traffic, and a wide variety of non-fast food restaurants and grocery stores, resulting in more food choice. In non-African-American majority tracts, the distance to a grocery store or fast food restaurant is roughly equal; fast food restaurants are only slightly closer in distance. This means that, in majority White, Latino, and diverse tracts, there are more choices when it comes to food: it is almost as easy to access a grocery store as it is to access a fast food restaurant or another type of restaurant. Generally, both grocery stores and fast food restaurants are positively correlated with income patterns: the higher the income of the consumers in that area, the higher the concentration of all types of food venues. Yet we find that fast food is often inversely correlated with income in certain African-American blocks, tracts, and communities: as income goes down, grocery store concentration goes down, but fast food concentration goes up. Furthermore, using different geographic units and methods of analysis, we consistently find that African-American communities are much more likely to cluster into food deserts where fast food outlets are more prevalent than grocers.

In *Fig. 24,* we see the starkness of the food desert pattern when we view the farthest distance tertile of food access to our category of all grocers. In other words, we are showing the "worst" scoring third of census tracts in the entire city, where one has to travel the farthest on average to reach a grocery store, and we code the tracts by majority race.

Distance to Fast Food by Tract



Note: In this map, **red** indicates **closest** distance.

Fig. 23

Distance to All Grocers by Farthest Distance Tertile Only by Race by Tract

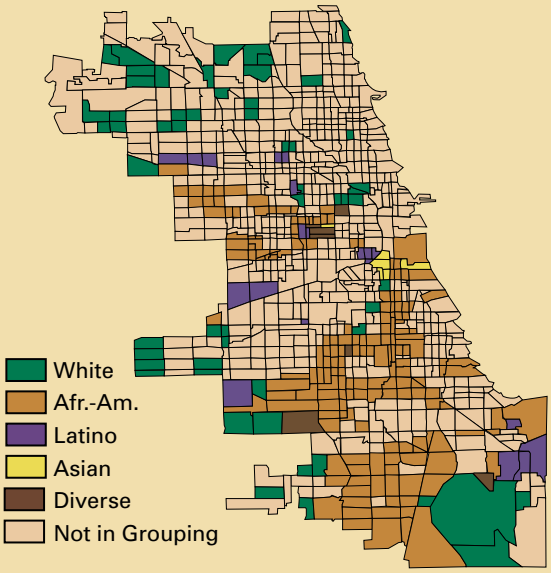


Fig. 24

Chicago Communities

1 ROGERS PARK
2 WEST RIDGE
3 UPTOWN
4 LINCOLN SQUARE
5 NORTH CENTER
6 LAKE VIEW
7 LINCOLN PARK
8 NEAR NORTH SIDE
9 EDISON PARK
10 NORWOOD PARK
11 JEFFERSON PARK
12 FOREST GLEN
13 NORTH PARK
14 ALBANY PARK
15 PORTAGE PARK
16 IRVING PARK
17 DUNNING
18 MONTCLARE
19 BELMONT CRAGIN
20 HERMOSA
21 AVONDALE
22 LOGAN SQUARE
23 HUMBOLDT PARK
24 WEST TOWN
25 AUSTIN
26 WEST GARFIELD PARK
27 EAST GARFIELD PARK
28 NEAR WEST SIDE
29 NORTH LAWNDALE
30 SOUTH LAWNDALE
31 LOWER WEST SIDE
32 LOOP
33 NEAR SOUTH SIDE
34 ARMOUR SQUARE
35 DOUGLAS
36 OAKLAND
37 FULLER PARK
38 GRAND BOULEVARD
39 KENWOOD
40 WASHINGTON PARK
41 HYDE PARK
42 WOODLAWN
43 SOUTH SHORE
44 CHATHAM
45 AVALON PARK
46 SOUTH CHICAGO
47 BURNSIDE
48 CALUMET HEIGHTS
49 ROSELAND
50 PULLMAN
51 SOUTH DEERING
52 EAST SIDE
53 WEST PULLMAN
54 RIVERDALE
55 HEGEWISCH
56 GARFIELD RIDGE
57 ARCHER HEIGHTS
58 BRIGHTON PARK
59 MCKINLEY PARK
60 BRIDGEPORT
61 NEW CITY
62 WEST ELSDON
63 GAGE PARK
64 CLEARING
65 WEST LAWN
66 CHICAGO LAWN
67 WEST ENGLEWOOD
68 ENGLEWOOD
69 GREATER GRAND CROSSING
70 ASHBURN
71 AUBURN GRESHAM
72 BEVERLY
73 WASHINGTON HEIGHTS
74 MOUNT GREENWOOD
75 MORGAN PARK
76 O'HARE
77 EDGEWATER

Chicago's Food Deserts by Tract with Community Boundaries

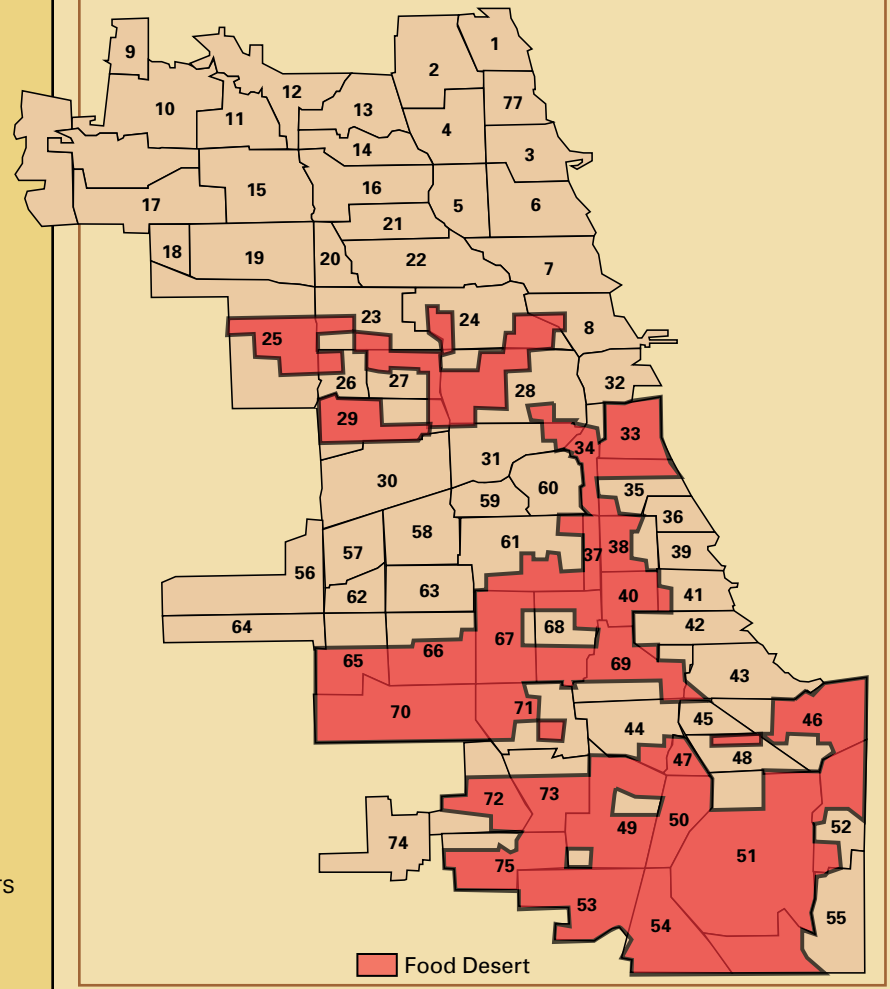


Fig.

