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U.S. Urban and Rural Food Deserts: Health Variables Associated with Limited Food Access

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U.S. Urban and Rural Food Deserts: Health Variables Associated with Limited Food

Access

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Abstract

Food deserts are typically associated with limiting health variables, which can contribute to poor nutrition and result in negative medical conditions among residents. Patterns in the differences and similarities in the experiences of residents within urban and rural food deserts are caused by a myriad of factors. This paper will display how all three of the referenced studies conducted on different urban and rural food desert locations within the U.S. indicate that rural residents face a greater amount of health disparities due to variables like affordability and income, distance, time of day, and social and demographic variables—all of which can affect one's nutritional intake. Researching and exploring comparisons between various urban and rural food deserts within the U.S. can indirectly lead to possible intervention and alleviation methods to improve access to nutritional foods. Research-based solutions that tackle nutritional intake in both urban and rural food deserts could effectively reduce and potentially mitigate a multitude of negative health consequences caused by living in a food desert, those of which tend to be made up of low-income residents and people of color. A more condensed food desert map within a singular state such as California was initially considered for a smaller area to analyze, but many available studies on food deserts conduct their research from different locations in the U.S.

Keywords: food deserts, urban, rural, health disparities, nutrition, variables.

U.S. Urban and Rural Food Deserts: Health Variables Associated with Limited Food Access

As stated by the United States Department of Agriculture, 10.9% of Americans in the U.S. lived with food insecurity, a challenge to accessing basic health foods, in 2019 (Coleman-Jensen et al., 2021). According to the Centers for Disease Control, these healthy food options include whole grains, fruits and vegetables, proteins, low-fat dairy, and products that are low in sugar. The National Institute of Health, National Library of Medicine, states, “In the United States of America, the number of communities without adequate access to healthy affordable food has declined, though more than 5.6 percent of the population still lives in low-access census tracts” (Karpyn et al., 2019). Food deserts are distinguished communal living areas with a multitude of restrictions, which affect access to nutritious and affordable foods in connection to economic and demographic disparities (National Institute of Health, 2019). In other words, residents of food deserts face major limitations in accessing healthy food (National Institute of Medicine, 2012).

Although the concept is not new, food deserts continue to exist in many places in the U.S. (National Institute of Health, 2008). Over long periods, food deserts have expanded to different landscapes alongside the invention and spread of mass-manufactured food products. Unfortunately, the realistic accessibility of healthy food options for residents has remained inadequate, demanding residents place a great emphasis on maintaining their health in food deserts (Karpyn et al., 2019).

Because of the many disparities affecting food access and food choices faced by residents of food deserts, maintaining daily nutritional standards can be especially challenging. An online analysis states, “The lack of access to nutritiously rich foods in food deserts is one of the factors

that may also contribute to obesity, diabetes, cardiovascular disease, and nutritional deficiencies” (National Institute of Health, National Library of Medicine, 2022). Residents experiencing these health consequences and risks often result from living in a food desert. However, the health limitations listed in the definition of a food desert do not branch out to include the effects of poor nutrition on other underlying genetic medical conditions residents may have. Residents with these specific genetic medical conditions due to poor nutrition can be excluded from unincorporated health consequences in related studies.

According to “Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa,” the study states, “Community-based research has demonstrated the importance of looking not only at the biological and behavioral aspects of the individual, but also the social and physical environments in which people live” (Smith et al., 2009). In essence, how residents interact with the conditions of food deserts can correlate to poor nutrition and health conditions depending on their surroundings, as “both household and retail food environments influence food choice and fruit and vegetable intake” (Dean et al., 2006). In examining social and environmental factors in households and food centers, they were found to directly affect nutritional intake for residents in one urban and six rural food desert communities. Specifically, the unmet minimum of daily fruit and vegetable intake in America, which is a 4.5 cup minimum, is much lower for urban and rural residents of food deserts (Dean et al., 2006). The lower minimum for food deserts could be a result of unfresh and less enticing produce often sold for purchase in grocery stores within food deserts. A custom number scale was used throughout the study to show the significance of the ratings for all participants in the food deserts, which allowed the authors to discover that the retail environment negatively affected the nutrition of many participants. Both of the studies show that not only do the quantifiable effects of living in

