

## Abstract

The overwhelming prevalence and associated morbidity and mortality of obesity, not to mention the **financial burden** that it is placing upon our health care system, demand **immediate intervention** (CDC 2010). **Interventions at the individual level have proven ineffective and insufficient**. It is time for approaches to obesity intervention to focus on the **nutrition and physical activity environments of communities** and for the topic to be approached from an ecological standpoint to examine the effects of **lack of access to and affordability of nutritious food** on individuals' dietary choices (Cummins & Macintyre 2006). The term **“food deserts”** has arisen to describe such “neighborhoods and communities that have limited access to affordable and nutritious foods” (IOM/NRC 2009). This project evaluates the presence of food deserts in **two suburban, low income, predominantly minority neighborhoods, Nicholtown and Sterling**. The results of this spatial analysis indicate a **deficiency of access to affordable nutritious food**, a problem compounded by **reduced access to personal vehicles** for households in these two communities. **Further community-level data collection is needed** in order to better contextualize communities of interest and to conduct meta-analyses, **comparing across communities** characterized by different income brackets, races or ethnicities, transportation access, etc.

## I. Introduction

**Obesity** is an epidemic of ever-increasing proportions in the United States, with **33.8% of adults 20 years old or older** being obese (BMI  $\geq 30$  kg/m<sup>2</sup>) and 68.0% being overweight or obese (BMI  $\geq 25$  kg/m<sup>2</sup>) (Flegal et al. 2010). The myriad of **negative health outcomes** associated with obesity include **hypertension, cardiovascular disease, stroke, type II diabetes, and many types of cancer** (including breast, ovarian, gall bladder, prostate, colon, and cervical). The estimated obesity-associated health care costs of 2006 alone reached \$147 billion (CDC 2010). Egger and Swinburn have looked beyond explanations at the individual level and have claimed that obesity is a **“normal physiology within a pathogenic environment”** (1997). The term **“food deserts”** has arisen to describe a category of such pathogenic environments: “neighborhoods and communities that have limited access to affordable and nutritious foods” (IOM/NRC 2009).

## II. Literature Review

**Geographic Information System (GIS) technology** has proven a useful tool for evaluating the presence and distribution of food deserts, a critical precursory step to intervention. The awareness afforded by such an evaluation can serve to **inform future public policy and community-level initiatives**. Howard and Goldsberry's use of GIS technology to map food deserts in Lansing, Michigan revealed the **suburbanization trend of supermarkets**. Their research also examined the **proximity of residents to food stores** as well as **transportation capacities** and found that accessing fresh produce is much easier for those with cars than for pedestrians without cars (Mapping 2011). In another study, Kristian Larsen and Jason Gilliland found that distinct urban food deserts exist in the mid-sized city of London, Ontario (2008). The researchers used GIS to examine **accessibility of supermarkets via walking and public transit, distance to the closest supermarket, number of supermarkets** within 1000 meters, and neighborhood **socioeconomic status**, to assess the **spatial distribution** of food deserts. Their purpose was to explore the evolution of food deserts over time in order to **inform public health policies** regarding not only economic, but spatial, inequities related to access to and affordability of nutritious foods (Larsen and Gilliland 2008). In Adrienne Samuels Gibbs' article, **“Watering the food desert,”** she explores lack of access to healthy, affordable foods and the **impact of such deficiencies in inner cities**, as well as various means of combating and improving, or “watering,” those food deserts (2010). In an effort to improve living conditions in and mitigate the risks associated with food deserts, Walgreens in areas deemed food deserts have been redesigned with expanded **healthy food selections** (WAG's 2010). Resurrection House Baptist Church in Southside Chicago added a **farmer's market** to their ministry offerings to better meet the needs of the local community (Fleeman 2010).

