Title Page

**Growing with Gardens: Rural Nutrition Inequity and the Development of a Gardening Nutrition Education Program for Children**

by

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Abstract

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University of Pittsburgh, 2019

**Abstract**

Chronic diseases are a significant public health concern and disproportionately affect rural populations. Development and maintenance of a healthy, balanced diet throughout the lifespan plays an important role in preventing chronic disease. However, many rural populations are affected by a lack of access to nutritious, affordable food. This lack of access is compounded by various layers of inequity which contribute to poorer nutritional outcomes and higher rates of chronic disease. Factors such as economic stability, proximity of grocery stores, cultural practices, and the local food environment all impact the ability of rural individuals and families to access nutritious food. Recent research has attempted to further understand some of the unique characteristics of rural populations and how best to develop effective health interventions. Some interventions have focused on increasing nutrition knowledge and improved access among rural children in an attempt to build healthy habits. One of these interventions utilizes a gardening program coupled with a nutrition education program. Based on these types of interventions, this paper will seek to first provide an overview of rural nutrition inequities followed by an example of the development of a gardening and nutrition education program offered in a rural community setting. As a result, the aim of this paper is to highlight the public health significance of issues related to nutrition and access in rural communities, along with a proposed method of intervening on these health concerns.

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# Introduction

Rural populations face unique health challenges that are affected by layers of inequity, making these challenges difficult to research and confront. One of the most significant is that these individuals are more likely to live with one or more chronic diseases than individuals residing in urban areas (Rural Health Information Hub, 2019). Many chronic diseases can be prevented through maintaining a healthy diet and an adequate amount of physical activity throughout the lifetime (CDC, 2015, 2019). However, rural residents are less likely to partake in a healthy diet and physical activity than their urban counterparts (Food Research and Action Center, 2018; Rural Health Information Hub, 2019). Reasons for these disparities are complex and necessitate an examination of the many factors that affect rural dietary patterns. The purpose of this paper is to present an overview of the challenges related to food access and nutrition in rural populations. In addition, this paper will also explore the development and impact of a program aimed at improving knowledge about nutrition among rural children and families. This gardening/nutrition program, offered in a library in a rural area in Westmoreland County, PA, is grounded in recommendations by Healthy People 2020 (2017) for such a program. These recommendations were based on research which found that this type of program increased children’s willingness to eat vegetables (Savoie-Roskos, Wengreen, & Durward, 2017). However, this evidenced based intervention has been largely offered in urban settings and in schools. Rarely in published literature has this intervention been offered in a rural, community setting. Thus, this paper will explore how a program based on these types of interventions may impact the complex factors that influence rural dietary patterns.

Instructing children on healthy eating in a manner that increases their willingness to eat vegetables may help them develop food habits that support a life-long healthy diet. Although a program such as this does not solve issues of access, it does teach children skills that they can use to determine what which food groups are healthy and which are unhealthy. In addition, because this type of program is offered in a community setting, it actively involves families in the process of intentionally learning about food and how to make decisions about healthy eating. Moreover, partnering with a local community organization, such as a library, encourages the discussion and promotion of health in diverse spaces and to a wider audience. As a result, at the individual, family, and community level, partners and participants are encouraged to make changes in their diet.

## Focus of Paper

The population of interest for this program and essay is largely focused on rural children and how their nutrition practices impact their health and life course. However, children, especially young children, are heavily affected by their family system and likely do not make many of the decisions about the foods that their family can access and purchase. Thus, individual and family level factors are closely related. Researching childhood nutrition and its connection to lifelong dietary patterns and chronic disease necessitates a close examination of the many complex factors that affect a family’s ability to make decisions about food. Beyond the influence of personal preference, the foods that make up a child’s diet depends on the influence of factors such as the family system, culture, neighborhood food environment, and economic circumstance. Therefore, this essay will address research that examines both the dietary patterns of children and adults/families in order to more accurately tease apart rural nutrition practices.

In addition, most public health organizations and research publications frame rural health inequities as issues related to weight status. As a result, until very recently, almost all research has focused on characterizing rural children and adults as being more likely to be overweight or obese than urban children and adults. In addition, using this proxy for health status leads to research that gathers data on weight status rather than closely examining the behaviors and systems that make up nutritional patterns. This focus has left large gaps in the scientific understanding of rural health. Instead of focusing on weight status, Public Health can focus on the diseases and health conditions that are more prevalent among rural adults and attempt to understand the behaviors and systems of inequity that contribute to those conditions. Thus, unless specifically citing an article or data source, this essay will largely use language framed around nutrition in rural children and the ways in which poor nutrition can impact health.

## Relevant Definitions

In order to more effectively research and discuss rural health issues, most literature uses population definitions set by the United States Census Bureau and the Office of Management and Budget. Using information such as population density and land use collected with each census, the US Census Bureau labels areas with 50,000 or more people “urbanized areas” (Ratcliffe, Burd, Holder, & Fields, 2016). Areas with more than 2,500 and less than 50,000 people are termed “urbanized clusters”. Finally, areas that contain less than 2,500 people are considered “rural”. The Office of Management and Budget uses definitions that rely on county population (US Census Bureau, 2017a). Metropolitan areas are counties that include at least one area of 50,000 people or more. Micropolitan areas are counties that include at least one area of between 10,000 and 50,000 people. Nonmetropolitan areas are counties that do not meet the qualifications for a metropolitan or micropolitan area (US Census Bureau, 2017a). These definitions are typically used to report statistics. Critically, the use of these definitions (rural verses urban and metropolitan verses nonmetropolitan) are *not* interchangeable. According to the American Community Survey, almost 55% of people who live in a rural area are also considered to live in a metropolitan area (US Census Bureau, 2017b). Due to the reliance on county lines, the use of metropolitan definitions often overlooks areas that would otherwise be considered rural. As a result, most researchers and literature use the definitions set by the US Census Bureau. However, many national reports and data collections still use metropolitan delineations. Unless otherwise noted, this paper will follow the language used by the authors of the data or literature being discussed.

# Background

## Overview of Inequities

Individuals residing in rural areas face unique health challenges which are affected by layers of inequity. These issues intersect in complex ways that create compounding problems which are difficult to tease apart. Thus, in order to effectively research, discuss, and intervene on rural health issues, the multiple layers of inequity faced by rural residents must be considered. According to the Rural Health Information Hub, individuals and families who live in nonmetropolitan areas are more likely to have a lower income than those who live in metropolitan areas (2019). In 2016, the average household income in a nonmetropolitan area was $46K while the average household income in a metropolitan area was $62K. In addition, nonmetropolitan residents are also more likely to live in poverty, which is defined by the US Census Bureau as a state of inadequate income and assets to meet needs, based on family size and earnings (US Census Bureau, 2019). In 2017, 16.4% of nonmetropolitan residents lived in poverty, compared to 12.9% of metropolitan residents. (Rural Health Information Hub). Further, persistent poverty, which is defined as 20% or more of residents living in poverty for over 30 years, is also more common in rural counties. According to research published in 2018, 15.2% of rural counties face persistent poverty, compared to 4.5% of urban counties (Probst, Barker, Enders, & Gardiner, 2018). In addition, the same study found that 28.2% of rural counties have persistent child poverty (20% or more children living in poverty for over 30 years), compared to 12.9% of urban counties. These disparities in poverty levels worsen when comparing levels of rurality, especially for individuals under 18. Counties considered completely rural, or counties where 100% of the population lives in rural areas, have a child poverty rate of 25.7%, compared to 21.9% in mostly rural counties (50% to 99.9% of population living in rural areas) and 15.3% in mostly urban counties (less than 50% of population living in rural areas) (Holder, Fields, & Lofquist, 2016).

