Research Sponsor

Walmart

Save money. Live better.

Food & Health In Washington DC

Technical Report

August 2012

Mari Gallagher
Research & Consulting Group

Acknowledgements

We are grateful to our colleagues at Walmart for sponsoring this public report. All of us hope it will be a resource to the many community, government, philanthropic, and market leaders who are working to improve healthful food choice in Washington DC. Warm thanks, especially, to Keith Morris, Senior Director, Community Affairs, and to our colleagues at Walker Marchant Group.

We also express our sincere appreciation to Peter Tatian of the Urban Institute for his insights and help in procuring health data. Peter is extremely knowledgeable about social, market, and policy issues in DC; his assistance was very valuable. The Urban Institute has been an important community-level data and research leader, both nationally and locally. Many other great people and organizations, in fact, are also tirelessly working in the trenches of our nation's capitol, in order to improve food access and health. We thank the Town Hall Education Recreation Campus (THEARC), the Center For Inspired Teaching, Common Threads, DC Central Kitchen, DC Scores, Hannah House, Martha's Table, McKenna's Wagon, NALEO Educational Fund, Social Compact, and Some, Inc., which stands for "So Others Might Eat". Because of space limitations, we are not able to applaud everyone – our apologies – but we do recognize your work as being critically important.

Internally, we heartily thank Joseph Ferrie, our closest research companion, who is not only the smartest person we know, but also fun to work with.

Two final acknowledgements: thank you to First Lady Michelle Obama, for her support on this issue, and for being an inspiration to all of us. Last, but not least, we thank the DC residents themselves, to whom this research is dedicated. We all must eat well as part of the human condition. Good food is our common denominator as people, and a uniting call for collective, strategic action that transcends race, class, and politics.

Contents

Regression results available at: www.marigallagher.com.

Also watch our website for additional information, as we continue engaging the community, soliciting feedback, and finalizing our suggested recommendations for improving food and health in our nation's capitol.

Executive Summary

From its earliest days, our nation has relied on agriculture to fuel the economy and to feed local residents. We learned from Native Americans how to grow squash, pumpkins, turnips, cabbage, and multiple varieties of corn and beans. European settlers added wheat, oats, potatoes, barley, rye, and buckwheat. They fished, hunted wild game, and cultivated livestock. Despite the challenges of occasional harsh winters, the food system was abundant and balanced.

Today, most families do not hunt, fish, grow, or can their own food. They buy it at a retail establishment. Our modern definition of food security, therefore, includes the types of food stores to which we have access. Consider where you live. Is it just as easy to buy skinless chicken as fried chicken? Can you choose fresh fruits and vegetables as easily as you can soda and candy bars? To what degree is what we eat and, thus, our health, dependent on where we live and on our food environment?

Food & Health in Washington DC probes this very question.

Given our foundational premise that the health and vitality of America's communities are block-by-block phenomena, our first task was to measure the distance from every block in DC to the closest healthful and unhealthful food purchasing option. Next, we conducted a spatial analysis, in order to interpret these block-by-block patterns. Finally, we studied the relationship between the food environment and diet-related health outcomes, accounting for key contributing factors such as education, income, age, and race.

Here is what we found:

1. Most of Washington DC has good or adequate access to food stores that sell a wide-range of healthful, nutritious items.

2. Food access inequities, however, do exist. Nearly 60,000 residents – a number equivalent to the entire population of Rockville, Maryland – live on blocks where the closest healthful food store is .8 to 1.5 miles away. Many

Food access inequities exist in Washington DC.

We found that they have a large and statistically significant impact on diet-related health outcomes.

Washingtonians who live far from healthful grocery options are low-income, and a disproportionate share of the low-food-access population is African American.

3. Why does grocer distance matter? One simple answer is consumer convenience. A second factor is that quality grocery stores attract other quality retailers to neighborhood markets. They provide jobs and economic development opportunities. They support vibrant business districts. But there is a third factor: public health.

4. There are many influences on personal health and vitality. What we are determining in this study is *whether or not* the food environment *also* contributes to public health. If so, to what extent? We found large and statistically significant negative health impacts when the closest distance to a healthful food store ranged from .6 miles to 1.5 miles away. Residents who live in those areas have higher rates of death from diet-related diseases, particularly cardiovascular disease. The impact intensifies as distance increases.

5. Additionally, we analyzed individual-level birth weight and its relationship to healthful grocery options. Here, we controlled for gestational age and the mother's income, education, age, alcohol and tobacco use, prenatal care, and marital status. The effect of healthful grocer distance was both large in magnitude and statistically significant. Between 6% and 8% of DC babies are born overweight (weighing more than 4,000 grams), as defined by the Centers for Disease Control. For a mother who resides an additional half-mile from a healthful food store, the probability of an overweight birth increases to between 7% and 9%, roughly a 10% increase. Does being born overweight matter? Yes. Immediately, the high birth weight puts the infant at a higher risk for birth injuries and infant mortality. High birth weight is definitively associated with adult obesity, diabetes, hypertension, insulin resistance, and other problems.

6. We also found that the ratio of healthful to unhealthful food stores impacts health outcomes. In total, over 200,000 DC residents – about one-third of DC's

Many who live in a poor food environment are more likely to die prematurely from cardiovascular disease, diabetes, and other conditions.

Distance to a healthful food store also impacts newborns.

When the store is too far from the mother's residence, the likelihood of the child being born overweight increases by 10%.

total population – live on blocks where the ratio is 3 or higher. This means that the closest healthful food store is three times as far or farther than the closest unhealthy food option. At this level of *Food Imbalance*, we found large and statistically significant negative health impacts with all diet-related diseases, especially cardiovascular disease and diabetes. The average Food Balance ratio for all DC blocks is 14, meaning that the healthful food store is 14 times as far as an option that primarily sells items such as chips, candy, donuts, soda, fried chicken, and processed foods high in salt, fat, and added sugar. These foods are high in calories but low in nutritional value.

The relationship between food access and health outcomes is complex. However, we stand by our conclusion that the DC food environment presents a serious health and wellness challenge to many residents, particularly existing and forthcoming populations of newborns. Unless the situation improves, we predict that the costs associated with those poor food-access patterns will be borne directly by communities and their residents, impacting their quality and length of life. These patterns will also increase the financial burden to the healthcare industry, to employers, to government agencies, and to other entities who bear the responsibility for treating diet-related health conditions.

We all must eat well as part of the human condition.

Good food is our common denominator as people, and a uniting call for collective, strategic action that transcends race, class, and politics.

Methodology & Findings

Block-Level Analysis

Health, wellness, and vitality of any community are block-by-block phenomena. Therefore, we do as much analysis as possible at the block-level. Our first task was to determine block-level population distribution for Washington DC, our study area. As identified in Table 1, there are 3,888 non-zero population blocks in our nation's capitol. There are an additional 552 zero population blocks, which can include parks, airports, and industrial areas. We highlighted zero population blocks on the maps that we present shortly in the report, but excluded them from the analysis, so as not to distort the findings. Half of DC's non-zero population blocks have an average of 83 residents. Roughly 10% have 19 or fewer residents. Of those latter blocks, 10% are very low in population density. Based on their spatial distribution, we determined that they should be included in our analysis, but we also highlighted them in our maps, in order to alert the reader.