Chicago's Highest Concentration of Single Mothers with Children Under 18 as a Percentage of Total Population by Tract with the Food Desert Overlay

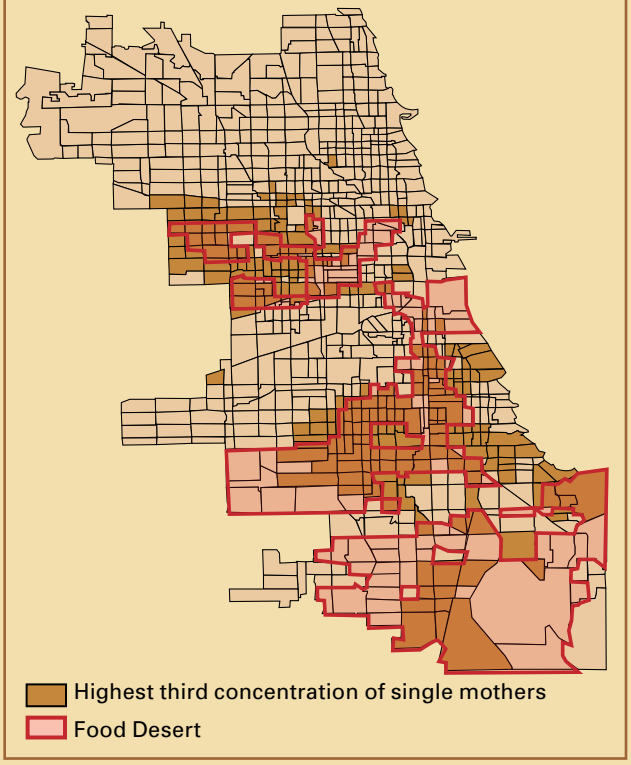


Fig. 26

Chicago's Highest Concentration of Children Under 18 as a Percentage of Total Population by Tract with the Food Desert Overlay

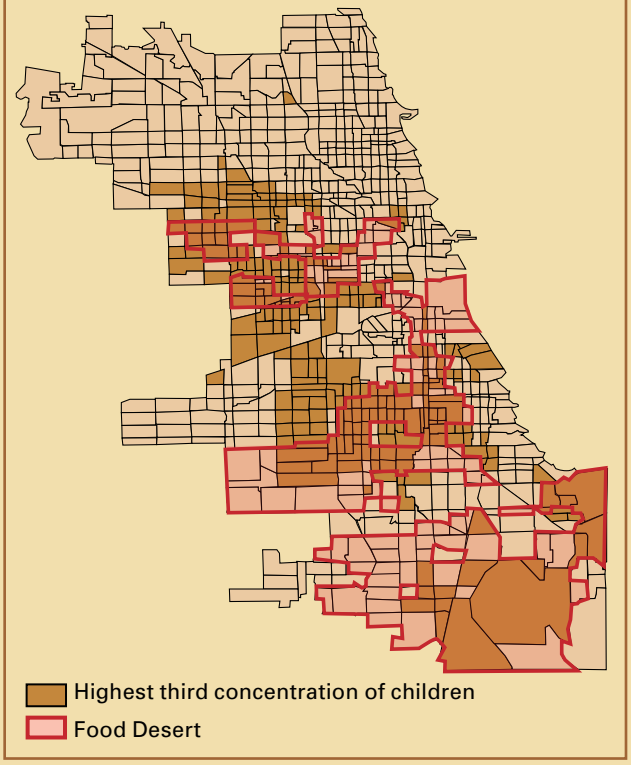


Fig. 27

Chicago's Highest Concentration of Grandparents with Primary Responsibility for Children Under 18 as a Percentage of Total Population by Tract with the Food Desert Overlay

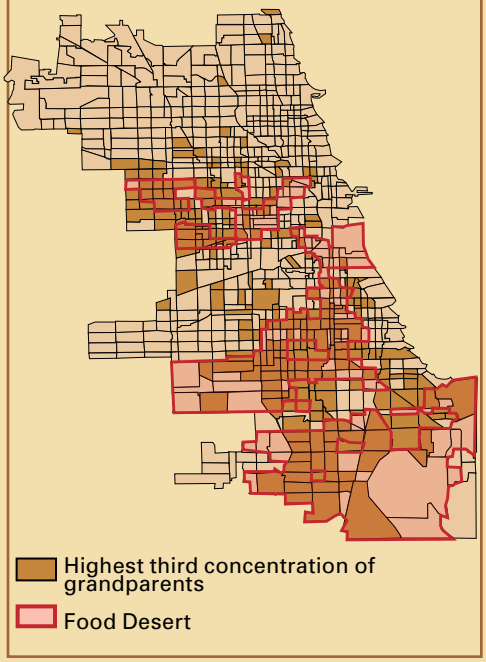


Fig. 28

Chicago's Highest Concentration of Disabled Children as a Percentage of Total Population by Tract with the Food Desert Overlay

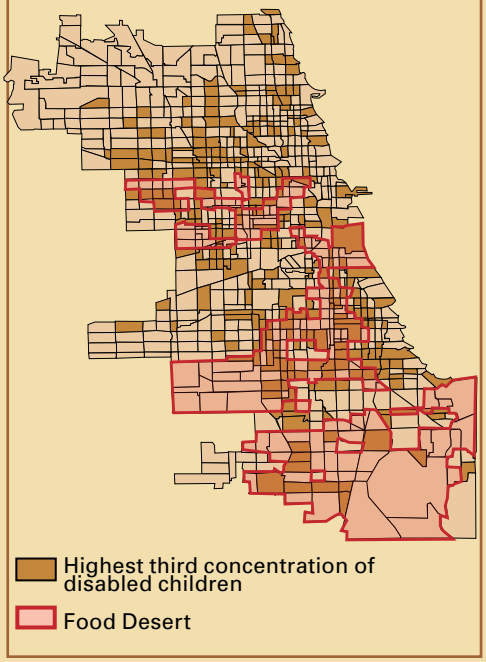


Fig. 29

Chicago's Highest Concentration of Disabled Adults as a Percentage of Total Population by Tract with the Food Desert Overlay

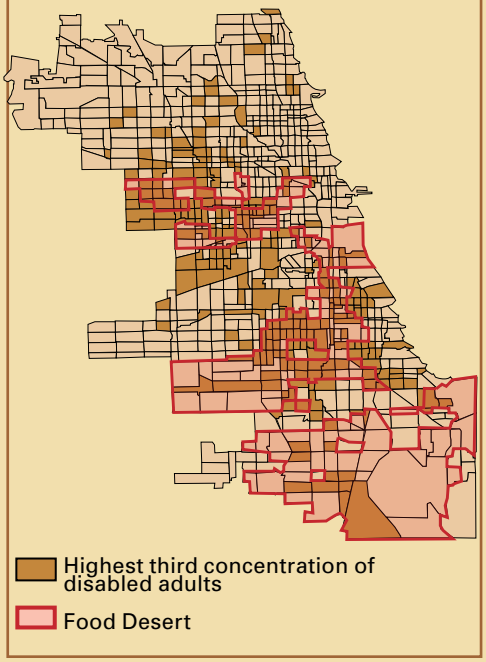


Fig. 30

We can easily see that African-American tracts dominate the food desert map and that they cluster dramatically. The most vulnerable populations are single mothers and children. We also see concentrations of grandparents with primary responsibility for grandchildren under 18 years of age, and for disabled populations. While disabled children are more disbursed throughout Chicago, as those children age, and as adults become disabled, we see a greater concentration of that population in the food desert.

It is also important to account for what we would expect the patterns of White, African-American, Latino, and diverse tracts to be if they were distributed equally across the city by their respective weights relative to food access and food balance. Analyzing the details of all three grocer distance tertiles and illustrating them by percentage point differentials allows us to do that. It also allows us to move away from simple averages across races, which can mask extreme patterns within racial groupings.

The farthest distance tertile chart is an alternative display of the data on the farthest distance tertile map that confirms – not accounting for other influencers such as income and store location strategies – that African-American majority tracts are over-represented in least-access-to-grocery-store outcomes, based on the total number of African-American tracts in Chicago. In other words, we calculated the percentage of tracts in each tertile by majority race. Then we calculated what the distribution by race would be in each tertile if each race were represented in proportion to the total tracts of that race across the city. Diverse tracts are under-represented in the worst outcomes tertile. In some cases, however, diverse tracts do indeed have negative outcomes concerning access to grocery stores, but they tend to be dispersed, not clustered, with other similar scoring tracts. White tracts are under-represented in the "worst outcomes" grouping. Latino tracts score roughly where we expect them to – they are only marginally under-represented in the tertile. But when we analyze the shortest distance tertile with the closest or best access to grocery stores, we see that Latino tracts are over-represented by 31 percentage points and that diverse tracts are over-represented by 53 percentage points. White tracts are only marginally over-represented and African-American tracts are under-represented by 23 percentage points.

