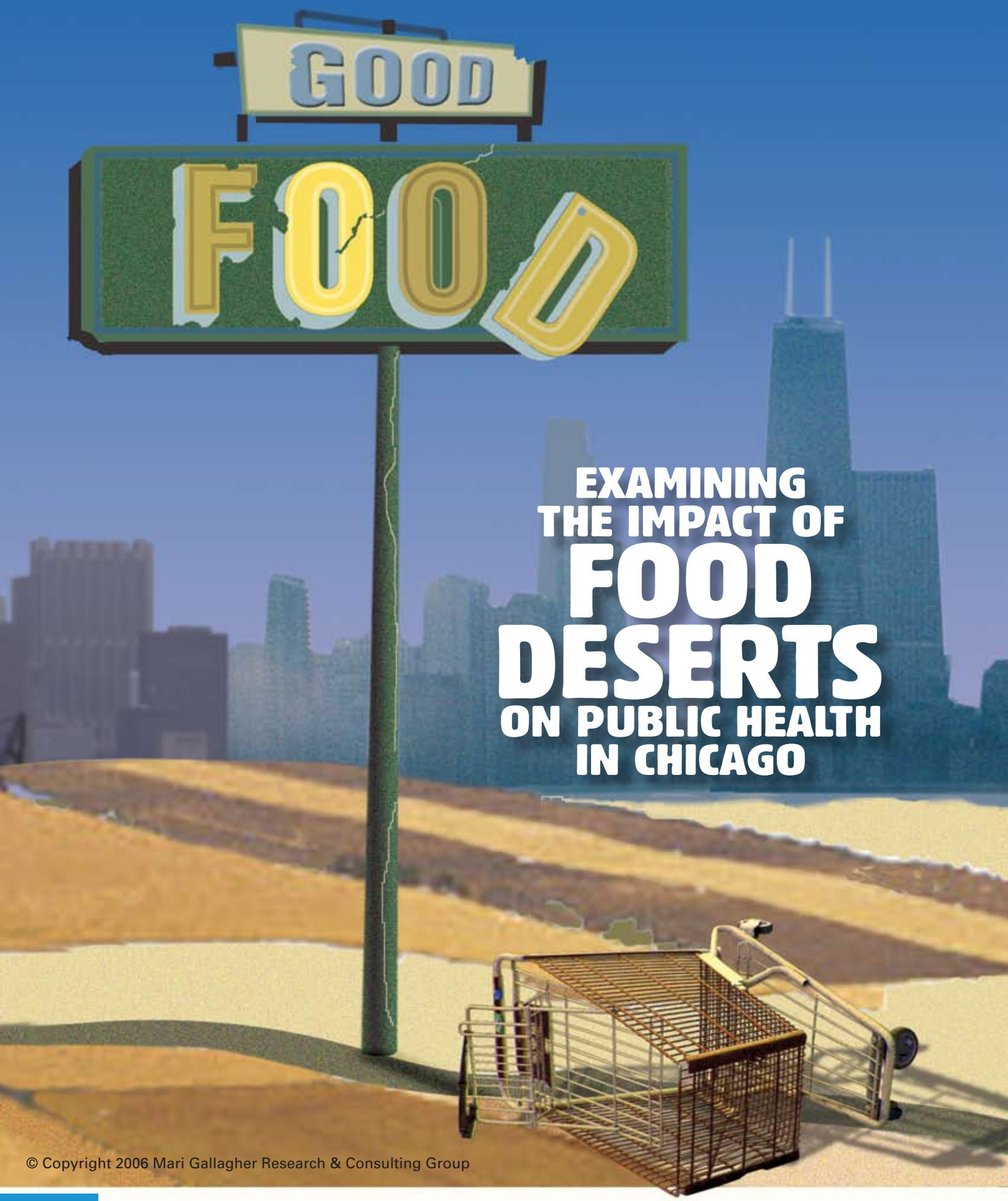


EXAMINING THE IMPACT OF FOOD DESERTS ON PUBLIC HEALTH IN CHICAGO

Mari Gallagher
Research & Consulting Group

Findings Only

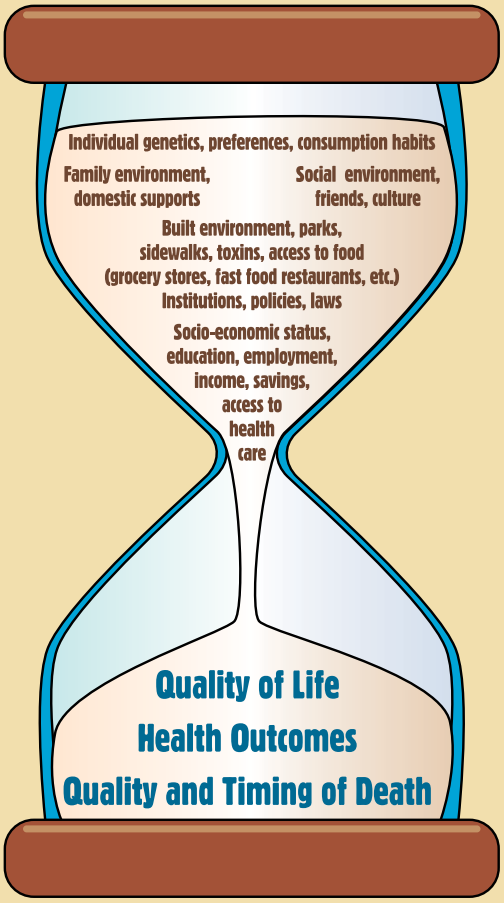


Fig. 14

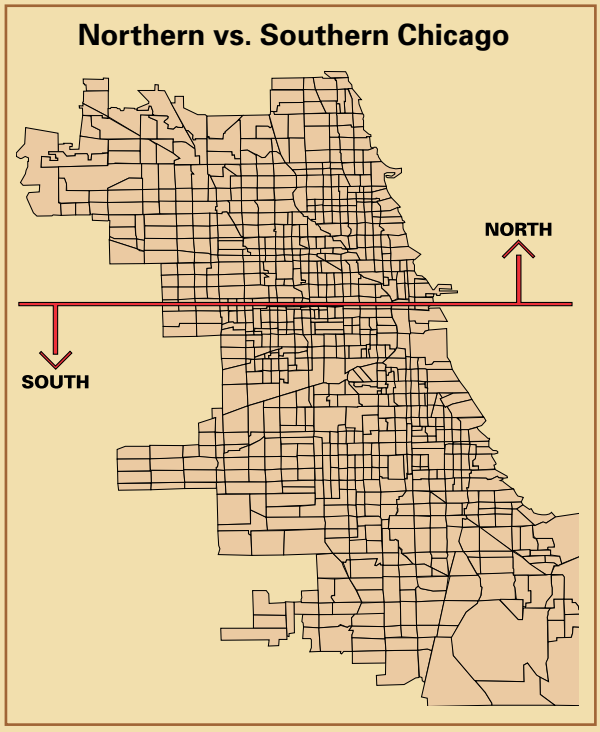


Fig. 15

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

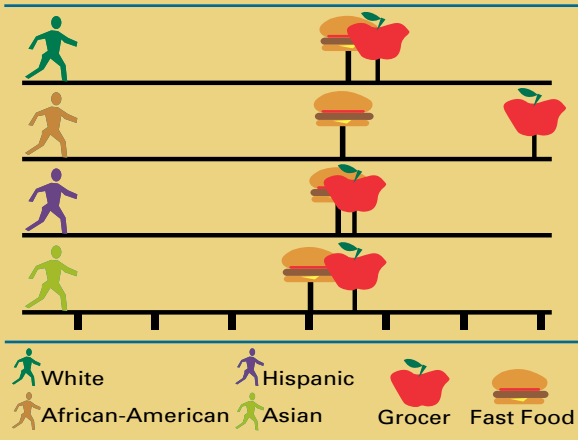


Fig. 18