Together, the zero and non-zero blocks constitute roughly 44 square miles, out of the 68 square miles of the total DC area. The total population for DC is just over 600,000 people. Approximately 40% are White, 51% are African American, and 9% are Latino. About 17% of the total population is children under 18 years of age.

Table 1
Washington DC Population Distribution for Non-Zero Population Blocks

Quantile	Average Population Estimate
100%	3,888
99%	882
95%	434
90%	288
75%	154
50%	83
25%	44
10%	19
5%	8

Source: 2010 US Census

Retail Data Development & Trends

We developed block-level food access data for every block in DC and for a three-mile buffer zone outside its borders, including areas in the states of Virginia and Maryland. The fieldwork began in spring of 2011 and was completed by early fall of that year. However, because the most recent Census data, at the level required, was not available until late in December 2011, we postponed the analysis on health impacts until January 2012, at which time the best demographic data would be available. So, in January, we also updated all of our retail data and related analysis.

The development of block-level retail data is a major component of the project. There are many different types of DC stores that sell some kind of groceries, and we

need to determine if they are contributing to or detracting from a healthful food environment. In addition to traditional grocers, stores today that sell food can include corner stores, convenience stores, gas stations, liquor stores, department stores, dollar stores[1], discount bakeries, pharmacies, and a multitude of other retailers. Diverse and aggressive competition for the traditional grocery dollar by non-grocers and non-supermarkets dates back to the late 1980s. Up until that time, the Consumer Price Index for food and the Producer Price Index for finished consumer foods moved together with traditional retailers dominating the marketplace. Then they began to diverge. Other types of big and small retailers saw and seized opportunities to sell groceries. In 1998, traditional food stores captured 80% of the food dollar, but by 2009, their share fell to 60%[2]. Also accelerating in the 1980s was an acquisition and merger wave within the grocery industry that contributed to some traditional grocery stores exiting low-income markets. What types of stores selling food took their place, were already present, and continue to persist in those markets and throughout the study area? To understand DC's food environment, we must quantify the many types of retailers competing for grocery sales. To address this complexity, the MG firm coined the terms "mainstream" and "fringe" in 2006, in order to classify food stores.

Mainstream & Fringe Food Stores

A mainstream grocer can support a healthful diet on a regular basis. Mainstream food stores can be large or small chain grocers, large independents, or very small "mom and pops". They can be small corner stores, for example, or large department stores; some department stores now sell enough healthful foods, such as produce, fruits, dairy, and meats, in order to qualify as mainstream. Other department stores sell food but are not, by our standards, mainstream. Another defining mainstream factor is that the store be open on a normal retail basis – not seasonally, occasionally, or one day a week for a few hours.

A fringe food location is the opposite; it is not inherently bad, but if it were the primary food source, local diets and public health would likely suffer – the very premise tested in this study. A defining fringe food factor is the primary sale of food that 1) is fast, readymade, boxed, canned, and/or processed, 2) is high in salt, fat, and sugar and 3) has very limited, if any, nutritional value.

A mainstream grocer can support a healthful diet on a regular basis

Mainstream food stores can be large or small chain grocers, large independents, or very small "mom and pops".

How the store is coded, in terms of mainstream and fringe, depends on what it sells. Coding does not depend on total sales or the *share* of grocery sales in the store's total sales. Total square footage of the store is also not important.

To illustrate how the mainstream and fringe coding works, we will use corner stores as an example. Corner stores have recently been an important focus in local community food assessments, because many efforts are underway nationally and locally to help support and improve them. Coding these stores as either mainstream or fringe allows an opportunity to acknowledge, and count as positive contributors, the corner stores that do indeed sell healthful food. Those corner stores that specialize in fringe food and other non-food items such as lottery tickets, phone cards, cigarettes, and so on, as primary offerings, are discounted in the data. We are not against fringe corner stores that provide the convenience of these items; supermarkets have them, too. However, these types of fringe stores are not mainstream food stores, because enough healthful food is not also available. Fringe retailers do provide consumer options, but when they are the only or dominant option, there can be negative consequences on public health. High concentrations of fringe stores can also depress local markets and economic development prospects, by repelling mainstream retailers. Grocers agglomerate and are attracted to other retailers of a similar quality and product mix. Now consider another example: gas stations. Some have "food marts" and others do not. Those that do, and that mostly sell fringe food, should be listed as fringe stores. Those that do not sell food should not be coded as mainstream or fringe; therefore, we exclude them from our data.

Fringe food stores primarily sell food that is fast, readymade, boxed, canned, and/or processed.

This food is generally high in salt, fat, and sugar, and has very limited, if any, nutritional value.

USDA SNAP Retail Data: A Useful Starting Point

We have found, through our work across the country, that a useful approach to sorting out these complexities is to begin with a detailed review of the United States Department of Agriculture Supplemental Nutrition Assistance Program (USDA SNAP, formerly called Food Stamps), which is described by the USDA as the "first line of defense against malnutrition". If the store participates in SNAP, we code it as either mainstream or fringe[3]. Most genuine supermarkets and full line grocery stores accept SNAP. However, we do find occasions where some stores do not. In those instances, we add them to our database and code them as mainstream. We also include "major

player"[4] fast food establishments such as burger and chicken restaurants as fringe food venues.

The SNAP database is relevant for many reasons. Here we cite two. First, these retailers have joined a federal program focused on selling groceries[5]. That information helps us cull retailers that at least claim to sell enough groceries to support a household's needs from those that do not. Second, these retailers, through SNAP, serve vulnerable, low-income families in need of nutritious food, a population of concern to our research objectives.

Additional Retail Data & Store Location Methods

Several additional datasets and methods were used to check food store locations: online lookups, satellite photos, phone calls to the stores (to ensure that they indeed exist and are operating, and to inquire about the availability of healthful foods), and, most importantly, fieldwork, which included visiting and inspecting food stores. The phone calls and visits were often the deciding factor in coding independents and small "mom and pop" stores.

Back To The Block: Food Access & Food Balance Metrics

Once the fieldwork was completed, we identified — from the center of every non-zero population block in the study area (DC) and within two miles of its borders (the buffer zone) – the closest mainstream and the closest fringe food store in the study area. Why do we include food stores just outside the border? Because those who live or work on the edge of DC, for example, might cross the official city line to buy groceries. So the data need to include, not just the food stores in the city, but also those in the larger buffer zone. There is not a perfect distance to a grocery store or a perfect number of grocery stores that would apply to all communities. We must identify and analyze block-by-block patterns across the study area, including potential impacts from borderline food stores, to determine ideal distances and any community shortages.

There is not a perfect distance to a grocery store or a perfect number of grocery stores that would apply to all communities.

After we conduct the block-level analysis, we identify what the standard should be.

To do so, our firm developed two key metrics. We also wrote a Statistical Analysis Software (SAS) program within our geospatial system to manage the retail data (and later, the health data), and to perform the millions of block-level calculations required.

The first metric is our Food Access score. This reveals each block's distance to mainstream food stores. There are almost 4,000 non-zero population blocks in DC. So from the center of block #1, we measure the distances to all the mainstream stores in our database, and note the shortest distance. Then we move on to block #2, and so on.