In addition to income and poverty levels, education is also an important indicator for the wellbeing of an area or population and may help to explain health disparities. According to the Rural Health Information Hub, 16.1% of young adult nonmetropolitan residents age 18-24 do not have a high school diploma, compared with 13% of metropolitan residents (2019). Overall, 14.5% of the nonmetropolitan population does not have a high school diploma, compared with 12.4% of the metropolitan population (Rural Health Information Hub, 2019). In addition, among rural counties that are completely rural, only 15.3% of individuals have a Bachelor’s degree or higher, compared to 16% of individuals in mostly rural counties and 23.1% of individuals in mostly urban counties (Holder, Fields, & Lofquist, 2016). According to the same report, completely rural counties have lower employment rates (63.5%) compared to mostly rural counties (64.8%) and mostly urban counties (69.6%). While the differences in these rates may seem small, they point to a consistent pattern that reveals that as rurality increases, the economic stability of these areas decreases.

Health care access is a significant issue for rural residents that manifests in various ways. Rural areas have a far greater shortage of all types of healthcare providers and facilities, including physicians, dentists, nurses, obstetricians, mental health resources, and substance abuse services (Rural Health Information Hub, 2019). In addition, while rates of those uninsured have fallen in recent years across the country, rural individuals, including those 18 and under, are still more likely to be uninsured than their urban counterparts (Rural Health Information Hub, 2019; Holder, Fields, & Lofquist, 2016). Similar to poverty rates, this pattern is found even when comparing rates of rurality. According to research published in 2016 that compared mostly rural counties with completely rural counties, completely rural counties had higher rates of individuals uninsured (15.8%) than mostly rural counties (14.8%) (Holder, Fields, & Lofquist). These rates were both higher than rates of individuals uninsured in mostly urban counties (12.2%). This pattern points to systemic issues which compound as levels of rurality increase. Even among the insured, living in an area with a shortage of healthcare providers and facilities impacts not only the personal expense associated with healthcare but also the quality of care received (Rural Health Information Hub, 2019). Rural residents are more likely than urban residents to bear a greater burden of personal healthcare costs, not including factors that further increase their financial expenditure, such as travel or time off work (Bolin, Bellamy, Ferdinand, Kash, & Helduser, 2015). While little to no qualitative research has focused on rural populations’ perception of healthcare quality, some research has shown that rural hospitals do not perform as well as urban hospitals on indicators such as preventable hospitalizations, post-discharge follow up, screenings, and star ratings by the Center for Medicare and Medicaid Services (Rural Health Research Gateway, 2019). Finally, of particular concern for young rural populations, a recent study found that 56.6% of rural counties did not have a pediatrician (Probst, Barker, Enders, & Gardiner, 2018). Issues related to healthcare access directly impact rural individuals and families by reducing their ability to receive preventative, curative, and palliative care.

Concerns related to poverty and income, lower education levels, and healthcare access are particularly salient for children from minority groups. Vulnerable populations who live in rural areas, such as individuals with disabilities, immigrants and seasonal workers, and older individuals, face unique challenges that their urban counterparts might not. These populations tend to have higher rates of poverty, less access to healthcare services and providers, and reduced opportunity for specialized services and resources (Rural Health Information Hub, 2019). In addition, racial and ethnic minorities who live in rural areas often face greater disparities related to income and access than both their urban counterparts and white rural residents, which may place them at a disadvantage. For example, 51.1% of African American children living in rural areas are considered to live in poverty, compared to 19.5% of non-Hispanic white, rural children (Probst, Barker, Enders, & Gardiner, 2018). According to the same study, Hispanic children are far more likely to be uninsured, compared to non-Hispanic white children. American Indians and Alaskan Natives are another minority population that faces marked inequities. Overall, these inequities are particularly significant for individuals and families who live on reservations, which are largely located in rural areas (Office of Minority Health, 2018). American Indians and Alaskan Natives have a lower average income, higher rates of poverty, lower levels of educational attainment (including holding at least a high school degree), lower rates of insurance, and higher rates of reliance on public insurance coverage such as Medicaid (Office of Minority Health, 2018). Intersecting issues of rurality and minority status have impacted these populations in ways that put them at a significant disadvantage compared to their urban counterparts or fellow rural residents of a majority group.

## Overview of Health Inequities

Though just an overview into the many complex disparities faced by rural residents, this discussion of issues related to income, education, and healthcare access serves as a primer for addressing the many health-specific disparities that rural populations encounter. Chronic disease is one of the most salient health disparities that exists between rural and urban populations; individuals living in nonmetropolitan areas are more likely to live with a chronic disease than individuals in metropolitan areas (Rural Health Information Hub, 2019). Rates of heart disease, diabetes, high cholesterol, hypertension, arthritis, chronic obstructive pulmonary disease, and depression are higher among nonmetropolitan residents than metropolitan residents (Shaw, Theis, Self-Brown, Roblin, & Barker, 2016). In addition, rural individuals also face higher mortality rates than urban individuals as a result of chronic conditions. According to a study published in 2017, nonmetropolitan residents have higher age adjusted death rates than metropolitan residents for all five of the leading causes of death, including heart disease, cancer, chronic lower respiratory disease, and stroke (Moy et al., 2017). For example, in 2015 there were 89.9 deaths per 100,000 due to heart disease in nonmetropolitan areas, compared to 56.6 deaths per 100,000 in metropolitan areas. Specific to children, infant mortality rates are higher in rural counties compared to urban counties (CDC, 2017). Disparities between rural and urban individuals are also found when examining comorbid illnesses. Nonmetropolitan individuals are more likely to report that they are living with 2-3 chronic conditions, (22.6% compared to 18.9%) and 4 or more chronic conditions (5.1% compared to 4.2%) (National Center for Health Statistics, 2017). These individuals are also more likely to report having poor health, at a rate of 21.5% compared to 17.7% (Shaw et al., 2016). Chronic diseases are expensive and put a strain on individuals in these areas who may already have limited resources. In turn, this places a huge burden on public resources and increases health care costs.