## III. Methodology

### Dataset:

- Nutrition Environment Measures Survey in Stores and Restaurants (NEMS-S and NEMS-R) data collected from Nicholtown and Sterling (two low-income, predominantly African-American neighborhoods in Greenville County, SC) by Reece Lyerly, Alicia Powers, Si Pearman, Matt Manly, and volunteers as part of a LiveWell Greenville initiative (Table 1, Figures 5-6)
- Sterling and Nicholtown boundary and buffer shapefiles from Reece Lyerly and LiveWell Greenville (Figures 1-6)
- American Census Bureau demographic block group level 2000 sf3 (income, vehicle availability) and 2010 sf1 (race) data from <http://factfinder2.census.gov> (Figures 2-4)
- Block group boundaries from <http://www.census.gov/geo/www/tiger/> (Figures 2-4)
- Greenville county boundary shapefile from the Geographic Information Systems (GIS) Division of Greenville County, SC (2010) (Figures 1-4)
- SC boundary shapefile from Environmental Systems Research Institute (ESRI) Data & Maps Online (2012). (Figure 1)
- Base layer for streets from Bing Maps in ArcGIS (Figure 1)

**Figure 1:** Location of Communities of Interest in Greenville County, SC (Sterling and Nicholtown boundaries and 0.5 mile buffers situated in larger geographical context)

**Figures 2-4:** Block group census data shown in terms of standard deviation from the mean % value

**Figures 5-6:** Location and NEMS-S/-R score, as a percentage of the total possible points, of the food stores and restaurants surveyed in Sterling and Nicholtown

**Table 1:** NEMS-S & NEMS-R Results

\*\*\*All maps created with ESRI ArcDesktop 10 (2012).

## IV. Results and Discussion

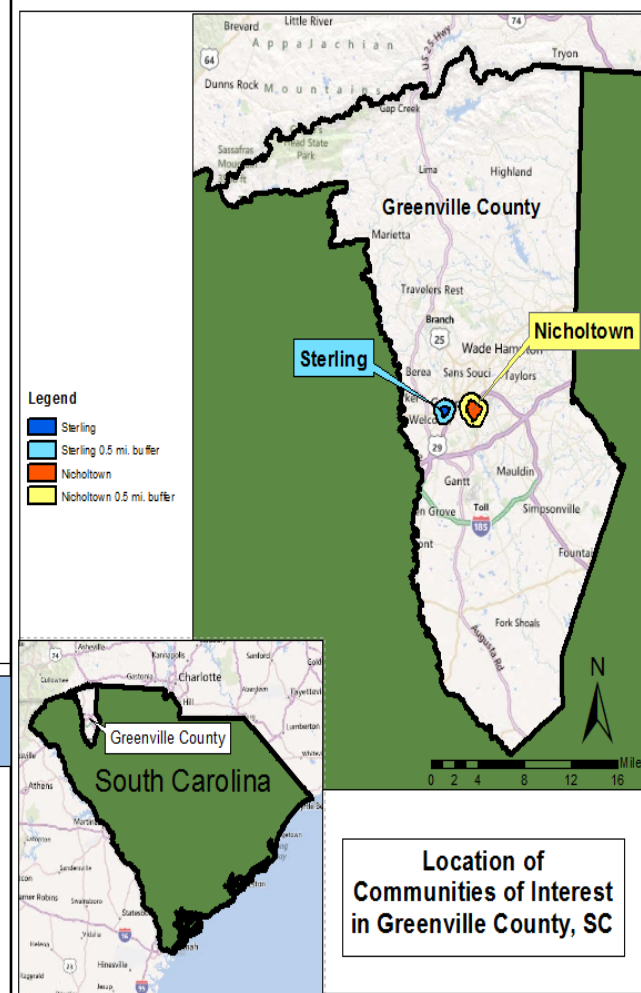


Fig. 1

-> Sterling and Nicholtown are communities characterized by a **predominantly minority** (specifically Black or African American) population, **low household incomes**, and high percentages of **no vehicle access**.

-> Food stores and food restaurants are **few and far between**; for the most part, those that do exist in the area received **low NEMS-S/-R ratings** (based on availability, quality, quantity, and affordability of nutritious food).

### Limitations:

- inability to collect NEMS-S data from two of the four food stores in Sterling due to **safety issues** and store owner's **refusal to participate**
- small sample sizes** and resulting limitations on feasible statistical analyses
- reality that certain restaurants included in the NEMS-R data still **outside the realm of affordability and accessibility** for the community residents, **catering to the more affluent downtown population**, even though they are within the 0.5 mile community buffer range
- lack of specifically georeferenced demographic data at the community level** and misalignment of block group boundaries with those of the two communities
- lack of equivalent data** on white and/or middle to high income communities for **comparison and contextualization**