We also look at the *balance* of food choice. The Food Balance score is our second key metric. It is the distance from the center of each block in the study area to the closest mainstream food venue in the study area and buffer zone, divided by the distance to the closest fringe food venue in the study area and buffer zone.

Table 2: The MG Food Balance Theory & Scoring

As communities become more out-of-balance in terms of food options, negative diet-related health outcomes increase, holding constant other key factors.

Food Balance Score Description	Examples
Above 1: The higher the score, the greater the imbalance of food choice	Mainstream food venue is 1 mile away, and fringe food venue is .5 mile away **1/.5 = 2**
Around 1: Indicates Food Balance and that choosing between mainstream and fringe stores has the same relative ease or difficulty in terms of distance	Mainstream food venue is 1 mile away and fringe food venue is 1 mile away **1/1 = 1**
Below 1: This means that the closest mainstream food store is closer than the closest fringe food store	Mainstream food venue is .5 miles away and fringe food venue is 1 mile away **.5/1 = .5**

For example, a community with a clustering of blocks with Food Balance scores of 2 means that the closest mainstream food store is 2 times as far as the closest fringe food store. A score of 3 means three times as far, and so forth. Our metric also accounts for the likelihood that there will generally be many more fringe stores than mainstream stores in a marketplace.

For illustration purposes, let us consider, for the moment, a hypothetical block that has a residential population of 100 people. On three of its four corners, there is a fringe food store. On the fourth corner, there is a mainstream food store. From the center of the block, all the distances are equal, so the Food Balance score is 1.

A second hypothetical block that has the same configuration of food stores but a residential population of 50 people instead of 100 would have the same score of 1; population density does not impact the score.

A third hypothetical block with a mainstream store on the first and second corners and a fringe store on the third and fourth corners would also have a score of 1 – again, regardless of the block's population total. Providing raw or per capita counts of mainstream or fringe stores has little meaning for our purposes. It would be unrealistic and unnecessary to strive for an equal number of mainstream and fringe food stores throughout our study area. What does matter, however, is 1) the *distribution* of different types of food stores, 2) the relative ease or difficulty of reaching mainstream food stores compared to fringe food stores (hence, the distance ratio), and 3) any measurable relationships between the food environment and health outcomes – our key objective which we explore shortly in the report. But, first, what *are* the grocer patterns in our study area?

If your larger food environment looks like this, your diet and your health over time might suffer.

Food Environment Findings

Our retail database as of January 2012 consisted of 2,616 total establishments. Some are located slightly outside the buffer zone; we included them in order to consider all relevant data. Of those retailers, 2,445 are some type of food store. Within DC's boundaries, there were 523 total food retailers in our database. Of these retailers, we determined 60 to be mainstream food stores, 145 to be major player fast food restaurants (fringe), and 318 additional types of fringe retailers participating in SNAP. The USDA captures data at a point-in-time – before and after stores open and close. As markets are fluid, changes are constant. We crosschecked the SNAP data with other sources and methods, taking out stores that closed or were nonexistent and adding ones that were missing.

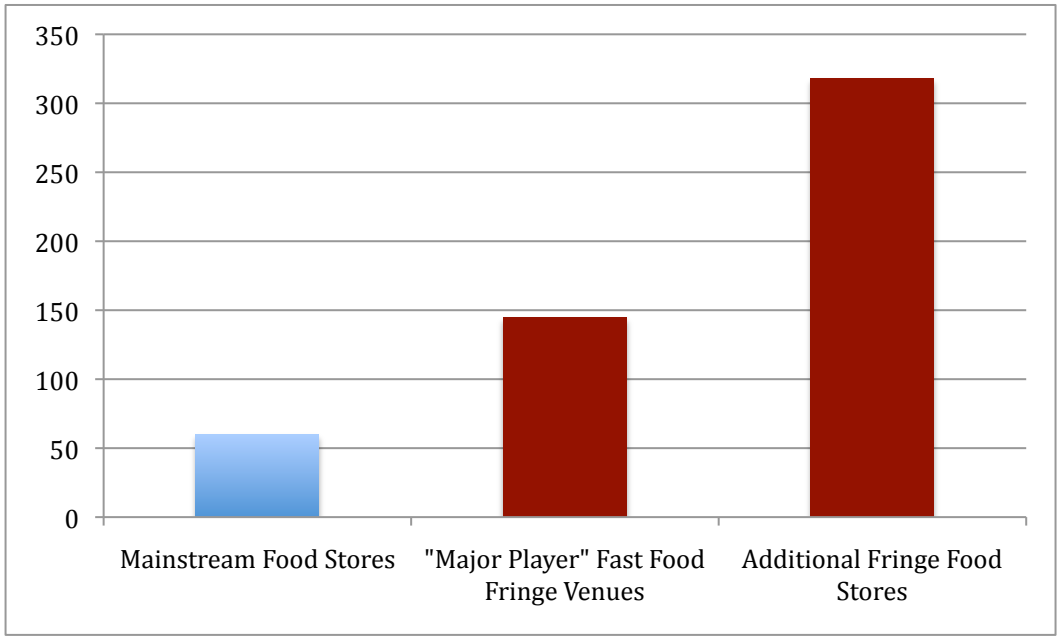


Figure 1

Counts of Mainstream Food Stores, Major Player Fast Food Restaurants, & Additional Fringe SNAP Food Stores In Washington DC

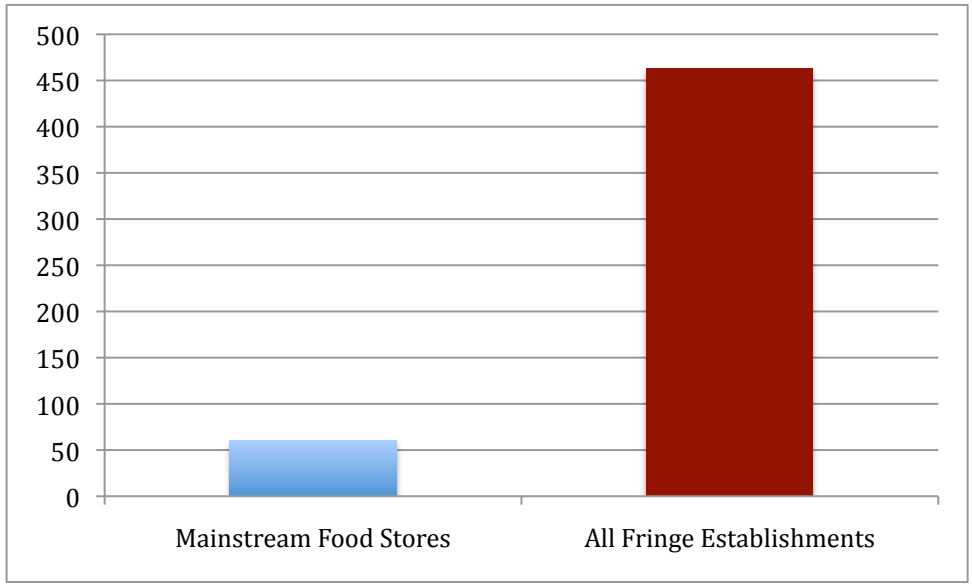


Figure 2

Counts of Mainstream Food Stores & All Fringe Food Venues Combined In Washington DC