Average Distance to All Grocery Stores by Chicago Census Tracts by Tertiles

	Number of tracts (848 total)	Percentage of total in grouping	What percentage would be if equally distributed	Percentage point differential
Farthest Distance (worst outcomes)				
White	58	19.40%	35.34%	-15.94%
Afr.-Am.	189	54.00%	41.37%	12.63%
Latino	21	13.73%	18.09%	-4.38%
Diverse	8	21.05%	4.49%	-16.58%
The average distance in this grouping to any grocery store was .78 miles. The range was .62 to 1.33 miles.				
Average Distance				
White	118	38.80%	35.34%	3.45%
Afr.-Am.	99	28.29%	41.37%	-13.09%
Latino	57	37.25%	18.09%	19.17%
Diverse	8	21.05%	4.49%	16.58%
The average distance in this grouping to any grocery store was .41 miles. The range was .38 to .54 miles.				
Shortest Distance (best outcomes)				
White	125	41.81%	35.1%	6.71%
Afr.-Am.	62	17.71%	41.1%	-23.37%
Latino	75	49.02%	18.0%	31.06%
Diverse	22	57.89%	4.5%	53.43%
The average distance in this grouping to any grocery store was .25 miles. The range was .07 to .22 miles.				

Note: There were 8 Asian minority communities in this analysis: zero in the shortest grouping, 2 in the middle grouping, and 6 in the farthest grouping.

Fig. 31

Percentage Point Differential of Average Distance to All Grocery Stores in Miles by Chicago Census Tracts

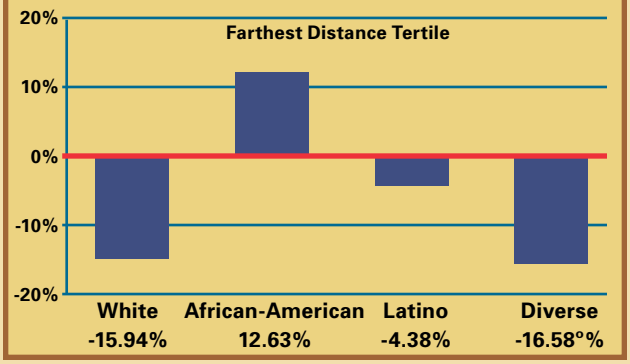


Fig. 32

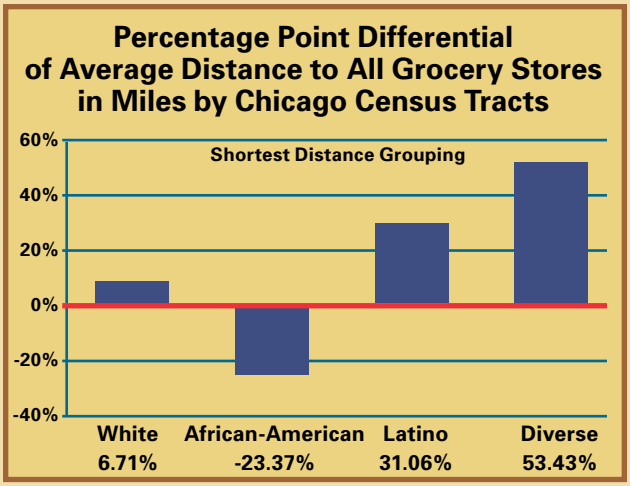


Fig. 33

In summary:

- Majority White tracts have above average access to grocery stores. Of all White tracts that fall in the farthest distance (worst) tertile, only a handful cluster, and they only cluster marginally. Combined, there are 219,265 total people who live in these farthest distance White tracts; 25.2% or 55,261 are students in school three years of age and older.
- Majority Latino tracts, in some cases, have far above average access to grocery stores, and for diverse tracts access varies from very low to very high, although we see overall access is high. Some diverse tracts are stable, while others might be either declining or gentrifying. There are 72,849 total people who live in the majority Latino farthest grocer distance tracts; 22,021 are students in school three years of age and older. For majority diverse tracts, there are 25,329 total people who live in the farthest grocer distance tracts and 30.2% or 9,618 are students in school three years of age and older.
- Majority African-American tracts have the least access to grocery stores and those tracts cluster strikingly. There are 521,488 total people who live in the farthest distance majority African-American tracts – almost twice the number of the farthest distance population in White, Latino, and diverse tracts combined. Of the population in African-American farthest distance tracts, one out of three or 172,082 are students in school three years of age and older.

We have already demonstrated that African-American blocks and tracts 1) have lower access to grocery stores and 2) that they have ample access to fast food restaurants. But do areas that have the very lowest access to grocery stores have comparatively high rates of fast food restaurants, and what, if any, effect might that have on community health?

The Food Balance Score

Our research objective is to compare food access and diet-related health outcomes across races, holding other influencers constant such as income and education to the degree possible given time and resource constraints. We test the theory that a balanced food environment is an important key to community health. In other words, do food deserts (areas with no or distant grocery stores) face nutritional challenges evident in diet-related health outcomes, and do outcomes worsen when the food desert has high concentrations of nearby fast food alternatives?

To test our core theory that food venue balance matters in health outcomes, we developed a ratio score: the distance to the closest grocer divided by the distance to the closest fast food venue. The average ratio for the entire city, a Zip Code, a Community Area, or a census tract, is the weighted average of the ratios for each block, with greater weight given to blocks with larger numbers of residents. We call this ratio the Food Balance Score.

Fig. 35 illustrates the highest scoring Food Balance Score tertile of tracts in the City of Chicago. In other words, we show the "worst" scoring tracts that are the most out-of-balance in terms of food access. These are the areas with no or distant grocery stores, but comparatively nearby access to fast food restaurants.

We see again the strong representation and clustering of majority African-American tracts compared to other tracts by racial groupings, particularly on Chicago's South side.

African-American tracts have the highest Food Balance Score in the worst scoring tertile among all races and the grocery store distance for those tracts is particularly far – a quarter and a third as far depending on the type of grocery store. African-American tracts, though they have the lowest average median household income, have roughly the same access to fast food restaurants as the other racial groupings in this tertile (.25 miles for African-American tracts, but .25 for diverse tracts, .19 for Latino tracts, and .18 for White tracts). What might the impact of this out-of-balance food desert be on health outcomes for African-Americans, and is there a health impact for other majority race tracts that have high Food Balance Scores but do not cluster, or only cluster marginally?

Food Balance and Community Health

We know that the racial disparity in health in the United States is substantial. The overall death rate for African-Americans today is comparable to the rate of Whites 30 years ago (Williams and Jackson, 2005). We can see those disparities by looking at health data by race for Chicago tracts with at least 20 diet-related deaths per tract for 2003. Whether measured by income, education, or occupation, socioeconomic status (SES) is a strong predictor of health outcomes and health variations among racial groups (Marmot, 2002, Williams and Jackson, 2005). Many additional factors besides SES contribute to poor health and premature death, such as food preference, genetics, and culture. To what degree, if any, does food access contribute to negative health outcomes?

Food Balance Scores

Food Balance Scores	Examples
Far Above 1: high score "worst outcomes" – closer to fast food, farther from grocers	Grocery store is 1 mile away, and a fast food restaurant is .5 miles away **1/.5 = 2**
Around 1: average score "average of balanced outcomes" – equal access to grocers and fast food	Grocery store is 1 mile away, and a fast food restaurant is 1 mile away **1/1 = 1**
Far Below 1: low score "best outcomes" – closer to grocers, farther from fast food	Grocery store is .5 miles away, and a fast food restaurant is 1 mile away **.5/1 = .5**

Fig. 34

Highest Scoring Food Balance Score by Race by Tract

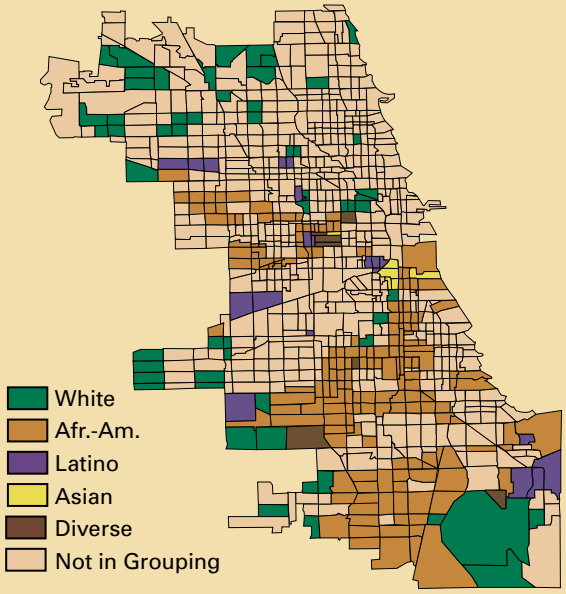


Fig. 35

Food Access by Distance in Miles by Highest Scoring Food Balance Score by Tertile
(worst outcomes)

By Majority Race of Tract	Food Balance Score	Average Household Income
White	3.00	$55,293
Afr.-Am.	3.37	$26,505
Latino	2.62	$33,451
Diverse	2.29	$36,024

Fig. 36

We analyze 226 tracts with at least 20 deaths from diet-related causes per tract for year 2003. Of those 226 tracts, 100 are majority White and 97 are majority African-American. Those aggregate numbers were large enough to analyze White and African-American tracts further, controlling for race and other influencers, by sorting them first by race and second by food balance, then splitting them at the median. This results in four groupings: two White groups, to compare to each other, and two African-American groups, to compare to each other.

