

NAVIGATING THE FOOD ENVIRONMENT:  
HEALTHY FOOD AVAILABILITY IN SNAP-AUTHORIZED DRUGSTORES IN  
NORTH CAROLINA

by

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## ABSTRACT

ASHLEY KENNEDY. Navigating the food environment: healthy food availability in SNAP-authorized drugstores in North Carolina. (Under the direction of DR. TERESA SCHEID)

The number of major drugstore chains (such as Walgreens, CVS, and Rite Aid) that accept Supplemental Nutrition Assistance Program (SNAP) benefits in North Carolina as dramatically increased. From 2000 to 2015, the number of stores accepting SNAP increased from 7 to 796 stores. This study examines the availability of food and beverage items among a sample of SNAP-authorized drugstores in three regions of North Carolina. Observations were made on 53 possible food and beverage items offered at 108 stores across three major chains (36 Walgreens, 36 CVS, and 36 Rite Aid). The frequency and percent of stores that offered each food and beverage item were calculated. Chi-square tests were employed to compare available food and beverage items by stores located in rural and urban locations, stores located in areas with majority white and majority minority residents, and stores located in food deserts. Results show only 3% of drugstores offered fresh fruit and 4% offered fresh vegetables. More than 90% of drugstores offered the following items: frozen entrees, whole or 2% milk, 100% fruit juice, white rice, peanut butter, dry pasta, low-sugar cereal, potato chips, low-sugar granola or cereal bars, soda, beer, and wine. The frequency of food and beverage items offered did not differ by rural/urban location, neighborhood race majority, or food desert status. In conclusion, while drugstores may not be used as a primary source for groceries, there are many SNAP-authorized drugstores in North Carolina. Researchers studying community food environment are encouraged to consider the role of drugstores as a food resource for SNAP recipients.

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## INTRODUCTION

The purpose of this study is to address a gap in the food access disparities literature by evaluating the availability of healthy food and beverage items among a sample drugstores authorized to accept Supplemental Nutrition Assistance Program (SNAP) benefits. Administered by the United States Department of Agriculture (USDA), the SNAP program, formerly known as the Food Stamp program, is by far the largest federal aid nutrition program that provides food-purchasing assistance for low-income Americans nationwide (An 2015). The SNAP program provides eligible participants with a cash-equivalent electronic card that can be used to buy food at SNAP-authorized retailers (USDA 2015). With the dramatic increase in the number of SNAP-authorized drugstores in North Carolina, drugstores now serve as a food resource in the community, especially for low-income individuals who lack access to a grocery store.

Substantial research shows that food access is an important determinant of Americans' diet quality and health. Access to adequate, nutritious foods provides a foundation for vigorous growth, development, and functioning across the life course (Cannuscio, Hillier, Karpyn, and Glanz 2014). In the United States, diet-related chronic diseases such as obesity, diabetes, and vascular diseases are the leading causes of disability and premature death. These diseases, which were once considered "adult-onset," now appear earlier in the life course and disproportionately affect socioeconomically disadvantaged groups, highlighting the importance of food and nutrition as contributors to health disparities between rich and poor populations (Lucan 2015; Cannuscio, Tappe, Hillier, Buttenheim, Karpyn, and Glanz 2013). With a general consensus that the rapid rise in obesity stems from environmental, policy,

and societal changes, research regarding the food environment is important and can help further our understanding of dietary behavior.

In this thesis, I begin by introducing the ecological framework that was employed throughout my descriptive study. Following this section is a review of the literature regarding changes in the food environment and disparities in access to healthy food. The next section focuses on my research questions and methods of research design. This thesis concludes with the study's results and a discussion of the study's strengths and limitations, policy implications, and recommendations for future research.

### An Ecological Framework

With over half of U.S. adults currently considered overweight or obese, public health experts are challenged to identify ways to promote the benefits and prevent the harms caused by food consumption (Cannuscio et al. 2014). Similar to theoretical approaches that underlie nutrition counseling, dietary change interventions for populations have been founded on social-psychological theories for understanding individual dietary behavior. However, sociological studies point out that the most important limitation of studying eating strictly as a behavior under the control of an individual, is that it exaggerates the extent to which rational choice drives what people chose to eat, and underestimates the extent to which eating is embedded in the flow of day-to-day life (Delormier, Frohlich, and Potvin 2009). Essentially, it is important to keep in mind that individual choices are conditioned by the context or environment in which they occur.

With an understanding that dietary behavior is highly complex and results from interplay of multiple influences across different contexts, this study employs an ecological framework to assess the food environment of SNAP-authorized drugstores

in three regions of North Carolina. Story, Kaphingst, Robinson-O'Brien, and Glanz (2008) explain that an ecological approach is useful in guiding research and intervention efforts because of its emphasis on multi-level linkages, the relationships among multiple factors that impact health and nutrition, and the focus on connections between people and their environments (Story, Kaphingst, Robinson-O'Brien, and Glanz 2008).

In terms of understanding dietary behavior, the ecological model considers individual-level factors in relation to the social environment, physical environment, and macro-level environment. Individual factors pertain to cognition, behavior, and demographics, while the social environment includes interactions with family, friends, and peers. These interactions exert important influences on dietary behavior through mechanisms like role-modeling and social norms (Story et al. 2008). For example, in a study focusing on overweight children, Davison and Birch (2001) explain that parents likely serve as role models for children's eating behavior because children will want to eat, and through repeated exposure, learn to like foods they see their parents eating (Davison and Birch 2001; Cannuscio et al. 2014). Moreover, the physical environment includes multiple settings in which people eat or procure food. The physical environment is particularly important because physical settings within a community can either create or hinder opportunities for healthy eating. Lastly, the macro-level environment refers to factors that operate within the larger society but have a powerful effect on what people eat. Macro-level factors include food marketing, food production and distribution systems, and price structures. As illustrated in Figure 1, together, factors from these environmental contexts interact and to some degree, influence dietary behavior (Story et al. 2008). This thesis focuses



on aspects of the physical and macro level environments of the ecological model to assess food and beverage availability in SNAP-authorized drugstores.

### Changes in the Food Environment

Over the last several decades there have been substantial changes to the American food environment, which have been broadly linked to dietary behaviors and the significant growth in adult and child obesity (Gordon-Larsen 2014). It is no doubt that these environmental changes have been driven by technological advances, U.S. food and agricultural policies, and economic, social, and lifestyle changes (Story et al. 2008). Over the years, Americans have adapted to expanding portion sizes, high-fructose corn sweeteners, automobile-dependent community designs, food advertisements everywhere, more and cheaper foods high in fat and sugar, soft drink and other unhealthy vending in schools, Internet-based entertainment, and an abundance of fast food (Sallis and Glanz 2009). In low-income urban communities, there has been an exodus of grocery stores and an influx of fast food restaurants, convenience stores, and other non-traditional food stores (including dollar stores and drugstores), which has contributed to the income and racial/ethnic disparities in access to healthy foods. Collectively, these environmental changes have influenced what, where, and how much we eat and are believed to have played a significant role in the current obesity epidemic (Story et al. 2008).

