

**Food Deserts and Faulty Foundations: How Urban Food Deserts Impact Childhood
Development and Education**

by

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Abstract

Urban food deserts are neighborhoods typically defined as low-income areas with low access to healthy food. These areas often have no grocery stores, grocery stores with limited or no produce, or convenience stores with unhealthy options. When children and their caregivers reside in urban food deserts, they are more susceptible to becoming food insecure. In the United States, over 10% of households are food insecure households with children. Despite these food insecure homes having children, adults generally protect their children from the burden of food insecurity. When children become food insecure, they can develop a variety of physical and mental conditions that can affect their ability to concentrate in school. In urban food deserts, children face similar barriers as adults. However, children are particularly affected as they are unable to autonomously travel for better food options. Subsequently, they must rely on their parents' choices, which are often limited by low incomes. Healthy food access is paramount to child development and achievement, particularly regarding education and standardized test scores. The public health significance associated with obtaining nutritious food items and living a healthy lifestyle is worth studying. Research indicates that a lack of access to nutritious food can lead to lower test scores among children from low-income backgrounds. This review of literature explores the association among urban food deserts, children's nutrition, and children's academic achievement.

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1.0 Introduction

In urban food deserts, children and their caregivers have reduced access to large supermarkets and grocery stores. Throughout the United States (U.S.), few data are available about the number of active urban food deserts. Urban food deserts disproportionately affect Black and low-income populations. Most low-income, Black children already face the social stigma associated with being a racial minority with few resources (Hager et al., 2017). This social stigma paired with residing in urban food deserts causes many low-income Black children and their families to opt for unhealthy food options from local fast-food restaurants (Garcia et al., 2018). Thus, most research focuses on food insecurity in association with urban food deserts.

For some children and their families, the burden of not having access to transportation makes grocery shopping a challenging task. When children cannot attain nutritious food, it can have detrimental effects on their physical and mental health (Holben & Marshall, 2017). For most children, passing school is their main priority. However, students who live in urban food deserts deal with other stressors and confounding factors that can negatively impact their academic achievement, particularly on standardized tests. In some instances, children's academic achievement in the present can influence their future outcomes. To better understand children's academic performance and nutrition when living in urban food deserts, it is important to investigate the barriers and stressors that promote urban food deserts.

The background of this review of literature highlights how food deserts are related to food insecurity. Children and their family members, of varying demographics, reside in food deserts which emphasizes that residence does not always correlate to food access. Despite this, most research about food deserts is framed from the perspective of food insecurity. This section outlines

and provides data about the impact that food insecurity has on nutrition throughout the United States. The background also details how food deserts influence the urban space, particularly noting some similarities and differences in urban locations of different sizes. Lastly, the background outlines the history of standardized testing and provides context about the role nutrition plays in children's academic performance.

In the methods section, the research questions and selected methodology are detailed. This paper utilizes a review of literature approach to explore how urban food deserts affect children's nutrition and academic achievement. To conduct the review of literature, searches are conducted in reputable databases to gather information. The results section outlines the important findings from the articles reviewed. In the results, the information becomes synthesized into categories that align with different levels of the Social Ecological Model.

The discussion provides recommendations for overcoming the barriers to children's nutrition and academic achievement. Using the Social Ecological Model, these recommendations can be applied at a variety of levels. However, emphasis is placed on community-level recommendations that can be used to amplify urban food deserts and provide them with sustainable initiatives. The conclusion of this review of literature addresses the study's limitations and provides a final overview about the factors that influence children's nutrition and academic achievement. More specifically, this review of the literature explores how factors like food insecurity, transportation barriers, and food purchasing habits affect children's ability to access nutritious meals and performance in school.

2.0 Background

Food deserts, particularly those located in urban areas, are contributors to various health disparities. In the public health field, the concept of food deserts is a recent development as the term was first coined in Scotland in the early 1990s (National Research Council, 2009). The initial definition of food deserts was developed by a Scottish resident who noticed how neighborhoods and populations interact with food differently in urban and rural areas (Cummins & Macintyre, 2002). The former definition aligns with the modern concept of urbanization, while newer definitions emphasize how food deserts can result in a lack of access to nutritious and affordable foods. Food deserts are often defined in the context of how they are measured as well as their locations.

In the United States, food deserts are frequently measured by proximity of healthy food options available to individuals, the presence of individual resources, and the availability of resources in one's community. An individual's proximity to healthy food is typically measured by one's distance to a grocery store and the number of grocery stores located in the area. Individual resources such as access to a reliable vehicle and a stable family income are additional factors related to food deserts. Similar to individual resources, neighborhood resources are measured by the quality and availability of public transportation as well as neighborhood income levels (United States Department of Agriculture, 2021). These measurements are utilized in both urban and rural environments to provide an estimate of the number of individuals residing in the United States who may be impacted by food deserts.

The majority of food deserts are the result of a myriad of social and economic disparities. Food deserts are frequently located in low-income environments, which are defined as areas with

a poverty rate of 20% or greater, or a median family income that is less than or equal to 80% of the median family income in the metropolitan area or statewide. In low-income locations with at least 500 people or 33% of the population living a distance greater than a half-mile in urban areas or greater than 10 miles in rural areas from a large grocery store, an estimated 53.5 million people or 17.4% of the United States' population resides in food deserts (USDA, 2021). As the distance from a large grocery store increases to one mile in urban areas, the number of people residing in food deserts decreases to an estimate of 18.8 million people or about 6% of the country's population (USDA, 2021). This trend indicates that most urban food deserts are located within a half-mile of a resident's home.

2.1 Food Deserts and Food Insecurity

The concepts of food deserts and food insecurity are closely related. Food insecurity is defined by the social and economic barriers that limit one's access to food (USDA, 2022a). Unlike food deserts, the definition of food insecurity has not changed much since the term's inception in the 1990s. Before the development of the concept of food insecurity, hunger was used to describe the involuntary shortage of food, which can result in malnourishment (National Research Council, 2006). This initial focus on hunger and malnourishment emphasizes the physical impact that food insecurity can have at the individual and community levels. While the concept of food insecurity is influenced by social and economic disparities, urban food deserts act as physical barriers to obtaining or maintaining a healthy and affordable diet.

Living in urban food deserts and experiencing food insecurity influences nutrition and health outcomes both individually and at the community level. In 2020, approximately 10.5% or

13.8 million people reported being food insecure (USDA, 2022b). Households with children experienced the most food insecurity as 14.8% were affected (United States Department of Agriculture, 2022b). Although households with children disproportionately faced food insecurity, only half of the children residing in these houses were food insecure (USDA, 2022b). The compounding effects of living in an urban food desert and experiencing food insecurity also make people more susceptible to developing chronic health conditions such as type 2 diabetes, heart disease, obesity, and specific cancers (National Center for Chronic Disease Prevention and Health Promotion, 2022). Food insecure children are at an increased risk for developing physical and mental conditions, such as recurrent stomachaches and headaches, anemia, asthma, childhood aggression, anxiety, depression, and hyperactivity among others (Holben & Marshall, 2017). Additionally, most food insecure children live in communities that are urban food deserts.

2.2 Urbanicity of Food Deserts

While food deserts exist in all types of urban areas ranging from small to large cities, medium and large cities often feel that burden the most. Children residing in large, central metropolitan food deserts had the highest rate of food insecurity at 13.2% in 2020; medium and small metropolitan food deserts impacted 10.5% of children (Ullmann et al., 2022). Large, central metropolitan counties are defined as cities with at least one million individuals residing within the largest principal city. In some cases, counties are designated as large, central metropolitan areas when at least 250,000 people reside in any principal city (National Center for Health Statistics, 2017). Cities such as Pittsburgh, Pennsylvania, Memphis, Tennessee, San Antonio, Texas, New Orleans, Louisiana, and Orlando, Florida were among the most food insecure in 2019 (Department

of Agriculture, 2021). Medium and small metropolitan areas are counties that have a principal city containing 250,000 – 999,999 inhabitants and fewer than 250,000 inhabitants, respectively (National Center for Health Statistics, 2017). A small city like Topeka, Kansas, and medium cities like Louisville, Kentucky, and Baltimore, Maryland, are considered urban food deserts that have existed for several years with few changes implemented to combat their effects (Greater Louisville Project, 2022; Jacques & Miller, 2016; Trickey, 2020). Across these small to large metropolitan cities, the culture, landscape, and residents may differ, but the associated harms of food deserts can be quite similar to those in large cities, especially when comparing specific population demographics.