The out-of-balance White tract group (with a Food Balance Score of 1.91) has a slightly higher diet-related death rate (6.10 diet-related deaths per thousand) than the in-balance White tract group (which has a Food Balance Score of .96 and 5.96 diet-related deaths per 1,000), even though income and education are slightly more favorable in the out-of-balance group. This is not a huge difference, but it moves in the direction of our theory. The out-of-balance African-American tract group (with a very high Food Balance Score of 2.71) has a considerably higher diet-related death rate (7.55 diet-related deaths per thousand) than the more in-balance African-American group (which has a Food Balance Score of 1.17 and 6.65 diet-related deaths per 1,000), even though income and education are about the same. This is almost a full percentage point differential; it is a big number. We also see that for the out-of-balance African-American group, there is a high proportion of single mothers with children under 18 years of age.

The data suggest that there could be a positive relationship between food balance and health outcomes, with a bigger impact on African-American tracts, as African-American incomes overall are lower than White incomes, meaning that they have less ability to compensate for low geographic access to grocery stores. Said another way, African-Americans are probably more reliant on public transportation and have less economic ability than Whites to drive by car or cab out of their communities to a grocery store where healthy food purchases can be made. Those clarifying assumptions aside, it appears that food balance does affect diet-related health outcomes in both African-American and White tracts.

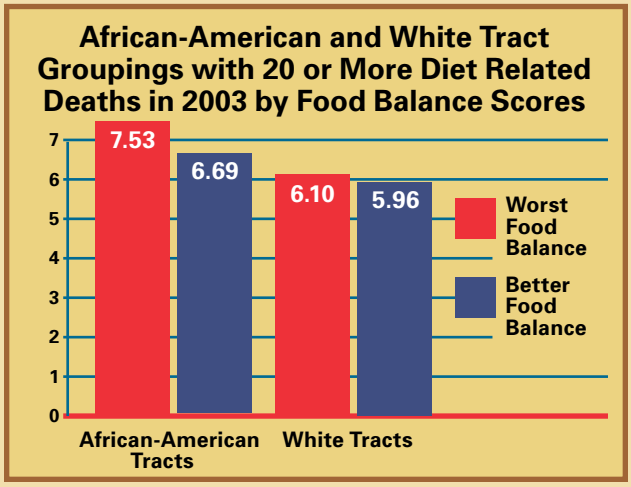


Fig. 37

Indicator	50 Majority White Tracts with Higher Food Balance Scores	50 Majority White Tracts with Lower Food Balance Scores	49 Majority African-American Tracts with Higher Food Balance Scores	48 Majority African-American Tracts with Lower Food Balance Scores
Food Balance Score	1.91	0.96	2.71	1.17
Diet-related deaths per thousand people of tracts with 20 or more diet-related in 2003 Cook County death records	6.10	5.96	7.55	6.65
Median household income	$50,864	$47,211	$33,323	$32,625
Total population	304,382	316,015	237,934	287,846
Females 15-34 years old	49,576	47,462	31,764	42,251
Single females with children under 18	4,748	4,672	12,217	17,847
Population over 21 with a disability	48,843	54,818	45,602	58,210
Number of grandparents responsible for grandchildren under 18	2,007	2,722	3,049	3,762
Percentage of 25+ population with a high school graduation or higher	82.10	79.37	71.16	72.35
Percentage of 25+ population with a BA degree or higher	34.58	27.12	12.70	14.92
Median age	37.6	38.0	33.2	33.3

Data is from the 2000 census unless otherwise noted.

Fig. 38

We also see health disparities among races when we analyze 2003 diet-related cardiovascular disease (CVD) death rates by high, middle, and low scoring tertiles by Community Area. African-American communities are far over-represented in the worst health outcomes tertile, and far under-represented in the best health outcomes tertile. White and Latino communities are under-represented in the worst health outcomes tertile and over-represented in the best health outcomes tertile. Diverse communities have an equal distribution in terms of health outcomes.

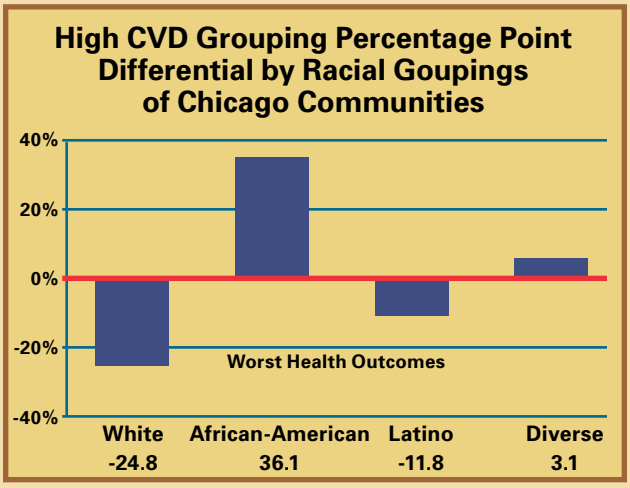


Fig. 39

We calculate average years of potential life lost and death rates for 2003 for cancer, diet-related cardiovascular disease, and diabetes by Community Area. Years of potential life lost (YPLL) is a statistic that measures the total number of life years lost due to premature death – not just the rate of death – in a population from a certain cause. We see that majority African-American communities have the greatest number of years of life lost for cancer, cardiovascular disease (CVD), and diabetes. For example, looking at CVD, the average

Low CVD Grouping Percentage Point Differential by Racial Goupings of Chicago Communities

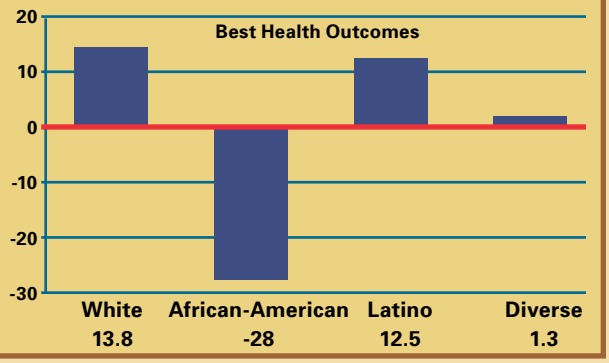


Fig. 40

African-American community in 2003 lost a total of 337 years that individuals from the community would have collectively lived had they not died prematurely from CVD. The death rate for CVD was 8.07 per 1,000 people – far more than twice the rate of any other racial grouping. In fact, in every single instance, African-American communities have the worst health outcomes. To what degree, if any, is the Food Balance Effect a contributor to negative health outcomes of African-American and other communities?

Chicago Community Areas Years of Potential Life Lost and Death Rates Per 1,000 Population by Diseases by Race

	Cancer YPLL	Cancer DR	CVD YPLL	CVD RD	Diabetes DR	Diabetes
White	212	7.56	173	5.49	15	0.42
Afr.-Amer.	299	10.28	337	12.18	45	1.44
Latino	206	4.70	177	4.02	31	0.75
Diverse	281	5.55	295	5.86	50	1.01
Average	255	7.94	258	8.07	35	0.98

Fig. 41

To further probe this important question, our first task is to compare YPLL outcomes to levels of food balance. In other words, we take each of the 75 Community Areas in our analysis and rank them by their Food Balance Score. Higher scores are more out-of-balance communities with no or distant grocery stores but nearby fast food restaurants. While all we can show is a positive associative pattern – not necessarily cause and effect – we see that, as the Food Balance Score increases, YPLL and death rates increase for each diet-related disease. Furthermore, the best food balance grouping has health outcomes that are above the average of all communities combined.