In addition to the high prevalence of almost all types of chronic disease, obesity, particularly childhood obesity, is a concern for rural populations. Previous literature on this topic has found that rates of self-reported obesity are consistently higher in rural areas than in urban areas (P. D. Patterson, Moore, Probst, & Shinogle, 2004). This study reported a 20.4% obesity rate in rural areas compared to a 17.8% obesity rate in urban areas. More recent research has supported this trend; a prospective cohort study found that individuals who spent a greater accumulated amount of time living in a rural area were more likely to be obese (K. A. E. Patterson et al., 2017) This disparity becomes even wider and rates become even larger when using direct measure rather than self-report. In a study that measured the heights and weights of their participants, the authors found a 39.6% obesity rate for rural adults and a 33.4% obesity rate for urban adults (Befort, Nazir, & Perri, 2012). Examining childhood obesity rates provides even more information into the disparities that exist between urban and rural populations and the potential reasons for these disparities. Just as rural adults are more likely to be obese than urban adults, rural children are also more likely to be classified as overweight or obese compared to their urban counterparts (Johnson & Johnson, 2015). In a large meta-analysis of over 74,000 children between the ages of 2-19, the authors found that rural children were 26% more likely to be obese than urban children (Johnson & Johnson, 2015). A report released by the US Department of Health and Human Services compared rates of overweight and obesity in children aged 10-17 in small rural areas, large rural areas, and urban areas (2015). These rates were 38.2% 35.5%, and 30.1%, respectively, showing that rates of children considered overweight or obese increase as rurality increases. This report also found that children living in poverty had higher rates of overweight and obesity, compared to children whose families had incomes above the federal poverty line. Non-Hispanic Black and Hispanic children were also more likely to have higher rates of overweight and obesity, compared to non-Hispanic White children. Although the rates of adult and child obesity in rural areas serve only as a proxy for health, they do point to potential patterns in nutrition and physical activity that may be influencing the health of rural populations.

## Individual and Cultural Dietary Practices

Both chronic diseases and obesity are affected by nutrition. Maintaining a healthy lifestyle with diet and exercise throughout the lifetime can reduce an individual’s overall chances of developing a chronic disease (CDC, 2015). However, this practice requires both the understanding of food groups and maintaining a balanced diet along with the ability to access and purchase healthy foods. Rural populations encounter unique challenges in both of these factors, due in part to socioeconomic and built restrictions but also due cultural dietary and lifestyle practices. The extremely high levels of childhood obesity in rural areas warrants a close examination of how dietary patterns in these areas might differ from urban dietary patterns. Furthermore, it is also important to consider literature that addresses access issues in rural areas. Recently, research on food access in rural areas has expanded to include a more detailed examination of how food environments impact the dietary patterns of rural residents. This research has encouraged a move away from research that places an emphasis on weight status and toward investigation of the impact of nutrition on obesity and chronic disease.

Research on rural dietary patterns has previously focused on either cultural/geographic area data or individual level data. Both types of research are necessary in order to understand the contributing factors toward rural health disparities, due in part to the variability of rural areas and communities. In a study that analyzed data from the National Health and Nutrition Examination Survey (NHANES), the authors found that rural children aged 2-11 consumed an average of 90 calories per day more than their urban counterparts (Liu et al., 2012). The study failed to find any other significant differences in dietary patterns of rural children and urban children, partially due to its reliance on self-reported risk factor data, but it did replicate previous findings that rural children were more likely to be overweight or obese than urban children. Similarly, another study found a few small differences in individual behaviors, namely that rural children were more likely to consume junk foods than their urban counterparts (Davis et al., 2008). Research that examined the home environment found that children who lived in homes with higher scores on their food environments (defined by survey responses concerning habits and routines about food and physical activity) consumed more vegetables and dairy and less added sugar (Jackson, Smit, Manore, John, & Gunter, 2015).

Alone, individual level differences do not account for the wide range of health disparities facing rural children and their families. However, they do point to some patterns that may be affected by the influence of culture in rural areas. For example, research on the Appalachian region revealed that only 30% of participants ate the recommended weekly amounts of fruits and vegetables (Hoogland, Hoogland, Bardach, Tarasenko, & Schoenberg, 2019). This research also found that younger residents (age 18-59) were even less likely to meet these recomendations compared to older residents (age 60 and older) at a rate of 25.6% compared to 42.45%. Some research points to the influence of Appalachian culture and traditional foods on individual diet; in focus groups with Appalachian residents living primarily in rural areas, participants identified social and culture factors as a factor that shaped their diets (Schoenberg, Howell, Swanson, Grosh, & Bardach, 2013). For example, participants identified social norms about people who eat healthy foods, family practices and preferences, and food served at social events as important to the decisions they made about food. These factors could either hinder or support healthy eating, depending on the context. Similar research on social norms has been conducted in other rural areas; participants in focus groups in rural Montana reported that their diets were heavily influenced by the diets of their partners and families (Sriram, Morgan, Graham, Folta, & Seguin, 2018). In addition, participants reported the social tradition of gathering around food or providing food to guests encouraged unhealthy eating. While these individual level behaviors and cultural practices may not hold true for every rural area in the US, the widespread health disparities among rural populations necessitate examining the ways in which many complex factors might be interacting to produce these disparities.

## Food Access

### Food Insecurity

Food insecurity is a concept that is often discussed when addressing issues related to childhood nutrition. This is a term used to describe households that, at various times during the year, were uncertain of having, or unable to acquire, enough food to meet the needs of all of their family members because they had insufficient money or other resources for food. In 2017, 11.8% of all households in the US were food insecure at some time during the year (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). Examining the data by place of residence reveals that households in nonmetropolitan areas are more likely to be food insecure than households in metropolitan areas, at a rate of 13.3% compared to 11.5%. However, 13.8% of households in principle cities within metropolitan areas were food insecure, suggesting that households in suburban areas were the most food secure when compared to urban or rural areas. Examining food insecurity by state shows that states in which a large proportion of the population lives in rural areas have high rates of food insecurity. For example, in Mississippi, where 51% of the population resides in rural areas, 15.9% of households are food insecure (Food Research Action Center, 2018). Food security depends on a great deal of factors, thus it is not uncommon to see inconsistent patterns when examining this issue by rurality. However, it is largely impacted by levels of poverty, which tend to be higher in rural areas. In addition, members of minority groups and single parents living in rural areas are at an increased risk of food insecurity due to the intersecting inequities that often affect these groups (Coleman-Jensen et al., 2018).

### Food Deserts

Household food insecurity is only one of the issues surrounding access in rural areas. The local availability of fresh, healthy foods also affects the dietary patterns of individuals living in these remote areas. The concept of “food deserts” is used to describe areas in which there is a limited availability of stores selling nutritious food at an affordable price. However, research on food deserts in rural areas has been sparse and often conflicting. Some research shows that due in part to the globalization of large supermarket chain stores, rural residents are forced to travel further distances, limiting their access to a constant supply of fresh, healthy foods (Blanchard & Lyson, 2007). Distance to a supermarket affects rural residents who are already disadvantaged most, such as the elderly and those of lower income brackets, as these groups are less likely to have constant access to a car or reliable transportation (Bitto, Morton, Oakland, & Sand, 2003). In turn, this may cause less frequent trips to the grocery store and a higher reliance on processed foods. In fact, Blanchard and Lyson (2007) discovered that individuals living in an area considered to be a food desert were 23.4% less likely to consume the recommended amount of vegetables and fruits compared to individuals in areas not considered food deserts. Recent research has begun to move away from a sole focus on food deserts, instead examining how the overall food environment contributes to dietary patterns. For example, a 2017 study examined the food environments of seven rural counties in Maryland and rated the availability of healthy foods (Campbell et al., 2017). The authors found that the most common store types in rural communities were convenience stores or other nontraditional stores such as dollar stores or gas stations. Moreover, according to an index used to rate the availability of healthy foods, these nontraditional stores had the lowest scores (Campbell et al., 2017). Thus, the closest options for purchasing food also had the least healthy food. This research suggests that rural food environments have limited food resources, leaving many rural residents with the choice of purchasing food from convenience establishments or traveling further for healthier food. The inherent geographic spread of resources in rural areas, combined with transportation issues often faced by low income individuals and families, contributes to difficulty accessing a constant supply of nutritious and affordable foods.