both urban and rural food deserts impede access to healthier and affordable food options, but factors also playing into nutrition availability are personal and psychological variables within a social space. Some examples of these variables from the studies can include the way participating residents were raised, their knowledge of healthful foods, their lifestyles obtained since living in a food desert, their food preferences, and their conscious choices. Limited availability in freshness and variety can lead to familiarity with lower-quality foods that are more common for food desert residents (Dean et al., 2006). During interview sessions conducted in “Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa,” the study noted that “physical sensory characteristics of food such as taste, texture, and visual appearance influence food choices for almost all participants” (Smith et al., 2009). One may observe that many of the participants preferred unhealthy food options, which looked more appealing than the usually second-rate produce available in urban and rural food centers, where produce was oftentimes considered unfresh or scarred.

According to, “The Influence of Parentary Dietary Behaviors and Practices on Children’s Eating Habits, National Institute of Health,” the article states, “It has been found that early modifications in eating habits, especially during childhood, might promote health and decrease the risk of developing diseases during later life” (2021). Consequently, since food deserts by definition cause poor access to healthy foods, these continued unhealthy eating habits that can start in childhood and extend into adulthood may often occur for the majority of residents living in urban and rural food deserts. This study displays how those who have grown up in a food desert for most of their lives have the potential to be more accustomed to continuing habitual unhealthy eating patterns in the future. Even the limited selection of healthy foods for sale in a food desert will not always be in top condition for purchase to permit these residents to consume

the meals they prefer. Therefore, while an early introduction to such a diet causes residents of food deserts to be slow to abandon it in adulthood, other factors that further limit food access and food choice are freshness and variety.

Both freshness and variety can trigger decreasing chances of a resident gaining the necessary nutrition they need from healthy foods. In line with the effects of poor access, the study, “Rural and Urban Differences in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake,” comments on the low variety of food in food deserts that affects food choice (Dean et al., 2006). For example, it states, “There is a greater variety in larger stores, which is more often located in urban centers. Greater variety has often been associated with greater FV (fruit and vegetable) intake.” In “Bringing Produce to the People: Implementing a Social Marketing Food Access Intervention in Rural Food Deserts,” the piece states, “Disparities in access to fresh produce because of the lack of supermarkets and large grocery stores in food deserts are associated with residents’ dietary intake and rates of obesity and chronic disease” (Ramirez et al., 2016). Residents living in both urban and rural food deserts may experience lower levels of variety from different food centers, which could negatively affect their ability to purchase healthy foods, especially given that there is a disparity in the products and produce sold within them. As stated in the quote, residents living in urban food deserts compared to residents of rural food deserts may have an advantage in finding more fresh fruits and vegetables, as well as the types of produce they prefer to consume. Subsequently, residents living in urban food deserts would likely have improved health compared to rural residents in the population from less nutritional deficiencies due to greater variety in food options. However, for a resident to find another food center containing more of a variety of fresh foods, they may need to consider the burden of traveling a much farther distance.

In “Rural and Urban Differences in the Associations between Characteristics of Community Food Environment and Fruit and Vegetable Intake,” the study calculates the distance to a food center for rural residents to be about 3 miles. For rural residents, on the other hand, the distance to a food center was discovered to be about 8 miles. Evidenced by the study, rural residents were required to travel a further distance to a food center compared to urban residents living in food deserts (Dean et al., 2006). Even though the studies present how both rural and urban residents have to travel considerable distances, they align in displaying how distances could significantly correlate with poor health outcomes associated with poorer nutrition, especially for rural residents. The study, “Rural and Urban Differences in the Associations between Characteristics of Community Food Environment and Fruit and Vegetable Intake,” relates how rural food desert residents experience more prominent spatial disparity in comparison to urban food deserts. It states, “As expected, the average distance to the nearest supermarket or supercenter was considerably greater for rural participants” (Dean et al., 2006). From this evaluation, rural residents may need to inconveniently travel further distances, which makes it harder to access stores with healthy food options with adequate amounts of fruits and vegetables, especially depending on the time of day.