Chicago Community Areas Average Years of Potential Life Lost and Death Rates Per 1,000 Population by Diseases by Race by Food Balance Groupings

Food Balance Groupings	Cancer		Cardiovascular Disease		Diabetes		All YPLL	Food Balance Score
	YPLL	Death Rate	YPLL	Death Rate	YPLL	Death Rate		
Worst	314.44	9.73	345.28	11.07	45.48	1.27	705.20	2.04
Middle	246.88	7.42	241.76	7.41	33.48	1.11	522.12	1.25
Best	204.04	6.68	185.48	5.72	25.36	0.56	414.88	0.87

Fig. 42

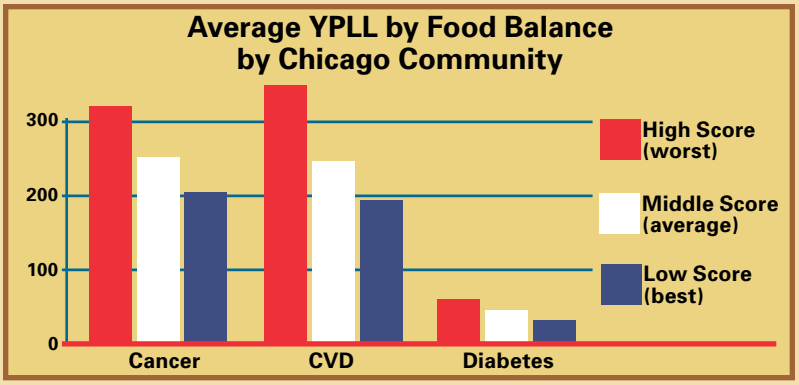


Fig. 43

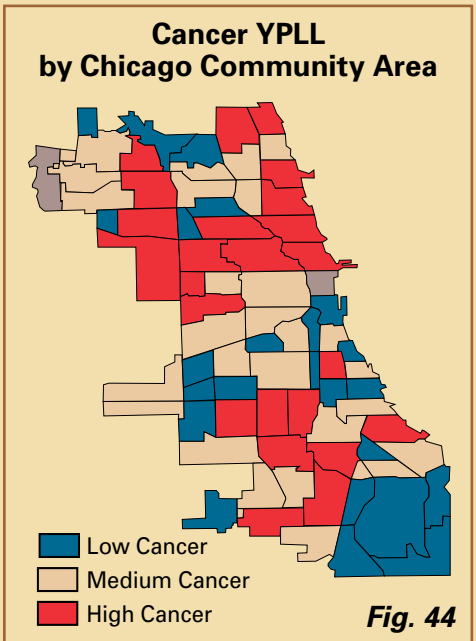


Fig. 44

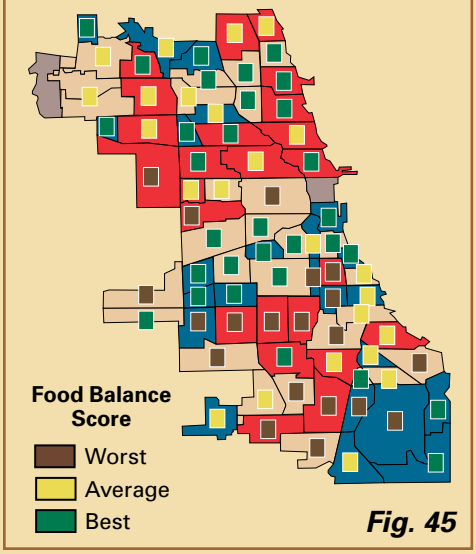


Fig. 45

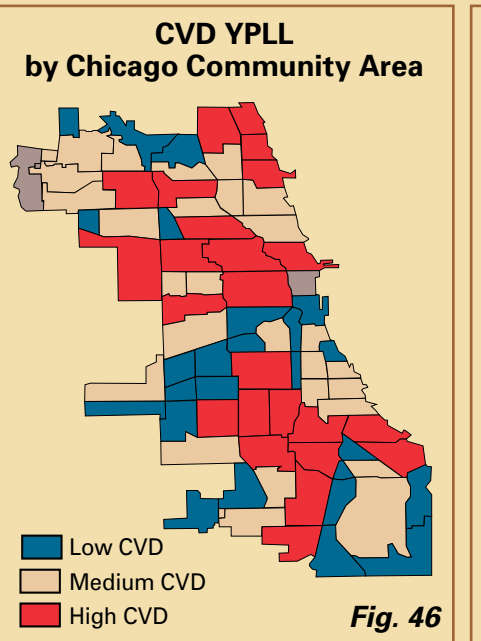


Fig. 46

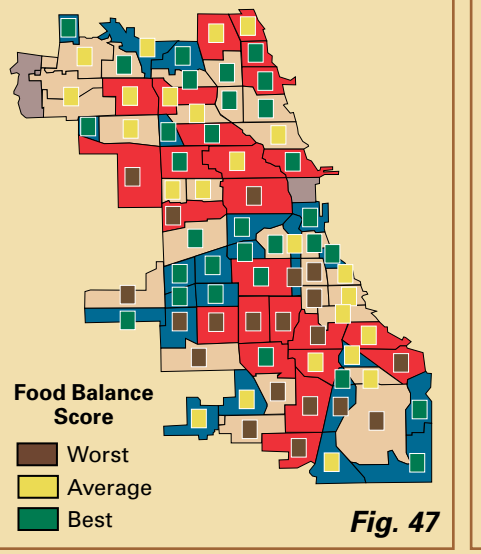


Fig. 47

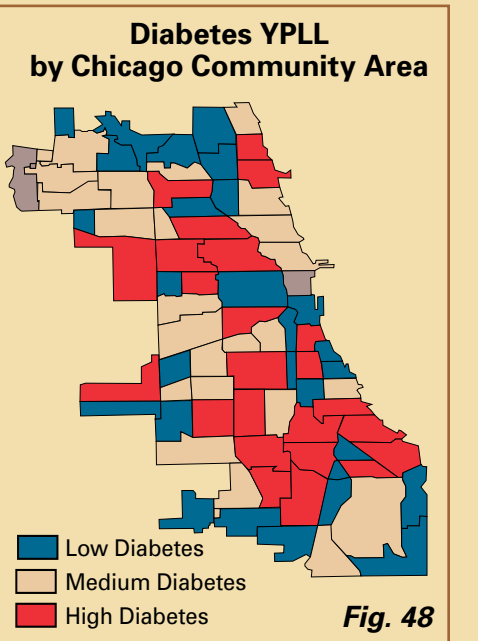


Fig. 48

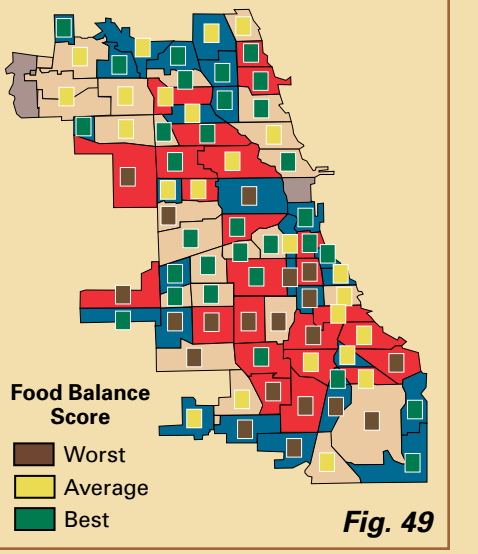


Fig. 49

Race, education, and income are important predictors of health outcomes that we also need to account for. When we sort all communities by Food Balance Scores into tertiles (the best, middle, and worst), our ability to sort within tertiles by race diminishes because of the skewed distribution across tertiles by race. For example, in the worst Food Balance tertile, there are 20 majority African-American communities but only 2 majority White communities, 1 majority Latino community, 1 majority Asian community, and 1 majority diverse community. To control for race, the best we can do is compare two majority African-American groupings – one African-American grouping in the worst food balance tertile (20 communities) to one African-American grouping in the average balance tertile (9 communities). Again, the worst food balance tertile has no or distant grocery stores but nearby access to fast food restaurants. The average or in-balance food access tertile has more of an equal distance of the closest grocer to the closest fast food outlet. In each case of those two African-American grouping comparisons, the average YPLL by cancer, diet-related cardiovascular disease, and diabetes are all substantially higher in the grouping with the worst Food Balance Score. When we look at total YPLL, we see that the difference between in-balance and out-of-balance means an increase in premature diet-related years of life lost by more than 50%. Income, also an influencer on health outcomes, is roughly equal in both groupings. Education attainment measures, however, are slightly lower in the worst Food Balance Score grouping. While we cannot be certain of a direct link, the data again suggest that there is a positive relationship between the Food Balance Score and diet-related years of life lost minimizing other possible influencers. In other words, as communities become more out-of-balance with food purchasing venues, negative diet-related health outcomes consistently increase.