### Food Swamps

Although food insecurity and food deserts both play a role in the dietary patterns of rural residents, they do not fully explain nutritional health disparities seen in these areas, especially among children. Access to fresh food in these areas has been declining but, critically, access to unhealthy food has been increasing rapidly. Across the US, the number of full service and fast food restaurants has steadily increased and the amount of time and money Americans spend at these establishments have also increased (Saksena et al., 2018). This growth has been most concentrated in the Southeast and Mid-Atlantic. In addition, although the number of both full service and fast food restaurants have grown, fast food restaurants are experiencing more extreme growth than full service restaurants, especially in rural areas (Saksena et al., 2018). This massive change in the restaurant landscape in the US over the past 40 years has had a large impact on dietary patterns and access to nutritious foods. Areas that experienced a large saturation of growth in these types of restaurants have been termed “food swamps”, due to the large availability of food high in fats and calories and low in nutritional value. This concept is relatively new, but some research is emerging that demonstrates the impact of food swamps. A 2017 study found that food swamps were better able to predict obesity rates than food deserts, demonstrating that lack of access to healthy foods is only part of the picture (Cooksey-Stowers, Schwartz, & Brownell, 2017). While this study did not examine this relationship by type of county (rural vs. urban), the authors did find that the association between food swamps and obesity rates was strongest in areas where individuals and families were low income or had less access to transportation. Lower socioeconomic status and reduced access to reliable transportation are characteristics that often affect rural residents, particularly when making decisions about purchasing food for themselves and their families. An increase in unhealthy options coupled with a decrease in access to healthy foods may be working together to impact the health status of rural children and families, directly influencing their long-term health.

## Intersecting Issues

Just as intersecting issues affect the social determinates of health for rural residents, they also affect the nutrition patterns of children and their families. Due to the sparsity of research on rural residents in general, research on vulnerable populations living in rural areas is even rarer. In addition, this research has often resulted in mixed and incomplete answers. Despite this, some common trends do seem to emerge. Namely, rural communities comprised mostly of low-income individuals, ethnic and racial minorities, and indigenous people have less access to affordable, nutritious foods. For example, research on American Indian rural communities has shown that these areas have limited access to nutritious, affordable food (Gundersen, 2007; O’Connell, Buchwald, & Duncan, 2011). This issue is affected and compounded by historical inequities often seen in these communities, such as extreme levels of poverty (Gundersen, 2007). This trend also characterizes some rural Hispanic communities; qualitative research into these communities found high rates of obesity compared to the national averages and inconsistent access to fresh foods (Ko et al., 2018). The participants in this study described various methods by which they accessed fresh produce, including their employment in the agriculture sector, following the farming season, trading with friends and family members, and shopping around for the best prices. Thus, although this research group had access to fresh produce, it was inconsistent and relied heavily on their employment and social networks.

## Protective Factors and Promising Interventions

Due to the variability in rural communities across the US, some rural residents, especially those who face multiple inequities, have found some methods to diminish the impact of food insecurity. Much like the rural Hispanic community, which used their employment and social networkers to access fresh foods, other qualitative research has examined some protective factors. In the Appalachian region, some research has shown that, when faced with closing grocery stores in their community, residents in this area found alternate ways of purchasing food (Miller et al., 2016). For example, many residents chose to travel further distances to purchase the majority of their food at grocery stores that they knew had more affordable prices. Even when a grocery store opened in their town, the residents continued to travel to stores outside the town that were cheaper, preferring only to shop at the in-town store when they only needed a few items. This study also found that these changes in grocery store options triggered a small increase in the number of residents who used gardening and preserving as a means to supplement their diets. Additionally, residents reported using local food pantries more often to obtain foods that they might have otherwise purchased at the grocery store. Specifically, of residents who use the food pantry, 43% told researchers that they make use of the food pantry as a way to provide food for themselves and their families that was previously bought at the grocery store (Miller et al., 2016). However, this study did not include individuals who did not have access to reliable transportation. This in-depth examination of a rural response to a decrease in access to fresh food demonstrates some of the ways in which these communities adapt to their food environment, given access to a car or some form of reliable transportation.

Similar research has also examined the food purchasing decisions of rural women in low-resource areas (MacNell, 2018). This research used both spacial analysis along with qualitative data to investigate where participants chose to shop and why they chose those particular stores. The author (MacNell, 2018) found that both rural and urban women ofen passed up stores closer to them in order to shop at a preferred store that may have been outside of their community. Rural women had to travel, on average, at least twice as far as urban women to shop at their preferred stores. Both groups of women reported making these decisions based on food prices, produce freshness and avalibility, transportation cost and accessability, and acceptance of SNAP benefits. Rural women were more likely to have access to their own car but were more likely to report the cost associated with traveling to the grocery store to be a reason why they were more likely to shop less frequently. In addition, both rural and urban women reported that price was one of the most important factors in their decisions about where to shop. This research suggests that proximity to a grocery store is not the most important factor concerning access to food, as previous literature has indicated. Instead, for both rural and urban individuals, economic factors play a larger role. However, these findings are particularly salient for rural individuals because rural families are more likely to be affected by poverty.

Additional research has examined how rural residents navigate their food environments, particularly when they are affected by poverty; a 2011 study of six rural communities in Maine conducted focus groups with low-income parents whose children were enrolled in state public insurance programs (Yousefian, Leighton, Fox, & Hartley, 2011). This research found that residents often used resourceful methods for purchasing and providing food for their children. For example, some study participants explained how they used large freezers to store grocery items they bought on sale. Participants also froze food gathered from traditional methods of hunting, fishing, and gardening. In addition, these families relied on cost saving methods such as the use of coupons or exclusively buying products (especially produce) that was in season and on sale. However, participants reported that use of these methods alone did not always provide enough food for their families. The authors (Yousefian et al., 2011) found that these low-income rural residents occasionally supplemented their food supply with items bought from farmers markets, food stands, small local stores that they knew had specials on certain products. However, participants also reported that the cost of farmers markets or farm-shares was a barrier to consistent use of these establishments. Some residents reported sharing or bartering with family and friends who hunted and had gardens. Utilization of methods such as stockpiling, supplementing food supply with hunting and gardening, and sharing of resources has been found in other studies on rural individuals and families (Smith & Morton, 2009; Valdez, Ramírez, Estrada, Grassi, & Nathan, 2016). Although many rural areas may lack adequate access to fresh, healthy foods, the rural residents included in the seminal articles discussed are often acutely aware of their environment and how best to provide enough food for their families for the most affordable price.