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

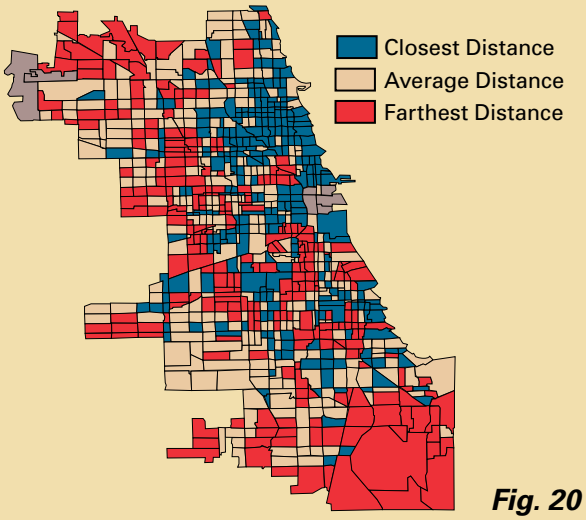


Fig. 20

Distance to Small Grocer by Tract

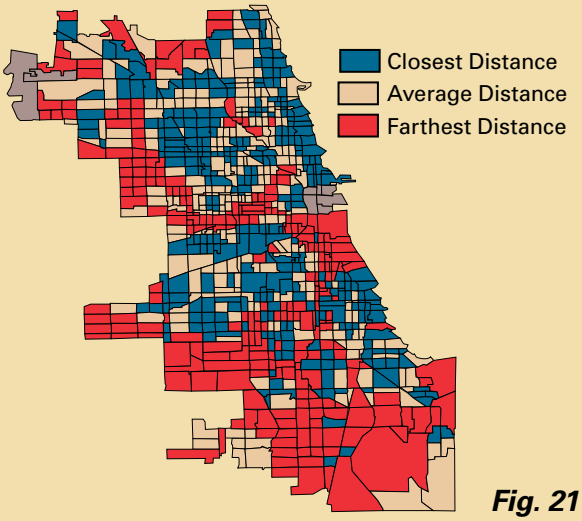


Fig. 21

Distance to Any Grocer by Tract

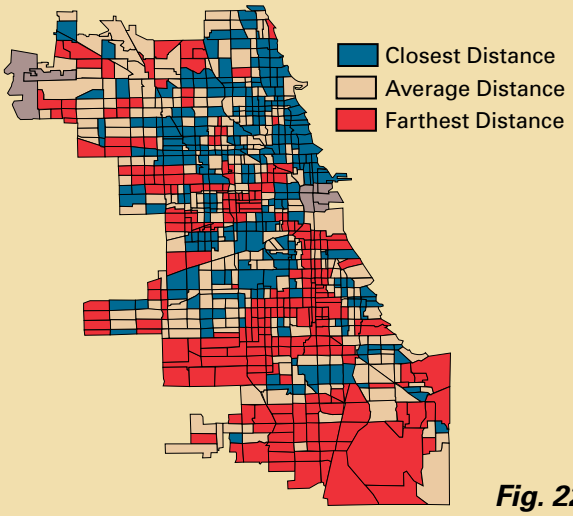


Fig. 22

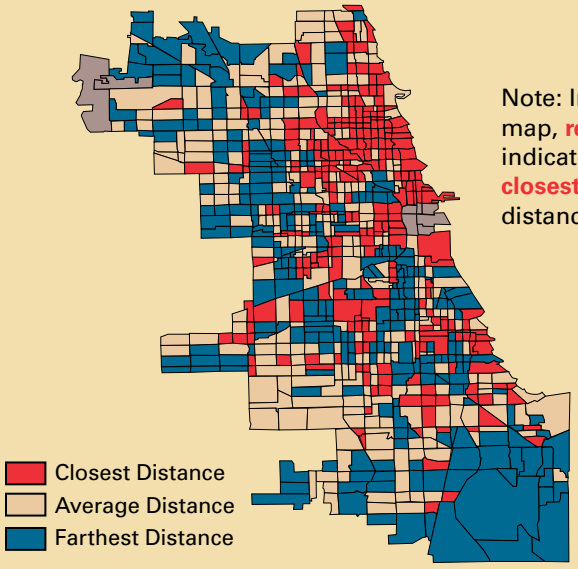
Because Chicago's blocks, tracts, and communities tend to be segregated by race, we see the impact of these