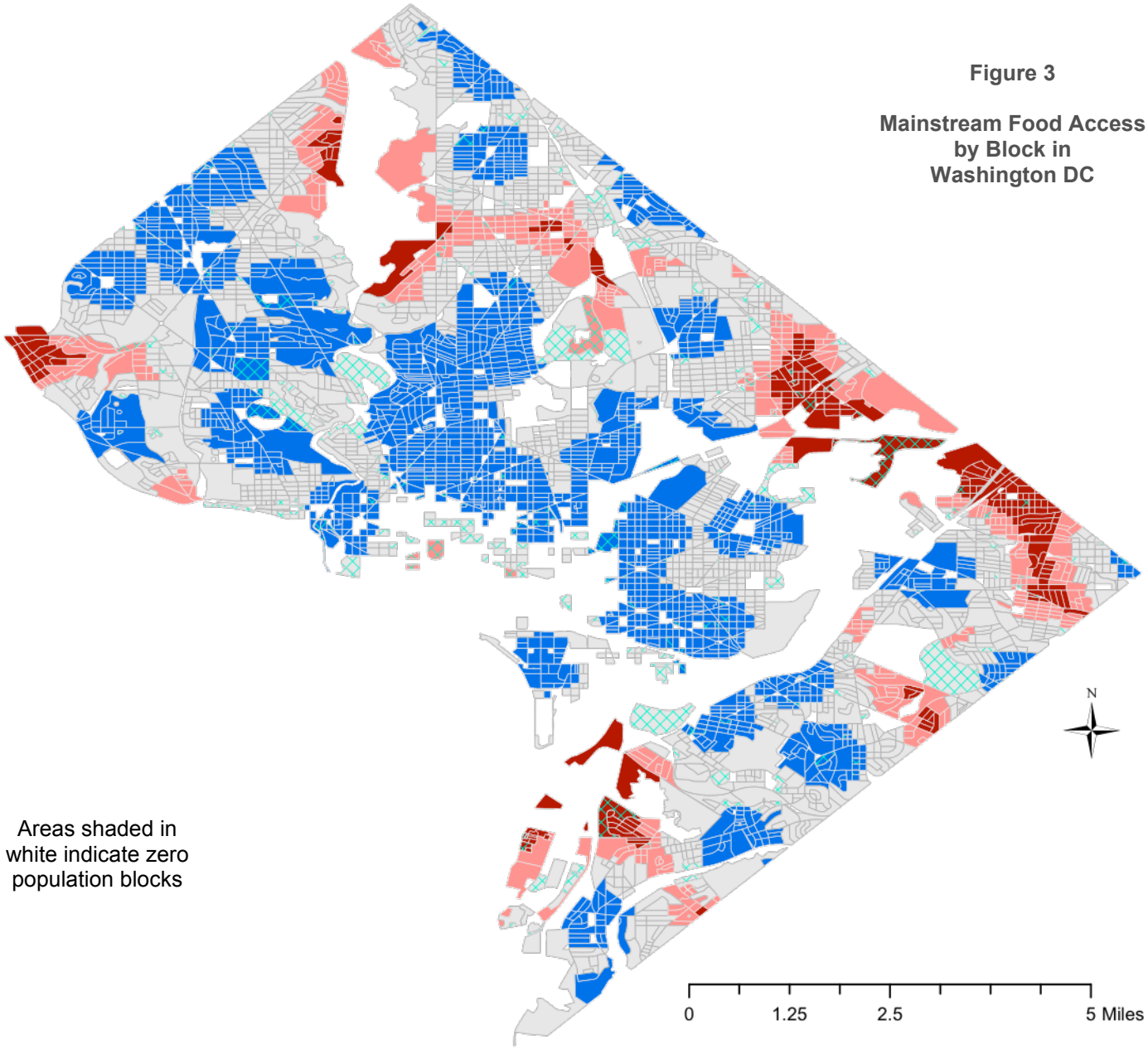
As we can see, there are many more fringe food establishments than mainstream ones, but what we are really concerned about is the *distribution* of the food retailers. After analyzing the block-level distances to mainstream and fringe food venues, and each block's ratio of the closest mainstream-to-fringe distances, we identified thresholds for our Food Access and Food Balance scores, which we detail in the next several pages in maps and corresponding data tables.

Food Access Patterns

Figure 3 is a map of the distribution of all of our Food Access scores in groupings. Details are also provided in the corresponding tables that follow the map. Blocks with mainstream distances of .8 to .99 miles are shaded in pink, to indicate concern. Blocks with distance scores of 1 to 1.5 miles are shaded in red, to indicate strong concern and the worst food access areas. We also show other distance groupings, as indicated in the legend. Blue shading indicates the best access to mainstream stores.

Figure 3

Mainstream Food Access by Block in Washington DC



Total Pop 1-19

Mainstream Distance

- 0.01 - 0.39
- 0.40 - 0.79
- 0.80 - 0.99
- 1.00 - 1.50

Areas shaded in white indicate zero population blocks

Table 3: DC Population **.80 to .99 Miles** from the Closest Mainstream Grocer (448 Blocks)	
Total Population	47,004
Tract Area (Square Miles)	5
White Population	7,789
African American Population	35,013
Hispanic Population	4,202
Population 18+ Years of Age	35,745
Population of Children Under 18 Years of Age	11,259
Single Mothers With Children Under Age 18	2,447
Population Age 25 and Over With Only H.S. Education	8,466
Households With Annual Income Below $25,000	5,136
Households With Annual Income $100,00 and Above	3,755
Owner-Occupied Housing Units	8,571
Renter-Occupied Housing Units	9,145
Households With No Vehicle Access	5,442

How far away is your closest healthful grocery store?

Table 4: DC Population **1.0 to 1.5 Miles** from the Closest Mainstream Grocer (215 Blocks)	
Total Population	20,720
Tract Area (Square Miles)	3
White Population	3,388
African American Population	16,318
Hispanic Population	1,014
Population 18+ Years of Age	15,678
Population of Children Under 18 Years of Age	5,042
Single Mothers With Children Under Age 18	1,117
Population Age 25 and Over With Only H.S. Education	3,976
Households With Annual Income Below $25,000	2,357
Households With Annual Income $100,00 and Above	1,482
Owner-Occupied Housing Units	3,608
Renter-Occupied Housing Units	3,748
Households With No Vehicle Access	2,345

If we simply looked at average distances to mainstream food stores, measured by aldermanic wards, community areas, or one average across a tract, it might appear that the overall food environment is equitable, or that most DC residents at least live within a decent distance of fresh and healthful food. But as discussed earlier, there is no perfect distance to a grocery store, and averages across large areas can mask the true patterns in the data. When we consider all the blocks one at a time, we come to understand what should be the standard for the DC market. Drilling into the data, we see that healthful food access is low for clusters of blocks that are each .8 miles or more from the closest mainstream food option – again, the pink and red shaded areas. This is the **low access distance threshold**; market inequities exist at that distance and greater distances. However, we found statistically significant negative health impacts – which we discuss in detail later in the report – beginning when the distance to a mainstream food store was somewhat closer – .6 miles away – and the strength of the relationship with health impacts increases as distance increases. We call this the **health impact distance threshold**; the effect is seen at that distance and greater distances.

Theoretically, each time we conduct these studies in different parts of the US, the low access distance threshold can be equal to, lower than, or higher than the health impact distance threshold. It is also possible that the data do not reveal problematic thresholds at all. We do not know what the result will be until we conduct the block-level analysis.