2.3 Nutrition and Standardized Testing

Residing in an urban food desert can have long-lasting effects on nutrition, which is a vital part of every person’s development, but particularly children. Eating healthy meals consistently is optimal during all stages of growth; however, the majority of children in the United States do not meet the recommended daily intake for fruits, vegetables, and whole grains (Spokane Regional Health District, 2022). The fact that most children do not meet the standards for healthy food consumption indicates that this issue is pervasive beyond food deserts, although in food deserts, the nutritional divide is only exacerbated. The importance of good nutrition for development can be viewed by exploring the association between nutrition and education, particularly its effect on children’s academic achievement.

Standardized tests have been the primary method for measuring children’s academic achievement for nearly two hundred years. In the 1830s, the first public school was developed by

Horace Mann who was a Massachusetts's legislator and secretary of the board of education (Center on Education Policy, 2020). Previously, children were tested using oral examinations; however, in the mid-nineteenth century, educators shifted most formal assessments into written examinations. As written examinations grew in popularity, students' scores were utilized to make administrative and policy decisions in the pre-Civil War era. This transition to documenting students' academic progress in an objective and methodical manner resulted in the development of a variety of other standardized tests used to assess students' mental capacity and college preparedness. College entrance examinations began as separate assessments according to school; however, between 1890 and 1900, these examinations were further standardized into similar versions and the tests were distributed across all schools. In the early 1900s, standardized tests featured subjects such as mathematics, handwriting, spelling, and reading (National Education Association, 2020). After the rapid standardization of test-taking during this period, modern standardized tests have only continued to evolve based on this foundation.

As college examinations increased in popularity, a non-profit organization, the College Board, launched in 1916 to develop six comprehensive yet varied tests that emphasized new skills such as translating foreign languages by sight and essay writing. By 1926, the College Board established the Scholastic Aptitude Test (SAT), which assessed students' knowledge about vocabulary and mathematics. Nearly five years after the SAT's founding, the examination assumed the form that many commonly know today. The SAT's success in tandem with the passing of the Elementary and Secondary Education Act (ESEA) of 1965, introduced additional modern, standardized tests such as the American College Testing Program (ACT) examination, Advanced Placement (AP) examination, and the Preliminary Scholastic Aptitude Test (PSAT) (National Education Association, 2020). While standardized tests rapidly modernized for secondary and

post-secondary students, standardized tests for elementary age children emerged just before the turn of the 20st century.

Since the inception of standardized testing in the 1860s, the results have been used to influence funding and develop local, state, and national educational policies in the United States. In the 1990s, modern standardized testing for elementary age children began as a result of former President Clinton's educational reform policies such as the ESEA, Goals 2000: Educate America Act, and the Improving America's Schools Act (IASA). These policies aimed to improve the education system by raising standards, accountability, and test scores across all schools. The Goals 2000: Educate America Act offered funding to states with thorough and systematic plans to make changes in schools K-12; however, progress was tracked by requiring all students to take standardized examinations in mathematics and reading.

Similarly, the IASA, which was enacted about six months after Goals 2000, amended Title I funding that was associated with the ESEA and offered funding for training teachers (National Archives and Records Administration, 2015). Title I funding provides local educational agencies with four grants to support children from low-income families to achieve the state's academic standards. In 2015, an average of \$1,227 was allocated to each child eligible for Title I funds; however, for school districts located in large urban areas, \$1,466 was allocated per child (U.S. Department of Education, 2016). The Title I spending trend is similar to that of food deserts where large, metropolitan cities are disproportionately affected by the associated burdens. Despite this rampant and consistent use of standardized testing paired with governmental funding, the 1996 public opinion polls indicated that the United States' education system still did not meet standards (National Archives and Records Administration, 2015). With this inability to raise standards, it is important to consider how nutritional factors affect education.

Maintaining a nutritious diet is important for children's academic achievement. Academic achievement is multi-faceted as it incorporates a student's academic performance, academic behavior, and cognitive skills. Nutrition affects a student's class grades, standardized test scores, and their likelihood to graduate. Additionally, factors such as class attendance, dropping out, and behavioral challenges at school are associated with poor nutrition (National Center for Chronic Disease Prevention and Health Promotion, 2014). Children spend most of their days in school for ten months a year, which makes nutrition inside and outside of school an important part of their health. Disrupted eating patterns such as skipping breakfast are associated with interruptions to a student's alertness, memory, and problem-solving abilities. When students do not consume a sufficient amount of fruits, vegetables, or dairy, they are more susceptible to getting lower grades in the classroom (National Center for Chronic Disease Prevention and Health Promotion, 2014). The effects of nutrition outside of school can be difficult to track; however, when schools have switched to healthier food distributors, average test scores increased by a standard deviation of 0.03 or 0.04 (Anderson et al., 2017).

In standardized testing, children who consumed breakfast before state testing earned higher scores than children who did not eat breakfast (Ptomey et al., 2015). Among the children who ate breakfast, those who ate a healthier breakfast that contained servings of whole grains and no juice, received higher scores in both mathematics and reading than children who had a breakfast containing juice (Ptomey et al., 2015). Consuming food prior to taking a standardized test can positively affect children's scores, but the associated harms that children residing in urban food deserts disproportionately face, including unhealthy foods or no access to food, often prevent them from having a healthy breakfast.

3.0 Methods

3.1 Research Topic

This review of literature aims to explore the influence of urban food deserts on children's nutrition and academic achievement. In the United States, urban food deserts are environments with little variety. Typically, urban food deserts have similar traits in terms of population demographics and behaviors despite the location. While there are numerous studies that focus on children's nutrition and academic achievement, few studies explore the association between academic achievement and residing in nutrient-deficient locations like food deserts. The dearth of research on these topics sparked the following research questions:

How do urban food deserts affect children's nutrition and their academic achievement?

What are the factors that affect children's ability to attain nutritious food options?

3.2 Methodology

To answer the research questions, a rapid review of literature was conducted between the months of May and August using the PubMed and Google Scholar databases. The majority of searches were conducted in the PubMed database. In PubMed, a total of 21 searches led to articles to be reviewed. From Google Scholar, one search was completed to add another article for review. In this rapid review of literature, these precise, hypothesis-generating research questions were

divided into queries that focused on factors such as urban food deserts, nutrition, and academic achievement.

3.3 Search Results

In PubMed, the queries that produced the most articles were “urban food deserts AND nutrition,” “urban food deserts AND school,” and “urban food desert AND test scores.” In Google Scholar, one query was completed using the variables, which was “urban food desert AND academic achievement” (**Table 1**). The first PubMed query, “urban food deserts AND nutrition,” produced articles between June 2017 and June 2022 and resulted in 27 articles. From this search, six articles were automatically excluded as the urban food deserts were not located in the United States. The remaining 21 articles were utilized to formulate the four categories used to synthesize the research questions. In Google Scholar, the “urban food deserts AND academic achievement” search resulted in one article that was produced within the last ten years. This Google Scholar article led to the discovery of the final article that was used to complete the review of literature. The rapid review of literature resulted in 22 articles that were used to synthesize the association between urban food deserts, children’s nutrition, and their academic achievement.

Table 1 Rapid Review of Literature Queries

Search Number	Database	Query	Articles Returned	Articles Reviewed
1	PubMed	Urban food deserts AND nutrition	27	21
2	PubMed	Urban food deserts AND test scores	410	0
3	Google Scholar	Urban food deserts AND academic achievement	1	1

4.0 Results

The relationship between urban food deserts and nutrition influences children's lives on various levels. Considering these different influences, the multi-level Social Ecological Model of Health is a framework that can be used to interpret the intersections at each level (Agency for Toxic Substances and Disease Registry, 2015). The Social Ecological Model of Health typically has four levels: individual, relationship, community, and societal. On the individual level, most children do not have the autonomy to make their own decisions, especially nutrition-based decisions. With this, it is important to understand how the other three levels interact to influence children's decision making as they grow older. For children residing in urban food deserts, their personal relationships, particularly with parents, other caregivers, and friends, determine factors such as access to nutritious food options and set the foundation for their future relationship with food.

4.1 Food Deserts and Adult Caregivers' Health Risks

In urban food deserts, parents and other adult caregivers such as grandparents, aunts, uncles, and siblings often experience the harshest effects of the lack of access to nutritious foods. Many adult caregivers who face the burden of food deserts are also affected by chronic health conditions that result from conditions within their neighborhoods or are exacerbated by those conditions. In a study conducted by Testa et al. (2020), adults age 24-34 years old who live in food deserts had a statistically significant association for developing cardiovascular health risks. Adult

caregivers are more susceptible to cardiovascular risk due to residing in locations that are over-saturated with unhealthy food retailers that often serve nutrient-deficient foods. In order to get nutritious foods, many adults have to venture outside of their neighborhoods, which gives them less time to participate in physical activity, thus increasing their risk of acquiring cardiovascular health conditions, especially when paired with over consumption of unhealthy foods. Additionally, considering that most adults who reside in food deserts are also food insecure, they already face financial strains that may prevent them from having consistent health check-ups or from having the ability to seek out medical services at all.