In addition to research on rural resident’s behaviors and decision making, one study focused on qualitative focus groups as a means for understanding perspective and planning for effective interventions (Carnahan, Zimmermann, & Peacock, 2016). In this unique research, the all-female participants provided valuable community input to Public Health’s understanding of the needs of rural communities. One of the major themes identified was barriers to access, which included living in poverty, distance to a grocery store, quality of fresh foods at grocery stores, and time available to prepare food. Due to these barriers, the women reported that they often relied on convenience stores or fast food restaurants to provide food for their families, despite knowing the limited amount of healthy foods available at these establishments. Like other rural residents, these women identified gardening and preservation as an effective food source and reported that they also used sharing/trading with friends and family. The focus groups also asked women to pinpoint some ways that nutrition could be improved upon at the individual, community, and policy level. Here, the women suggested providing education for rural residents about gardening, preserving, and shopping on a budget. They also proposed improving the availability of farmers markets in the area, along with planting community gardens. Since transportation was identified as a major barrier, the women suggested finding ways to increase public transportation in their areas. Finally, at the policy level, the women discussed forming community coalitions in order to advocate for programs and policy change that improve access to healthy foods in rural areas. Through participation in these focus groups, the women were able to provide their perspectives on the most critical issues facing their communities in relation to food access, which in turn may better inform programming and interventions in rural areas in the future.

Along with qualitative methods for understanding the best practices for meeting rural needs, some rural-specific interventions have been put in place to increase healthy habits, especially among children. In a study examining the effects of a health promotion program conducted by trained staff in rural elementary schools over a 3-year period, the intervention was found to increase students’ consumption of foods that met nutritional guidelines (King & Ling, 2015). The intervention aimed to educate children about the importance of nutrition and physical activity, encourage practice of healthy eating habits and exercise, and partner with teachers, families, and communities to impact the culture surrounding food in these homes, schools, and neighborhoods. This intervention was found to increase students’ consumption of foods that met national nutritional guidelines, such as increased daily consumption of fruits and vegetables. This was due in part to improvements made in the meals served at school, which is often an important source of food for children in rural, low-income families. However, this intervention did not directly address issues related to access in rural families. Future recommendations include engaging families and communities at a larger scale in order to impact some of these issues in rural areas. Despite the lack of attention to access, this intervention demonstrates that school and community-based education and activities has the potential to affect the nutrition of rural children, which in turn influences their overall health.

## Knowledge Gaps

In general, rural communities, families, and individuals receive much less research attention than urban areas. This is due in part to the inherent geographic spread of these areas, and often the lack of local health resources such as community organizations or academic institutions. This has resulted in an overall lack of knowledge about health issues in rural communities. In addition, research that has been conducted has often focused mostly on weight status, instead of nutrition or the systems that perpetuate inequity and low access. As a result, there is little information about what has perpetuated the higher proportion of rural children and adults affected by obesity and chronic disease. Research that does attempt to address this is often conflicting, due to the wide variability in rural communities and culture throughout the country. Sparsity of research is especially salient for minority populations living in rural areas, including racial and ethnic, sexual and gender, and ability minorities. While some epidemiological information is known about the health issues that these populations face, little research has examined the causes of these health disparities. Furthermore, the complex ways that multiple layers of inequity overlap to produce health outcomes in minority children and their families has often been overlooked. Research in minority populations is critical to developing a greater understanding of these complexities and how to create effective interventions. Overall, this issue requires a more thorough examination of the characteristics of rural areas that contribute to inequity in health.

In addition to knowledge gaps in the literature, there is also a lack of understanding about programs and interventions in rural areas. Overall, few studies examine various interventions aimed at improving nutrition. Thus, there is a weak evidence base for many interventions, especially concerning implementation in diverse rural settings. Typically, rural interventions are conducted in a small area and are not replicated, making generalizability a large issue. In addition, just as variability in rural culture affects research results, it may also affect intervention outcomes. Rural areas such as the Appalachian region differ in important ways from other rural areas, such as the Southeastern US (Hoogland et al., 2019). These differences may lead to variations in research and outcomes. Thus, more investment of research and resources in rural areas must occur to fully understand health disparities. In addition, interventions developed for urban use can be adapted for rural communities, given sufficient understanding of that particular community and its needs.

# Program Development

## Healthy People 2020 Recommendations and Conceptual Model

In 2017, Healthy People 2020 published a recommendation of interventions that coupled gardening and nutrition education programs in schools with the aims of improving children’s attitudes toward fruits and vegetables and increasing their willingness to eat these types of foods. These recommendations were based on a systematic review that investigated the impact of gardening interventions (Savoie-Roskos et al., 2017). According to their review, these interventions had a strong evidence base and were effective in improving children’s attitudes toward and willingness to eat vegetables but not fruits. Recommendations for implementing this intervention include details about content, setting, and the type of garden that can be used (Healthy People 2020, 2017). Interventions such as these must include a garden component in order to allow participants the chance to observe and learn about growth, along with providing the responsibility of tending to the garden. However, the review makes clear that the garden does not have to be a typical outdoor, in-ground garden. Gardens can range from indoor plants or garden towers to microfarms or large community gardens. In addition, incorporating the use of a nutrition education program is recommended, in order to provide participants with the knowledge about the vegetables they are growing and how they contribute to a healthy lifestyle. This recommendation is based on the finding from the systematic review that interventions that included both a garden and education program were more effective than gardening programs alone (Savoie-Roskos et al., 2017). Finally, although most of the interventions were located in schools or after-school programs, Healthy People 2020 (2017) states that these programs can be implemented in diverse settings, including community spaces. Based on these recommendations, I developed a gardening and nutrition program that was tailored to the needs of the rural community that it was held in.

In order to inform the development and goals of my program, I used Schulz and Northridge’s Social Determinates of Health model (Schulz & Northridge, 2004). This model was developed after the authors’ work in communities revealed that interventions must seek to look beyond just changing behaviors of the individual. By examining the multiple ways that systems interact, Public Health can create interventions that more accurately address health problems in a sustainable way. Although my program largely focuses on individual/family level behaviors, I wanted to include a reminder of the multiple layers that contribute to and affect poor nutrition in rural communities. To do so, I used pieces from each of the four main levels proposed by Schulz and Northridge (2004) (Figure 1). Although my program does not make large, sweeping change such as adding infrastructure to improve the built environment, it does address community and social context. My program is not only offered in the community, it is developed and implemented with the partnership of an important community stakeholder. In addition, while there are many stressors that exist in rural communities, I chose to highlight economic disadvantage because it is one of the most consistent issues across many diverse rural areas (Probst et al., 2018; Rural Health Information Hub, 2019). Since my program seeks to improve nutrition knowledge of children, I sought to include the many factors that impact a child’s ability to eat healthy foods, beyond his or her own individual or family’s abilities. Finally, improved nutrition status has the potential to affect future health outcomes, such as chronic disease, which is represented in the last box of the model.

Figure 1 Conceptual Model

## Partnership with Community Stakeholder

Along with utilizing a model that includes reminders of various stressors that impact rural nutrition practices, I also wanted to develop this program in partnership with a community stakeholder. Working with community members and organizations encourages collaboration that better prioritizes the relevant needs of the community. In addition, partnering with stakeholders helps to mitigate some of the issues surrounding sustainability, since these are the community leaders and members that would be responsible for continuing the program in the future. Public libraries are increasingly becoming spaces that work to improve the health of their communities (Morgan et al., 2018, 2016; Whiteman et al., 2018). Libraries are often trusted sources for information in communities and research has shown a greater call from both patrons and employees to offer health based programming and training (Morgan et al., 2016; Whiteman et al., 2018). Rural areas, which often lack access to a variety of health resources, may especially benefit from a local public library that offers a wide range of information and programming. Based on this, I partnered with a public library in a rural area in Western Pennsylvania that has recently expanded its resources to better serve the surrounding community.