In the case of DC, setting the ideal mainstream food access benchmark at .8 miles or closer is reasonable from a market standpoint *and* from a community health standpoint. As officials, community leaders, and market actors develop healthful food options in low access areas (where mainstream food stores are .8 miles away or farther), those investments can have a ripple effect into neighboring areas just outside those zones, namely the grouping with better mainstream distance scores of .4 to .79 miles, shaded in gray, which includes the health impact threshold of .6 miles.

Figures 4 and 5 show that the red and pink block clusters are typically adjacent to the gray block clusters – again, the gray shading is the grouping with better mainstream distance scores of .4 to .79 miles. Imagine that you have the opportunity to improve food access and public health for a low access area. Maybe you are a developer,

We found statistically significant negative health impacts when the closest distance to a mainstream food store was.6 miles away or farther.

bringing a full-service grocer to that block, or a community leader, working with a corner storeowner, in order to increase the quality and selection of fresh fruits and vegetables. In Figure 4, the small black box icon (◈) indicates a hypothetical new mainstream food store and the black line around it indicates scenarios for where corresponding improvements might result. Clearly, the blocks closest to the one where our hypothetical project takes place have the greatest potential to improve, but only by recalculating the universe of all 4,000 non-zero population blocks, as illustrated in Figure 5, and accounting for this new mainstream entrant, do we know the true level of impact and the shape it takes. It might not take the shape of a concentric ring; it might instead comprise an entirely different land area.

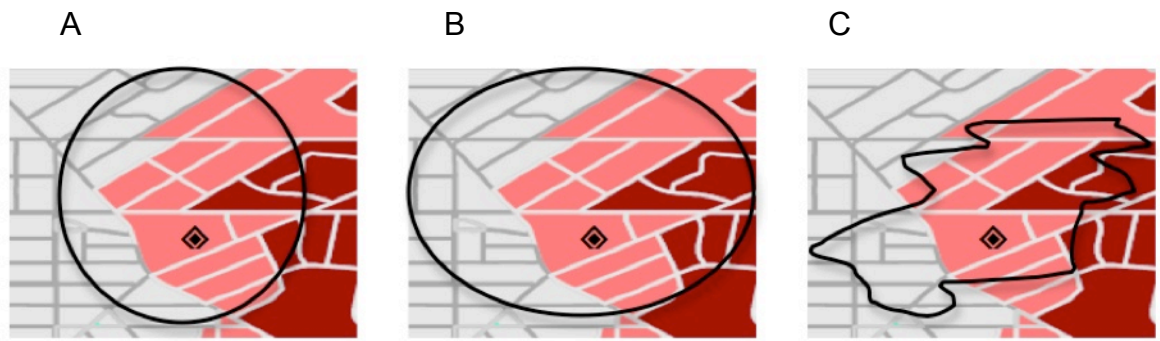


Figure 4, A-C

Spatial Patterns of Impact Scenarios

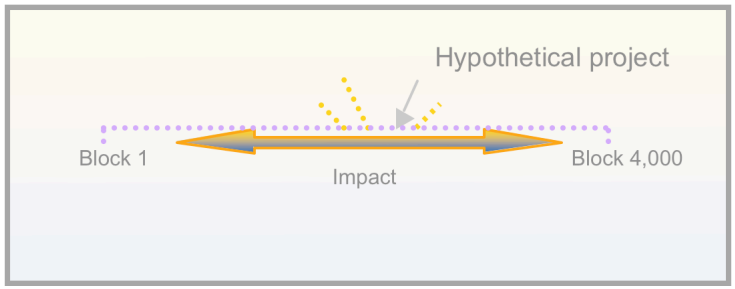


Figure 5

The Impact Analysis

We see from the preceding tables that over 47,000 DC residents live on blocks where mainstream food access is between .8 to .99 miles away. Of that population, nearly 75% are African American and over 5,400 households do not own automobiles. Over 11,000 are children under 18 years of age.

The worst mainstream access grouping (a distance of 1 to 1.5 miles away) impacts fewer people, although many do suffer. Over 20,000 DC residents live on blocks in this range. Of that population, nearly 80% are African American and over 2,300 households do not own automobiles. Over 5,000 are children under 18 years of age.

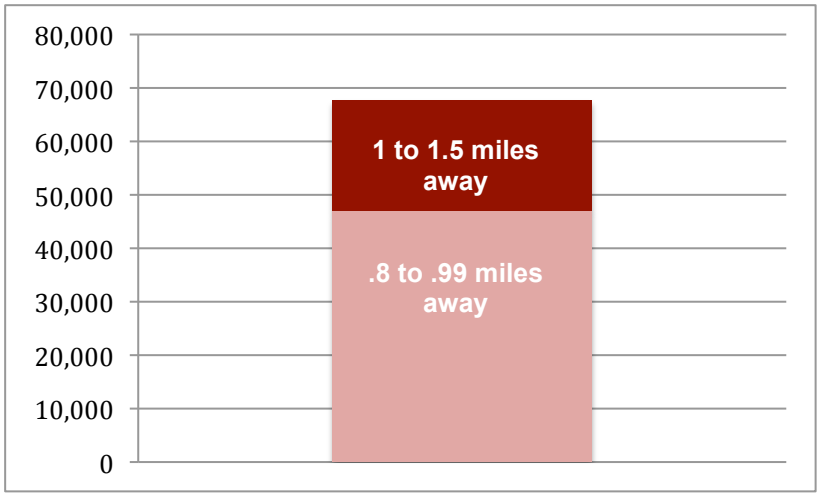


Figure 6

The Worst Mainstream Food Access Groupings

In total, we see that nearly 60,000 DC residents live on blocks where mainstream food access is substandard. Many are low-income families. A disproportionate share of the population is African American.

Food Balance Patterns

For the *balance* of food choice, we become concerned when the Food Balance score is 2 or higher. **This is our Food Balance market threshold**; at this score and higher, residents live on blocks where the closest healthful food option is twice as far,

or farther, from the closest fringe food option. Residents are at a relative disadvantage in reaching healthful food, as compared to fringe food. However, we found statistically significant negative health impacts – which we discuss in detail later in the report – beginning only when the Food Balance score reaches 3. We call this the **Food Balance health impact threshold**; the effect is seen at that score and at increasing strength, as the score increases. The two thresholds can theoretically be equal to, lower than, or higher than each other, or problematic thresholds might not exist. Until we conduct the block-level analysis, we do not know what the result will be. In the case of DC, consumers might be inconvenienced by, or at a nutritional disadvantage from, food shopping options when the Food Balance score is between 2 and 3. But we do not see the health effects until mainstream food venues are triple the distance or farther than fringe food venues.

We discuss these patterns further after we present Figure 7, a map of the distribution of Food Imbalance areas, which are shaded in pink to indicate moderate concern and darker shades of red to indicate increasing concern. Following the maps, we show corresponding data tables.

When the closest healthful food store is triple the distance than the closest fringe food store, statistically significant health outcomes result.

What are the Food Balance patterns in your neighborhood?