Moreover, Gordon-Larsen (2014) stresses that changes in the food environment not only impact Americans, but also affect the health of individuals around the globe. For example, the relative costs of fruit and vegetables have increased tremendously in comparison to the price of refined grains and sugars, making access to all sorts of processed foods progressively easier, particularly for low-income individuals (Gordon-Larsen 2014). Extensive research has documented

that as a consequence of poor grocery store access, low-income individuals have increased exposure to “empty calorie” (high energy, low nutrient) dense foods available at fast food establishments, convenience stores, drugstores, etc. A diet consumed of processed foods, frequently containing high contents of fat, sugar, and sodium, often lead to poorer health outcomes compared to a diet rich in complex carbohydrates and fiber (Walker, Keane, and Burke 2010).

Moreover, the number of drugstores now accepting Supplemental Nutrition Assistance Program (SNAP) benefits has changed the landscape of the food environment. As previously mentioned, the SNAP program provides eligible participants with a cash-equivalent electronic card that can be used to buy food at SNAP-authorized retailers (USDA 2015). In the U.S., a total of 19,741 major chain drugstores, such as Walgreens, CVS, and Rite-Aid, accept SNAP. In North Carolina, the number of drugstores that accept SNAP benefits has increased from 7 stores in 2000 to 796 stores in 2015 (USDA 2016). Looking at the nation as a whole, in 2008, 10 billion dollars were spent on food items at U.S. drugstores, totaling an estimated 3 trillion calories (Gordon-Larsen 2014). Over the years, food sales at drugstores have continued to rise. For example, in 2014, drugstores accounted for 5.2 percent of U.S. food sales, totaling to 61.1 billion dollars (Willard Bishop 2015). Taking this into account, there is no question that the dramatic increase in SNAP-authorized drugstores, especially those located in low-income areas, now serve as a food resource for area residents.

#### Disparities in Access to Healthy Food

The presence of food stores and the availability of healthful products in those stores are important contributors to healthy eating patterns among neighborhood residents. Research on the food environment has shown that in terms of the various

types of retail stores that sell food, full-service grocery stores offer the greatest variety of healthy food at the lowest cost. Public health researchers point out that a major issue here is that low-income and minority neighborhoods have fewer full-service grocery stores and more convenience stores and other non-traditional food stores (including dollar stores and drugstores) in comparison to middle and high-income white neighborhoods (Story et al. 2008; Moore and Roux 2006; Ghosh-Dastidar, Cohen, Hunter, Zenk, Huang, Beckman, and Dubowitz 2014). Although little research has explored the in-store food contents of convenience stores, dollar stores, and drugstores, what has been done indicates that these stores offer a variety of unhealthy foods and a limited selection of healthy staple foods. For example, Laska, Borradaile, Tester, Foster, and Gittelsohn (2009) found that among their sample of urban convenience stores the most commonly observed healthy items were: bottled water, nuts, pretzels, peanut butter, canned fruit, and canned beans/lentils/chickpeas. Other healthy/healthier items such as low-fat dairy products, fresh fruits and vegetables, high-fiber bread, brown rice, and baked chips varied significantly across store sites. The researchers concluded that while healthy food and beverage items were found at each site, overall healthy food availability was limited (Laska, Borradaile, Tester, Foster, and Gittelsohn 2009). Coupled with this finding, another study found that compared with other types of primarily non-food stores, drugstores were highly likely to offer energy-dense foods, with 96 percent of drugstores offering snack foods, 90 percent offering candy, and 89% offering sweetened beverages within 10 feet from the checkout (Whitehouse, Simon, French, and Wolfson 2012). All things considered, with differential access to food resources, vulnerable low-income populations are at a disadvantage in achieving healthy eating habits and thereby, have an increased risk of diet-related chronic diseases (Zachary, Palmer, Beckham, and Surkan 2013).

In addition to the increased health risks associated with being low-income, individuals who receive SNAP benefits are even more vulnerable. In terms of financial and nutritional need, research indicates that SNAP participants tend to be worse off than non-participants (FRAC 2011). In 2014, SNAP served approximately 46.5 million people—about one in seven Americans—of which 84 percent lived in poverty (Andreyeva, Tripp, and Schwartz 2015). Since its existence, the core goal of SNAP has been to alleviate hunger and malnutrition by increasing the food-purchasing power of low-income households. With that being said, SNAP households may use their benefits freely to purchase food items of their preference (An 2015).

Moreover, unlike the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), SNAP regulations do not require vendors to stock healthy foods, but require that they offer three varieties of four categories of staple foods (i.e. meat, poultry or fish, bread or cereal, fruits or vegetables, dairy products) with perishable foods in two of these categories. Thus, a vendor could meet these lenient requirements by stocking foods such as high-fat meats, white bread, and ice cream. The Agricultural Act of 2014, also known as the 2014 Farm Bill, mandated alterations to these stocking requirements, requiring stores to carry seven items across the four categories of staple foods, including perishable items in three categories. This ruling is still under review by the USDA, where they have the authority to specify that these new requirements focus on healthy foods such as fruits, vegetables, low-fat dairy products, and whole-grain rich products (Laska, Caspi, Pelletier, Frieber, and Harnack 2015).

All things considered, the unfortunate reality for all low-income individuals is that maintaining a healthy diet is difficult and related to a variety of environmental factors associated with poverty. For example, a lack of financial resources presents a

barrier to healthy eating. In fact, the high cost of fruits and vegetables is described as the primary barrier to obtaining nutrient-rich foods among SNAP recipients (Walker et al. 2010). In this regard, SNAP participants may purchase nutrient-poor foods and beverages instead of purchasing fruits and vegetables in order to stretch their budget (Leung, Hoffnagle, Lindsay, Lofink, Hoffman, Turrell, Willett, and Blumenthal 2013). Regardless, it cannot be stressed enough that having the ability to make healthy choices can occur only in a supportive environment with accessible and affordable healthy food options (Story et al. 2008).

Lastly, in terms of measuring healthy food access, “food deserts” refer to communities that do not contain healthy food retailers. Individuals residing in these communities have no opportunity to purchase healthy foods, such as fruit and vegetables, and must travel outside their community to feed their families a healthy diet (The Support Center 2013). The USDA defines a food desert as a low-income area where a significant number or percentage of residents is at least half to one mile away from a grocery store in urban areas or more than 10 miles away in rural areas (ERS USDA 2013). Specifically for North Carolina, there are 171 food deserts in 57 counties across the state, and more than 1.85 million residents—nearly 20 percent of the state population—have low access to a grocery store. In fact, 6.5 percent of North Carolinians are low-income and have restricted access to a grocery store in comparison to 5.6 percent of Americans nationwide (The Support Center 2013; Morgan, Downer, and Lopinsky 2014).