Average Years of Potential Life Lost by Community Area by Race

Food Balance Score Groups	YPLL Cancer	YPLL CVD	YPLL Diabetes	Total YPLL	Food Balance Scores	Percent high school or higher	Percent BA or higher	Average household income
Highest scoring tertile, but of those 20 African-American communities only	354	397	52	804	2.04	69.5	14.4	$15,464
Average scoring tertile, but of those 9 African-American communities only	231	264	39	534	1.24	72.4	17.5	$16,422

Fig. 50

We conducted a regression analysis by Chicago Community Area for years of potential life lost (YPLL) controlling for race, education (percentage high school graduate or higher) and per capita income to study the effect of food balance on diet-related community health. We applied our Food Balance Score: the closest distance to a grocer divided by the closest distance to a fast food restaurant at the block level, aggregated up, block-by-block, to the Community Area level. For diabetes YPLL, the coefficient (Dgrocery/Dfastfood) is in the expected linear direction (positive) for all but diverse communities and is statistically significant for majority African-American communities (at the 5% level, meaning we can confidently account for 95% of the regression for majority African-American communities) and for majority White communities (at the 10% level, meaning we can confidently account for 90% of the regression for majority White communities). This means that we can be reasonably confident about the direction of the association and the strength of the statistical relationship, especially for African-American communities. The impact of food balance on predicted diabetes YPLL can be seen in the figures at right. For both African-American and White communities, the regressions indicate that as the Food Balance Score increases, YPLL from diabetes steadily increases. Said another way, majority African-American and White communities that have no or distant grocery stores, but nearby access to fast food restaurants, will have statistically higher rates of residents dying prematurely from diabetes, and that African-American communities are the most likely to experience the greatest life lost in total years due to the numbers of them living in affected areas and due to the strength of the regression.

For cancer YPLL, the coefficient for (Dgrocery/Dfastfood) is positive for African-American, White, and Latino communities (meaning that as communities become more out-of-balance, diet-related deaths increase) but these effects are not statistically significant. The same is true for cardiovascular disease. For chronic liver disease and cirrhosis, the effect is positive and statistically significant only for African-American communities (at the 10% level, meaning we can confidently account for 90% of the regression for African-Americans). We hadn't expected to find a relationship between chronic liver disease and cirrhosis and the Food Balance Score. Instead, we expected that access to alcohol would be the most useful measure to test a health effect. We began that analysis through the lens of liquor license data, but more work needs to be done to isolate and understand potential impacts from the types of alcohol access.

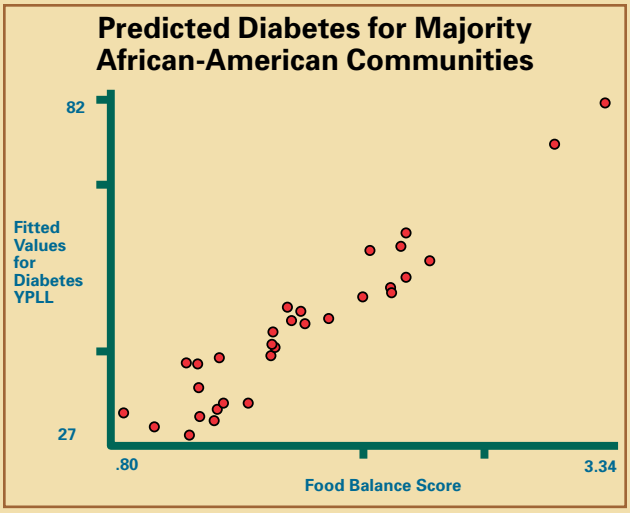


Fig. 51

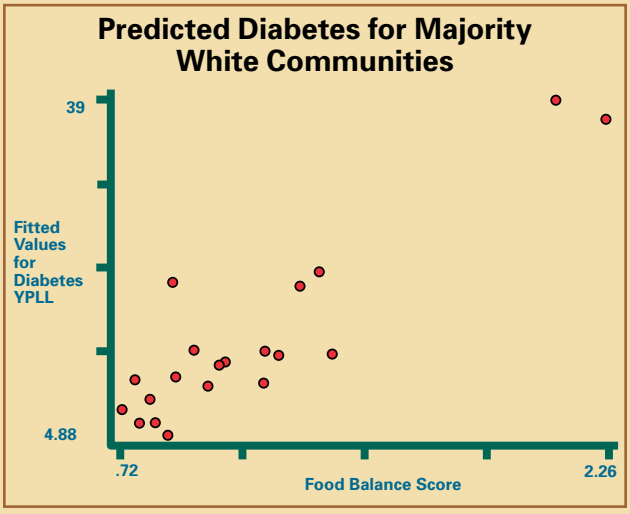


Fig. 52

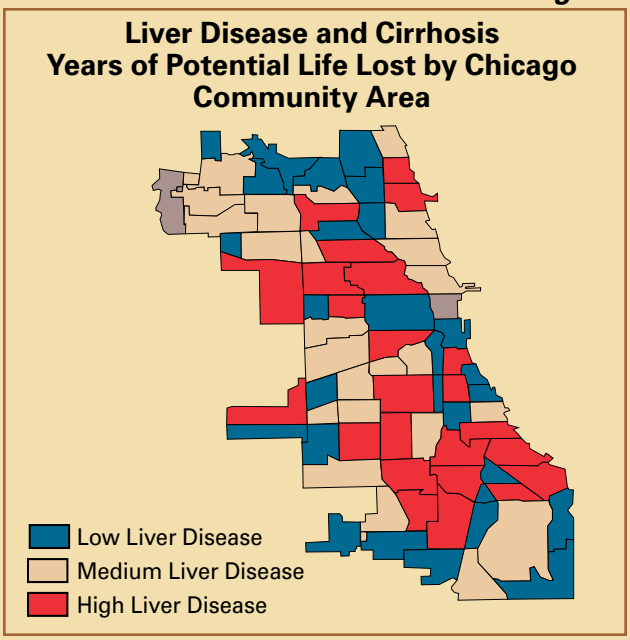


Fig. 53

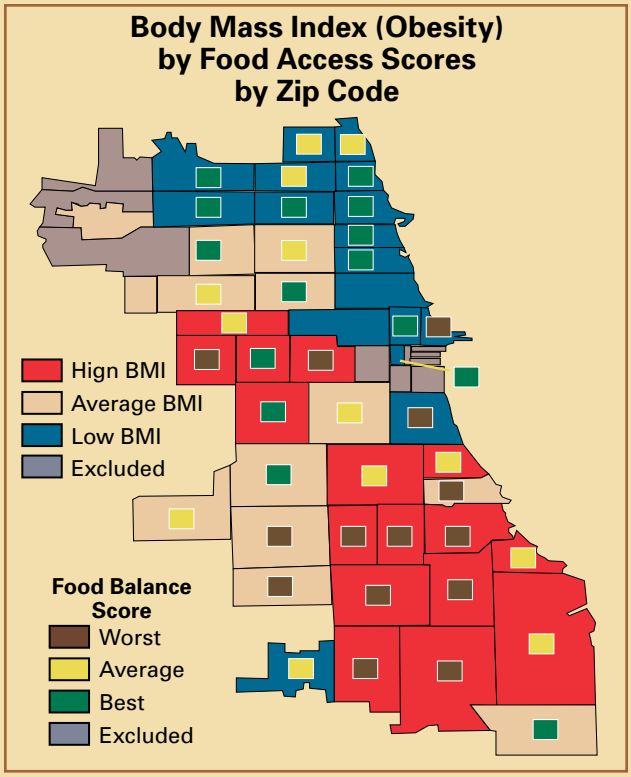


Fig. 54

Alcohol is purchased and consumed in many venues, including small liquor stores, chain grocery stores, pharmacies, and sit-down restaurants. Generally, our focus on alcohol access was not deep enough to draw any conclusions. However, in the future, we might test the theory that alcohol access from liquor stores as opposed to other venues might be positively correlated to the Food Balance Score. In other words, as access to grocery stores decreases, and access to fast food increases (an out-of-balance condition and thus a high Food Balance Score), access to liquor stores might also increase.