NEMS-S & NEMS-R Results	Nicholtown		Sterling	
	n	mean	n	mean
<b>Restaurants</b>	<b>21</b>	<b>(63 possible)</b>	<b>11</b>	<b>(63 possible)</b>
Sit Down	4	9	6	8
Fast Casual	5	10	5	8
Fast Food	12	11	-	-
<b>Stores</b>	<b>5</b>	<b>(54 possible)</b>	<b>2</b>	<b>(54 possible)</b>
Convenient Stores	4	10	2	5
Grocery Stores	1	26	-	-

Table 1

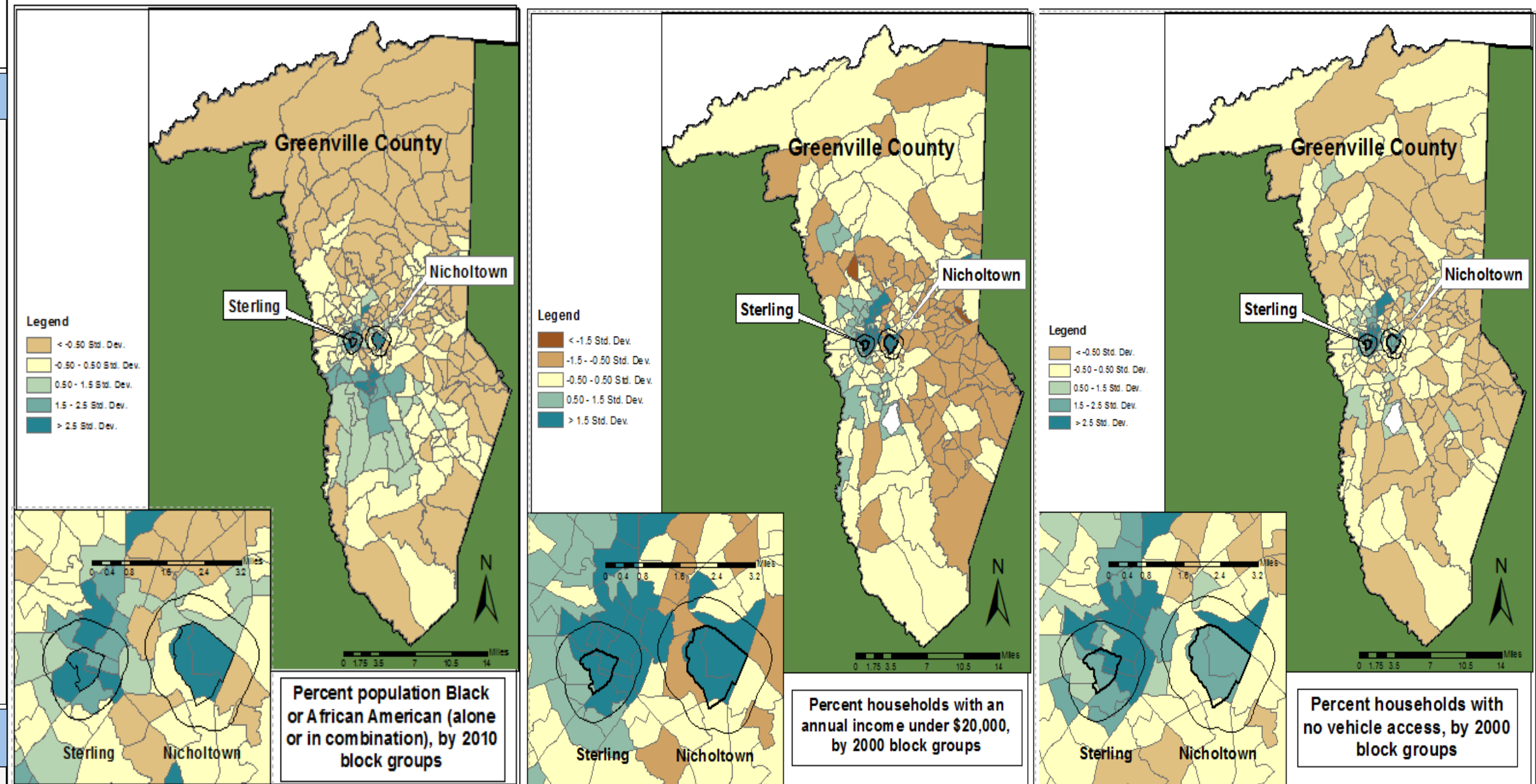


Fig. 2

Fig. 3

Fig. 4

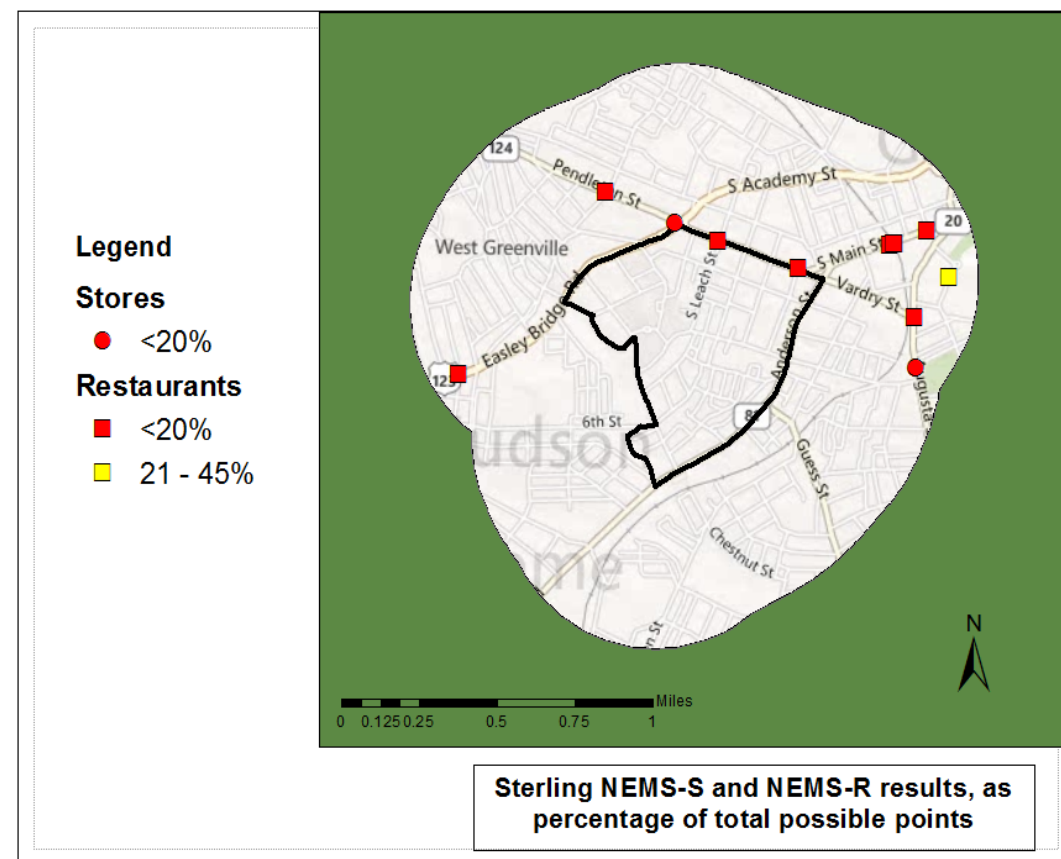


Fig. 5

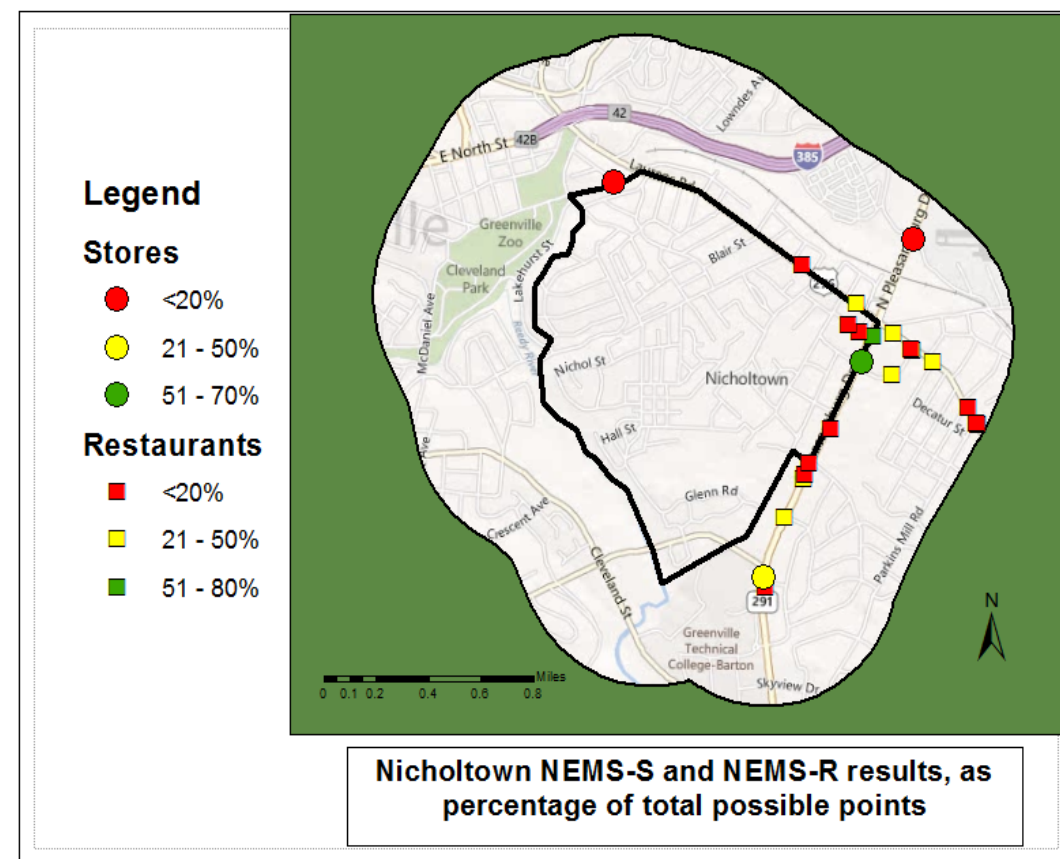


Fig. 6

## V. Conclusion

- The lack of accessible, affordable nutritious food makes these two communities appear to be **food deserts**. However, in order to be able to more conclusively support this claim and determine the severity of these food deserts, parallel data from other communities for **comparison** is critical.
- Intervention approaches for this food desert problem could include community-based and community-driven initiatives, possibly including **traveling farmers' markets, produce stands, Community Supported Agriculture** programs, **community gardens, kitchen gardens, refurbishing of already existing food stores** to include **healthy options for affordable prices, menu alterations** at already existing restaurants, etc.