### Description of Agency and Rural Community

Rostraver Public Library is located in Rostraver Township, Westmoreland County. While it primarily serves Westmoreland County residents, it is located in an area that is just a few miles from both Washington County and Fayette County. Due to this unique position, the library is accessible for residents from these three counties. While Westmoreland County is designated as an urban county, Washington County and Fayette County are both considered rural counties (The Center for Rural Pennsylvania, 2010). Thus, Rostraver library seeks to provide programming and services that appeal to a range of individuals from various environments. To do so, the library relies on funding from local and state governments, along with grants and individual contributions. Despite financial and size constraints, Rostraver library has recently attempted to expand its services to include health resources for the local communities.

## Curriculum Development

Developing the curriculum for the gardening and nutrition program first began with meetings with the library director and staff. The library had a small patio garden that it had previously used for programming. However, garden programs had never before been coupled with a nutrition education component. Funding for the garden and for the program came from a grant the library had received in previous years. All plants and gardening equipment were bought through this grant money. After meeting with the library director and determining that there was a need at this organization for a nutrition education program, curriculum development formally began. At the onset, the director and I decided to offer two programs for two different age groups; 4-6 and 7-12. Due to developmental differences in these age groups, we determined that splitting them up would allow for programming that was better tailored for age-appropriateness. Thus, two curriculums were developed; one for ages 4-6 and one for ages 7-12.

Both curriculums were developed with the needs and contexts of rural communities in mind. A critical piece of this program is that it was offered in a community setting, and thus required the endorsement of the library and the voluntary involvement of families in the community. Because a gardening/nutrition program such as this does not impact issues of access (unless perhaps accompanied by a community garden), it was important to engage multiple members of the community to have the greatest possible impact. For example, on the last day of the program, there was no education component. Rather, I decided to hold a picnic. I provided foods made with the types of vegetables grown in the library garden and encouraged the children and their families to bring their favorite healthy snacks. Though they were not required to bring anything, most families brought food to the picnic. In addition, I invited library staff to join us on the patio. Here, my goal was to create a social gathering that centered around healthy foods. Many students tried new foods and shared their favorite vegetables with their peers and the other family members. This fostered excitement and curiosity about the different ways that healthy foods could be prepared.

In addition to promoting social norms around healthy foods, another important part of the curriculum was accurate and engaging nutrition education. In order to inform my decisions about what information to include and what levels that information should be presented at, I consulted national sources for nutrition education. For example, I often used ChooseMyPlate, which provides resources for teachers, parents, and children about nutrition and healthy eating (U.S. Department of Agriculture, n.d.). In addition, I developed crafts and activities to supplement the information I presented. For example, the younger students played a game in which I called out different types of food and they ran around in a grassy area if the foods were healthy and stopped running if they were unhealthy. On the same day, the older student brainstormed foods that fit into one of three categories; woah (foods that should only be eat occasionally), slow (foods that should be eaten in moderation), and go (foods that should be eaten regularly) (US Department of Agriculture, n.d.). Not only did activities such as these engage the children in the lesson, they provided an alternate way of understanding nutrition.

Finally, although nutrition education curriculum resources are easily accessible, there are few publicly available gardening/nutrition programming resources. As a result, I created my own lesson plans to direct the objectives of each session. In addition, these lesson plans can be used in the future when Rostraver Library holds a gardening/nutrition program again, thus creating potential for sustainable programming. The goal of the education component was to help students learn how plants grow and how plants help human bodies to grow. Thus, the first two sessions focused on plant growth and included STEM activities, close examination of the garden’s development, and anatomy lessons. The remaining three sessions focused on nutrition and included education surrounding portion sizes, the health value of fruits and vegetables, nutrition labeling, and identifying healthy foods. Each lesson plan was developed based on national recommendations from the CDC and the US Department of Agriculture. In all sessions, students kept a garden journal and were allowed time to go out to the gardening space and record plant growth. They were also provided with gloves and watering cans, so they could water the plants and weed the garden area. Additionally, once produce began growing, students were encouraged to pick the produce and take it home if they wanted. Here, the goal was to integrate nutrition education along with the responsibility of learning about gardening and tending to plants, in order to promote investment in healthy foods.

## Community Impact

Due to time and privacy constraints, no data was collected on the impact of this program. This encouraged closer adherence to the recommendations made by the evidence-based interventions promoted by Healthy People 2020 (Healthy People 2020, 2017). Despite the lack of data, there were some anecdotal findings that demonstrated the value of this program. At the midpoint and close of the program, the library director reported that the community was benefiting from the addition of this program to their services. Many participants and families reported enjoying the program and found its content informative, engaging, and useful. Additionally, attendance and retention of participants across the span of the program was steady, especially among the younger group. Some families expressed interest in starting or expanding personal gardens after observing the investment of the children in the gardening process. One family reported starting their own garden after attending the first session of the program. Finally, at the picnic at the end of the program, many participants in both groups tried new foods that contained vegetables grown in the garden and expressed willingness to eat vegetables in the future.

# Implications and Future Use

There are various strengths to this type of program,. As found in the systematic review, encouraging participation in the production of food items through gardening increases children’s willingness to eat vegetables (Savoie-Roskos et al., 2017). In addition, by offering this program in a trusted community setting, local partnerships were formed surrounding the importance of nutrition and health. Building on local strengths of rural communities that may already have fewer community health resources encourages organizations such as libraries to continue expanding the services they offer. Since this program required families and guardians to sign up and bring their children, it encouraged participation at the family level which has the potential to have a greater influence on dietary practices than engaging children alone. Another strength of a gardening/nutrition program is its flexibility. Although there are certain recommendations for the program, it is highly adaptable to the needs and restrictions of the community setting that it is offered in (Healthy People 2020, 2017). Finally, by combining gardening, nutrition education, and activities, participants were engaged in learning about plants and the value of fresh foods. Creating a dynamic and stimulating program that included developing quantitative skills, exploration of scientific processes, and artistic expression encouraged learning in multiple forms while stressing the importance of health and nutrition.

Despite the strengths and potential of a gardening/nutrition program such as this, there are a few weaknesses to consider. Most critically, this program does not address issues related to access, which is one of the most important factors in rural dietary patterns. Addressing problems related to food access requires system-level intervention and advocacy that was beyond the scope of the current project. However, future gardening/nutrition programs could include elements of system-level intervention, such as creation of a community garden, development of a food pantry, or education and support on navigating nutrition and budgetary restrictions. Another weakness of this program is closely related to one of its strengths; the community setting. Although voluntary participation encourages family engagement, it also heightens the chance that participants who select to visit the library and attend a nutrition program are different than participants who do not. Finally, although certain recommendations are made by Healthy People 2020 (2017), there is little direction on what a gardening/nutrition education curriculum should include. For the purposes of this project, the curriculum was developed based on the needs of the community, the resources available at the library, and with the input of library staff. Future programs should seek to include evidenced-based input from other professionals, such as dietitians or educators. Moreover, future garden/nutrition programs should continue evaluating the effectiveness of this intervention, especially if it includes aspects meant to address access.