Our study also had access to data from an extensive research project that includes direct measurements on obesity and hypertension from 2001 to 2003. Field technicians actually measured these outcomes; they were not self-reported as in a survey. More work needs to be done to link individual-level health data to individual-level food access data. However, from the universe of approximately 3,000 observations from this representative Chicago sample, we were able to analyze results by Community Area for the 23 communities with 50 or more observations each. Not controlling for race, we divide those 23 communities at the median by Food Balance Scores. While we cannot completely control for education and income either, we see that the relationship between Food Balance Scores and negative health outcomes repeats itself. On average, communities with more out-of-balance food choices have 24% higher rates of obesity and 27% higher rates of hypertension.

Divided at the median by Food Balance Scores	Grocer to fast food score	Household income	Percent high school or higher	Percent BA or higher	Percent obese	Percent hypertensive
More out-of-balance grouping **(worst outcomes)**	1.54	$21,529	74%	23%	31%	33%
In-balance grouping	.95	$25,928	73%	34%	25%	26%

Fig. 55

We continue our study of obesity with a more robust, albeit self-reported, sample of height and weight from all 2005 driver's license records by Zip Code. Height and weight, included in those records, allows the calculation of body mass index (BMI), an accepted measure for obesity. The map at left *(Fig. 54)* shows a striking clustering pattern: Chicago's North and Northwest sides have the lowest rates of BMI and the West and South sides have the highest rates of BMI. The data is grouped into equal tertiles, not by empirical definitions of obesity as calculated by BMI.

# of Zip Codes	Majority race	Food Balance Score	Median household income 1999	Percent 4 years of college or more	BMI
26	White	1.39	$52,467	24	24.58
14	African-American	1.74	$29,899	9	26.50
5	Latino	1.03	$28,181	6	21.59
6	Diverse	1.60	$37,003	14	25.34

Fig. 56

Tertile grouping by Zip Codes	Grocer to fast food score	Median household income 1999	Percent 4 years of college or more	BMI
Highest scoring	2.22	$43,957	15	25.75
Average scoring	1.26	$41,234	16	25.30
Lowest scoring	0.94	$42,681	21	24.93

Fig. 57

BMI	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

Fig. 58

We remind our readers of the important point that equal tertiles, not the above weight status breaks, were used previously in the BMI by Zip Code maps.

It is difficult to compare outcomes in this fashion across or within races because of differences in income and education, and because of the averaging across such large geographies. Because we are restricted to the average BMI at the Zip Code level, much of the nuance is lost. But the pattern is consistent with our overall findings. We see that, comparing tertiles, as communities become more out-of-balance in food choices, BMI increases.

When we run the regression for BMI controlling for income and whether the Zip Code Tabulation Area (ZCTA) had a majority of African-Americans, a more out-of-balance score was associated with a higher average BMI that was statistically significant. The regression does not control for education because, as *Fig.57* shows, there is a very strong, positive correlation between income and education at the ZCTA level. Because of this, income and education cannot be entered into the regression simultaneously.

We also found that if either the average distance to a grocer or the average distance to a fast food outlet is used instead of the ratio of these distances (the Food Balance Score), both independently have a positive and statistically significant association with a higher BMI. But the regression showed that if both of these average distances are entered at the same time, only the average distance to a grocer shows up as having a statistically significant relationship to BMI: a ZCTA where the average distance to a grocer is one mile greater will have an average BMI that is 1.643 greater than the BMI in an otherwise identical ZCTA.

Measured by the R-Squared statistic, the regressions that best fit the data (i.e. that explain the greatest amount of the variation in BMI across ZCTAs) are those in the following chart.

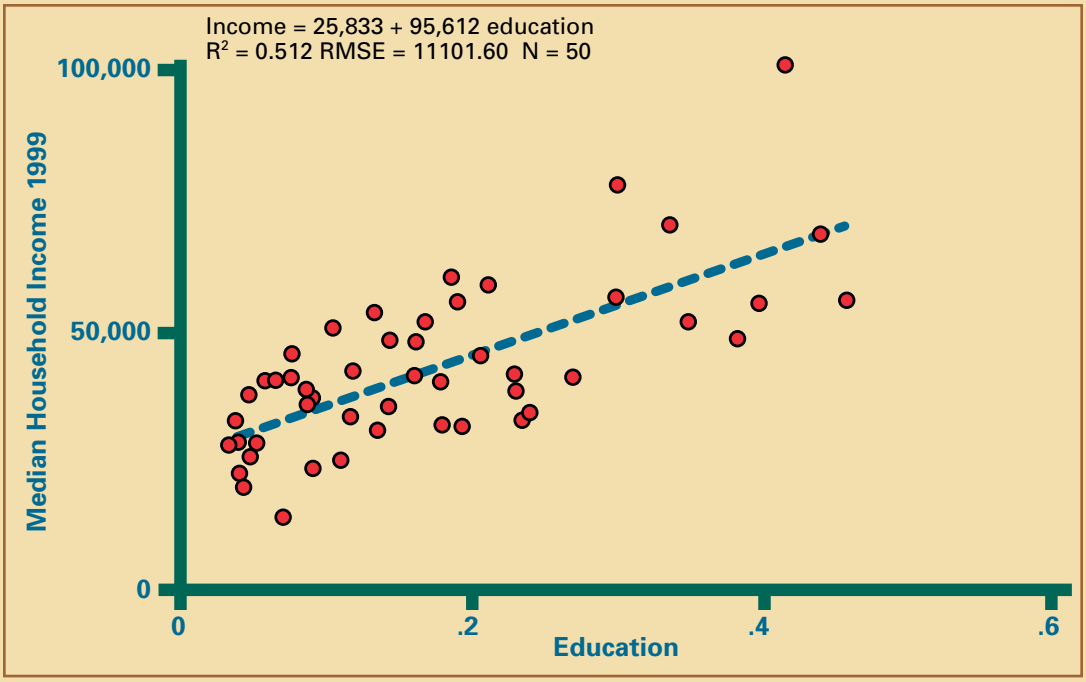


Fig. 59

Summary of Findings

All of these findings point to one conclusion: communities that have no or distant grocery stores but nearby fast food restaurants instead – i.e. communities that are out of balance regarding healthy food options – will likely have increased premature death and chronic health conditions, holding other influencers constant. Although we must set our findings in the context of the challenges and limitations of linking cause and effect and of predicting, with certainty, the exact statistical magnitude of the relationship between food access and health, it is clear that food deserts, especially those with an abundance of fast food options, pose serious health and wellness challenges to the residents who live within them and to the City of Chicago as a whole. Mothers, children, the disabled, and the elderly are the most vulnerable residents of the food desert. The costs associated with this effect will be borne directly by them as it relates to the quality and length of life, and indirectly by the heath care industry, by employers, by government agencies and by others who take on the financial burden of pre-death treatments.

Author's Comments, Conclusions and Acknowledgements

For someone with a strong background in market dynamics, the study of food access as a pathway to community health might seem at first glance like a professional shift. What drives real estate development decisions? What makes a grocery store project credit worthy in the eyes of its financiers? Where are the untapped business opportunities in underserved markets? And how does food availability steal or extend productivity, time, resources, and vitality? In many minds, it is this last question that is out of place in the set. Yet as George Kaplan points out in his eloquent Foreword to this report, the life and death of any real estate deal – and the life and death of mankind – are highly impacted by three things: location, location, location.

Throughout my entire first career as a community development practitioner, I learned hard lessons about location. In fact, there is something about location itself that beckons community developers to begin with. Long ago I managed a commercial strip on the far Southeast Side of Chicago that had an unsightly, sloping, vacant lot in the heart of the district, strewn with litter and tires. A man was chased down and beaten to death there. A policeman, thinking back on the incident, shook his head and said matter-of-factly: "This is a pretty bad location." It was. Gangs. Drugs. Violence. Commercial decay. Something had to be done. Working with the community, we turned the vacant lot into a garden. It sprouted flowers, vegetables, an art show, and even a wedding. For lots of reasons, it eventually improved on the location radar, to the extent that the land became more valuable and demand for it increased. The private sector built a storefront on the site several years later, and the garden was no more. The land returned to its intended function. In community development, and in neighborhood markets, too, the cycle of boom, bust and revival is always a local condition.