- Improvements in the transportation situation** of residents could also help alleviate some of the negative outcomes. Improving the **walkability, bikability, safety, and public transit systems** in and around these communities could help connect residents with healthy food sources.
- Education** is a key factor in the larger obesity context. Families not only need access to affordable nutritious food, but also a knowledge base with regards to **what constitutes a healthy diet and how to prepare nutritious foods/meals**.

## V.I. Future Research

There exists a need for **more extensive empirical data** rather than an imprudent reliance upon factoids when it comes to food desert policy making (Cummins and Macintyre 2002). It is paramount that policy makers critically consult empirical data to avoid misinformed policy decisions (Cummins and Macintyre 2002).

Several gaps in the literature still exist:

- Most of the research has been conducted in **urban rather than suburban areas**.
- Much of the data is **not specific enough** to support thorough analysis. (Existing measures of **bikability and walkability** are mostly limited to presence or absence of sidewalks and bike lanes, with no data on **traffic flow, safety, condition**, etc. Similarly, the simple evaluation of food deserts according to proximity of food stores and restaurants with no information on **affordability, quality, and accessibility of the food offered** is inadequate when one realizes that not all supermarkets, convenience stores, restaurants, or fast food chains are equal (Powers, Lyerly & Manly)).
- There are few studies of the nutrition environment on a **micro-scale** (Glanz et al. 2007).
- More **comprehensive, detailed** studies of access to healthy foods, especially in minority, low-income, **suburban** communities, are needed.
- There is limited literature on food deserts in **Hispanic** communities; a comparison of food deserts in African American versus Hispanic communities could provide some interesting insight. (Data collected by LiveWell Greenville from the predominantly Hispanic Berea community could be included in future analyses, potentially affording an interesting **inter-minority comparison** with the predominantly African American communities of Nicholtown and Sterling.)
- No comparable data collected at this level from other **higher income** communities in the area or elsewhere exists to serve as a **comparison**; it would also be helpful to have widespread, georeferenced **demographic data** available at the same **community/neighborhood level**.

## VIII. Acknowledgements

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