patterns geographically in the following series of maps. The North side of the city tends to have greater access to all types of grocers, while the West and South sides tend to have less access. 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

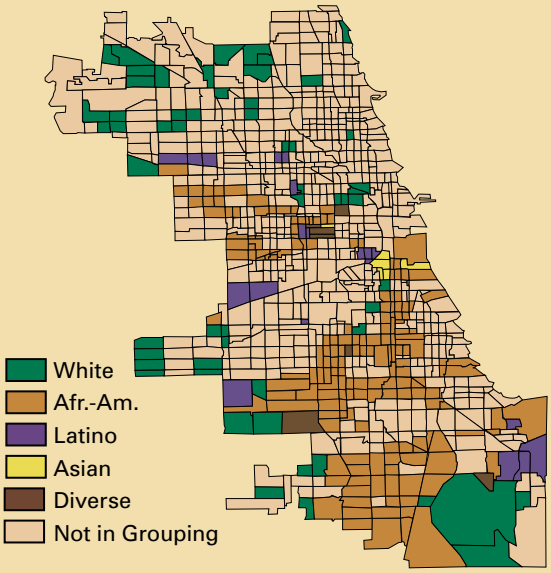


Fig. 24

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

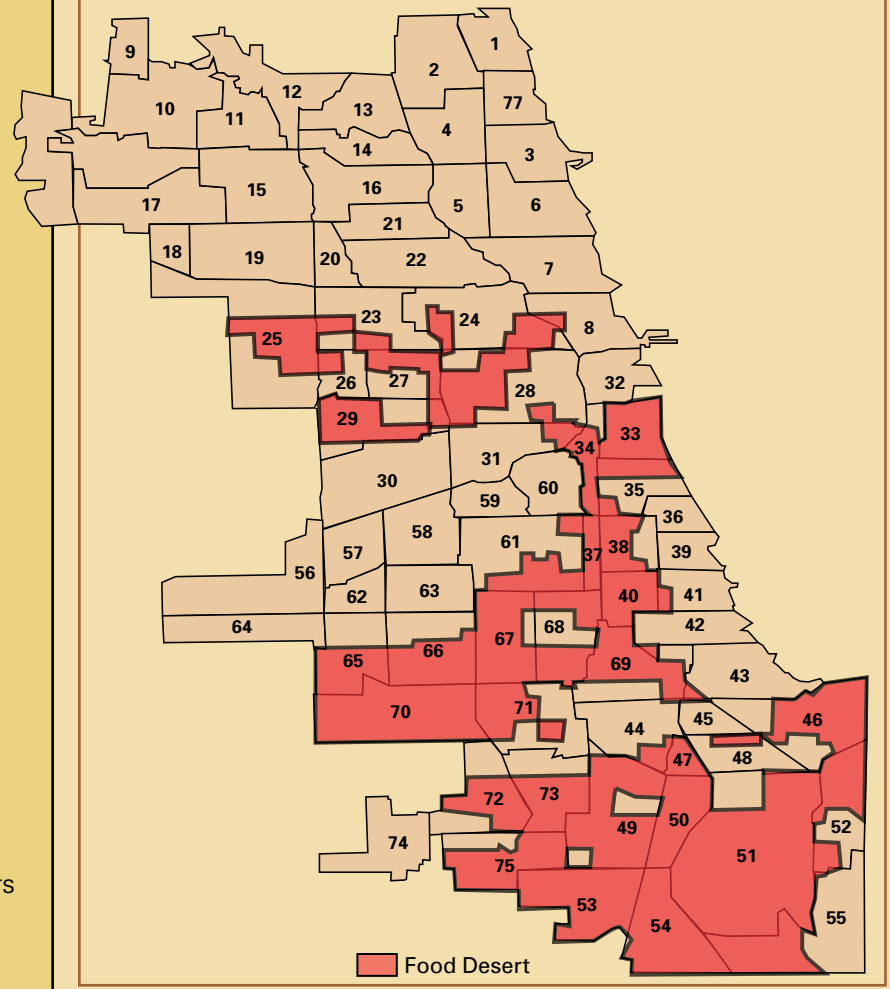


Fig.