On top of the distance needed to travel by rural and urban residents to buy food from food centers, another challenge is the time of day a resident may take transportation. Factors such as scheduling, work hours, and time of day ultimately serve as barriers to both urban and rural food desert residents. It relates to the variable of distance in that it affects rural residents of food deserts more greatly than urban residents of food deserts. Unless more than one person lives in a household, which might make it possible to balance schedules and tasks for grocery shopping, there are many other considerations, which can increase food access difficulties, such

as the number of children and dependents. Variables such as affordability and income go deeper into the challenges that affect nutritional intake and lead to health conditions for food desert residents.

According to “Rural and Urban Differences in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake,” the study noted that rural residents who participated in the study reported greater barriers to food access due to affordability, which caused them to opt for more unhealthy food options due to their longer shelf life. Similarly, the study also states, “Rural participants reported greater inadequacy of household food resources in all 3 measures: food did not last, they could not afford balanced meals, reduced meal size, or skipped meals” (Dean et al., 2006). These results display how residents who experience barriers to buying healthy food options within food deserts were more likely to be prevented from reaching adequate health standards due to a lack of necessary nutrients. According to the study, “All community informants lived in USDA designated food deserts, yet only 37.8% reported that they could not purchase healthy foods near their homes,” and, “When the issue of accessibility came up as a barrier to eating healthily in the interviewed focus groups, it was related to financial and time-dependent access rather than physical access.” Potential reasons for which there are different barriers to consuming healthy and nutritious food in rural areas of Merced, California in contrast with Brazos Valley, Texas, Minnesota, and Iowa include higher produce prices, varying schedules, and reduced access to alternative modes of transportation. Some reasons for different barriers to healthy and nutritious eating in a food desert in rural parts of Merced, California in contrast with Brazos Valley, Texas, Minnesota, and Iowa include how produce is priced higher, residents have varying schedules, or have access to

another mode of transportation. In connection to freshness and variety, the variables of affordability, income, distance, and time of day are also affected by the supply of available foods.

In “Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa,” residents had incomes equal to or less than \$39,000 and similarly commented on the need for more grocery stores. The study states, “Participants believed that lack of competition impacted their daily life by influencing their household economics because local food prices were too high, or because they had to buy fuel for the car to go to an adjacent county to shop” (Smith et al., 2009). A decreased distance to grocery stores would particularly benefit food desert residents in terms of easier and more affordable food access. More importantly, when comparing the provided distances between both urban and rural food deserts, the average distances to the nearest food centers mainly depends on the differences in the availability of available transportation services. The distance to obtain food from a food center might be around the same for both rural and urban food deserts, but low-income rural residents would be more likely to face additional transportation difficulties. Low-income rural residents may need to travel further to get to a bus stop or train, have greater difficulty affording a car, or depend on another person to travel to a food center and back more often than their urban counterparts. Although these variables serve as barriers to food access in food deserts, there is also a correlation between education and economic background in food deserts, which works to increase aforementioned impacts.

Since data on the types of food centers and the varying levels of prices of their foods weren't provided, available data on income level patterns in correlation with resident education along with resident ethnicity were used. Data from interviews on-site show that 57% of participants in Minnesota completed some of high school as their highest level of education

while 33% of participants in Iowa listed high school as their highest level of education. In terms of income, 58% of Minnesota participants made less than \$10,000 per year and 42% of Iowa participants made less than \$10,000 (Smith et al., 2009). In addition, similarities were found in “Bringing Produce to the People, Implementing a Social Marketing Food Access Intervention in Rural Food Deserts,” as interviews between the researchers and the residents were conducted at mobile food truck sites in the rural parts of Merced County, California, which contained community resources to aid in food access outreach. In the study, 30% of the participants listed elementary school as their highest education level and 49% of participants listed themselves as unemployed. The methodologies of gathering data between the studies carried out in Minnesota, Iowa, and Merced County were slightly similar in that interviews were conducted at sites where residents intentionally sought easier access to food (Ramirez et al., 2016).

In “Household Income Differences in Food Sources and Food Items Purchased,” “Population-based surveys of individual intake show that lower income is associated with a poorer quality diet. Individuals with [a] lower income consume fewer fruits and vegetables, a greater proportion of energy from fat, and less fiber compared to higher-income individuals. Data show that income disparities have a greater effect on dietary quality rather than on the amount of calories consumed” (Wall et al., 2010). Both studies show that the income levels and educational levels in rural food deserts were similar in that there is a correlation between income, education, and a resident’s ability to afford healthier options at a food center within the food desert they live in.