## RESEARCH QUESTIONS AND STUDY DESIGN

This descriptive study aims to address a gap in the food environment research by: (1) evaluating the availability of healthy food and beverage items among a sample of SNAP-authorized drugstores in three regions of North Carolina focusing specifically on Walgreens, CVS, and Rite-Aid; (2) test whether the foods available vary among stores located in majority white and majority minority neighborhoods; (3) test whether the foods available vary by stores located in rural and urban areas; (4) test whether the foods available vary by stores located in food deserts. As previously mentioned, this thesis focuses primarily on aspects of the physical and macro-level environments of the ecological model. The model in Figure 2, which was adapted from Glanz, Sallis, Saelens, and Frank (2005), is helpful for conceptualizing nutrition environment variables based on the ecological framework that are believed to impact eating behavior. Judging by Figure 2, my study focuses on one part of community food environment, the consumer food environment of major chain drugstores (Glanz, Sallis, Saelens, and Frank 2005). The consumer environment of drugstores represents the physical environment, and macro-level environment is represented by drugstores having SNAP authorization. With the absence of individual level data, healthy food availability is measured against variables of neighborhood race majority, rural/urban status, and food desert status, all of which are relevant characteristics of the retail food outlet.

In terms of study design, this study utilized data from a previous study (Racine, Batada, Kennedy, and Story 2016) where I was a data collector and contributing author. The previous study aimed to compare available food and beverage items by drugstore chain (Walgreens, CVS, Rite-Aid) and neighborhood income level. The findings showed that while the majority of food and beverage items

were similarly available, there were significant differences in the availability of fruits and vegetables and other healthier staple foods by store chain. Interestingly, there were no significant differences in the availability of food and beverage items by stores located in low, middle, and high-income neighborhoods. Review by the IRB was not required for this study because human subjects were not involved.

#### Data Sources and Sample Strategy

Four primary data sources were used for this study. First, a listing of all the SNAP-authorized drugstores in 25 counties in North Carolina (hereafter the research area) were downloaded in May, 2015 from the USDA SNAP Retailer Locator website. Second, data from the U.S. Census American Community Survey 2009-2014 were used to understand the demographic characteristics of the counties in the research area and the drugstore census tracts. Third, data from the USDA Food Access Research Atlas were used to determine which census tracts were food deserts. Fourth, trained data collectors (from the Racine, Batada, Kennedy, and Story (2016) study) visited 108 drugstores throughout the regions of Charlotte, Asheville, and Durham, North Carolina, and completed a food environment inventory worksheet that assessed the variety and healthfulness of foods available.

Figure 3 illustrates the sampling strategy applied to this study. Within the research area, there were 390 SNAP-authorized drugstores representing the three major chains: Walgreens (n=114), CVS (n=160), and Rite-Aid (n=116). More than a quarter of the available drugstores were selected for observation (108 of 390). To get a good understanding of the consumable items available at each of the three major chains, a total of 36 drugstores from each chain were observed. To ensure there was equal representation of drugstores sampled from low, middle, and high-income areas, 12 drugstores per chain were observed from each income category. Furthermore, to

make sure the sample equally represented each region, 39 drugstores were visited in both the Charlotte and Durham regions, while 30 drugstores were visited in the Asheville region. Fewer stores were observed in the Asheville region due to driving distance for data collectors. It is important to keep in mind that this data was compiled with the intention to compare differences in the availability of food and beverage items by drugstore chain and neighborhood income level. My study continues to explore the data collected by focusing on food and beverage availability as it corresponds to community variables of race majority, rural/urban status, and food desert status.

#### Measures

The population percent of non-Hispanic White, non-Hispanic Black, and Hispanic were demographic characteristics reported for each drugstore census tract. To investigate whether food and beverage availability differed among areas that had majority white or majority minority residents, the race variable was recoded as a dummy variable (0=majority minority, 1=majority white). Similarly, rural/urban county status was reported for each drugstore census tract. The rural/urban county status was defined by the NC Rural Center using US Census 2010 data where 'rural' counties were those with population density less than 250 people per square mile or those with population density between 250-350 people per square mile but retained significant rural characteristics; 'urban' counties were those with 350 people per square mile or more. Lastly, food desert status was obtained from the USDA Food Access Research Atlas, where census tracts were identified as food deserts if they were a low-income tract with at least 500 people or 33 percent of the population living more than half mile (in an urban area) or more than 10 miles (in a rural area) from the nearest grocery store or supercenter.



## Observation Tool

To measure in-store food contents, a food inventory worksheet (See Figure 4) was used when making observations at the 108 drugstore locations. This observation tool was adapted from Laska and colleagues' assessment of food products at convenience stores (Laska et al. 2009). In addition to basic information about the date and time of data collection, the location and size of the store, and the identity of the data collector, the observation tool included 53 possible food and beverage items. The tool also included items on the marketing of food and beverages through outdoor and in-store signage, as well as specific types of foods and beverages available at the checkout counter. To help guide data collectors in categorizing food and beverage items available, specific food definitions were provided on the inventory worksheet.

To increase the validity of our measurement instrument, the observation tool was piloted at three locations before any real observations were made. Two other data collectors and I made store observations in June 2015. On average, 17 minutes were spent collecting data at each store. Eight stores were visited twice and the inter-rater reliability score on 109 variables was 84.4%. Out of the 108 stores sampled, 36.1% were located in a food desert, 7.4% were located in a rural area, and 12.0% were located in neighborhoods with majority minority residents.

## Statistical Analysis

Due to multiple factors directly and indirectly contributing to influence within the food environment, this study relied on methods determining association rather than causality. To test whether the foods and beverages offered at drugstores varied by neighborhood race majority, rural/urban status, or food desert status, the chi-squared statistic was used. This approach resulted in 109 chi-squared tests. To minimize the risk of type I error, the Bonferroni correction was used and statistical

significance was determined at  $p < 0.0005$  ( $0.05/109$ ). A secondary analysis was conducted as a final step to reduce the amount of data and degrees of freedom in the model. The secondary analysis employed the chi-square test. Due to the small sample size in the analysis, statistical significance was determined at  $p < 0.05$ . Data was originally compiled in Microsoft Excel before being imported into SAS (version 9.4) for analysis.

## RESULTS

### Description of the Research Area

The 25 counties included in the research area (See Figure 5) varied considerably in economic status with median household income ranging from \$35,297 in McDowell County in western North Carolina to \$55,444 in Mecklenburg County in the south, and \$66,006 in Wake County in the northeast; for comparison, the state median household income was \$46,334. The research area included nearly 4.7 million residents, 74% Non-Hispanic White, 15% African American, 8% Hispanic, and 3% other. Sixteen percent of the residents lived in poverty and approximately 14% of households had SNAP benefits (The United States Census Bureau 2016a; The United States Census Bureau 2016b).

The resident demographics were similar across SNAP drugstore chain. For instance, the median percent of the population that were Non-Hispanic Black was 14.5% in Rite-Aid census tracts, 12.4% in Walgreens census tracts, and 14.0% in CVS census tracts. The median percent of the population that were SNAP participants was 8.5% in Rite-Aid neighborhoods, 7.0% in Walgreens neighborhoods, and 8.9% in CVS neighborhoods. In addition, the three chains were similarly represented in food deserts; 35.3% of Rite-Aid stores, 34.2% of Walgreens stores, and 32.5% of CVS stores were located in food deserts.