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

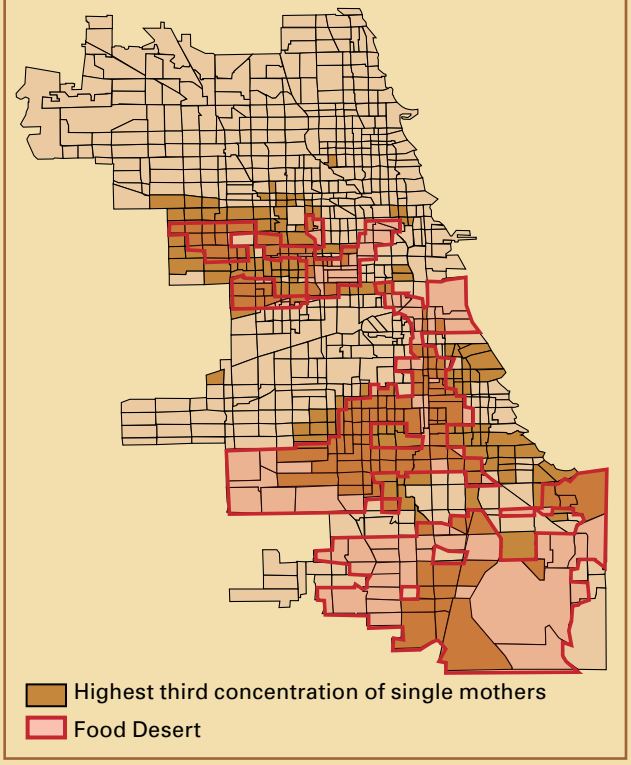


Fig. 26

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

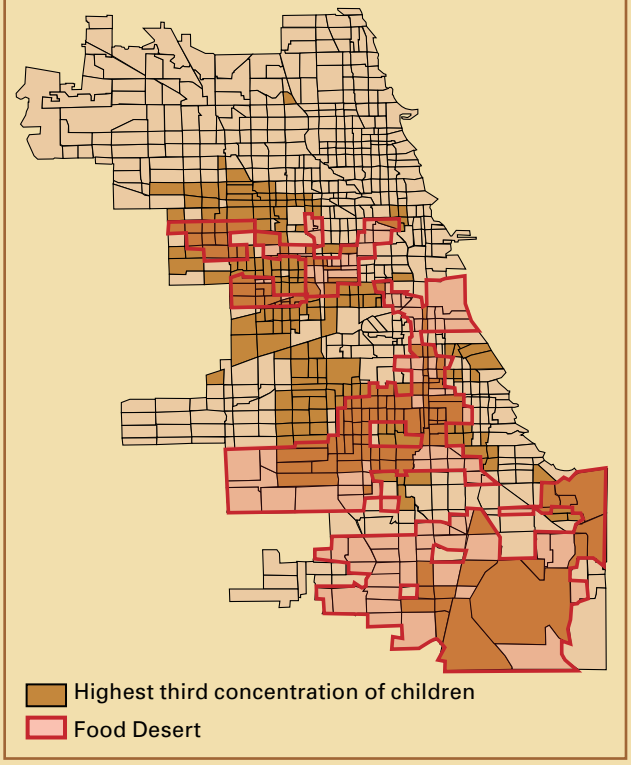


Fig. 27

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

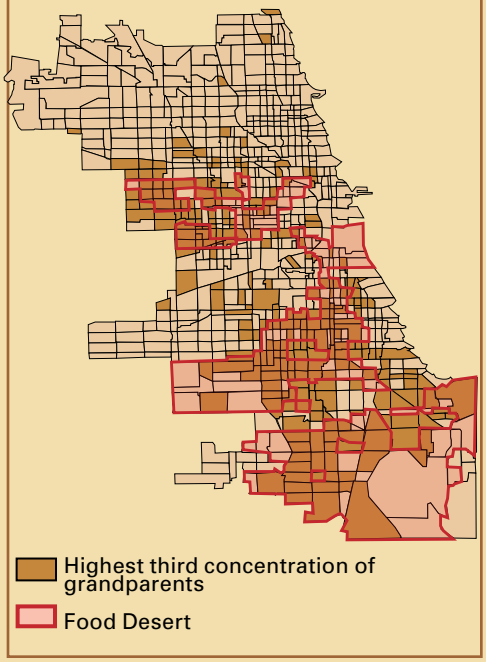


Fig. 28

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

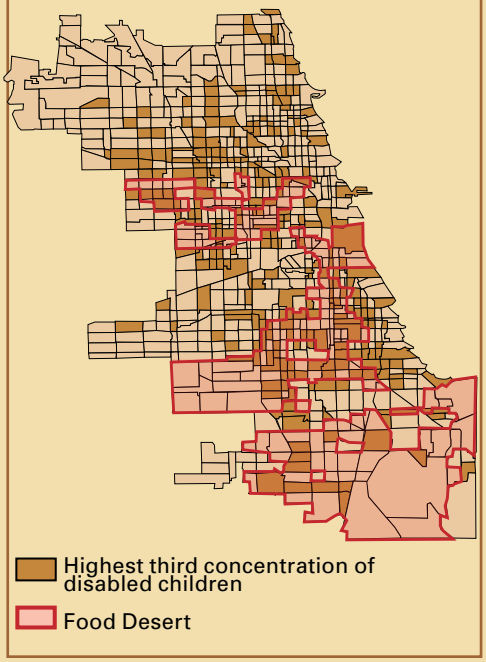


Fig. 29

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