After the conclusion of the Testa et al. (2020) study, an association was found between adults living in food deserts and the development of cardiovascular health risks, which was particularly impacted by area and socioeconomic status. This result differs from other studies like Kelli et al. (2017) in which income was the primary driver of cardiovascular health risk rather than living in a food desert. The study by Testa et al. (2020) further explores how food deserts impacts individuals of different socioeconomic strata. In particular, the study deduces that low-income people residing in food deserts are more likely to develop cardiovascular health risks than low-income people who do not live in food deserts, or people who live in food deserts but earn at least an average income. This trend indicates that food insecure caregivers living in food deserts frequently deal with chronic health conditions that can ultimately impact the nutrition and development of their dependents.

In a study conducted by Kelli et al. (2017), adults living in food deserts across a large metropolitan area, particularly the locations surrounding Atlanta, had a higher prevalence of oxidative stress, inflammation, and arterial stiffness, which are symptoms associated with cardiovascular disease (CVD). These adults are also more susceptible to developing CVD because

of the prevalence of CVD related risks happening in their communities such as higher rates of hypertension, smoking, fasting blood glucose levels, body mass indexes, and ten-year risk for contracting CVD. Interestingly, while individuals residing in food deserts experience increased rates of CVD, low food access or living in a food desert was not the primary driver of CVD. Instead, income played a primary role in determining risk for developing CVD. While these two cardiovascular related studies had different outcomes when comparing the same variables of interest, this variation emphasizes how diverse urban food deserts can be, especially in the context of health. Since adult caregivers living with chronic health conditions can influence the nutrition of their dependents when living in an urban food desert and combatting food insecurity, it is important to consider how grocery shopping habits also relate to children's nutrition.

4.2 Caregivers' Grocery Shopping Habits in Urban Food Deserts

In an urban food desert, children and their adult caregivers are often overwhelmed by a plethora of convenience stores that offer largely unhealthy food options. Given the proximity, some caregivers opt to feed themselves and their families the convenience store offerings rather than traveling to a supermarket for nutritious food choices. However, many caregivers find themselves leaving their neighborhoods to shop at grocery stores; in some cases, caregivers will even travel further outside of a food desert beyond the closest grocery store to do their shopping. A caregiver's grocery shopping preferences are heavily influenced by available resources and present barriers within their urban food desert; thus, it is important to understand what causes this dichotomy.

Consistent intake of nutritious foods is an important part of children's development. However, current research on urban food deserts produces conflicting results about the impact of increasing access to healthy foods in these locations. Some studies like MacNell (2018) indicate that caregivers who shop at large grocery stores tend to purchase and consume more produce than caregivers who shop at convenience stores, while other studies show no relationship between a caregiver's distance from the grocery store and their family's consumption of fruits and vegetables (Dubowitz et al., 2015). Urban food desert research has many domains and exploring a caregiver's shopping habits is one of the newer focuses in research. Few studies decipher the relationship between a caregiver's geographic spatial relation to an urban food desert and their shopping behaviors.

A study by MacNell (2018) explored this relationship between geographic space and a caregiver's shopping practices by conducting both quantitative and qualitative analyses in urban and rural food deserts. In the urban food desert, the quantitative aspect of this study was modeled from geo-ethnographic data collected by a geographic information systems (GIS) analysis of census tracts, which have been overlaid by ethnographic data collected in interviews. This mixed methods approach was further amplified by conducting pre-study and post-study interviews. During the initial interviews, basic demographic information such as gender and race, household composition, food security status, and access to transportation was collected to be used during the study and for analyzing the results afterwards. The post-study interviews focused more on the caregivers' shopping habits, particularly seeking information about the three grocery stores that each caregiver frequents the most. This study defined caregivers as females, many of them mothers, with children between the ages of two and eight at the time of the study. While all caregivers who reside in urban food deserts are not food insecure, approximately half of the

caregivers in this study were food insecure based on their self-reported incomes at or below the 200% federal poverty line.

This urban food desert, which is located in East Branson County, Missouri, mostly featured caregivers between the ages of 22 and 52 and who identified as Black (MacNell, 2018). This trend indicates that young and middle adult aged Black women and their children are disproportionately affected by urban food deserts. Considering income, across all three food deserts, caregivers residing in urban food deserts had a monthly annual income nearly 500 to 1,000 dollars less than caregivers in the predominantly white, rural food deserts. Despite receiving lower wages, fewer women living in urban food deserts reported experiencing food insecurity than caregivers in rural food deserts. As mentioned, food security status affects a caregiver's ability to navigate urban food deserts. While the relationship between a caregiver's food security and shopping behaviors is important, for the basis of this study, food security is not a primary factor of analysis when gauging these shopping habits. However, studies like those by Hammelman (2018) and Colón-Ramos et al. (2018) discuss how factors such as reliable social networks can influence caregivers impacted by urban food deserts and food insecurity.

As mentioned, some caregivers prefer to grocery shop outside of the confines of their food desert. Similarly, in the MacNell (2018) study, most women residing in the urban food desert avoided the grocery store closest to their homes in preference for larger supermarkets located nearly two miles further away. These larger supermarkets are popular chains like Food Lion and Walmart. In the urban food desert, the closest grocery store was actually observed to be a large, chain supermarket, Food Lion, which is located approximately a mile away. Despite this proximity to a large supermarket, most caregivers still preferred to shop at different supermarkets (MacNell, 2018). One reason that women preferred to shop outside of the urban food desert was the increased

variety of store options. Some caregivers frequently shopped at membership-based supermarkets like Costco and Sam's Club, larger farmer's markets that offer fresh produce, and international markets that provide options akin to their cultural backgrounds (MacNell, 2018). These trends emphasize that caregivers' shopping behaviors are influenced by factors such as availability of specific food options and the perks associated with a supermarket membership.

Considering that only 55% of caregivers living in the urban food desert had access to a car, nearly half of the other caregivers who are leaving their neighborhoods to shop face the additional burden of accessing transportation (MacNell, 2018). Caregivers who are able to utilize public transportation are often unable to obtain the same amount of healthy food due to limited physical space on most buses, taxis, and trains, and the inability to carry as many groceries by hand. In a study by Hammelman (2018), Latina women residing in or near Washington D.C.'s food deserts reported additional barriers to accessing transportation such as cost of transit, the inability to access affordable supermarket options by transit, and safety concerns. The caregivers in the MacNell (2018) study frequently depended on their social networks for transportation to and from grocery stores. Mothers with access to a car also faced the financial strain associated with fueling up their cars. These barriers to transportation and the cost of food are large factors in forming a caregiver's shopping behaviors and preferences.

The price of food was the primary factor in determining which supermarkets the caregivers' frequented the most. In the MacNell (2018) study, approximately $\frac{3}{4}$ of the participants coined price as the factor that affects their shopping decisions the most in all three food deserts. Additionally, over 90% of women indicated that price and one additional factor were often tied as the most important factor in their decision-making. Since price is a primary focus, caregivers often prioritize seeking the largest quantities of food at the most affordable price point to feed their children rather

than on convenience. In an urban food desert, most women found themselves shopping around at multiple stores in search of the best deal. In scenarios where the caregiver may need to prioritize convenience, most women still chose to shop at their preferred supermarket over the closest supermarket (MacNell, 2018). For example, if a caregiver living in the urban food desert happened to be missing a necessary ingredient, often times they would forego that item instead of shopping at the more convenient supermarket or convenience stores. The primary motivation for avoiding the nearest food outlets is price, particularly because local convenience stores consistently upcharge for the same products that caregivers can get for cheaper at their preferred supermarkets (MacNell, 2018). Despite price being the largest barrier when determining which foods to purchase, caregivers with strong social networks often depend on them to feed themselves and their families.