In “Rural and Urban Differences in the Associations between Characteristics in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake,” although the education levels and the ethnicities of the residents in Brazos

Valley, Texas were not disclosed, a similarity it shared with the other studies was a recorded income level, which displayed that 15.5% of both urban and rural residents were in poverty. However, a main difference in the study carried out in Brazos Valley, Texas is that data was gathered in both urban and rural food deserts. In the urban food deserts, 9.8% were considered low-income and 13.2% were considered in poverty. In the rural food deserts, 15.1% were considered low-income and 16.8% were considered in poverty (Dean et al., 2006). As can be seen within the results, while both urban and rural locations contained residents who were considered low-income, they also contained residents who were below the poverty line, which was not shown in the previous two studies. The percentages may not appear to look as significant in representing the residents' income levels as in the previous two studies conducted in Minnesota, Iowa, and Merced County, California, but the population size of the sample was far greater. Furthermore, based on the percentages, rural food desert residents had lower income levels overall compared to urban food desert residents. As a result, those with lower incomes were less able to access healthy foods. Another difference from this study is its usage of random-digit dialing phone calls from a variety of numbers used to reach residents of both urban and rural food deserts in Brazos Valley, Texas. By implementing this method, not only were researchers able to access a larger sample size, but the sampled participants were not concentrated in one area of a food desert, unlike those in which only community outreach services were available. Therefore, the study shows a more diverse sample from multiple food deserts, those of which showcase participants in food deserts who may not be low-income or in poverty, and it provides a more accurate financial representation of the participants. In this study, the researchers gave demographic and economic backgrounds for the specific areas within both Iowa and Minnesota in which the food deserts were located. The patterns of the participants'

annual income in correlation to their education level show that the degree of schooling a person receives is an indicator of food access in that it relates to one's ability to afford produce sold in food deserts in adulthood.

Another pattern of difference between both studies is the ethnicities of the residents, which in Merced County, California, mostly consists of Latinx communities. The definition of a food desert associates food deserts with minority populations, but it goes to show that depending on the location of a food desert, this is not always the case. Exceptionally, both the one urban food desert and six rural food deserts in Minnesota and Iowa contained a majority of caucasian participants. However, in terms of participant demographics in the food deserts, which are largely described as being made up of low-income and ethnic minorities, this assumption pertained to residents living in rural food deserts in Brazos Valley, Texas, and Merced County, California. Although food deserts mostly contain a minority ethnicity makeup, depending on the population of an area, this statement can be proven false. An additional and striking similarity between all three of the studies pertains to the disproportionately large ratio of women to men participants largely represented, which leads to the observation of gender as a factor of limited food access in food deserts.

According to "Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa," 62% of participants in Minnesota identified as women, and in Iowa, 67% of participants were women. Participants were located by community food resources within the food deserts observed while in the studies conducted in Minnesota, Iowa, and Merced County, California, participants were collected on-site instead. In "Bringing Produce to the People, Implementing a Social Marketing Food Access Intervention in Rural Food Deserts," 84% of

participants living in the observed food deserts in Merced County were women, which is a far majority out of the total resident participants” (Ramirez et al., 2016).

All participants who were a part of the study came to the research sites themselves before being asked to take part in it. In the combined analysis of urban and rural food deserts in Brazos Valley, Texas, 70.7% of participants were identified as women (Dean et al., 2006). In the case of the study in Brazos Valley, Texas, since the method used to gather participants provided dispersed data, uncondensed information from a vast location, there may be less correlation to the average logistics of the area in comparison. Based on these statistics, it could be a coincidence that many of the female participants were selected, but considering the significance found in all three of the studies, women most likely face increased health risk factors associated with living in a food desert. Despite a higher number of women population samples in all three of the studies, this correlation doesn't necessarily mean more women are living in both urban and rural food deserts, but it could play a possible factor in responsibilities revolving around engaging in domestic activities. If the women in the studies lived in households with other people including men, it could weaken the significance of women experiencing an increased risk of health issues based on greater participation rates at food center sites. Although the data may display this potential bias, this is not to assume men living in food deserts don't also face the same consequences of food access within a food desert as women do, which can be seen as an example of societal disparities. Out of the considerable factors intertwining with the variables within rural and urban food deserts affecting food access and food choice, gender makeup had a significant effect in all of the studies highlighted.