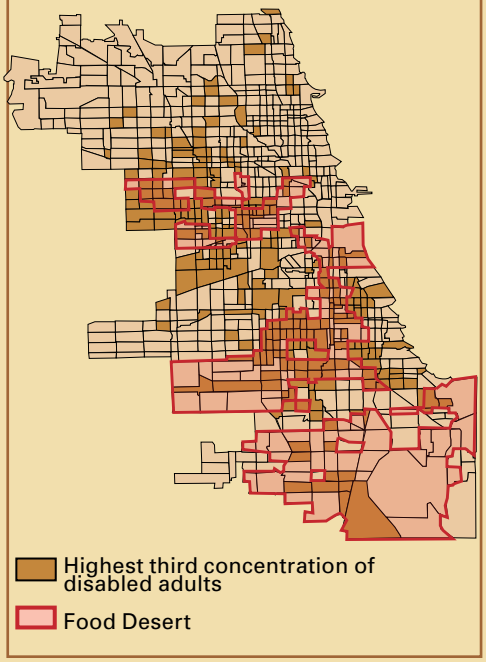


Fig. 30

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

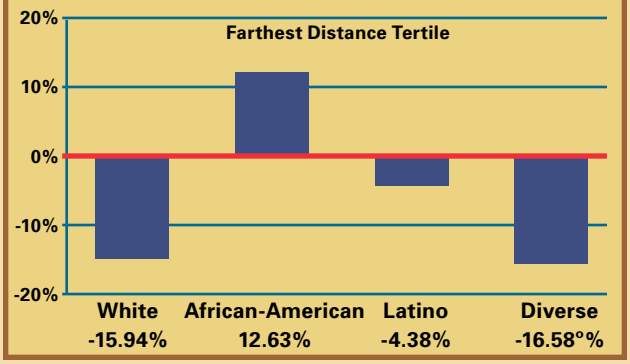


Fig. 32

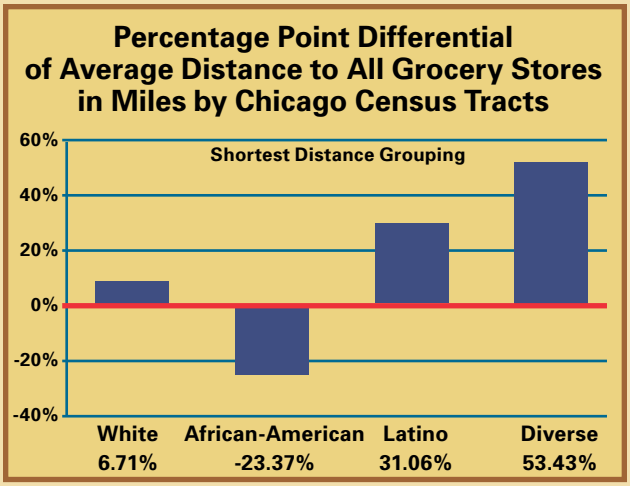


Fig. 33

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

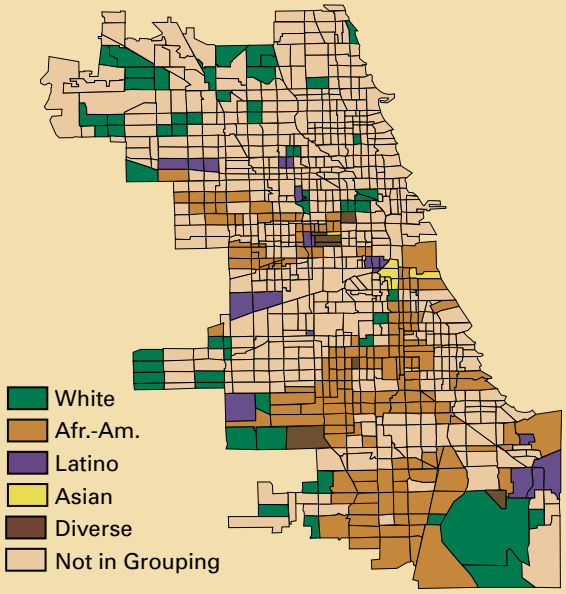


Fig. 35

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.

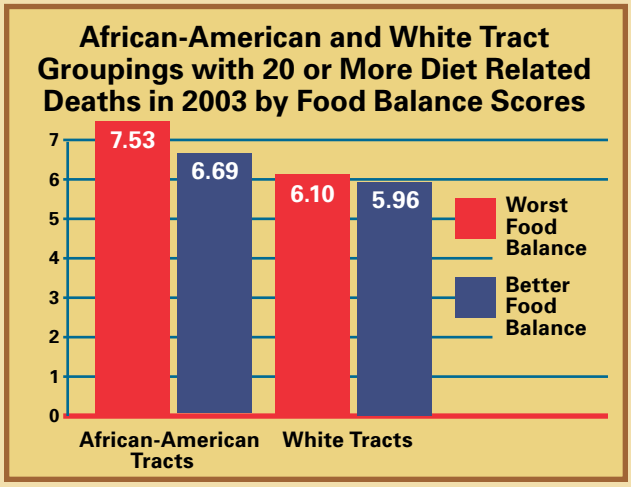


Fig. 37

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.