In the Hammelman (2018) study, Latina women utilized their social networks to share food, transportation, and household responsibilities to combat the harms of residing in an urban food desert and navigating food insecurity. As mentioned, safety is a large concern for the women residing in Washington D.C.'s food deserts; the majority of women in the Hammelman (2018) study preferred to shop with a friend to increase safety. Shopping with a friend also reduces the costs associated with using public transportation. In ideal cases, Latina women can depend on their friends to provide transportation as well as accompany them on their shopping excursions. Similar to the mothers in the MacNell (2018) study, the Latina women frequented membership-based grocery stores located on the outskirts of their neighborhoods, when they can obtain rides from their friends, because of the ability to purchase larger quantities of food in a relatively safe location. For the Latina women, the price and preference for specific foods often trumps convenience as they are willing to move throughout Washington D.C. to find the most affordable options. A

caregiver's grocery shopping habits, which in turn affects children's nutrition, are impacted by a variety of factors such as price of food, availability of food options, access to transportation, safety of the surrounding areas, and the ability to rely on social networks. Another method that can be utilized to explore how these factors interact in urban food deserts is Photovoice.

Generally, urban food deserts disproportionately impact Black populations more than others, as twice as many Black people live in urban food deserts than their white counterparts (Dutko et al., 2012). This disparity has resulted in many Black caregivers having less access to healthy foods in their neighborhoods, which in some cases can negatively affect the nutrition of their children. Black caregivers are also more susceptible to experiencing racism, which persists within urban food deserts, particularly in these local grocery stores. This undue burden can prevent Black caregivers from conveniently purchasing the best food for their families.

In the Colón-Ramos et al. (2018) study, Black caregivers who reside in Washington D.C. used Photovoice, a qualitative method composed of taking photos to answer a research question, and participated in supplemental interviews that provided additional context about their photos. The study consisted of ten caregivers, eight of whom were grandparents and two were mothers. This study primarily sought to understand the kinds of foods that Black caregivers feed their children and if they were pleased with these food options. The majority of caregivers had no issues with the kinds of foods that they were feeding their children despite some of the options being considered unhealthy. Among the ten caregivers, providing their children with a wide variety of food options was the main priority. Interestingly, factors like time and convenience affected the food choices of mothers unlike the food choices of the grandparents. With this, mothers were more likely to feed their children fast food, particularly fast-food breakfasts, more frequently than grandparents. For grandparents, unhealthy food options consisted of snack foods like popsicles,

candy, and chips. As mentioned, some caregivers also live with chronic health conditions that can affect their food purchasing habits. In the Colón-Ramos et al. (2018) study, caregivers living with chronic health conditions like diabetes were more likely to purchase healthy food options for their children. In addition to prioritizing the provision of a variety of food options, caregivers also prioritized purchasing food that their children would enjoy. With this, there is more variation in what is considered healthy foods as some children fervently avoid fruits and vegetables. In these cases, caregivers strive to give their children the healthiest options of the foods they are willing to eat. For example, one caregiver took a picture of their child's favorite food, a jelly sandwich. To make this sandwich healthier, the caregiver usually purchases healthier bread options such as multigrain or whole wheat, and real fruit jam rather than artificial fruit jelly. Throughout this study, caregivers describe how location and societal tensions around race impact their ability to navigate an urban food desert.

The majority of Black caregivers in the Colón-Ramos et al. (2018) study lived in a neighborhood with only one grocery store as the second store closed down before the start of the study. The caregivers described the local supermarket as small and congested with limited parking and less cleanliness than other stores. These barriers paired with higher food costs result in some caregivers opting for takeout food options. Similar to the MacNell (2018) study, the Black caregivers in the Washington D.C. food desert also noted having less quality food options in their local supermarket. In the pictures taken by the caregivers, some images highlight spoiled fruits and vegetables while other caregivers commented on poor meat quality and lack of food variety available in the local supermarket. One caregiver also mentioned that the local supermarket consistently has a surplus of expired foods and a tendency of promoting sales for these expired foods, sometimes several months after the products have expired. Despite some caregivers

continuously bringing this issue up to management, it persists, which again speaks to societal barriers.

Many Black caregivers in the Colón-Ramos et al. (2018) study felt intentionally disregarded in their own community due to their race and low economic status. These caregivers also described the differences between the supermarket located in their neighborhood and the supermarkets in surrounding affluent neighborhoods. In particular, the caregivers noted that the more affluent supermarkets were frequently better stocked than their local supermarket. On the other hand, in the urban food desert, tensions around race and low economic status permeated beyond the local supermarket to other areas of society. The areas that are particularly impacted included education, health care access, benefits programs, presence of parks and green spaces, employment opportunities, and housing. While this research primarily focuses on the food habits of the caregivers and their families, one mother submitted a photo of her child playing in the park. Although this image does not directly pertain to food habits, it shows the influence that food has on a child's physical development. The mother also notes the disparity in the quality of the playground equipment at the park in the urban food desert, particularly highlighting broken swings and a slide. Children who live in urban food deserts and have reduced access to green space or parks can be more susceptible to developing health conditions and may have more challenges concentrating in school.

Similar to participants in the Hammelman (2018) study, Black caregivers in the Colón-Ramos et al. (2018) study relied heavily on their social networks to navigate the urban food desert. With the support of their family members and friends, Black caregivers have the increased flexibility to shop outside of their neighborhoods to purchase food for their children. Despite relying on their social networks to provide transportation and occasionally financial support, these

caregivers were most affected by the prices of healthier foods. Some caregivers depended on national programs like SNAP benefits and their children's school lunch program to supplement their grocery shopping due to these elevated food costs.

While many of the caregivers relied on national programs for additional support, only a few caregivers also utilized local programs to supplement their shopping (Colón-Ramos et al. (2018). The caregivers who used these local programs were often connected to entities like churches and schools via their social networks. One caregiver described picking up a different type of vegetable at the food drive that takes place at their children's school each month. In addition to the vegetables, caregivers were provided with a manual that included the vegetables' nutritional information and some recipes to use the ingredients. These caregivers strive to do the best that they can for their children; thus, relying on social networks, shopping at a variety of different supermarkets for the best deals, purchasing the healthiest food options they can afford, and supplementing groceries, as necessary, with national and local food resources, are additional steps that caregivers are willing to take to ensure that their children have the best food available. The experiences of the Black caregivers living in Washington D.C. are not universally those for caregivers living in all urban food deserts. To gain a better understanding of the nutritional experiences of children and their caregivers in an urban food desert, it is important to explore the impact of the urban food deserts in surrounding cities like Baltimore, Maryland.

4.3 Navigating Baltimore's Food Deserts

While access to supermarkets and a caregiver's shopping habits are the main factors typically considered in an urban food desert, it is important to consider the effect that food prepared

outside of the home can have in this environment. Similar to other urban food deserts, the food deserts in Baltimore are oversaturated with fast food restaurants and other take-out food options. Fast food and other takeout food options typically have lower nutritional quality than a meal cooked at home, and when these meals are consumed in excess, can result in the development of chronic health conditions like obesity. The increased uptake of take-out food disproportionately affects low-income individuals, particularly low-income Black caregivers and their children, more than other populations. One reason for this disparity is the high cost associated with purchasing groceries, especially healthy food options (Colón-Ramos et al., 2018). A study conducted by Garcia et al. (2018) in Baltimore's food deserts explored the behaviors that motivate a caregiver to prepare meals at home rather than purchasing take-out. The study also highlighted the frequency in which caregivers purchased take-out meals versus preparing meals at home. A total of 298 caregivers, mostly Black women, participated in this study and 51% of them prepared meals at home at least once a day. The caregivers who cooked at least once a day also purchased fewer take-out foods on a weekly basis and had positive perceptions about healthy foods. In this study, most caregivers preferred fast food restaurants and take out options more than cooking as 59% of caregivers ate take-out more than once per week. Caregivers who were more inclined to eat take-out options multiple times a week were less likely to eat healthy foods and lacked an understanding about the importance of eating healthy foods.

Considering that in this study, most caregivers eat take-out food at least once a week, this indicates that their children are also eating take-out foods with similar frequency (Garcia et al., 2018). Children who eat excess amounts of take-out foods are also susceptible to becoming obese. In an urban food desert, some children do not have access to safe places to get exercise. This factor coupled with children's higher consumption of unhealthy foods has raised concerns about

children's nutrition and the development of health conditions like obesity. In Baltimore, pediatric obesity is a pressing issue primarily affecting young Black girls from low-income backgrounds (Hager et al., 2017). This trend of pediatric obesity is a result of routine intake of foods with low nutritional value (Hager et al., 2017). In an urban food desert, pediatric obesity is also affected by factors such as the built environment, increased access to fast food and take-out restaurants, and the availability of a supermarket in their neighborhoods. As mentioned, the definition of an urban food desert is multi-faceted. For some, urban food deserts are solely defined by a lack of access to grocery stores in an environment. While for others, urban food deserts are defined by both a lack of access to grocery stores and the availability of food options, which are often considered unhealthy. As a result of this, some researchers consider locations oversaturated with unhealthy food options to be food swamps rather than food deserts.