Figure 7

Worst Food Radio Scores by Block in Washington, DC

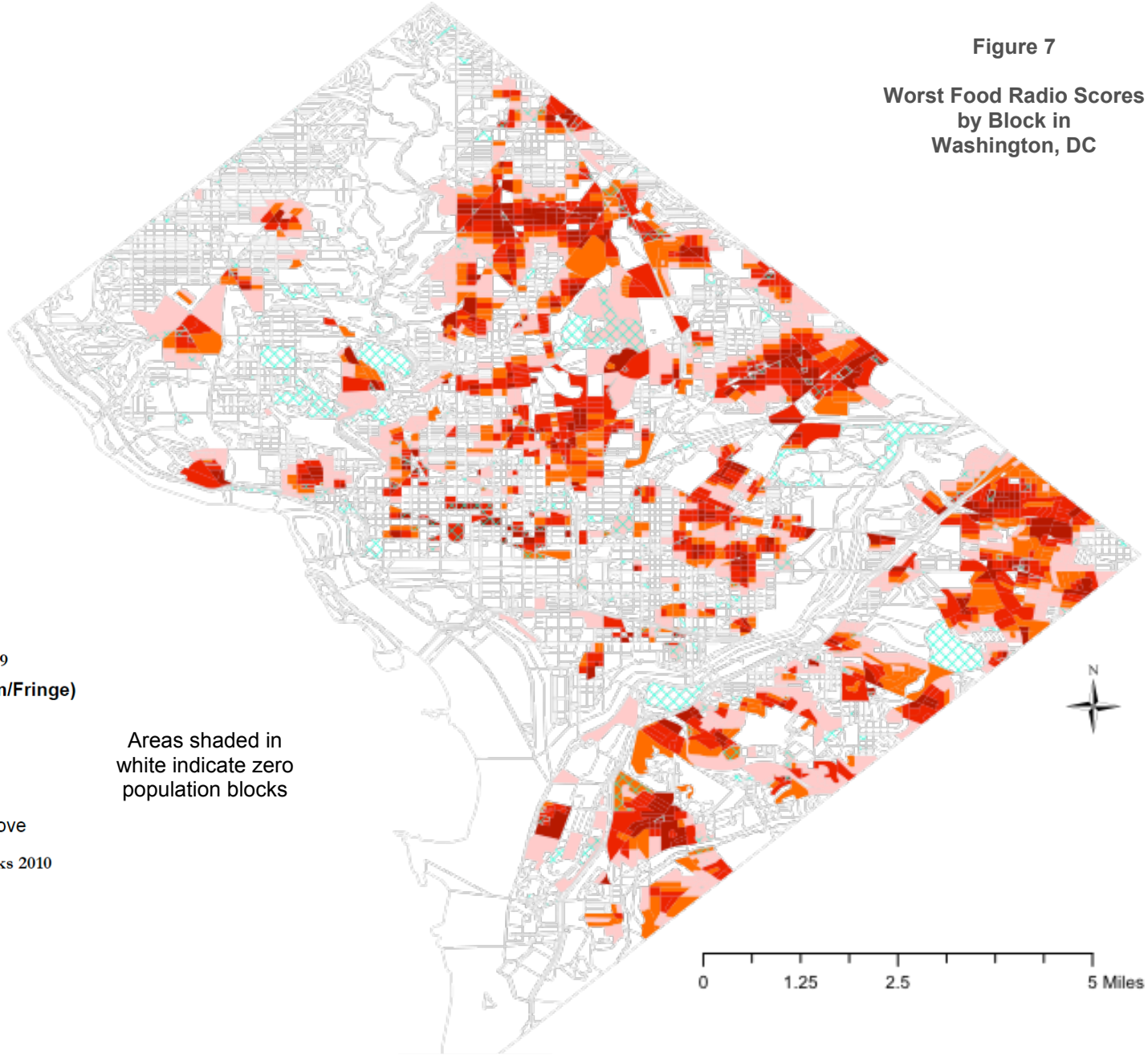


Table 5: DC Population With Food Balance Scores of **2 to 3** (773 Blocks)	
Total Population	106,157
Tract Area (Square Miles)	7
White Population	36,883
African American Population	61,353
Hispanic Population	7,921
Population 18+ Years of Age	86,532
Population of Children Under 18 Years of Age	19,625
Single Mothers With Children Under Age 18	4,405
Population Age 25 and Over With Only H.S. Education	15,317
Households With Annual Income Below $25,000	11,304
Households With Annual Income $100,00 and Above	11,929
Owner-Occupied Housing Units	18,271
Renter-Occupied Housing Units	25,672
Households With No Vehicle Access	16,050

Table 6: DC Population With Food Balance Scores of **3.1 to 4.0** (506 Blocks)	
Total Population	67,154
Tract Area (Square Miles)	4
White Population	20,447
African American Population	41,252
Hispanic Population	5,455
Population 18+ Years of Age	54,734
Population of Children Under 18 Years of Age	12,420
Single Mothers With Children Under Age 18	3,024
Population Age 25 and Over With Only H.S. Education	10,745
Households With Annual Income Below $25,000	7,393
Households With Annual Income $100,00 and Above	7,135
Owner-Occupied Housing Units	11,777
Renter-Occupied Housing Units	15,824
Households With No Vehicle Access	10,001

Table 7: DC Population With Food Balance Scores of **4.1 to 8.0** (665 Blocks)	
Total Population	93,882
Tract Area (Square Miles)	6
White Population	24,166
African American Population	60,741
Hispanic Population	8,975
Population 18+ Years of Age	77,341
Population of Children Under 18 Years of Age	16,541
Single Mothers With Children Under Age 18	4,004
Population Age 25 and Over With Only H.S. Education	15,248
Households With Annual Income Below $25,000	10,718
Households With Annual Income $100,00 and Above	8,593
Owner-Occupied Housing Units	15,477
Renter-Occupied Housing Units	21,782
Households With No Vehicle Access	14,264

Table 8: DC Population With Food Balance Scores of **8.1 & above** (331 Blocks)	
Total Population	38,630
Tract Area (Square Miles)	2
White Population	9,457
African American Population	23,613
Hispanic Population	5,560
Population 18+ Years of Age	31,844
Population of Children Under 18 Years of Age	6,786
Single Mothers With Children Under Age 18	1,518
Population Age 25 and Over With Only H.S. Education	6,246
Households With Annual Income Below $25,000	4,271
Households With Annual Income $100,00 and Above	3,670
Owner-Occupied Housing Units	6,816
Renter-Occupied Housing Units	8,710
Households With No Vehicle Access	5,600

As we see from the preceding map, Food Imbalance affects a good portion of DC. Over 106,000 DC residents live in blocks where the closest mainstream food store is two to three times farther than the closest fringe food store. Of this population, over 16,000 households do not own automobiles. Well over half of that population is African American. Nearly 20,000 residents are children under 18 years of age. An additional 67,000 residents live in blocks where the score is between 3.1 and 4. Blocks with scores from 4.1 to 8 contain 93,000 residents. 38,000 people live in blocks with scores of 8.1 or higher. The two highest scores in our database are 76 and 144. Those two scores are extreme. If we eliminate them from our 8.1 and over category, we see that the average Food Balance Score for those 329 blocks (331 minus the two extreme blocks) is 14.

In total, over 305,000 DC residents – about half of DC's total population – live on blocks with Food Imbalance. Almost 200,000 of those residents – roughly one third of total population – live with scores where this imbalance, statistically, is significantly related to negative diet-related health impacts.