### Food and Beverage Availability

As previously stated, there are four research aims to my study: (1) evaluate the availability<sup>1</sup> of healthy food and beverage items among the sample of 108 SNAP-authorized drugstores within three regions of North Carolina; (2) test whether the

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<sup>1</sup> Food and beverage items are considered available only if in stock during the time of data collection.

foods available vary among stores located in majority white and majority minority neighborhoods; (3) test whether the foods available vary by stores located in rural and urban areas; (4) test whether the foods available vary by stores located in food deserts. The complete count and frequency of the food and beverage items is available in Table 1. In the 'fruit and vegetable' category, only 3% of drugstores offered fresh or prepackaged vegetables, and 4% offered fresh whole or prepackaged fruits. None of the drugstores offered frozen fruit, but 28% did have frozen unseasoned vegetables. In terms of canned goods, 90% of drugstores offered canned fruit in a light syrup, while only 4% offered low-sodium canned vegetables. Further, 30% of drugstores offered no sugar added applesauce. All drugstores offered 64 oz. containers of 100% fruit juice.

Moreover, in the 'dairy' category, 87% of drugstores offered low-fat white milk (1% or skim), 99% offered 2% or whole milk, 70% offered low-fat yogurt, 49% offered (not imitation) low or reduced fat cheese, and 65% offered (not imitation) regular cheese. In the 'healthier snack' category, the majority of drugstores offered the following items: pretzels (salted, no other flavors), popcorn (low-fat or microwave), low-fat trail mix and/or dried fruit, nuts (no sugar added). For the 'healthier staple foods' category, the majority of pharmacies offered peanut butter, high fiber cereal, and low-sugar cereal. Only 26% of drugstores offered whole wheat dry pasta, and 21% offered brown rice. In terms of frozen or refrigerated meats, only 11% of pharmacies offered chicken parts, 16% offered ground beef, 20% other meats such as ground turkey or seafood. The majority of drugstores offered the foods listed in the 'additional items' category such as frozen entrees, regular dry pasta, white rice, potato chips, sodas, beer, and wine. Only 50% of drugstores offered regular hotdogs, 29% offered low-fat hotdogs (<15% DV fat), and 58% offered loaves of white bread.

### Differences in Food and Beverage Availability

As Table 1 indicates, the availability of virtually all foods and beverages were the same regardless of whether the drugstore was located in a majority minority neighborhood, located in an urban or rural area, or located in a food desert. The one exception was for chips, which were available at 100% of all urban stores and 87.5% of rural stores,  $p=.0004$ . Although this p-value indicates significance, this statistic should be taken with caution, since 107 of the 108 stores offered chips. Looking at the availability of all other food and beverage items, since  $p>.0005$ , we cannot say that the in-store food contents of the 108 drugstores observed vary by store neighborhood race majority, rural/urban location, or food desert status.

Moreover, as Table 2 indicates, the secondary analysis conducted only concerned the following five foods: brown rice, whole-wheat dry pasta, no sugar added applesauce, unseasoned frozen vegetables, and low-fat hotdogs. Results show the availability of brown rice to be significant when stratifying stores by rural/urban status. Since  $p>.05$  for the other four food items in this sample, we cannot say these items vary by store neighborhood race majority, rural/urban location, or food desert status.

## DISCUSSION

The number of major drugstore chains that accept SNAP benefits has dramatically increased in North Carolina. As previously mentioned, from 2000 to 2015, the number of stores accepting SNAP increased from 7 to 796 stores. The literature on food access disparities has described low-income and minority areas as having little to no access to grocery stores and greater access to fast food restaurants, convenience stores, and drugstores. This restricted access is likely to be problematic since grocery stores stock a variety of foods, including fresh fruits and vegetables, while it is believed that most other food retailer types do not. Research on the food environment has documented the importance of measuring in-store food contents, yet there is scant peer-reviewed research to date that has systematically evaluated the availability of healthy food and beverage options by retailer type. This study aimed to address a gap in the research by evaluating the types of foods offered at three major drugstore chains in North Carolina.

Data collected in this study reveal that there are indeed healthier food options available in drugstores. However, healthier foods are not as widely or consistently available as less healthful foods. Being that drugstores are health-promoting environments, the limited availability of healthful options for purchase is disturbing and counterproductive to their health promotion function in the community. For example, out of a sample of 108 drugstores, only 2.8% offered fresh vegetables, 3.7% offered fresh fruits, 27.8% offered frozen (unseasoned) vegetables, and 3.7% offered low-sodium canned vegetables. In contrast, nearly all stores offered soda, candy, chips, sugar sweetened beverages, and regular frozen entrees. Results from the first analysis did not find significant differences in the types of foods available after stratifying by neighborhood race majority, rural/urban status, and food desert status.

This finding is somewhat interesting given that other food environment studies have found significant differences in healthy food and beverage availability after stratifying by similar community variables.

Interestingly, the secondary analysis looking only at five healthy/healthier food items (brown rice, whole-wheat dry pasta, no sugar added applesauce, unseasoned frozen vegetables, and low-fat hotdogs) found brown rice to be significant when stratifying by rural/urban status. As previously mentioned, when Racine, Batada, Kennedy, and Story (2016) stratified by chain and income category, the only significant differences in food availability were by store chain. Considering the results from both studies working with this data, it is believed that while there is an overall lack of healthy items available in comparison to unhealthy items, each store chain has established vendors and makes stocking decisions regarding food from a centralized, corporate office. With the fact that these three chains are ranked in the top 30 among the top 75 retailers in the U.S., it isn't surprising that they would make decisions based on the company as a whole rather than pick and choose what each store sells based on community demographics (Penton 2016).

#### Strengths and Limitations

The major strength of this study is that it focuses on drugstores, a highly under-researched area in the food environment literature. With knowledge that food and eating environments likely contribute to the increasing epidemic of obesity and chronic diseases over and above individual factors, there is a need for more research to explore in-store contents of food retailers. In terms of limitations, this study does not cover the complete food environment. In addition, this analysis does not examine the reasons why some food and beverage items are available and others not, but it is expected that the reasoning partially involves consumer demand. Moreover, while this

study only considers drugstores that are SNAP-authorized, it is not known if SNAP recipients are using their SNAP benefits at these stores. Lastly, the variables observed in this study may not accurately depict the in-store food contents of stores located in majority minority areas or those in rural areas due to the unequal sampling of these stores. As previously discussed, this data was sampled for what it was originally intended to measure, differences in food availability by chain and income category.

#### Policy Implications and Recommendations for Future Research

Although there are several limitations to this study, the food availability data collected on the major drugstore chains helps fill a void in the food environment research. While this study does not view drugstores as a primary source for food shopping, understanding the types of foods drugstores offer is important, especially being that these establishments accept federal money from SNAP and the fact that food sales have increased dramatically from 2008 to 2014. As Story et al. (2008) explains, improving dietary and lifestyle patterns and reducing obesity will require a sustained public health effort, which addresses not only individual behaviors but also the environmental context and conditions in which people live and make choices. In order to help influence individual behavior, initial steps are needed to make healthful food choices available, identifiable, and affordable to people of all races, incomes levels, and in all types of geographic locations (Story et al. 2008). Being that drugstores serve health-promoting roles in the community, interventions that increase availability, variety, and pricing of healthy food options should be explored. In addition, making point-of-choice nutrition information available may help consumers identify healthier products in stores. In terms of macro-level policy, the changing requirements for SNAP vendors outlined in the 2014 Farm Bill, has the power to better the local food environment if the USDA specifies that changes must focus on



healthy food items. The research community must reach out to government representatives and encourage such changes be made. Finally, in addition to observing in-store food contents of food retailers, future research should apply the ecological framework to understand the factors and barriers individuals face when making food choices. Engaging individuals will help provide guidance in developing appropriate intervention strategies to influence healthy eating.