A study by Hager et al. (2017) explores the dichotomy between young Black girls who live in urban food deserts and those living in urban food swamps in Baltimore. In the context of this study, urban food swamps were designated as areas with four or more convenience stores within a 0.25-mile radius of residents' homes. This study included 632 female participants between the ages of 10 and 14; over half of the girls who participated were classified as overweight or obese. Approximately 32% of the girls lived in urban food swamps while 26.5% of participants lived in urban food deserts. Some of the girls, approximately 16%, resided in both an urban food swamp and food desert. In this study, the researchers sought to understand how the consumption of healthy foods such as fruits and vegetables and unhealthy foods were similar or different across the two environments. Young girls who lived in urban food swamps ate more snacks and desserts daily than girls who did not reside in urban food swamps. Interestingly, among the girls who lived in urban food swamps, those who lived near four or more convenience stores consumed more snacks

and deserts than those who lives near one to three convenience stores. Considering children's nutrition, girls with a lower BMI than average for age consumed more snacks and desserts than girls with a higher BMI than average. This trend indicates that pediatric obesity is influenced by factors beyond unhealthy food consumption in this environment. While urban food deserts and urban food swamps were compared in this study, there was no association found between living in an urban food desert and consuming fewer fruits and vegetables daily. There are several reasons why an association may not have been determined; however, one important reason is the low consumption of fruits and vegetables by the girls overall (Hager et al. 2017).

Most families who live in urban food deserts obtain their food outside of their neighborhoods (Kelli et al., 2017). Often times, caregivers will rely on their own mode of transportation, social networks or public transportation to get groceries (Hammelman, 2018). However, in some cases, caregivers do not have that flexibility and must rely on local convenience stores or shops to get necessary items. Additionally, as mentioned, many families that live in urban food deserts have low incomes, which qualifies them for governmental benefit programs such as the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). With the assistance of SNAP and WIC, eligible caregivers can receive a monthly benefit that is calculated based on household size and one's net income (Center on Budget and Policy Priorities, 2022). Caregivers have the opportunity to use this monthly benefit at most grocery stores and certain convenience stores as long as they maintain specific requirements. In December 2016, stores that accepted SNAP, were required to have at least seven options in the four staple food categories (meat, poultry, or fish; bread or cereals; fruits or vegetables; and dairy products), to stock at least three units of each offering, and to ensure that at least three of the staple food categories had perishable items available for purchase (Ross et al.,

2018). Prior to the requirement, SNAP-eligible stores were only required to have three options in each staple food category. These community and societal changes to SNAP are large improvements for caregivers residing in urban food deserts and those struggling with food insecurity.

A study by Ross et al. (2018), which took place in Baltimore, investigated the changes to SNAP benefits from the perspective of the convenience shop owners. More specifically, the researchers were interested in discovering how prepared convenience shop owners were for the SNAP changes. With the updated SNAP requirements, convenience shop owners became required to stock at least double the number of products as they had before in each of the four staple food categories. For some convenience shop owners, increasing product stock resulted in necessary structural changes and changes with food sourcing as well. The study included a sample size of 17 stores. Of these 17 stores, 14 convenience shop owners were completely uninformed of the updates to SNAP. The three convenience shop owners who were aware of the changes learned this only from local community organizations. This lack of awareness of the changes by most convenience store owners indicates that the updates to SNAP were not properly communicated to many store owners.

In addition to these updates, researchers were interested in exploring the convenience store owners' general understanding of SNAP program requirements and conditions (Ross et al., 2018). Unfortunately, none of the convenience store owners were aware of the SNAP stocking requirements or could describe the necessary conditions for maintaining status as a SNAP-eligible business (Ross et al., 2018). While these convenience shop owners have a responsibility to remain informed about SNAP, when updates are so drastic, it is important to ensure that all parties are aware. As mentioned, three convenience store owners were aware of the SNAP update; however,

only two of those owners met the necessary requirements at the time of study (Ross et al., 2018). Despite the majority of convenience store owners being unprepared for the update, once informed, most of them remained confident that they would meet the requirements.

Considering the benefits of this update, most convenience store owners did not see a personal or professional benefit with the SNAP change (Ross et al., 2018). However, some convenience store owners noted the customer benefit, particularly how quick access to healthier food options could promote healthier lifestyles within these urban food deserts. Other convenience shop owners found a minor professional benefit with the new SNAP update. Those owners, in particular, believed that introducing these stocking changes would result in a reduction of SNAP trafficking from illegitimate businesses throughout Baltimore. SNAP trafficking refers to businesses that are set up only to redeem their customers' benefits for money; often times, these businesses do not provide food options beyond snacks and candy. Despite their presence, these SNAP trafficking businesses are a minority throughout the city. Most convenience store owners run their business by providing goods that they know their clientele will purchase. In the Ross et al. (2018) study, the convenience store owners had the perception that their customers would not seek out healthier food options.

The owners in the Ross et al. (2018) study also had concerns about stocking and pricing these new items. Some owners believed that they would not be able to continually maintain stock of products that do not sell well. Also, some owners were worried about competing with grocery stores in surrounding neighborhoods that provide lower prices for the same goods. While the addition of healthier food options in convenience stores is a benefit for SNAP-eligible families living in urban food deserts, convenience store owners' lack of awareness about SNAP poses a great concern for families seeking a healthier lifestyle.

With the right assurances, low-income caregivers and their children who live in urban food deserts can shop for nutrient-rich products in their own neighborhood. Like Baltimore's food deserts, food deserts in other cities have similar community-level trends regarding the overconsumption of fast foods and take-out foods, pediatric obesity rates, and SNAP eligibility. Given these similarities throughout other sections of the community, it is important to understand how urban food deserts interacts with schools, particularly children's academic achievement.

4.4 Academic Achievement in Urban Food Deserts

Outside of the time children spend with their caregivers, most children's mealtime decisions are made by other adults in an academic setting. Historically, schools have not always provided the healthiest meal options. For example, in the 1990s, major fast food corporations like McDonalds provided school lunch options for children (Wells, 2021). With the increased uptake of fast food, fast-food corporations grew richer while the pediatric obesity rate swiftly climbed. The turn of the 21st century resulted in major shifts with school lunch providers as fast-food corporations were replaced with subsidized lunch distributors. Despite these changes, school lunches still had room for improvement in regard to providing healthy food options. It was not until former First Lady Michelle Obama implemented the *Let's Move!* program in 2010 that schools were incentivized to provide healthy breakfast and lunch options (Obama, 2010). Under this program, schools were required to integrate more whole grains, fruits, and vegetables into all meals while reducing fat and sodium levels. Meals were also portioned to align with children's daily nutritional intake. During the span of the program, over 20,000 schools in all 50 states and Washington D.C. participated and reached over 11 million students (Obama, 2010). By

introducing healthier school meals, reducing pediatric obesity was the main goal; however, through these changes some researchers have become interested in the impact on academic achievement.

A study by Frndak (2014) explored the connection between urban food deserts and academic achievement for a sample of 4th grade students based in New York. Prior to this study, most research focused on poor nutrition in the context of obesity and hindered cognitive development. Previous studies that have investigated children's diets reported that students who ate nutritious meals received higher scores than students who did not have a nutritious meal. On the other hand, students who were combatting food insecurity received lower scores than their food secure classmates.

The Frndak (2014) study connected concepts from previous studies and sought to understand if children residing in urban and suburban food deserts negatively affected standardized test scores in English, math, and science. However, this study showed no association between students with low access to food and achieving poorly academically. Considering that residing in a food desert does not always equate to food access, the results may have been skewed based on these factors. When additional factors related to food deserts such as low-income status and access to transportation were observed, the trends in academic achievement were more in line with what was expected. Students with low food access and incomes had significantly lower test scores across all three subjects than students who did not have low food access or families with low incomes. When exploring the association of access to transportation with low food access, students also received significantly lower test scores than their counterparts. These trends indicate that living in an urban food desert may not influence children's grades; however, confounding factors such as

income and access to transportation, which can affect one's ability to access food, do at least indirectly impact children's grades.