# Conclusion

Fostering healthy habits from a young age is important in laying a foundation for a healthy lifestyle. Chronic diseases make up a huge portion of healthcare spending per year in the United States; heart disease and stroke alone cost the healthcare system almost $200 billion per year while costs for diabetes reaches almost $240 billion (CDC, 2019). This massive cost places a large strain not only on the nation’s healthcare resources, but also on the individuals and families that these diseases affect. Compounding this issue, rural populations are also more likely to have lower incomes, less educational attainment, and a higher chance of being uninsured and lacking access to all types of health care (Rural Health Information Hub, 2019). In addition, beyond financial implications, poor nutrition across the lifespan and chronic diseases impact quality of life. Rural populations are sicker than urban populations but still receive little attention or resources from public health institutions. As a result, these health inequities persist. Health professionals have a responsibility to continue researching this population, its unique needs, and ways in which interventions can successfully mitigate these serious health concerns.

In addition to the importance of continued research investment, it is also critical that rural communities are engaged in their own health advocation. Involving community members is important for development and sustainability but it also allows space for the community to identify its own needs, strengths, and goals. In order to create lasting change, rural health inequities must be addressed at the broader community and policy level. Engaging individuals, families, and communities may lead to a more widespread call for investment of resources in rural communities. Moreover, a collaborative partnership between communities, academia, health advocates, and/or policymakers is likely to produce results that are more effective than work done without the input of the community. Continued investment coupled with community engagement has the potential to positively affect issues related to food access and a healthy lifestyle among rural populations which, in turn, may reduce disparities and improve health outcomes.

# Bibliography

Befort, C. A., Nazir, N., & Perri, M. G. (2012). Prevalence of obesity among adults from rural and urban areas of the United States: findings from NHANES (2005-2008). *The Journal of Rural Health : Official Journal of the American Rural Health Association and the National Rural Health Care Association*, *28*(4), 392–397. https://doi.org/10.1111/j.1748-0361.2012.00411.x

Bitto, E. A., Morton, L. W., Oakland, M. J., & Sand, M. (2003). Grocery store acess patterns in rural food deserts. *Journal for the Study of Food and Society*, *6*(2), 35–48. https://doi.org/10.2752/152897903786769616

Blanchard, T. C. B., & Lyson, T. (2007). Retail Concentration, Food Deserts, and Food Disadvantaged Communities in Rural America. In C. Hinrichs & T. Lyson (Eds.), *Remaking the North American Food System: Strategies for Sustainability*.

Bolin, J., Bellamy, G., Ferdinand, A., Kash, B., & Helduser, J. (Eds.). (2015). *Rural Healthy People 2020*. Southwest Rural Health Research Center.

Campbell, E. A., Shapiro, M. J., Welsh, C., Bleich, S. N., Cobb, L. K., & Gittelsohn, J. (2017). Healthy food availability among food sources in rural maryland counties. *Journal of Hunger & Environmental Nutrition*, *12*(3), 328–341. https://doi.org/10.1080/19320248.2017.1315328

Carnahan, L. R., Zimmermann, K., & Peacock, N. R. (2016). What rural women want the public health community to know about access to healthful food: A qualitative study, 2011. *Preventing Chronic Disease*, *13*, E57. https://doi.org/10.5888/pcd13.150583

CDC. (2015). The Health Effects of Overweight and Obesity. Retrieved October 13, 2019, from https://www.cdc.gov/healthyweight/effects/index.html

CDC. (2019). About Chronic Diseases . Retrieved October 24, 2019, from https://www.cdc.gov/chronicdisease/about/index.htm

CDC. (2017). Infant Mortality Rates in Rural and Urban Areas in the United States, 2014. Retrieved November 20, 2019, from https://www.cdc.gov/nchs/products/databriefs/db285.htm

Coleman-Jensen, A., Rabbitt, M., Gregory, C., & Singh, A. (2018). *Household Food Security in the United States in 2017* . United States Department of Agriculture.

Cooksey-Stowers, K., Schwartz, M. B., & Brownell, K. D. (2017). Food swamps predict obesity rates better than food deserts in the united states. *International Journal of Environmental Research and Public Health*, *14*(11). https://doi.org/10.3390/ijerph14111366

Food Research Action Center. (2018). Food Insecurity and Rurality State Map 2016-2018. Retrieved September 12, 2019, from https://www.frac.org/maps/food-security/food-security-rural.html

Food Research and Action Center. (2018). Rural Hunger in America: Get the Facts . Retrieved October 24, 2019, from http://frac.org/wp-content/uploads/rural-hunger-in-america-get-the-facts.pdf

Foster, J. S., Contreras, D., Gold, A., Keim, A., Oscarson, R., Peters, P., … Mobley, A. R. (2015). Evaluation of Nutrition and Physical Activity Policies and Practices in Child Care Centers within Rural Communities. *Childhood Obesity (Print)*, *11*(5), 506–512. https://doi.org/10.1089/chi.2015.0030

Gundersen, C. (2007). Measuring the extent, depth, and severity of food insecurity: an application to American Indians in the USA. *Journal of Population Economics*, *21*(1), 191–215. https://doi.org/10.1007/s00148-007-0152-9

Healthy People 2020. (2017). Nutrition: Gardening Interventions to Increase Vegetable Consumption Among Children. Retrieved September 20, 2019, from https://www.healthypeople.gov/2020/tools-resources/evidence-based-resource/nutrition-gardening-interventions-to-increase-vegetable

Holder, K. A., Fields, A., & Lofquist, D. (2016, December 22). Rurality Matters. Retrieved September 19, 2019, from https://www.census.gov/newsroom/blogs/random-samplings/2016/12/rurality\_matters.html

Hoogland, A. I., Hoogland, C. E., Bardach, S. H., Tarasenko, Y. N., & Schoenberg, N. E. (2019). Health behaviors in rural appalachia. *Southern Medical Journal*, *112*(8), 444–449. https://doi.org/10.14423/SMJ.0000000000001008

Jackson, J. A., Smit, E., Manore, M. M., John, D., & Gunter, K. (2015). The Family-Home Nutrition Environment and Dietary Intake in Rural Children. *Nutrients*, *7*(12), 9707–9720. https://doi.org/10.3390/nu7125495

Johnson, J. A., & Johnson, A. M. (2015). Urban-rural differences in childhood and adolescent obesity in the United States: a systematic review and meta-analysis. *Childhood Obesity (Print)*, *11*(3), 233–241. https://doi.org/10.1089/chi.2014.0085

King, K. M., & Ling, J. (2015). Results of a 3-year, nutrition and physical activity intervention for children in rural, low-socioeconomic status elementary schools. *Health Education Research*, *30*(4), 647–659. https://doi.org/10.1093/her/cyv029

Ko, L. K., Enzler, C., Perry, C. K., Rodriguez, E., Mariscal, N., Linde, S., & Duggan, C. (2018). Food availability and food access in rural agricultural communities: use of mixed methods. *BMC Public Health*, *18*(1), 634. https://doi.org/10.1186/s12889-018-5547-x

Liu, J.-H., Jones, S. J., Sun, H., Probst, J. C., Merchant, A. T., & Cavicchia, P. (2012). Diet, physical activity, and sedentary behaviors as risk factors for childhood obesity: an urban and rural comparison. *Childhood Obesity (Print)*, *8*(5), 440–448. https://doi.org/10.1089/chi.2012.0090

MacNell, L. (2018). A geo-ethnographic analysis of low-income rural and urban women’s food shopping behaviors. *Appetite*, *128*, 311–320. https://doi.org/10.1016/j.appet.2018.05.147

Miller, W., Rogalla, D., Spencer, D., Zia, N., Griffith, B., & Heinsberg, H. (2016). Community adaptations to an impending food desert in rural Appalachia, USA. *Rural and Remote Health*, *16*(4).