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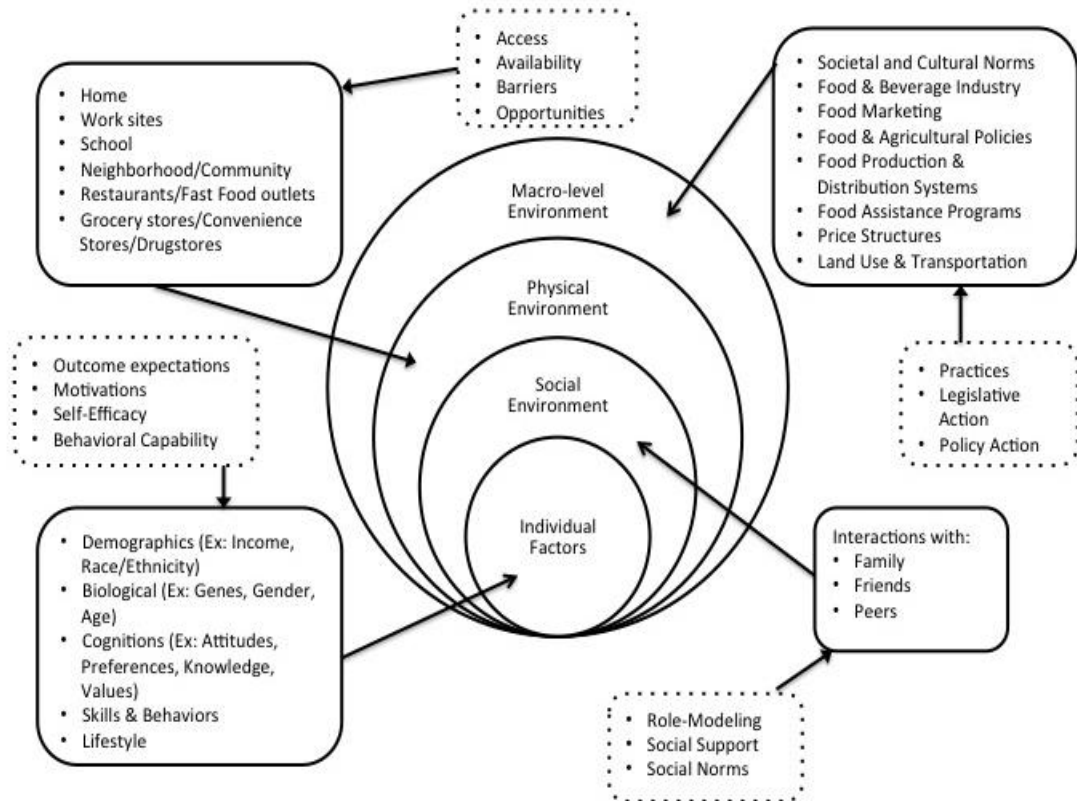
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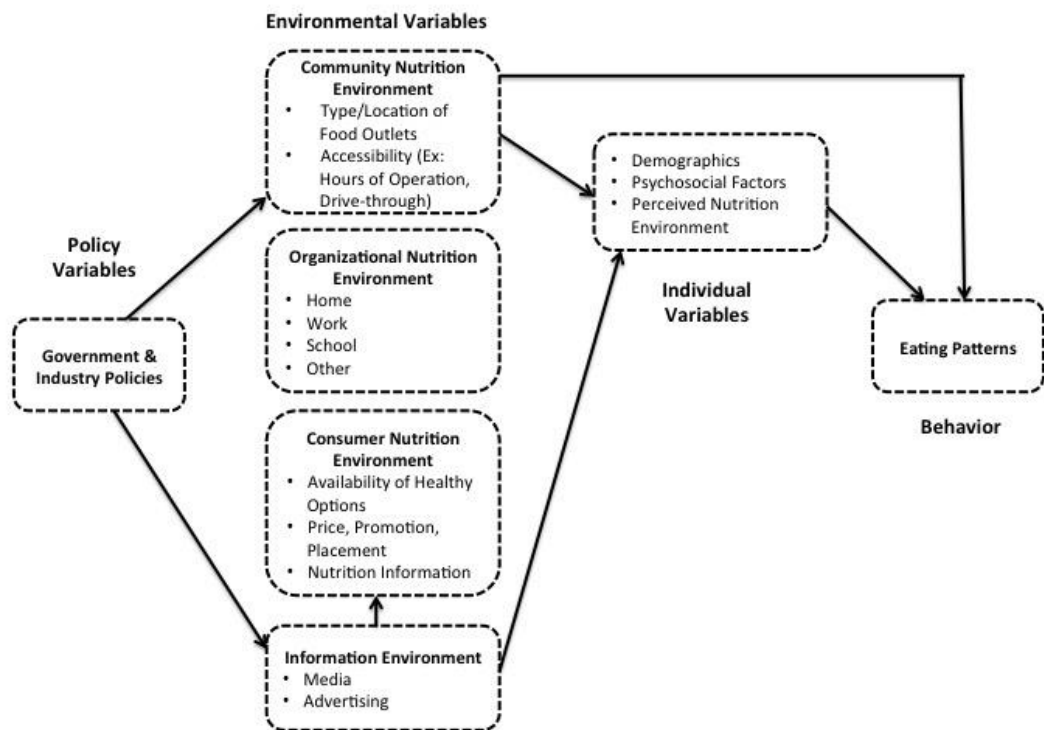
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## APPENDIX A: FIGURES