Similarly, the Long Shadow study by Alexander et al. (2014), explored how a student's low-income background can affect their academic achievement and social mobility in the future. This longitudinal study followed about 800 Baltimore students, the majority of whom resided in urban food deserts, from the first grade until their late 20s. Among children whose parents were of low socioeconomic status, only 4% of participants went on to achieve their bachelor's degrees. Considering social mobility, 10% of participants with low socioeconomic statuses moved into higher socioeconomic statuses. In Baltimore's food deserts, Black residents are disproportionately affected as 35% of Black residents live in food deserts while only 8% of white residents live in food deserts. Children, in particular, are affected by urban food deserts as 35% of children in Baltimore County lived in urban food deserts. As mentioned, children who live in urban food deserts are also more susceptible to becoming malnourished which can affect their cognitive development.

Children's cognitive development and academic achievement are highly related. In Baltimore's urban food deserts, Black students are least likely to graduate (Rubinstein, 2015). Generally, food secure children perform better academically than food insecure and marginally food insecure children. Food insecure children are more likely to develop chronic illnesses that can increase their chances of entering the hospital or developing pediatric obesity (Rubinstein, 2015). As mentioned, caregivers in urban food deserts tend to frequent fast-food and take-out restaurants more than their counterparts. Research indicates that children with increased fast-food consumption often underperform academically compared to children with consistently nutritious diets (Colón-Ramos et al., 2018). In addition to academic challenges, food insecure children are

also more likely to develop behavioral difficulties that can result in future involvement with the prison industrial complex (Rubinstein, 2015). Once children get involved with the system, they become 25% to 30% less likely to find employment in the decade following incarceration, which can affect one's social mobility in the future (Rubinstein, 2015).

The importance of consuming healthy food options is one that should be instilled in children at a young age. One study found that increased uptake of processed foods can negatively affect a child's IQ score in the future (Alexander et al., 2014). These trends indicate that proper nutrition is not only associated with achievement in school but can drive achievement in young adulthood and beyond.

Lastly, school meals can prove to be a stressor for children and their families on their own. Typically, school meals are associated with a cost that is contributed by tax-payer support and the money that students pay for school breakfasts, lunches, and a la carte items (Sorrells, 2022). Following the 2008 recession, the National School Lunch Program (NSLP) launched an expansion program known as Community Eligibility Provision (CEP) that allowed schools to offer free and reduced price lunches for all students (Fleischhacker & Campbell, 2020). With the launch of CEP, fewer students nationally have been participating in the NSLP. In addition to fewer students utilizing NSLP, the rising cost of school lunches, which is approximately \$2.60 apiece, has resulted in an increase in unpaid school meal debt (Fleischhacker & Campbell, 2020). Unpaid school meal debt is the amount of money that a student owes to a school meal program. A recent report indicates that over 75% of school districts in the nation have school meal debt with a median balance of \$3,400. While the cost of school meals should not be the burden of children, students with unpaid lunch debt face embarrassment and often go without breakfast or lunch (Fleischhacker & Campbell, 2020). The burden of school lunch debt has an impact on children's academic

achievement. When children are unable to concentrate due to missing meals or are bullied for not having the means to afford school meals, achieving academically is not their main priority as their basic needs have not been met.

5.0 Discussion

Children who live in urban food deserts typically face confounding barriers, many of which are not in their control, that affect their ability to perform academically. Using the Social Ecological Model, these multi-level barriers are explored from interpersonal, community, and societal perspectives. Interpersonally, children's nutrition is largely influenced by their caregivers and peers. In the community, children's nutrition is impacted by school, their housing accommodations, and factors associated with the urban landscape. At the societal level, race and socioeconomic status are the largest factors affecting a children's nutrition and academic achievement.

The results of this review of literature indicate that urban food deserts can affect children's nutrition and academic achievement; however, the associations can differ based on the level and factors that are being studied. At the interpersonal level, the behaviors of children's caregivers have a large impact on the types of food children can access. For example, in studies that have explored the association between urban food deserts and chronic health diseases such as CVD, caregivers living in urban food deserts are more susceptible to developing CVD (Kelli et al., 2017). Caregivers who develop CVD often experience increased stress from seeking out groceries within their environment and increased consumption of fast-food and take out restaurants. When CVD is studied in the context of poverty, there was no association found between caregivers with low incomes developing CVD (Kelli et al., 2017). This indicates that urban food deserts can largely impact the health risks of caregivers, which can affect their ability to provide nutritious food options for their children and families. In urban food deserts, children who have caregivers with CVD have difficulties performing well in school because they are stressed about the health

outcomes of their caregivers and are not equipped with the proper nutrients to deal with the stressors.

Some caregivers manage chronic health conditions while living in an urban food desert; however, a burden that all caregivers in these environments face is a lack of access to grocery stores. When caregivers do not have access to grocery stores, their grocery habits are influenced by a variety of external factors such as access to transportation and distance to grocery stores caregivers face. As expected, most studies that focused on caregivers' shopping habits indicated that caregivers generally preferred to shop outside of the confines of the food desert (MacNell, 2018). These caregivers preferred to shop outside of their neighborhoods because the grocery stores further away are often larger. There is a tendency for a variety of chain grocery stores to be present outside of urban food deserts, which gives caregivers' an opportunity to seek out the best deals from the available options.

Interestingly, the majority of caregivers who were studied did not have access to transportation; thus, many of them relied on public transportation or their social networks to complete most of their shopping (Hammelman, 2018). Most caregivers were motivated by the price of groceries; therefore, locations with decent prices were frequented the most despite distance and the transportation barrier. Caregivers' shopping habits have a large impact on their children's nutrition, which in turn can affect their academic achievement. For example, caregivers who have to leave their neighborhoods to grocery shop on a weekly or bi-weekly basis have less time to commit to their children's homework and school projects. This inability to consistently commit to their children's coursework can result in missed opportunities for learning and concept reinforcement in their homes, which can lead to poorer grades on tests in the future.

On one hand, caregivers are motivated to leave urban food deserts for better quality food; however, all caregivers do not prioritize nutritious food options. Urban food deserts are notorious for containing more fast-food restaurants, take-out restaurants, and convenience stores than non-food deserts. The review of literature results indicates that about half of caregivers prepare at least one home-cooked meal each day; however, the majority of caregivers frequent fast-food restaurants more than once a week (Garcia et al., 2018). Since caregivers have the largest influence on children's nutrition, increased uptake of fast-food by caregivers results in a similar uptake among their children. Food from fast-food restaurants are often high in calories and fat and can lack necessary nutrients. When children eat these foods often, they become more susceptible to developing pediatric obesity and other chronic health issues that can follow them well into their futures (Hager et al., 2017). Similar to their caregivers, children are affected by the stressors of their environments. In an urban food desert, most areas have a large built environment and lack access to greenspaces which are also promoters of pediatric obesity. While pediatric obesity does not directly affect children's academic achievement, the stress of living in an urban food desert with little means of exercising can cause children to lack the energy that is necessary to sustain them through their classes and examinations. Obese children may face more instances of bullying which can also affect academic performance.

The role of caregivers is important in establishing and maintaining children's nutrition. In addition to caregivers, the location of the urban food desert can impact children's nutrition and academic achievement. The review of literature explores urban food deserts in Maryland, Missouri, New York, and Washington D.C. Among these states, Maryland is most notable for urban food deserts in the city of Baltimore. In Baltimore's food deserts, caregivers generally follow similar health, grocery shopping, and eating habits as previously outlined. One aspect that is

prevalent in research studies exploring Baltimore's food deserts is the impact of the Supplemental Nutrition Assistance Program (SNAP) in mitigating the food access gap.

SNAP is a benefit that many low-income caregivers utilize to supplement their income as a means of getting food for their children and families. In Baltimore's food deserts, SNAP is readily accepted at many convenience stores which makes it convenient for caregivers to shop for staple items without having to leave their neighborhood. Although SNAP is present in these neighborhoods, Baltimore residents also prefer shopping outside of urban food deserts because of the conditions inside many of their convenience stores. The review of literature emphasizes that convenience store owners' understanding of SNAP is largely varied throughout the city, especially following the updates to the program in late 2016. When SNAP updated in December 2016, local convenience stores became required to double the number of staple food items that must be stocked (Ross et al., 2018). In addition to the increased burden with the new requirements, many convenience store owners' lack of awareness about this program relates to the racial and social tensions present throughout the city.