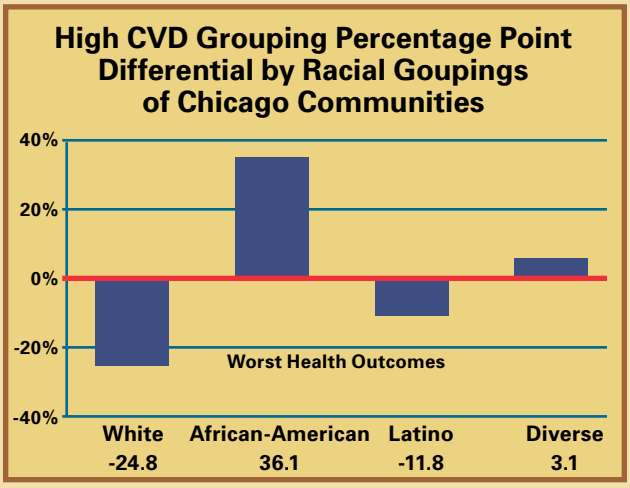


Fig. 39

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

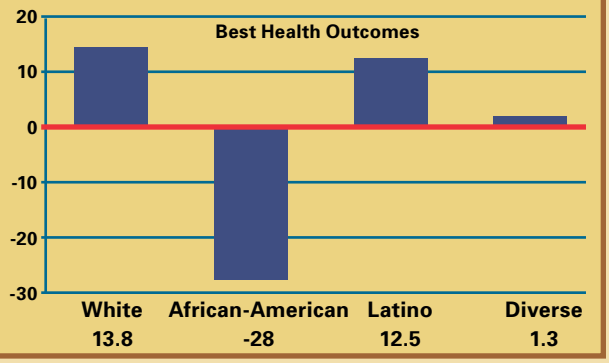


Fig. 40

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

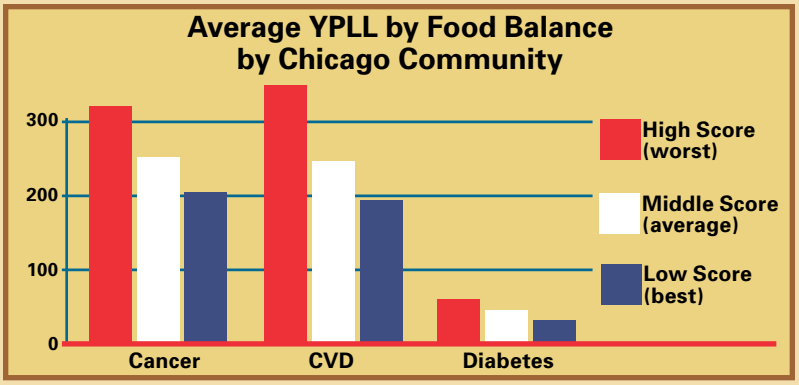


Fig. 43

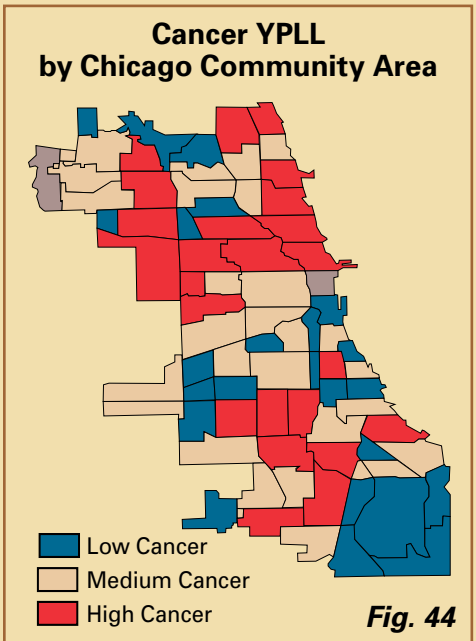


Fig. 44