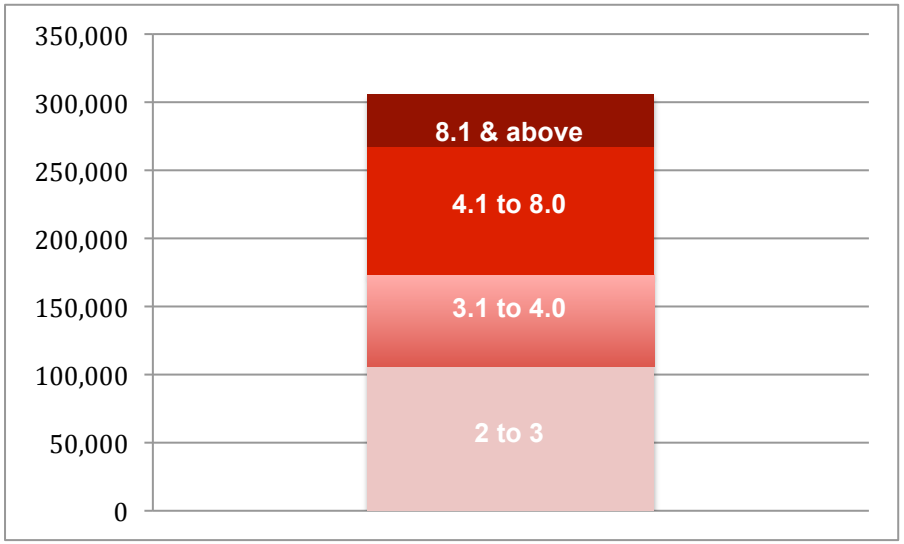


Figure 8

Worst Food Imbalance

The DC Food Environment & Community Health

As stated throughout this report, there is no perfect distance to a mainstream food store that would be suited to every urban or rural area across the US. Our goal is to analyze block-level patterns, both in terms of market inequities and health impacts, in order to identify whether or not improvements need to be made.

This section solely concerns testing the relationship between the food environment and specific diet-related health outcomes, controlling for other key contributing factors. This allows us to determine if and when Food Access and Food Balance scores have any significance. The health analysis is conducted by using all the block-level scores aggregated to the tract – not just the block-level scores that are above the problematic thresholds identified previously.

In the case of DC, we found statistically strong and reliable negative impacts on various health outcomes, based on increased distance to mainstream food retailers (when the closest mainstream venue was .6 miles away or farther), and when the Food Balance score was 3 or higher (meaning that the closest healthful food choice was triple the distance, or farther, than the closest fringe food store). Our most surprising finding was the statistically significant relationship between mainstream food distance and overweight newborns. We discuss these details next.

We found statistically significant negative health impacts.

Our most surprising finding was the relationship between mainstream food distance and overweight newborns.

Statistical Details

Diet-related death and other types of health data were obtained from the Urban Institute, for the years of 2003 to 2007. First, we examined the link between proximity to food retailers (mainstream or fringe) and the “Years of Potential Life Lost” (YPLL), at the tract level. YPLL is a statistic that measures the total number of life years lost in a population, due to premature death from a certain cause. We used the tract as the unit of observation, because the U.S. Census provides measures of both the population by age (necessary to calculate YPLL) and various demographic characteristics (such as income and education attainment necessary to control for influences on health, but not directly related to food access). The block-level mainstream food access scores for every non-zero block were aggregated up to the tract level. This was not done by developing one average across the tract, but by

taking all the block-level scores in the tract and averaging them. As weights, we used the share of the tract's population on each of its blocks. The U.S. Census tract-level characteristics were drawn from the 2005-10 American Community Survey.

The outcome we examined, YPLL, tells us the number of deaths at ages below 69 that are in excess of those we would expect, simply based on the age structure of the population in a tract. A higher number indicates that more deaths than expected are occurring in a tract. A one-unit difference in YPLL (measured on a per 1,000 persons basis) between two tracts corresponds to a difference in one collective year of life, spread across those 1,000 individuals.

To isolate the impact of food access on YPLL from the impact of other factors on YPLL, a regression analysis was conducted with YPLL as the dependent variable, plus three independent variables: (1) either the distance to a mainstream food venue or the distance to a fringe food venue or the ratio of these distances (mainstream distance/fringe distance) for a tract; (2) the percentage of families in the tract with family incomes below $25,000 per year; and (3) the percentage of the tract's population over age 25, with at least a high school education. A larger percentage of low-income households should increase YPLL, and a larger percentage of high school graduates should decrease YPLL. Another factor that should influence YPLL, race, was excluded from the analysis because of its high correlation with the other two demographic control variables (income and education): the percentage of African American population in a tract had a correlation of 0.63 with the percent of families in the tract with incomes below $25,000 per year. Further, the percentage of African American population in the tract had a correlation of -0.67 with the percent of adults holding at least a high school education. The results reported here did not change substantially when race was included, in place of either income or education.

YPLL was used in three different ways: overall YPLL (from all non-violent causes), YPLL from diet-related causes overall and from specific causes related to diet (cancer, cardiovascular disease, diabetes, and alcoholism), and YPLL from accidental deaths. The last analysis was included as a check on the plausibility of the diet-related deaths: if mainstream food access is really contributing to YPLL from diet-related diseases, then it should not have a strong relationship to deaths from accidents.

Years of Life Loss is a statistic that measures the total number of life years lost collectively in a population, due to premature death from a certain cause.

For all causes of death, specifically diet-related deaths grouped together, and for deaths from cardiovascular disease and diabetes, a lower ratio of mainstream to fringe distance (again, our Food Balance score) was consistently associated with lower YPLL. These relationships were statistically significant, at the 95% level or better (in other words, we can be confident that the observed relationship is unlikely the result of a chance pattern in the data). These diet/mortality relationships are also large in magnitude.

For example, consider two tracts, A & B. Tract A is 0.50 miles from a mainstream retailer and 0.50 miles from a fringe retailer, so its ratio is 1.0. Tract B is 0.50 miles from a mainstream retailer and 0.25 miles from a fringe retailer, so its ratio (the Food Balance Score) is 2.0. Tract A will have 22 fewer diet-related years of collective life lost below age 69, per 1,000 people (17 from cardiovascular disease and 4 from diabetes) than will Tract B, even if the tracts have identical income and education levels. When the distances to mainstream and fringe retailers are used separately in the analysis (rather than combining them into their ratio), the mainstream food store distance consistently makes the greatest difference. Tracts at greater distances from mainstream grocers have higher aggregate rates of diet-related deaths and deaths from cardiovascular disease, as grouped separately. The diet-related deaths grouped together are significant at the 90% level, and the cardiovascular deaths are significant at the 95% level. Tracts that are a half-mile closer to mainstream grocers, as compared to otherwise identical tracts, have 18 fewer years of potential life lost to cardiovascular disease, per 1,000 residents.

To test the influence of mainstream food access, a final analysis was conducted in which the outcome was YPLL from accidents, which should be relatively unaffected by diet. If distance to mainstream food stores influences diet, and diet does not influence accidental deaths, YPLL from accidents should have a weaker relationship to mainstream food access, than should YPLL from diet-related causes. This is in fact true: the effect of an additional half-mile to a mainstream food store was more than twice as great for diet-related deaths as it was for accidental deaths.