As mentioned, cost and quality of food options are some of the most important factors in determining where a caregiver shops. Baltimore's convenience stores tend to offer the same products, but the quality is often poorer, and the quantity of items is usually smaller. In order to turn a profit, convenience store owners tend to charge more money than large supermarkets to shelve the same products. This disparity in price difference often results in caregivers opting for the cheaper store option, which results in a surplus of food that goes to waste at the convenience stores. Another factor prevalent in Baltimore's food deserts is a history of SNAP trafficking, which occurs when convenience store owners collect SNAP benefits in exchange for SNAP-ineligible items (Ross et al., 2018). These trends of Baltimore's SNAP benefits do not directly correlate to

children's academic achievement. However, the presence of racial and social tensions paired with the expensive prices of food at convenience stores, does not incentivize children or their caregivers to shop locally. When these communities continuously deal with race and social issues, children may find it difficult to concentrate in school and perform well on tests due to these stressors. Children may also be afraid to shop at convenience stores because of tensions in the city. Therefore, during the times when children need a nutritious meal conveniently, they still may opt for fast-food or no food, which is not conducive for navigating their school environments.

In addition to the other community-level factors, children's nutrition and academic achievement are influenced by their time spent in school. Most students spend nearly half a year attending school, which makes it vital that they are obtaining nutritious meals. The results from the review of literature emphasize that school meals have become healthier as time has progressed; however, school meals still are not very nutritious (Wells, 2021). Compared to similar countries, school meals in the United States generally have fewer fresh fruits and vegetables, more carbohydrates and sugars, and often feature more processed ingredients. Despite the American school meals including more unhealthy ingredients, living in an urban food desert, and eating school meals are not correlated with low academic achievement. This lack of association between living in an urban food desert and low school performance is likely due to urban food deserts being studied separately from factors like food access. As mentioned, once factors like income and access to transportation were associated with urban food deserts, standardized test scores were significantly lower among children from urban food deserts.

Current research has not extensively studied the interaction between urban food deserts and children's academic achievement. The lack of research on this topic is likely attributed to the COVID-19 pandemic. During the last two years, public schools throughout the nation have

provided free meals to their students. However, effective June 2022, the free school meal provisions have expired for most schools. With this, many schools are reverting to the family income-based model to determine if a student qualify for the National School Lunch Program (NSLP) or the Community Eligibility Provision (CEP). For many children, the cost of school meals will become an undue stressor that can prevent students from performing well on standardized tests or in their classes.

5.1 Recommendations

After the articles have been synthesized using the levels of the Social Ecological Model, several recommendations can be made to improve the nutrition standards for children living in urban food deserts. By increasing children's access to nutritious foods, improvements to their academic achievement will only follow. First, when considering children's interpersonal relationships with their caregivers, one method of improving children's nutrition is by directly appealing to their caregivers. For caregivers who are dealing with chronic health conditions, partnering with local pharmacies or medical offices is one way to spread nutritious messages for caregivers and their children. When adults attend medical offices, they may not have access to information about healthy eating as readily as visiting a dietician, for example. Providing this information in spaces that caregivers already frequent is one way to passively influence their nutritional habits. Considering the role that income played in most studies, future studies should further explore the impact that food insecurity can potentially have on CVD, especially given the relationship between finances and food security.

Another barrier that caregivers face when trying to provide their children with nutritious foods is lack of access to transportation. A recommendation to increasing access to transportation would be partnering with local food banks to sign residents up for reduced bus fare in their neighborhoods. For example, in Baltimore, Maryland, residents who receive SNAP benefits are eligible for reduced bus fare, which increases their access to healthy food options. One limitation to this recommendation is the lack of space on public transportation. To overcome this limitation, local organizations can form urban garden centers that bring fresh fruits, vegetables, and herbs right into the backyards of the residents. With proper local, state, and federal funding, urban gardens can become a sustainable way to supplement the diets of children and caregivers living in urban food deserts.

At the community level, children's nutrition can be promoted by increasing access to greenspaces, parks, and youth activities that promote fitness such as participation in team sports. When children have different modes of releasing stressors, they can have an easier time concentrating in academic environments. Considering updates inside the classroom, school boards should make it a priority to frequently update their health curriculum to ensure topics about healthy eating are not outdated. School administration can also partner with local health organizations to provide monthly seminars for children and their families that focus on obtaining and maintaining a healthy lifestyle. During these monthly seminars, local food banks could provide staple goods at the events either in-person or by way of mobile food banks. These recommendations rely on promoting local organizations, which will lead to sustainable practices throughout the community.

On the societal level, improvements need to be made to ensure that SNAP benefits are understood by local convenience store owners. Although SNAP recently expanded the number of food staples that SNAP-eligible businesses must stock, there should be more emphasis placed on

providing nutritious food options, so that children and their family can grab healthy foods conveniently. Future updates to SNAP benefits should be explicitly shared with all SNAP-eligible businesses to ensure that the requirements can be met and maintained. Additionally, SNAP information should be communicated in a variety of languages to prevent miscommunication due to a language barrier. In order to maintain legitimate SNAP-eligible businesses, governmental agencies should establish a consistent verification process which would ensure that all businesses are appropriately utilizing the SNAP benefits. This verification process should include a yearly recertification exam to ensure that SNAP requirements are being upheld.

6.0 Conclusion

6.1 Concluding Remarks

Children's nutrition and academic achievement are affected by a multitude of factors that can be amplified when residing in urban food deserts. For half a century, standardized tests have been used as the standard for determining children's academic success. As testing grew in popularity, researchers sought to better understand how nutrition affects academic performance. This review of literature discusses how nutrition, academic achievement, and their associated confounding factors, interact with urban food deserts to impact the children living in these areas.

Through the review of literature, the effects of children's caregivers, neighborhood resources, food insecurity, and access to transportation were uncovered as factors that can impact one's ability to navigate urban food deserts. One neighborhood resource in particular, school meals, are another factor that influence children's ability to perform in school. In recent years, the burden associated with purchasing school meals has been alleviated. However, with the rapid resurgence of these costs in the upcoming school year, some children living in urban food deserts will be facing additional stressors that can affect their academic achievement. By partnering with the community and implementing the recommendations, residents of urban food deserts can achieve nutritious lifestyles. For children in urban food deserts, meeting their nutritional goals can also impact other important areas of their lives such as performance in school and ability to pursue certain extracurricular activities.

6.2 Limitations

There were a few limitations in this review of literature. The first limitation, as mentioned, was the scarcity of articles that focused explicitly on urban food deserts and academic achievement. The small number of articles made it difficult to determine a direct association between living in urban food deserts and children's academic achievement. Another limitation can be found in the methodology. Since this is a rapid review of literature, it is not entirely comprehensive of all articles that meet the inclusion criteria. For studies that aim to have a broader understanding of the associations at work, a systematic literature review is another method that can be used to fill in the gaps. The last limitation is that reviews of literature can lack relevance. This occurs because researchers do not usually have any form of stakeholder engagement when conducting these studies. Future studies should consider a mixed-methods approach like Photovoice that can explore the perspectives of children residing in urban food deserts in a particular city.

This review of literature is one of few reviews that explore the association between urban food deserts, children's nutrition, and academic achievement. While there was no association found between living in urban food deserts and performing well in school, there is an association between children's nutrition and academic achievement. When additional factors such as income and access to transportation were associated with living in an urban food desert, students were less likely to perform well on standardized tests. These results indicate that urban food deserts can influence children's academic achievement, especially when interpersonal, community, and societal-level factors are explored as well. As noted, children's academic achievement and development are improved with access to nutritious food. Future research should aim to understand the relationship between urban food deserts, nutrition, and academic performance. Every child

deserves a firm foundation to propel them into their future. Through the recommendations made in this review of literature, sustainable solutions can be made to move closer to this goal.

Bibliography

- Agency for Toxic Substances and Disease Registry. (2015, June 25, 2015). *Models and Frameworks for the Practice of Community Engagement*. https://www.atsdr.cdc.gov/communityengagement/pce_models.html
- Alexander, K., Entwisle, D., & Olson, L. (2014). *Long Shadow, The: Family Background, Disadvantaged Urban Youth, and the Transition to Adulthood* Russell Sage Foundation. <https://www.jstor.org/stable/10.7758/9781610448239>
- Anderson, M. L., Gallagher, J., & Ritchie, E. R. (2017). *How the quality of school lunch affects students' academic performance* <https://www.brookings.edu/blog/brown-center-chalkboard/2017/05/03/how-the-quality-of-school-lunch-affects-students-academic-performance/>
- Center on Budget and Policy Priorities. (2022). *A Quick Guide to SNAP Eligibility and Benefits*. <https://www.cbpp.org/research/food-assistance/a-quick-guide-to-snap-eligibility-and-benefits>
- Center on Education Policy. (2020). *History and Evolution of Public Education in the US*. <https://files.eric.ed.gov/fulltext/ED606970.pdf>
- Colón-Ramos, U., Monge-Rojas, R., Stevenson, T. R., Burns, H., Thurman, S., Gittelsohn, J., & Gurman, T. A. (2018). How Do African-American Caregivers Navigate a Food Desert to Feed Their Children? A Photovoice Narrative *Journal of the Academy of Nutrition and Dietetics*, 118(11), 2045-2056. <https://www.clinicalkey.com.pitt.idm.oclc.org/#!/content/playContent/1-s2.0-S2212267218306506?returnurl=null&referrer=null>
- Cummins, S., & Macintyre, S. (2002). "Food deserts"—evidence and assumption in health policy making. *BMJ*, 325(7361), 436-438. <https://doi.org/10.1136/bmj.325.7361.436>
- Dubowitz, T., Ghosh-Dastidar, M., Cohen, D. A., Beckman, R., Steiner, E. D., Hunter, G. P., Flórez, K. R., Huang, C., Vaughan, C. A., Sloan, J. C., Zenk, S. N., Cummins, S., & Collins, R. L. (2015). Diet And Perceptions Change With Supermarket Introduction In A Food Desert, But Not Because Of Supermarket Use. *Health Affairs*, 34(11). <https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2015.0667>
- Dutko, P., Ploeg, M. V., & Farrigan, T. (2012). *Characteristics and Influential Factors of Food Deserts* (Economic Research Report, Issue. U. S. D. o. Agriculture. https://www.ers.usda.gov/webdocs/publications/45014/30940_err140.pdf