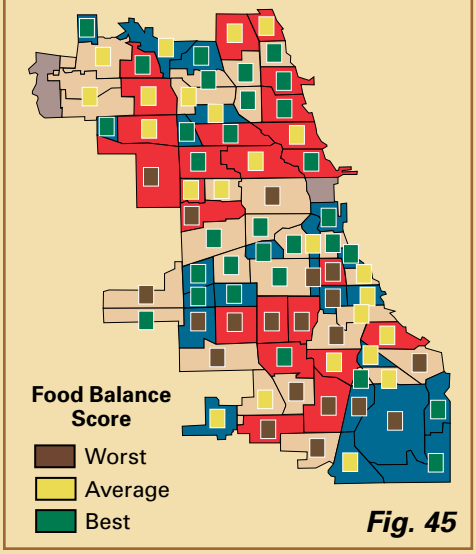


Fig. 45

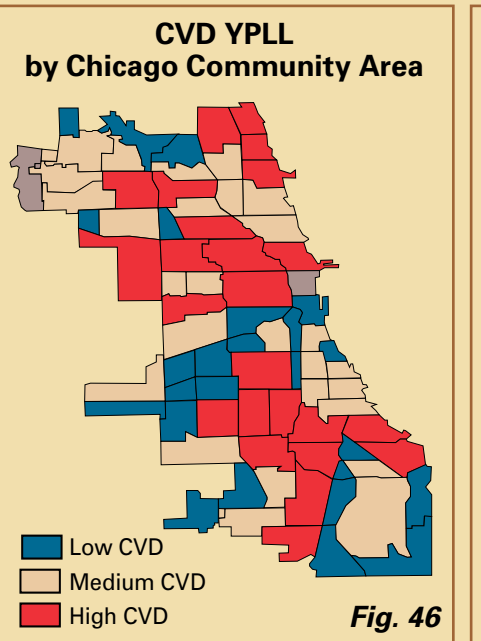


Fig. 46

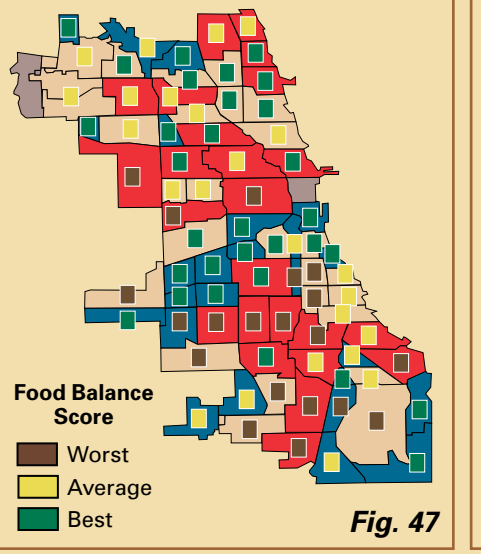


Fig. 47

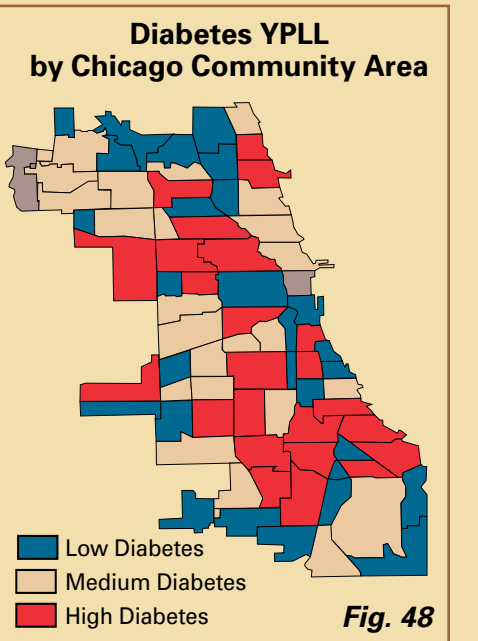


Fig. 48

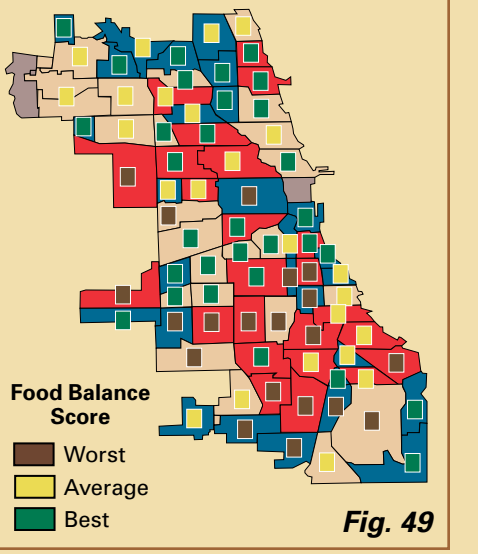


Fig. 49

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.

