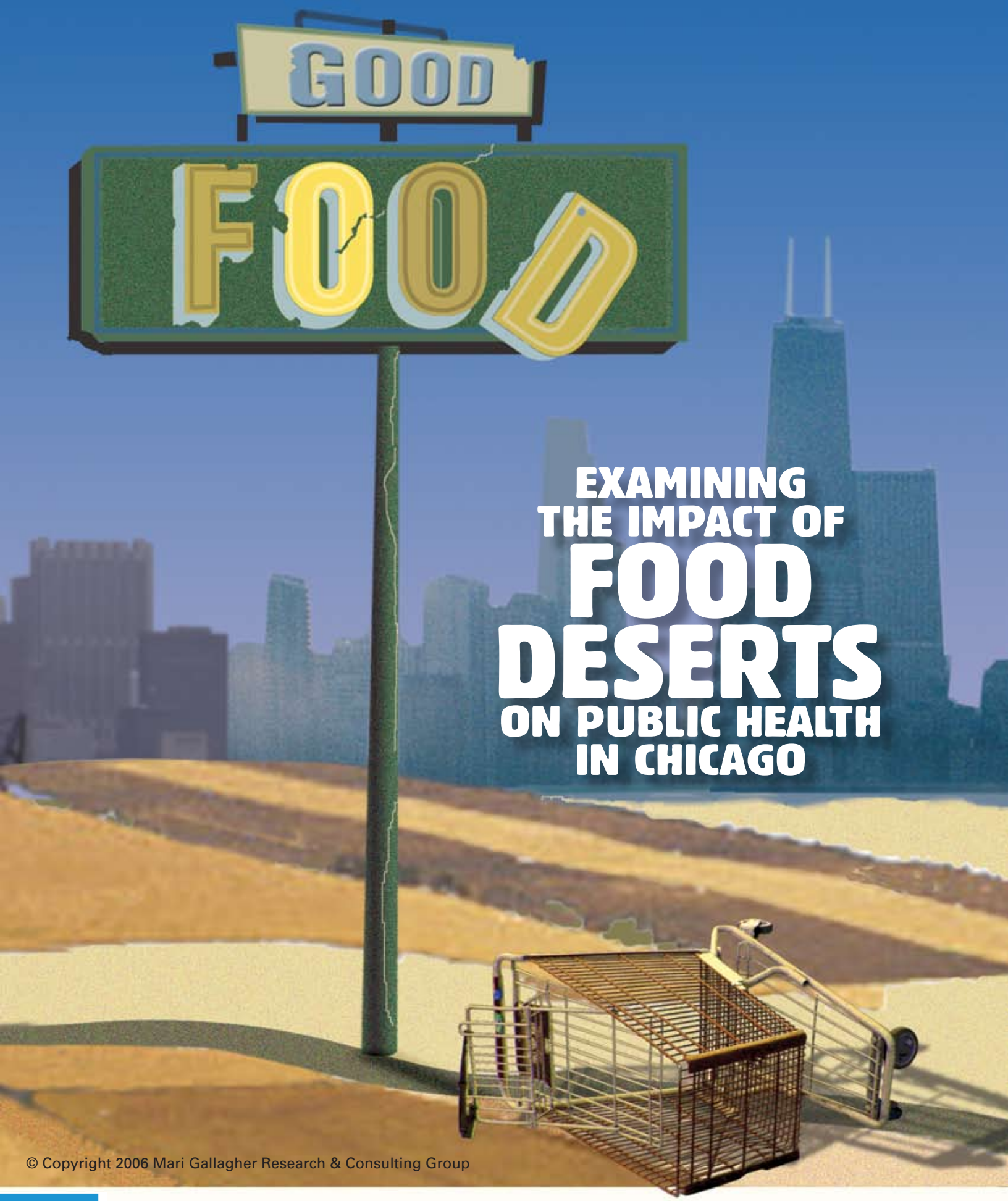

EXAMINING THE IMPACT OF FOOD DESERTS ON PUBLIC HEALTH IN CHICAGO

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Methodology & Data Development Only

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).

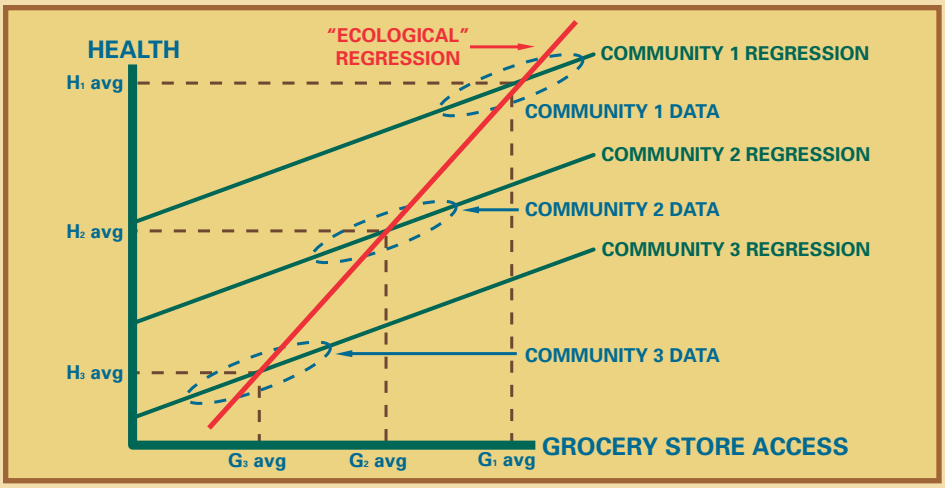

Fig. 13

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.