- Fleischhacker, S., & Campbell, E. (2020). Ensuring Equitable Access to School Meal. *Journal of the Academy of Nutrition and Dietetics*, 120(5). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7176575/>
- Frndak, S. E. (2014). An Ecological Study of Food Desert Prevalence and 4Th Grade Academic Achievement in New York State School Districts *Journal of Public Health Research* https://journals.sagepub.com/doi/10.4081/jphr.2014.319?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%20pubmed
- Garcia, M. T., Sato, P. M., Trude, A. C. B., Eckmann, T., Steeves, E. T. A., Hurley, K. M., Bógus, C. M., & Gittelsohn, J. (2018). Factors Associated with Home Meal Preparation and Fast-Food Sources Use among Low-Income Urban African American Adults. *Ecology of Food and Nutrition*, 57(1), 13–31. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5884711/>
- Greater Louisville Project. (2022). *Food Deserts*. <https://greaterlouisvilleproject.org/factors/food-desert/>
- Hager, E. R., Cockerham, A., O'Reilly, N., Harrington, D., Harding, J., Hurley, K. M., & Black, M. M. (2017). Food swamps and food deserts in Baltimore City, MD, USA: associations with dietary behaviours among urban adolescent girls. *Public Health Nutrition* 20(14). <https://www.cambridge.org/core/journals/public-health-nutrition/article/food-swamps-and-food-deserts-in-baltimore-city-md-usa-associations-with-dietary-behaviours-among-urban-adolescent-girls/3E8A0082E3CF8AD5B5B82BB2EC399B36>
- Hammelman, C. (2018). Investigating connectivity in the urban food landscapes of migrant women facing food insecurity in Washington, DC. *Health & Place*, 50, 89-97. <https://reader.elsevier.com/reader/sd/pii/S1353829217305415?token=27D66587E1681EAFEAD8B88CAF0BCE605D567C2A6A3F492087E32631A1647ED870010A3D220175FC30220C005BBD29EF&originRegion=us-east-1&originCreation=20220828235152>
- Holben, D. H., & Marshall, M. B. (2017). Position of the Academy of Nutrition and Dietetics: Food Insecurity in the United States. *Journal of the Academy of Nutrition and Dietetics*, 117(12), 1991-2002. <https://www.sciencedirect.com/science/article/pii/S2212267217316180>
- Jacques, S., & Miller, M. (2016, February 12, 2016). Food availability a problem in smaller urban cities, despite dense populations, a Kansas State University study finds. *K-State News*. <https://www.k-state.edu/media/newsreleases/feb16/foodavail21216.html>
- Kelli, H. M., Hammadah, M., Ahmed, H., Ko, Y.-A., Topel, M., Samman-Tahhan, A., Awad, M., Patel, K., Mohammed, K., Sperling, L. S., Pemu, P., Vaccarino, V., Lewis, T., Taylor, H., Martin, G., Gibbons, G. H., & Arshed A. Quyyimi. (2017). Association Between Living in Food Deserts and Cardiovascular Risk. *Cardiovascular Quality and Outcomes*, 10(9), 569-589. https://www.ahajournals.org/doi/10.1161/CIRCOUTCOMES.116.003532?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%20pubmed

- MacNell, L. (2018). A geo-ethnographic analysis of low-income rural and urban women's food shopping behaviors. *Appetite*, 128(1), 311-320. <https://www.sciencedirect.com/science/article/pii/S0195666318300400?via=ihub#bib24>
- National Center for Chronic Disease Prevention and Health Promotion. (2022, June 6, 2022). *Poor Nutrition* <https://www.cdc.gov/chronicdisease/resources/publications/factsheets/nutrition.htm>
- National Center for Health Statistics. (2017, June 1, 2017). *NCHS Urban-Rural Classification Scheme for Counties*. Centers for Disease Control and Prevention https://www.cdc.gov/nchs/data_access/urban_rural.htm
- National Education Association. (2020). *History of Standardized Testing in the United States*. <https://www.nea.org/professional-excellence/student-engagement/tools-tips/history-standardized-testing-united-states>
- National Research Council. (2006). *Food Insecurity and Hunger in the United States: An Assessment of the Measure* (G. S. W. a. J. L. Norwood, Ed.). The National Academic Press. <https://nap.nationalacademies.org/read/11578/chapter/1#i>
- National Research Council. (2009). *The Public Health Effects of Food Deserts: Workshop Summary*. <https://www.ncbi.nlm.nih.gov/books/NBK208016/>
- Ptomey, L. T., Steger, F. L., Schubert, M. M., Lee, J., Willis, E. A., Sullivan, D. K., Szabo-Reed, A. N., Washburn, R. A., & Donnelly, J. E. (2015). Breakfast Intake and Composition is Associated with Superior Academic Achievement in Elementary School Children. *Journal of American College of Nutrition* 35(4), 326-333. <https://doi.org/10.1080/07315724.2015.1048381>
- Ross, A., Krishnan, N., Ruggiero, C., Kerrigan, D., & Gittelsohn, J. (2018). A mixed methods assessment of the barriers and readiness for meeting the SNAP depth of stock requirements in Baltimore's small food stores. *Ecology of Food and Nutrition* 57(2), 94-108. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6233298/>
- Rubinstein, G. H. (2015). Hungry in the "Land of Pleasant Living": Combating the Effects of Baltimore's Food Deserts on Childhood Education Through Eminent Domain. *University of Maryland Law Journal of Race, Religion, Gender and Class*, 15(2), 28, Article 11. <https://digitalcommons.law.umaryland.edu/cgi/viewcontent.cgi?article=1256&context=rrgc>
- Sorrells, A. (2022). *Behind the lunch tray: A look at how school meals are funded*. <https://www.ednc.org/school-meals-finance/>

- Spokane Regional Health District. (2022). *Nutrition (Children): Dedicated to promoting healthy eating habits for children and adolescents*. <https://srhd.org/health-topics/healthy-living/nutrition-children>
- Testa, A., Jackson, D. B., Semenza, D. C., & Vaughn, M. G. (2020). Food deserts and cardiovascular health among young adults. *Public Health Nutrition*, 24(1), 117-124. <https://doi.org/doi:10.1017/S1368980020001536>
- Trickey, E. (2020). How Baltimore Is Experimenting Its Way Out of the Food Desert. *Politico* <https://www.politico.com/news/magazine/2020/01/23/baltimore-food-desert-policy-100121>
- U.S. Department of Education. (2016). *Title I: Fast Facts*. National Center for Education Statistics <https://nces.ed.gov/fastfacts/display.asp?id=158>
- Ullmann, H., Weeks, J. D., & Madans, J. H. (2022). *Children Living in Households That Experienced Food Insecurity: United States, 2019 - 2020*. National Center for Health Statistics.
- United States Department of Agriculture. (2021). *Food Access Research Atlas: Definitions of Food Access*. <https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/>
- United States Department of Agriculture. (2022a). *Definitions of Food Security*. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/definitions-of-food-security/>
- United States Department of Agriculture. (2022b, April 22, 2022). *Food Security Status of U.S. Households in 2020*. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/key-statistics-graphics/>
- Wells, J. (2021). *What School Lunch Looked Like Each Decade Since 1900*. <https://www.mentalfloss.com/article/87238/what-school-lunch-looked-each-decade-past-century>