Story et al. 2008

Figure 1: The ecological model for investigating food environment



Glanz et al. 2005

Figure 2: Model of community nutrition environment

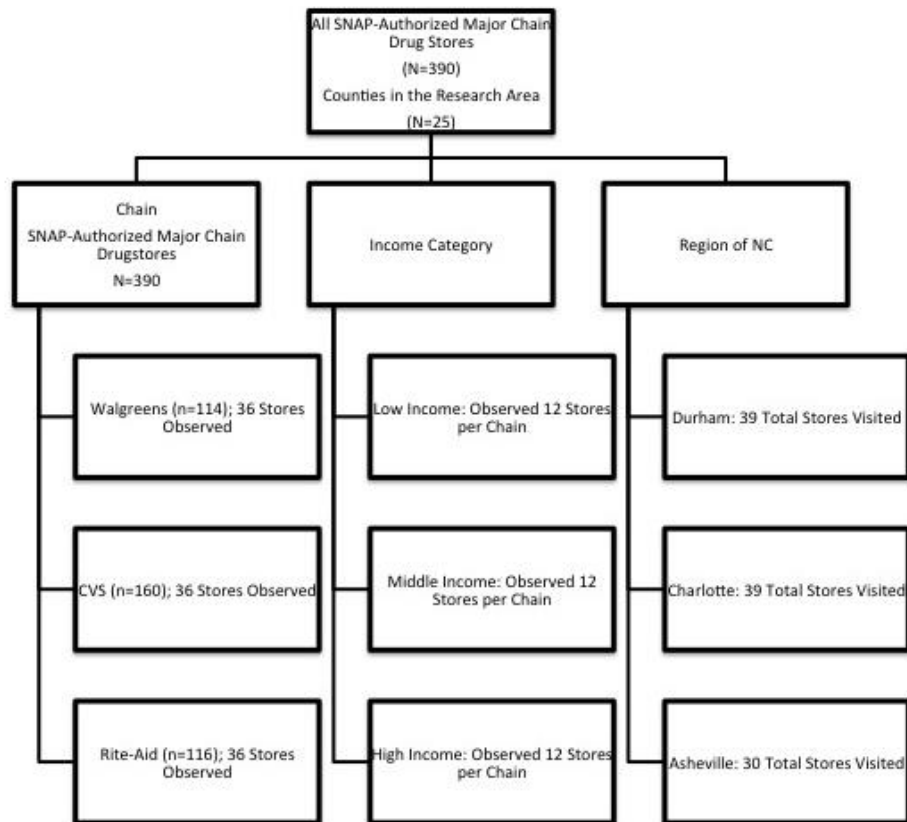


Figure 3: Sampling strategy for SNAP-authorized drugstores

## Food Store Worksheet

UNCA\_\_\_ UNCC\_\_\_ Duke\_\_\_

Date: \_\_\_\_\_ Start Time: \_\_\_\_\_ End Time: \_\_\_\_\_ Data Collector: \_\_\_\_\_

Store Name/Location: \_\_\_\_\_ Store ID: \_\_\_\_\_

Presence of Ad/Promotions At Store	Food/Beverage	Tobacco	Alcohol
On register or behind checkout counter	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No
Hanging from the ceiling or on the wall	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No
Posters or sign boards outside or seen from the outside	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No
Specific foods/beverages advertised:			

Products at Checkout (can be reached while standing at the checkout)			
Unhealthy		Healthy	
Candy	1-Yes 0-No	Granola/Protein/Energy Bars	1-Yes 0-No
Soda	1-Yes 0-No	Popcorn	1-Yes 0-No
Wine or beer	1-Yes 0-No	Bagged Nuts/Seeds	1-Yes 0-No
Chips	1-Yes 0-No	Fresh Fruit	1-Yes 0-No
Cigarettes	1-Yes 0-No	Bottled Water	1-Yes 0-No
Energy Drink or shot	1-Yes 0-No		

## Signage

	Front door	At checkout	On the shelf under items	Cooler doors
WIC	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No
SNAP/EBT	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No	1-Yes 0-No

What percent of the store is dedicated to food/beverage?

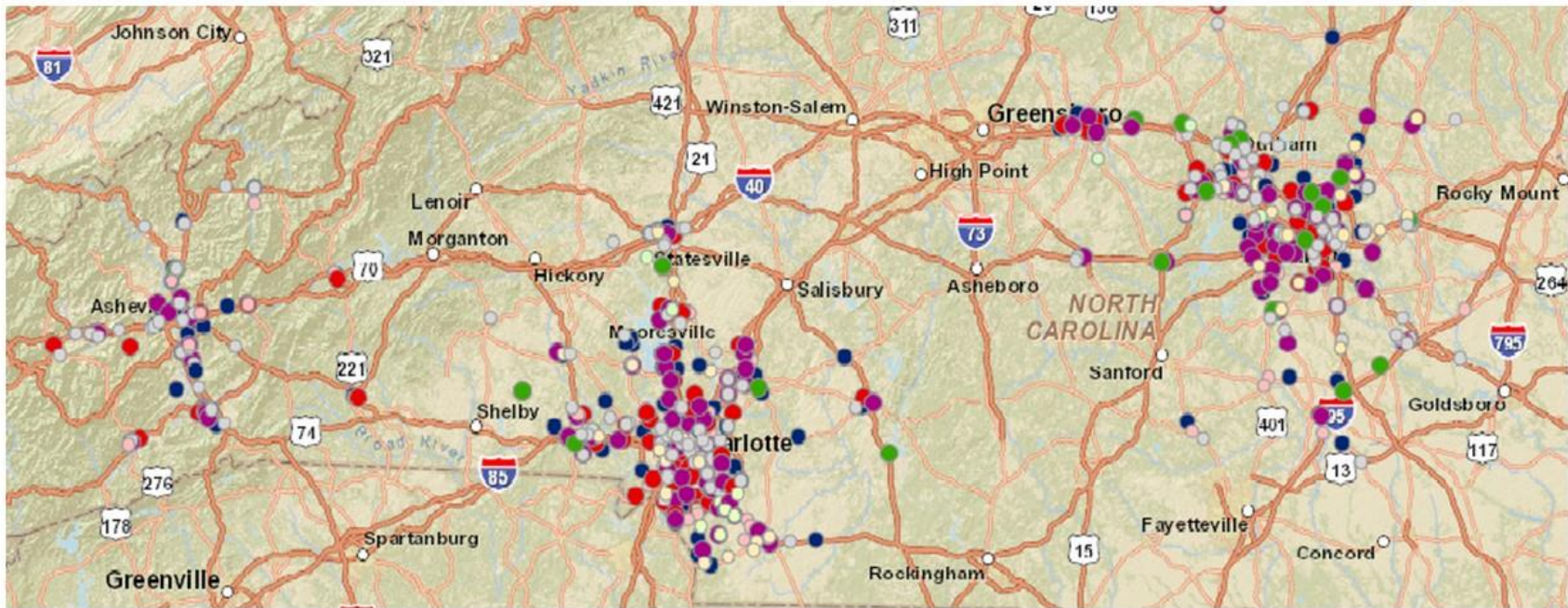
&lt;25%      25-50%      &gt;50%

Figure 4: Food store worksheet used in the observation of SNAP-authorized drugstores