Morgan, A. U., D’Alonzo, B. A., Dupuis, R., Whiteman, E. D., Kallem, S., McClintock, A., … Cannuscio, C. C. (2018). Public library staff as community health partners: training program design and evaluation. *Health Promotion Practice*, *19*(3), 361–368. https://doi.org/10.1177/1524839917735304

Morgan, A. U., Dupuis, R., D’Alonzo, B., Johnson, A., Graves, A., Brooks, K. L., … Cannuscio, C. C. (2016). Beyond books: public libraries as partners for population health. *Health Affairs (Project Hope)*, *35*(11), 2030–2036. https://doi.org/10.1377/hlthaff.2016.0724

Moy, E., Garcia, M. C., Bastian, B., Rossen, L. M., Ingram, D. D., Faul, M., … Iademarco, M. F. (2017). Leading Causes of Death in Nonmetropolitan and Metropolitan Areas- United States, 1999-2014. *MMWR. Surveillance Summaries : Morbidity and Mortality Weekly Report. Surveillance Summaries / CDC*, *66*(1), 1–8. https://doi.org/10.15585/mmwr.ss6601a1

National Center for Health Statistics. (2017). Health, United States 2017. Retrieved September 19, 2019, from https://www.cdc.gov/nchs/data/hus/2017/039.pdf

O’Connell, M., Buchwald, D. S., & Duncan, G. E. (2011). Food access and cost in American Indian communities in Washington State. *Journal of the American Dietetic Association*, *111*(9), 1375–1379. https://doi.org/10.1016/j.jada.2011.06.002

Office of Minority Health. (2018). Profile: American Indian/Alaska Native. Retrieved September 19, 2019, from https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=62

Patterson, K. A. E., Gall, S. L., Venn, A. J., Otahal, P., Blizzard, L., Dwyer, T., & Cleland, V. J. (2017). Accumulated exposure to rural areas of residence over the life course is associated with overweight and obesity in adulthood: a 25-year prospective cohort study. *Annals of Epidemiology*, *27*(3), 169–175.e2. https://doi.org/10.1016/j.annepidem.2017.01.007

Patterson, P. D., Moore, C. G., Probst, J. C., & Shinogle, J. A. (2004). Obesity and physical inactivity in rural America. *The Journal of Rural Health : Official Journal of the American Rural Health Association and the National Rural Health Care Association*, *20*(2), 151–159. https://doi.org/10.1111/j.1748-0361.2004.tb00022.x

Probst, J. C., Barker, J. C., Enders, A., & Gardiner, P. (2018). Current state of child health in rural america: how context shapes children’s health. *The Journal of Rural Health : Official Journal of the American Rural Health Association and the National Rural Health Care Association*, *34 Suppl 1*, s3–s12. https://doi.org/10.1111/jrh.12222

Ratcliffe, M., Burd, C., Holder, K., & Fields, A. (2016). *Defining Rural at the US Census Bureau*. US Census Bureau.

Rural Health Information Hub. (2019). Rural Health Information Hub. Retrieved September 19, 2019, from https://www.ruralhealthinfo.org

Rural Health Research Gateway. (2019). Quality of Care in Rural Hospitals. Retrieved September 18, 2019, from https://www.ruralhealthresearch.org/assets/2645-9942/quality-of-care-in-rural-hospitals-recap.pdf

Saksena, M., Okrent, A., Anekwe, T., Cho, C., Dicken, C., Effl, A., … Tuttle, C. (2018). *America’s Eating Habits: Food Away From Home* . United States Department of Agriculture.

Savoie-Roskos, M. R., Wengreen, H., & Durward, C. (2017). Increasing Fruit and Vegetable Intake among Children and Youth through Gardening-Based Interventions: A Systematic Review. *Journal of the Academy of Nutrition and Dietetics*, *117*(2), 240–250. https://doi.org/10.1016/j.jand.2016.10.014

Schoenberg, N. E., Howell, B. M., Swanson, M., Grosh, C., & Bardach, S. (2013). Perspectives on healthy eating among Appalachian residents. *The Journal of Rural Health*, *29 Suppl 1*, s25-34. https://doi.org/10.1111/jrh.12009

Schulz, A., & Northridge, M. E. (2004). Social determinants of health: implications for environmental health promotion. *Health Education & Behavior : The Official Publication of the Society for Public Health Education*, *31*(4), 455–471. https://doi.org/10.1177/1090198104265598

Shaw, K. M., Theis, K. A., Self-Brown, S., Roblin, D. W., & Barker, L. (2016). Chronic disease disparities by county economic status and metropolitan classification, behavioral risk factor surveillance system, 2013. *Preventing Chronic Disease*, *13*, E119. https://doi.org/10.5888/pcd13.160088

Smith, C., & Morton, L. W. (2009). Rural food deserts: low-income perspectives on food access in Minnesota and Iowa. *Journal of Nutrition Education and Behavior*, *41*(3), 176–187. https://doi.org/10.1016/j.jneb.2008.06.008

Sriram, U., Morgan, E. H., Graham, M. L., Folta, S. C., & Seguin, R. A. (2018). Support and sabotage: A qualitative study of social influences on health behaviors among rural adults. *The Journal of Rural Health*, *34*(1), 88–97. https://doi.org/10.1111/jrh.12232

The Center for Rural Pennsylvania. (2010). Demographics: Rural/Urban PA. Retrieved September 30, 2019, from https://www.rural.palegislature.us/demographics\_rural\_urban\_counties.html

US Census Bureau. (2017a). Metropolitan and Micropolitan. Retrieved September 19, 2019, from https://www.census.gov/programs-surveys/metro-micro.html

US Census Bureau. (2017b). Rural America - Story Map Series. Retrieved September 19, 2019, from https://gis-portal.data.census.gov/arcgis/apps/MapSeries/index.html?appid=7a41374f6b03456e9d138cb014711e01

US Census Bureau. (2019, September 27). How the Census Bureau Measures Poverty . Retrieved October 10, 2019, from https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html

U.S. Department of Agriculture. (n.d.). Choose My Plate. Retrieved October 8, 2019, from https://www.choosemyplate.gov

Valdez, Z., Ramírez, A. S., Estrada, E., Grassi, K., & Nathan, S. (2016). Community perspectives on access to and availability of healthy food in rural, low-resource, Latino communities. *Preventing Chronic Disease*, *13*, E170. https://doi.org/10.5888/pcd13.160250

Whiteman, E. D., Dupuis, R., Morgan, A. U., D’Alonzo, B., Epstein, C., Klusaritz, H., & Cannuscio, C. C. (2018). Public libraries as partners for health. *Preventing Chronic Disease*, *15*. https://doi.org/10.5888/pcd15.170392

Yousefian, A., Leighton, A., Fox, K., & Hartley, D. (2011). Understanding the rural food environment--perspectives of low-income parents. *Rural Remote Health*, *11*(2), 1631.