It is the same with public health. Local land use decisions are, in many respects, public health decisions. And while one plot of land does not directly cause either life or death, or community revitalization or decline, it certainly can influence those outcomes. As far back as 1926, the Supreme Court rendered an opinion that government has a responsibility to promote and protect public health, and that government can, therefore, control land use to that end, which typically happens through zoning laws. So to be a community planner and not care about health, or to be a health official and not care about the built environment, means opportunities are lost. But there is another dimension of lost opportunities: the market.

Can the market do well by doing some good? Why not? Our study identifies a half million plus people who live in a food desert with no or distant grocery stores but nearby access to fast food. A substantial number of them are single mothers and children. My guess is that women, more than anyone else, know the importance of food to stitching together the delicate continuum of life. It is ironic that these women are the most disenfranchised from the food market given that they probably value and understand it more than any other consumer group. Food is indeed our most basic common denominator, arguably more than housing or any other good. We all need food regularly to live, but our response to food as a commodity differs. The community health advocate might stress local needs and deficiencies, and nutritious food as a human right, while market proponents focus on unit prices, sales volume, profit margins, and the credit worthiness of the grocer leaseholder.

We are living in a world of biological, social and economic complexity. Robert Wright, in his fascinating book, *Nonzero: The Logic Of Human Destiny,* talks about how the best of the best, even competitors, have collaborated over time in pursuit of mutual self-interest and biological, social and economic evolution – progress, as some would call it. In this day of information, technology, and mass production, a food desert is the antithesis of progress, and the costs associated with living within one will be borne directly by those residents through their quality and length of life, and indirectly by the health care industry, by employers, by government agencies, and by others who take on the financial burden of pre-death treatments. Therefore, we might look at food markets in underserved areas through Wright's game theory lens to see how a myriad group of actors might band together with distinct agendas to make the wheel turn in a new way. This would be progressive, as well as smart.

Grocery store locations proved in our study to be a significant factor in obesity outcomes; the farther the grocery store, the higher the obesity rate. That poor health outcomes can be moderated by access to food and to food balance is an important finding. Translation: something can be done about it. The built environment constitutes a set of deliberate choices: to develop, subsidize or finance a grocery store – or not to – happens by choice, not by chance.

One hundred billion dollars is a substantial sum of money to spend each year on obesity. If 5 percent of that were invested in grocery store development paired with local campaigns for healthy eating as an anti-obesity savings measure, that would generate $100 million per state to enhance the sustainability of new business opportunities. Small, mid-size and independent grocers – not just chains – could be the point of focus.

Cost-benefit scenarios such as these are worthy of examination. So is the fast food industry in terms of its potential contributions to improved food access, food choice and community health. To simply demonize the fast food industry for the negative health outcomes associated with the Food Balance Effect would be to miss several key points.

First, the fast food industry has invested in areas otherwise devoid of food options, whereas many grocers over the last few decades have, by contrast, deserted these areas. The fast food industry delivers a highly convenient and filling just-in-time food product at a low price and is a source of community jobs. Its competitive advantage is important considering that the food desert primarily consists of working families and, specifically working mothers, who struggle with the pressure of multiple children, multiple jobs, multiple bills and multiple life stresses. Only with great naiveté could we assume that they would spend all their time cooking elaborate healthy meals if only given access to a grocery store. Furthermore, fast food outlets have flourished in markets that other food venues and retailers have deserted or avoided. They have achieved sustainability in the pure market sense of the word. Finally, the fast food industry is evolving, albeit under pressure from books like *Fast Food Nation*, but evolving nonetheless into a new dimension of food lines that include healthier options and reduced saturated fat content. This suggests the potential for forward movement, something better, progress. Less important now is what the fast food industry has been. More important are what it is becoming, what it could become, and how to improve data systems to better gauge market opportunities and community health moving forward. As a former practitioner and now a researcher who still spends considerable time conducting market analyses and commercial site assessments, I repeatedly see the need for improved data systems and better market sizing methods. In urban micro-markets especially, "bad data" is a key obstacle to grocery store development. With the right skills, mindset and resources, this can be remedied on a market-by-market basis, but what can be done to make improved data systems more widely available across markets to actors who make development decisions and to community leaders who monitor change?

There are other strategic questions that can be explored as well:

1) What can the grocery industry learn from the fast food industry in order to better compete in underserved markets?

2) Would foundations or others provide credit enhancement to make mid-size and independent grocers more viable in areas that need them?

3) Can a franchise of micro-entrepreneurs mimic successful companies such as Pea Pod in the to-the-door distribution of healthy food items? What is the viability of mobile grocery stores, such as fruit and vegetable trucks and even bicycle carts that sell fresh snacks and produce?

4) What does the ubiquitous vending machine industry have to offer areas that suffer from food imbalance? Can publicly available vending machines dispense apples, low-fat yogurt, bags of carrots and multigrain bread, instead of soda and candy bars, and turn a profit? This is a focus now in certain public school systems across the country, but it could be an opportunity everywhere.

5) Individuals who work often spend more than half of their time awake each day in their employers' environs. By encouraging healthy eating and exercise in the workplace, can employers increase employee productivity and reduce the costs of employer-supported health care coverage?

6) Is a "food literacy" education campaign needed? Do we all know how to read recipes and food labels, measure ingredients, size food portions appropriately, cook, and maintain healthy food choices? Food literacy might be as important in some communities as financial literacy. The two could also complement each other.

7) What would shift our culture away from the television into the kitchen? Would busy parents, particularly time-pressured single mothers, form cooking clubs where healthy food is prepared in bulk and eaten, exchanged, or frozen for later consumption? What can community organizations do to support and encourage healthy cooking and eating habits?

8) Last, while education campaigns are laudable, is it dishonest to tell people to eat healthy foods if there is no realistic place nearby to acquire them? This brings us full circle to the core challenge at hand: to be able to choose healthy foods you must first have access to them. It all boils down to location.

Earlier in this narrative, I told the story of the unsightly vacant lot that harbored drugs and gang members and discouraged commercial investment. It was a pretty bad location. The community was galvanized to action, and improvements were made, but not until a man was beaten to death there.

Knowing that food imbalance steals life and vitality from communities and their residents can provide this same urgent call for action. A first breath, the final one, and the daily food that sustains life in-between, is a continuum that every mortal shares. As we all need to eat to live, food might be the unifying thread that transcends race, place, class, and outdated development models that just don't work in these underserved communities. Identifying market as well as needs-based solutions that promote access to nutritious foods and healthy food choices will require input and support from the food desert residents themselves as well as from grocers, banks, brokers, developers, planners, health advocates, educators, government, foundations – ultimately everyone – to achieve even a modest level of success.

Examining the Impact of Food Deserts on Public Health in Chicago assesses the link between food imbalance and the quality and length of life, and the quality and cause of death. This body of work, and its call for collective action and community partnership, would not have been possible without the **generous support of LaSalle Bank**. I'm deeply grateful to LaSalle for underwriting the research, the report, and the forum, for their graceful manner of opening new doors in support of the research while not interfering with it, for convening the Roundtable, and for their courage to explore and help resolve a sensitive community health issue that has relevance across urban America. LaSalle's leadership on this project in Chicago will set a new example nationwide for how a nontraditional set of actors – banks, the private sector, community development leaders, and others – can address neighborhood sustainability through the lens of community health and wellness. This will strengthen bridges across diverse disciplines and, more importantly, improve and extend lives. I am especially thankful for the contributions and team spirit provided by the following LaSalle Bank colleagues:

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We invite your feedback and participation moving forward.

Mari Gallagher, Principal
Mari Gallagher Research & Consulting Group
1929 West Patterson
Chicago, IL 60613
(312) 339-0640
mari@marigallagher.com
www.marigallagher.com

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Report authored by
Mari Gallagher Research & Consulting Group
1929 West Patterson
Chicago, IL 60613
(312) 339-0640
www.marigallagher.com

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(312) 904-2866

Mari Gallagher
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