<b>Food Availability Checklist</b>		<b>Available?</b>		<b>Food Definitions*</b>		
Fresh Veggies whole and/or precut/packaged		1-Yes	0-No	100% fruit juice	Must be 100%	
Fresh Fruits whole and/or precut/packaged		1-Yes	0-No	Low fat	< 10% DV for fat (will be <6.5 g fat per serving)	
Fresh/pre-packed sandwiches		1-Yes	0-No	Low sugar	< 10 g sugar	
Hot dogs (regular)		1-Yes	0-No	100% whole wheat	First ingredient is whole-wheat flour or 100% whole-wheat flour	
Hot dogs (<15% DV fat)		1-Yes	0-No	High fiber	≥ 10% DV for fiber	
Frozen entree (regular)		1-Yes	0-No	*Unless otherwise noted		
Frozen entree (<15% DV fat)		1-Yes	0-No	Types of meat*:		
Low-fat white milk (1% or skim)		1-Yes	0-No	Ham steak	Refrig.	Frozen
Whole or 2% milk		1-Yes	0-No	Chicken	Refrig.	Frozen
Yogurt (low/non-fat)		1-Yes	0-No	Ground Beef	Refrig.	Frozen
Low/reduced fat cheese (not imitation)		1-Yes	0-No	Steak	Refrig.	Frozen
Regular cheese (not imitation)		1-Yes	0-No	Seafood	Refrig.	Frozen
Refrigerated fresh cuts of meat –if yes complete meat box		1-Yes	0-No	Other:	Refrig.	Frozen
Frozen cuts of meat -if yes complete meat box		1-Yes	0-No	*Not processed or seasoned, not deli meat, not sausage/ hot dogs		
Frozen veggies (unseasoned)		1-Yes	0-No	<b>Size</b>		
Frozen fruit (no sugar or seasoning added)		1-Yes	0-No			
100% Whole Wheat bread (loaf)		1-Yes	0-No			
White bread (loaf)		1-Yes	0-No			
White rice		1-Yes	0-No	Indiv.		Multi-serv
Brown rice		1-Yes	0-No	Indiv.		Multi-serv
Canned or dry beans/chickpeas (unseasoned)		1-Yes	0-No	Indiv.		Multi-serv
Peanut butter		1-Yes	0-No	Indiv.		Multi-serv
Whole wheat dry pasta		1-Yes	0-No	Indiv.		Multi-serv
Regular dry pasta		1-Yes	0-No	Indiv.		Multi-serv
Canned fruit (in light syrup or juice)		1-Yes	0-No	Indiv.		Multi-serv
Canned vegetables (low sodium)		1-Yes	0-No	Indiv.		Multi-serv
High fiber cereal		1-Yes	0-No	Indiv.		Multi-serv
Low sugar cereal		1-Yes	0-No	Indiv.		Multi-serv
No added sugar applesauce		1-Yes	0-No	Indiv.		Multi-serv
Low sugar pudding packs		1-Yes	0-No	Indiv.		Multi-serv
High fiber crackers		1-Yes	0-No	Indiv.		Multi-serv
Energy shots		1-Yes	0-No	Indiv.		Multi-serv
				<b>Smallest (oz.)</b>		<b>Largest (oz.)</b>
Chips		1-Yes	0-No			
Baked/low fat chips		1-Yes	0-No			
Low sugar & low fat granola/cereal bars		1-Yes	0-No			
Pretzels (salted no other flavors)		1-Yes	0-No			
Popcorn (low-fat popped or microwave)		1-Yes	0-No			
Low fat trail mix and/or dried fruit		1-Yes	0-No			
Nuts (no sugar added)		1-Yes	0-No			
Seeds (like pumpkin, sunflower )		1-Yes	0-No			
Sports drinks		1-Yes	0-No			
Energy drinks		1-Yes	0-No			
Soda		1-Yes	0-No			
Diet soda		1-Yes	0-No			
Sugar sweetened beverage (not soda)		1-Yes	0-No			
Water		1-Yes	0-No			
100% Fruit Juice (not tomato)		1-Yes	0-No			
Beer		1-Yes	0-No			
Wine		1-Yes	0-No			

Figure 4: (continued)



Alamance, Buncombe, Cabarrus, Chatham, Durham, Franklin, Gaston, Granville, Harnett, Haywood, Henderson, Iredell, Johnston, Lincoln, Madison, McDowell, Mecklenburg, Orange, Person, Rutherford, Stanly, Transylvania, Union, Wake, and Yancey

Figure 5: Counties within the research area (25)

APPENDIX B: TABLES

Table 1: Food and beverage availability in drugstores observed in North Carolina stratified by race, county Status (Urban/Rural), and food desert status (n=108), 2015

Food Category		All Stores Observed n=108	Race		p	County, Rural/Urban Status		p	Food Desert		p
			Majority Minority n=13	Majority White n=95		Rural n=8	Urban n= 100		Not Food Desert n=69	Food Desert n=39	
			n (%)			n (%)			n (%)		
Fruit and Vegetables	Fresh Veggies whole and/or precut/packaged	3 (2.8)	0 (0.0)	3 (3.2)	0.5158	0 (0.0)	3 (3.0)	0.6193	1 (1.5)	2 (5.1)	0.2638
	Fresh Fruits whole and/or precut/packaged	4 (3.7)	0 (0.0)	4 (4.2)	0.4509	1 (12.5)	3 (3.0)	0.1710	2 (2.9)	2 (5.1)	0.5556
	Fresh/pre-packed sandwiches	6 (5.6)	0 (0.0)	6 (6.3)	0.3511	1 (12.50)	5 (5.0)	0.3729	3 (4.4)	3 (7.7)	0.4661
	Frozen veggies (unseasoned)	30 (27.8)	3 (23.1)	27 (28.4)	0.6866	2 (25.0)	28 (28.0)	0.8554	21 (30.4)	9 (23.1)	0.4122
	Frozen fruit (no sugar or seasoning added)	0 (0.0)	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a
Dairy	Low-fat white milk (1% or skim)	94 (87.0)	10 (76.9)	84 (88.4)	0.247	7 (87.5)	87 (87.0)	0.9677	62 (89.7)	32 (82.1)	0.2462
	Whole or 2% milk	107 (99.1)	12 (92.3)	95 (100.0)	0.0066	8 (100.0)	99 (99.0)	0.7763	68 (98.6)	39 (100.0)	0.4501
	Yogurt (low-fat)	76 (70.4)	11 (84.6)	65 (68.4)	0.2304	5 (62.5)	71 (71.0)	0.6124	52 (75.4)	24 (61.5)	0.1307
	Low/reduced fat cheese (not imitation)	53 (49.1)	5 (38.5)	48 (50.5)	0.4144	4 (50.0)	49 (49.0)	0.9566	34 (49.3)	19 (48.7)	0.9556