Limitations

There were multiple limitations in regard to the results due to different methodologies used between the studies on food deserts. In terms of the studies examining the effects of the retail environment, which is composed of a variety of food store types, further clarifications on the varieties could be made for future studies on food deserts. In the studies, the conclusion of the retail environment negatively affecting the nutrition of many participants was reached (Dean et al., 2006). Despite the similarities in analyzing personal and psychological aspects in food desert settings, the studies have differences on the classification of the environment, where nutritional intake could be affected. The study “Rural and Urban Differences in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake” specifically notes it’s only in the household and in food centers where nutritional intake is affected (Dean et al., 2006), while in “Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa,” the locations where residents’ nutritional intake was commonly affected were not specified, which can mean any environmental space within a food desert can affect a residents’ nutritional intake (Smith et al., 2009). Given that these differences in locations affect food access and food choice, an inaccuracy appears when comparing observation methods used to measure the interaction between residents and their nutritional intake in those settings. In turn, this gray area mainly prevents a clear distinction of which method from both of the studies is more accurate in their findings. Moreover, the questions asked of the participants in “Rural Food Deserts: Low-income Perspectives on Food Access in Minnesota and Iowa” on how social behavior affects food access were either very specific or general, and much of the language used in their formatting may not be commonly known such as scientific terms. Although the study conducted in Brazos Valley, Texas mentioned the types of food centers that were considered

“retail food environments,” it is not stated whether the participants also had access to the variety of those specific types of food centers. In addition, the article stated, “Food in the smaller food stores typical of rural environments is often of lower quality than the food available in the larger grocery stores found mainly in urban settings, reducing the access of rural populations to higher-quality fresh and frozen food” (Dean et al., 2006). This information from the study reflects observations from the rural and urban food deserts in parts of Brazos Valley, Texas, but can also be applied to other rural food deserts, where there are generally lower populations. It also brings up a consideration that although the frozen foods in the food deserts of the study do not account for the nutritional intake of frozen fruits and vegetables in residents, there is a lack of high-quality frozen food, which could mean there is less of a chance of residents purchasing them over fresh versions. A limitation to this correlation, in addition to the author’s absence of a clear definition of “quality,” is it does not account for the possibility of participants purchasing canned or frozen fruits and vegetables, which still contain vitamins and nutrients. For instance, processed and frozen fruits and vegetables would not be greatly affected by appearance over time and can be stored for much longer. Thus, the data on nutritional intake, while still relatively low in food deserts, might not be as accurate as the study claims. Regardless of the difference in the affordability of canned and frozen fruits and vegetables, these grocery options would most likely be more common compared to fresh fruits and vegetables in food deserts, which might often not be available.

Another limitation in comparing these studies is that the questions asked of residents during in-person and phone interviews were different. The issue with gathering data based on experiences and perspectives is that participants can all have different interpretations of the questions asked depending on their wording and their experiences of the topic at hand. For

example, in “Rural and Urban Differences in the Associations between Characteristics of the Community Food Environment and Fruit and Vegetable Intake,” in response to the random-digit-dialing questions of residents living in food deserts in Brazos Valley, Texas, some of the revealed types of questions asked by the interviewers were about rating the variety, freshness, and price of fruits and vegetables at a frequented store. As a result, the correlating variables can be defined and interpreted differently depending on the person and their previous experiences (Dean et al., 2006). Furthermore, the other studies didn’t utilize numbered scaling to rate people’s interpretations. In “Bringing Produce to the People, Implementing a Social Marketing Food Access Intervention in Rural Food Deserts,” the study reported conducting multiple interviews to access “residents’ perspectives on food access in their communities” in rural parts of Merced County known as South Merced and Planada (Ramirez et al., 2016). These broader questions can cause participants to receive greatly varying responses from each other, so the findings in the study might not be exactly correlated with the data. While it is important to test the effects of psychological and behavioral factors on nutritional intake within urban and rural food deserts, it is important to note that these factors from research studies are never quite definitive. The results might have led to similar findings within the studies, but more definitive questions could have produced widely varying answers and thus equally varying results. Therefore, the results of these interviews may be slightly inaccurate when compared together, especially from the perspectives of residents living in rural and urban food deserts.