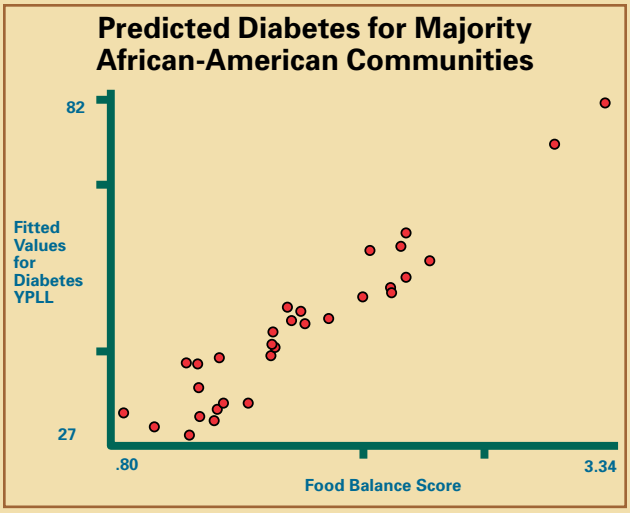


Fig. 51

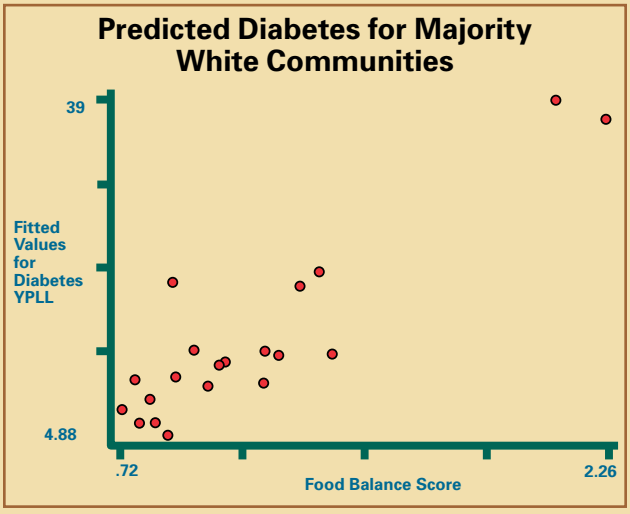


Fig. 52

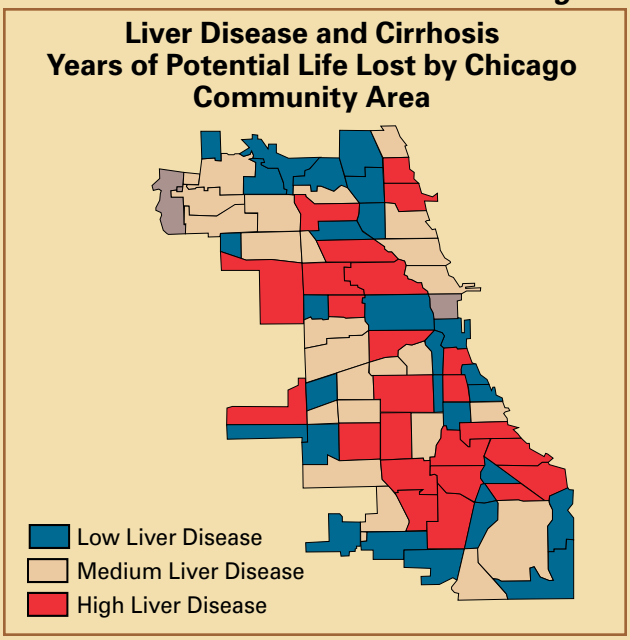


Fig. 53

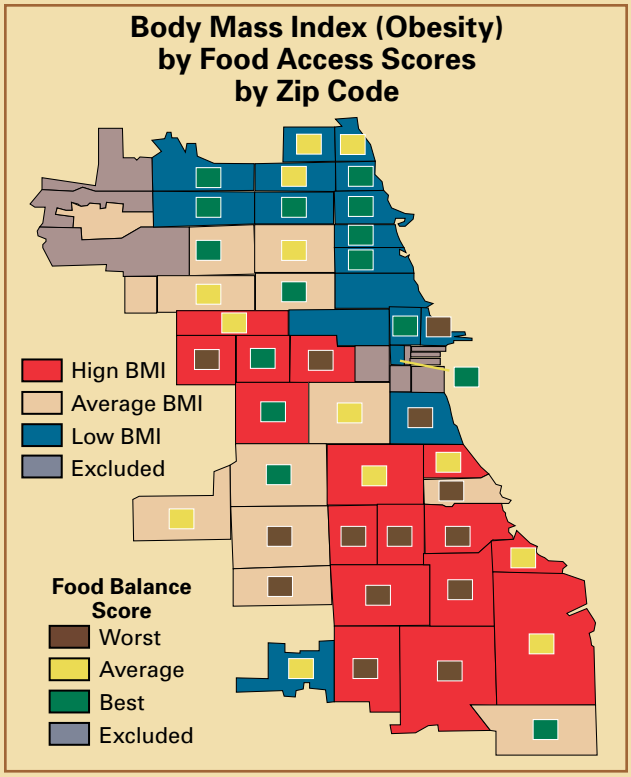


Fig. 54

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.

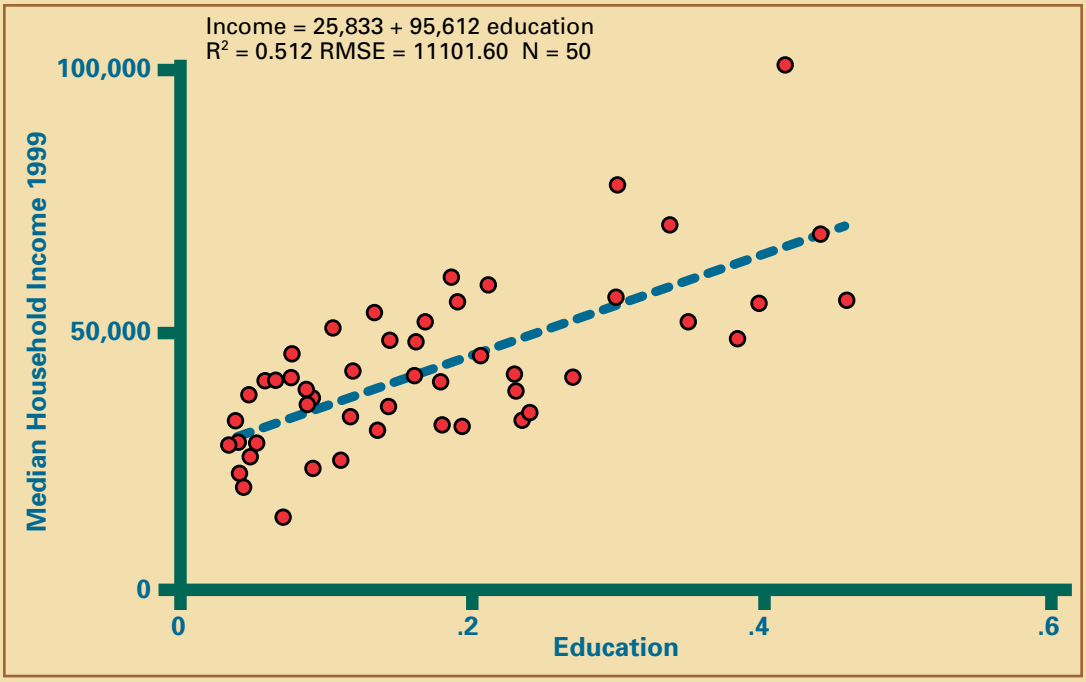


Fig. 59

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.