	Regular cheese (not imitation)	70 (64.8)	8 (61.5)	62 (65.3)	0.792	4 (50.0)	66 (66.0)	0.3618	47 (68.1)	23 (59.0)	0.3393
	Low sugar pudding packs	3 (2.8)	0 (0.0)	3 (3.2)	0.5158	0 (0.0)	3 (3.0)	0.6193	1 (1.5)	2 (5.1)	0.2638
Healthier Snacks	Baked/low fat chips	70 (64.8)	7 (53.9)	63 (66.3)	0.3772	6 (75.0)	64 (64.0)	0.5307	44 (63.8)	26 (66.7)	0.7619
	Low sugar & low fat granola/cereal bars	106 (98.15)	13 (100.0)	93 (97.9)	0.5975	8 (100.0)	98 (98.0)	0.6864	67 (97.1)	39 (100.0)	0.2832
	Pretzels	106 (98.15)	13 (100.0)	93 (97.9)	0.5975	8 (100.0)	98 (98.0)	0.6864	67 (97.1)	39 (100.0)	0.2832
	Popcorn (low-fat popped or microwave)	106 (98.15)	12 (92.3)	94 (99.0)	0.0958	8 (100.0)	98 (98.0)	0.6864	68 (98.6)	38 (97.4)	0.6798
	Low fat trail mix and/or dried fruit	103 (96.3)	13 (100.0)	90 (95.7)	0.4484	7 (87.5)	96 (97.0)	0.1744	65 (95.6)	38 (97.4)	0.6277
	Nuts (no sugar added)	106 (99.1)	13 (100.0)	93 (98.9)	0.7087	8 (100.0)	98 (99.0)	0.7752	67 (98.5)	39 (100.0)	0.4467
	Seeds	103 (96.3)	12 (92.3)	91 (96.8)	0.4227	8 (100.0)	95 (96.0)	0.5623	67 (98.5)	36 (92.3)	0.1025
	Canned fruit	96 (89.7)	12 (92.3)	84 (89.4)	0.7431	8 (100.0)	88 (88.9)	0.3196	63 (91.3)	33 (86.8)	0.4670
	Canned vegetables (low sodium)	4 (3.7)	0 (0.0)	4 (4.3)	0.4484	0 (0.0)	4 (4.0)	0.5623	3 (4.4)	1 (2.6)	0.6277
	No added sugar applesauce	32 (29.6)	1 (7.7)	31 (32.6)	0.0648	4 (50.0)	28 (28.0)	0.1898	21 (30.4)	11 (28.2)	0.8074
	High fiber crackers	103 (96.3)	11 (91.7)	92 (96.8)	0.3732	8 (100.0)	95 (96.0)	0.5623	66 (97.1)	37 (94.9)	0.5660
	100% Fruit Juice	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
Healthier Staple Foods	100% Whole Wheat bread (loaf)	40 (37.0)	1 (7.7)	39 (41.0)	0.0195	4 (50.0)	36 (36.0)	0.4301	27 (39.1)	13 (33.3)	0.5490
	Brown rice	22 (20.6)	1 (8.3)	21 (22.1)	0.266	4 (50.0)	18 (18.18)	0.0322	14 (20.6)	8 (20.5)	0.9926

	Canned or dry beans/chickpeas (unseasoned)	58 (54.2)	9 (69.2)	49 (52.1)	0.246	2 (25.0)	56 (56.6)	0.0848	35 (51.5)	23 (59.0)	0.4534
	Peanut butter	106 (99.1)	13 (100.0)	93 (98.9)	0.7087	8 (100.0)	98 (99.0)	0.7752	69 (100.0)	37 (97.4)	0.1758
	Whole wheat dry pasta	28 (26.2)	4 (30.8)	24 (25.5)	0.6872	4 (50.0)	24 (24.2)	0.1109	19 (27.9)	9 (23.1)	0.5817
	High fiber cereal	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Low sugar cereal	107 (99.1)	13 (100.0)	94 (98.9)	0.7102	8 (100.0)	99 (99.0)	0.7763	68 (98.6)	39 (100.0)	0.4501
	Water	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	All Meat (frozen or refrigerated)		3 (23.1)	30 (31.6)	0.5325	2 (25.0)	31 (31.0)	0.7230	22 (31.9)	11 (28.2)	0.6901
	Ham steak (frozen or refrigerated)	0 (0.0)	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a
	Chicken parts (frozen or refrigerated)	12 (11.1)	1 (7.7)	11 (11.6)	0.6758	1 (12.5)	11 (11.0)	0.8966	7 (10.1)	5 (12.8)	0.6709
	Ground beef (frozen or refrigerated)	17 (15.7)	1 (7.7)	16 (16.8)	0.3956	1 (12.5)	16 (16.0)	0.7937	13 (18.8)	4 (10.3)	0.2394
	Steak (frozen or refrigerated)	0 (0.0)	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a	0 (0.0)	0 (0.0)	n/a
	Other meat (frozen or refrigerated)	19 (20.2)	2 (16.7)	17 (20.7)	0.7433	2 (25.0)	17 (19.8)	0.7245	13 (21.7)	6 (17.7)	0.6410
Additional Items	White bread (loaf)	63 (58.3)	10 (76.9)	53 (55.8)	0.1472	4 (50.0)	59 (59.0)	0.6193	40 (58.0)	23 (59.0)	0.9191
	White rice	102 (94.4)	12 (92.3)	90 (94.7)	0.7199	8 (100.0)	94 (94.0)	0.4759	67 (97.1)	35 (89.7)	0.1088
	Hot dogs (regular)	54 (50.0)	6 (46.1)	48 (50.5)	0.7674	5 (62.5)	49 (49.0)	0.4624	36 (52.2)	18 (46.2)	0.5478
	Hot dogs (<15% DV fat)	30 (27.8)	3 (23.1)	27 (28.4)	0.6866	1 (12.5)	29 (29.0)	0.3160	22 (31.9)	8 (20.5)	0.2051

	Frozen entree (regular)	103 (95.4)	12 (92.3)	91 (95.8)	0.5753	8 (100.0)	95 (95.0)	0.5172	66 (95.7)	37 (94.9)	0.8529
	Frozen entree (<15% DV fat)	95 (88.0)	10 (76.9)	85 (89.5)	0.1921	6 (75.0)	89 (89.0)	0.2416	60 (86.7)	35 (89.7)	0.6690
	Regular dry pasta	105 (97.2)	13 (100.0)	92 (96.8)	0.5158	8 (100.0)	97 (97.0)	0.6193	66 (95.7)	39 (100.0)	0.1866
	Chips	107 (99.1)	13 (100.0)	94 (99.0)	0.7102	7 (87.5)	100 (100.0)	0.0004*	68 (98.55)	39 (100.0)	0.4501
	Energy shots	79 (77.4)	12 (92.3)	67 (75.3)	0.17	3 (37.5)	76 (80.9)	0.0049	53 (80.3)	26 (72.2)	0.3507
	Sports drinks	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Energy drinks	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Regular soda	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Diet soda	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Sugar sweetened beverage	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Beer	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a
	Wine	108 (100.0)	13 (100.0)	95 (100.0)	n/a	8 (100.0)	100 (100.0)	n/a	69 (100.0)	39 (100.0)	n/a

Table 1: (continued)

Table 2: Second analysis with data condensation

	n(%) All Stores	Rural/Urban County Status		p	Race		p	Food Desert		p
		Rural Area n=8	Urban Area n=100		Majority Minority n=13	Majority White n=95		Not Food Desert n=69	Food Desert n=39	
Brown rice	22 (20.56)	4 (50)	18 (18.18)	0.0322*	1 (8.33)	21 (22.11)	0.2660	14 (20.59)	8 (20.51)	0.9926
Whole-wheat dry pasta	28 (26.17)	4 (50)	24 (24.24)	0.1109	4 (30.77)	24 (25.53)	0.6872	19 (27.94)	9 (23.08)	0.5817
No added sugar apple sauce	32 (29.63)	4 (50)	28 (28)	0.1898	1 (7.69)	31 (32.63)	0.0648	21 (30.43)	11 (28.21)	0.8074
Frozen unseasoned vegetables	30 (27.78)	2 (25)	28 (28)	0.8554	3 (23.08)	27 (28.42)	0.6866	21 (30.43)	9 (23.08)	0.4122
Low-fat hotdogs	30 (27.78)	1 (12.5)	29 (29)	0.3160	3 (23.08)	27 (28.42)	0.6866	22 (31.88)	8 (20.51)	0.2051

\*Statistically significant  $p < 0.05$