As for comparing the effects of distance on food desert residents between the studies, a major limitation within each of the studies is that only estimations on their expected distances to food centers from a household are utilized. The addition of exact distances in the studies would make these corresponding statements more precise. However, a crucial missing component of

claiming rural residents face more difficulties than urban residents in regard to affordability is whether rural residents aren't making as much money compared to urban residents, or if the food prices are more expensive in rural food deserts than in urban food deserts.

Moreover, the correlation between affordability and health in food deserts is different for every resident, even within different rural food deserts. To corroborate, the study conducted in Minnesota and Iowa looked for rural food deserts with county poverty levels higher than the poverty levels of the entirety of both states to include in their respective research in their selection. However, the study failed to disclose the types of food centers in which participants traveled to buy groceries, nor did they disclose examples of certain food prices. The study in Brazos Valley, Texas compares the other two studies by mentioning that “the retail food environment is composed of a variety of food store types, such as supercenters, supermarkets, small grocery stores, mass merchandisers or discounters, and pharmacies with food areas” (Dean et al., 2006). However, this information never disclosed how rural food deserts compared in income levels with the urban food deserts. These limitations show that since the studies are focused on very specific areas, information from the perspectives of the effects of being low-income and accessing specific food centers was not included in the study.

When taking a closer look at the methodologies used to gather information within the studies, the data from all of the studies except for the study pertaining to Brazos Valley, Texas, were conducted in-person. These statistical statements could alter the perspective that the majority of these rural food desert residents in Minnesota, Iowa, and Merced County, California are at significant risk of lacking food resources solely due to being low-income. In truth, only a much smaller number of residents are displayed. Lastly, the data on income and education collected was all organized into a singular chart with other categories without distinguishing

which pieces of data were from areas in Iowa or Minnesota. As an income of \$10,000 annually is below the poverty line, affordability would be a significant limitation for healthier food options in these rural food deserts. Also, the methodology behind the researchers' data collection could've skewed data because interviewed residents were approached already at community outreach sites.

Discussion

In regard to possible interpretations based on the results of the studies, intervention is evidently necessary. In "Bringing Produce to the People, Implementing a Social Marketing Food Access Intervention in Rural Food Deserts," mentions, "Decreasing barriers to food access by building stronger infrastructure within...food safety systems, and by creating alternatives, such as community gardens, informal transportation networks, or enhancing programs...through higher volunteer involvement...could also decrease food insecurity and improve long-term health outcomes for rural residents" (Ramirez et al., 2016). These various solutions could alleviate the chances of increased health limitations for food desert residents. Devising solutions for food insecurity that target the challenges residents of food deserts face in their current or future landscapes is important because of the clear understanding of how numerous variables disproportionately and negatively affect their health. Residents have a higher chance of experiencing health limitations from simply living in a food desert. In some cases, residents may not even be able to afford to pay for medical treatments that can be extremely expensive. It is possible for these health limitations to also occur for non-food desert residents, but food desert residents have more restricted food access overall, which could put them at far greater risk.

Conclusion

A key pattern in all three of the studies indicates that rural residents face a greater amount of health disparities due to non-behavioral and quantifiable variables like affordability and income, distance, time of day, and social and demographic variables that affect nutritional intake. However, many limitations arose when comparing the effects of food access and food choice, especially with environmental and demographic variables within the studies, as the effects were dependent on the perspectives of the participants, which contributed to interpretive data. Despite these health limitations, from comparing all the studies included in this research, it is evident that rural residents are more likely to face challenges to obtain adequate nutrition overall from these variables: produce of potentially lesser freshness, less variety due to the presence of fewer food centers, lower income levels that are correlated with a lesser ability to afford healthy and balanced produce, and greater traveling distances necessary to get to food centers, which they would need to plan at certain times of the day. Therefore, rural residents have an increased chance of having obesity, diabetes, and chronic illnesses than those residing in urban food deserts. Further research is necessary to implement effective solutions to target variables associated with limiting food access and food choice in rural and urban food deserts. No one solution may be suitable for every food desert, but each solution should be tested in pursuit of decreasing limitations in research while accommodating the needs of residents living in their respective food desert, rural or urban, one limiting variable at a time.

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