Data from birth records allowed us to conduct another analysis of the influence of mainstream food access on community health. This analysis generated our most surprising finding. Using birth data from 2003-07, we analyzed, at the individual level,

Many who live in a poor food environment are more likely to die prematurely from cardiovascular disease, diabetes, and other conditions.

birth weight and its relationship to mainstream food access. Usually, we have the ability to control for the *subject's* income, race, age, and education. Here, we were also able to control for the *mother's* income, education, age, alcohol and tobacco use, prenatal care, and marital status. Additionally, we were able to control for gestational age of the subject. Gestation is the period of time between conception and birth, during which the fetus grows and develops inside the mother's womb. Gestational age of the newborn is an important health factor. The effect of mainstream grocer distance was both large in magnitude and statistically significant at the 95% level. Between 6% and 8% of DC babies are born overweight (weighing more than 4,000 grams), as defined by the Centers for Disease Control. For a mother who resides an additional half-mile from a mainstream grocer, the probability of an overweight birth increases to between 7% and 9%, which is roughly a 10% increase.

Here is the breakout by distance ranges:

Table 9

Mother's distance to the closest healthy grocery store	Number of children born to these mothers yearly	Percentage of total births	INCREASED probability of being born overweight due to food environment
Under a half-mile	4,940	66.06	7% of children are born overweight because of a variety of factors, but there is no *additional* contribution of overweight from the food environment
.50 to .74	1,263	16.89	7.7% of children are born overweight, a 10% increase over the baseline risk
.75 to .99	1,164	15.57	8.05% of children are born overweight, a 15% increase over the baseline risk
1.0 or more	110	1.48	8.40% of children are born overweight, a 20% increase over the baseline risk

This is a large impact. Immediately, the high birth weight puts the infant at a higher risk for birth injuries and infant mortality. Long-term, the overweight condition could contribute to other negative diet-related outcomes over the course of life, including adult-level obesity, and much worse conditions. It can also transition short-term into obesity during childhood. This can impact quality of life and contribute to the shortening of lifespan. High birth weight is definitively associated with adult obesity, diabetes, hypertension, insulin resistance, and other problems.

While we demonstrate in this study the relationship between the food environment and diet-related health outcomes, 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. First, we recognize population mobility. Although we found statistically significant correlations, we must keep in mind that the official residence of a person at the time of death might not be reflective of the environment in which he or she lived over the course of a lifetime. We also wish to be clear that we are not suggesting that plopping down a grocery store completely solves the problems associated with diet-related conditions; education, food preferences, personal choices, the cost of healthy foods, low employment, and so many other challenges need to also be tackled. Nonetheless, we stand by our conclusion that low healthful food access and food imbalance presents a serious health and wellness challenge to many DC residents, including existing and forthcoming populations of newborns. We cannot choose healthy food unless we have access to it. Unless the situation improves, we predict that the costs associated with those poor food access patterns will be borne directly by communities and their residents, impacting their quality and length of life. These patterns will also increase the financial burden to the healthcare industry, to employers, to government agencies, and to other entities who bear the responsibility for treating diet-related health conditions.

A Excel table of the regressions can be found at www.marigallagher.com.

The relationship between food access and health is complicated.

However, we stand by our conclusion that low healthful food access and food imbalance presents a serious health and wellness challenge to many DC residents, including young infants and newborns.

Endnotes

[1] Dollar stores' rising shares of consumables, as well as market expansion plans, have made national headlines. Family Dollar recently reported that year-over-year quarterly profits jumped 11% to $134.9 million, largely because of increased sales of consumables, which are defined as the food and household products traditionally sold by grocers. These items now make up 70% of the company's sales *(Dollar Store Earnings Fatten On Food Sales, But Neighbors Say "Stay Out!"* by Alice Hines of The Huffington Post, January 27, 2012). Family Dollar now plans to expand its food selection and to increase its market presence by 450 to 500 new stores. Together, Family Dollar, Dollar General, and Dollar Tree operate 19,500 outlets across the United States (*Overview of the Retail Dollar Store Market in the United States – Opportunities for Canadian Agri-Food Exporters* by Ben Berry, May, 2011).

[2] *The Public Health Effects of Food Deserts* by the Institute of Medicine and National Research Council, a report prepared for Congress, 2009.

[3] There are some cases where we code the SNAP store internally as "not applicable". This does not mean it is not important, only that, for the purposes of our analysis, it is not suited as either mainstream or fringe. For example, there are a few DC farmers' markets that are open year-round. The farmers' markets have smaller units within them that are also open throughout the week, rather than just for part of a Saturday or weekend. These locations regularly offer mainstream food, so we code them as mainstream. However, seasonal farmers' markets that are open one day per week, during warm weather months, do not consistently offer mainstream food or any type of food. They operate occasionally, and not consistently, as do retailers. Therefore, we do not code those as mainstream or fringe. Usually in this work, we find a handful of other cases where the establishment does not operate like a retail establishment; therefore, it does not receive a coding and is not included in the analysis.

[4] MG developed the term "major player" to indicate a fast food chain restaurant with ubiquitous advertising and a strong market presence.

[5] The following is based on materials provided by the USDA:

> To be eligible to participate in the Supplemental Nutrition Assistance Program (SNAP), store(s) must sell food for home preparation and consumption and meet one of the criteria below:
>
> (A) Offer for sale, on a continuous basis, at least three varieties of qualifying foods in each of the following four staple food groups, with perishable foods in at least two of the categories:
>
> - Meat, poultry or fish
> - Bread or cereal
> - Vegetables or fruits
> - Dairy products
>
> For more information on Criterion A, see below.

♦♦♦♦♦ OR ♦♦♦♦♦

(B) More than one-half (50%) of the total dollar amounts of all things (food, nonfood, gas and services) sold in the store must be from the sale of eligible staple foods.

Definitions for Criterion A: Continuous basis means that on any given day of operation, a store must offer for sale and normally display in a public area, qualifying staple food items, with no fewer than three different varieties of food items in each of the four staple food categories.

Perishable foods are items that are either frozen staple food items; or, fresh, un-refrigerated or refrigerated staple food items that will spoil or suffer significant deterioration in quality, within 2 to 3 weeks.

Variety means different types of foods, such as apples, cabbage and squash, in the fruit or vegetable category; or, milk, cheese and butter, in the dairy category. The following does not meet the variety requirement: having different brands and sizes; having the same item but with varying ingredients (e.g., plain sausage and spicy sausage); or having the same item, but offering different types of the item (e.g., Granny Smith and Red Delicious apples). Food items with multiple eligible ingredients (e.g., pizza, frozen dinners) will be counted only once as a staple food, in the category of the main ingredient.

Retail sales include all retail sales of the firm, including food, non-food, gas and services (such as rental fees, games, dry cleaners, lottery). However, fees directly connected to the processing of staple foods such as raw meat, poultry, and fish may be calculated as staple food sales, under Criterion B.

Staple foods do not include accessory foods such as coffee; tea; cocoa; soda; non-carbonated drinks such as sports drinks, punches, and flavored waters; candy; condiments; spices; hot foods; or foods ready to go or made to take out, such as prepared sandwiches or salads.