Studying the Access to Grocery Stores and the Economic Status of African Americans in Food Deserts

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Literature Review

In many cases, proper nutrition is a big part of many individuals' lives and is a necessity for a generally healthy life. Nutrition is a huge factor into people's daily lives, as it pertains to the status of their wellbeing and overall health. For many decades, it has been a known principle that the food that an individual eats affects their overall wellbeing in multiple different ways. Building the habit of having a healthy diet is encouraged because "People with healthy eating patterns live longer and are at lower risk for serious health problems such as heart disease, type 2 diabetes, and obesity" (Why it Matters | Nutrition | CDC, n.d.). While everyone is at risk for these problems with their wellbeing, a few races have been proven to be at a higher risk of these than others. African Americans, according to the U.S. Department of Health and Human Services Office of Minority Health, "were 1.3 times more likely to be obese as compared to non-Hispanic whites" (Obesity and African Americans, n.d.).

Many African Americans face multiple economic disadvantages. These economic disadvantages include housing, food insecurity, and even transportation. Research from Tamara Dubowitz and others found that during the Coronavirus pandemic, many individuals were affected by the shut downs that were caused because it affected not only their incomes but also some modes of transportation. They researched how this paired with failing food assistance programs impacted food insecurity. (Dubowitz, T, 2021) . Location plays a big part in how people's health choices are chosen and how they are able to approach the topic of their physical wellbeing. If a person lives in an area that is economically challenged then they could also be living in an area with a high amount of food insecurity, which is also known as a food desert. According to the United States Department of Agriculture, a food desert is defined as "an area that has either a poverty rate greater than or equal to 20% or a median family income not exceeding 80% of the median family income in urban areas, or 80% of the statewide median family income in nonurban areas" (PharmD, J. C., 2024). It also has to meet the requirements of "in urban areas, at least 500 people or 33% of the population must live more than 1 mile from the nearest large grocery store. In rural areas, at least 500 people or 33% of the population must live more than 10 miles from the nearest large grocery store" (PharmD, J. C., 2024). These areas can cause many individuals, especially African Americans, to not be able to obtain the necessary nutrition in order to take care of their health properly, causing their health to be lower in their list of priorities. The purpose of this study is to observe if there is any correlation between how much access African Americans have to grocery stores in their area and the economic status of their community. This topic needs to be researched because African Americans are often at a disadvantage with the economics in the places and communities that they reside in so there could be a chance that there is a connection between this and how they are able to acquire healthy produce and goods.

Consequences of the Food Deserts

It was found that about 12.8% of America's population lives in or around a food desert, and while this might not seem like a significant amount of people, that is 39.5 million people that are experiencing the effects of not having a sufficient flow of healthy food around them. (The Annie E. Casey Foundation, 2021). Many studies have researched the multiple different consequences that these areas have had on the general populations that make up these populations. James D. Wright et. al., the authors of Food Deserts: What is the Problem? What is the Solution?, defines a food desert as urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food. Instead of supermarkets and grocery stores, these communities may have no food access or are served only by fast food restaurants and convenience stores that offer few healthy, affordable food options" (Wright et. al 1). These communities are the ones who feel most of the effects of living in areas that are considered food deserts in their physical well being. Seth A. Berkowitz et al., the author of "Food Insecurity, Food "Deserts," and Glycemic Control in Patients With Diabetes: A Longitudinal Analysis", found more on the effects of residing in food deserts, specifically on people that have to live with the health issue of diabetes. They found that "Twenty percent of respondents reported food insecurity, and 31% resided in an area of low physical food access" (Berkowitz et al.). This is significant because the people who suffer from diabetes put great emphasis on their health and pay very close attention to their eating habits and lifestyles. However, if they are living in a food desert where there is not extra attention put onto how the nutrition is, that can have a detrimental effect on how they handle their health in the future.

African Americans Health and Food Deserts

Building onto this research that was previously covered, many more researchers have studied the physical effects that living in food deserts can have on specifically African Americans. One source, however, "Food insecurity among African Americans in the United States: A scoping review" by Elizabeth Dennard et al. found that there were many risk factors and gaps that could impact a researcher's overall results of how African Americans' health is impacted by the food desert environment. She also focuses on how the health of African American was affected during the Coronavirus pandemic. Her findings included the fact that the more below the poverty level African Americans were the more food insecurity they had. This could affect African American health over the course of time and cause negative effects on physical wellbeing (Dennard, E., 2022). One of the problems that could be caused by these environments could be diabetes. It was found in 2019, that African Americans were twice as likely to die from diabetes than white people along with the fact that in 2018, they were also found to be 60 percent more likely to be diagnosed with diabetes compared to white people (Diabetes and African Americans, n.d.). Another problem that could arise is the amount of heart diseases and high cholesterol that can occur in predominantly African American neighborhoods, especially in food deserts. It was found that "in 2019, African Americans were 30 percent more likely to die from heart disease than non-Hispanic whites" and "although African American adults

are 30 percent more likely to have high blood pressure, they are less likely than non-Hispanic whites to have their blood pressure under control" (Heart disease and African Americans, n.d.). These statistics are not helped when African Americans are living in areas that do not promote a healthy lifestyle and focus on people's nutritional health, therefore, the number of African Americans that experience the health problems of food deserts are only going to increase.

Method

The method that was utilized for this study was made in order to produce findings for the question: What is the correlation between African Americans' access to grocery stores and the economic status of food deserts? In order to do this the method of a quantitative ex post facto study was used. Ex post facto studies use and analyze pre-existing data in a certain field of research. Qualitative research "is the process of collecting and analyzing numerical data. It can be used to find patterns and averages, make predictions, test causal relationships, and generalize results to wider populations" and used for "for descriptive, correlational or experimental research" (Bhandari, P., 2023). These ways of research were used because the data that was publicly provided by the United States Census Bureau would be very accurate and reliable so that the researcher could thoroughly answer the research question and examine the correlation between the access of grocery stores for African Americans and their economic status in food deserts. The USDA Food Access Research Atlas was also utilized for the research. Both of these databases provided the information that was needed regarding the economics of various areas to produce a conclusion for the gap of the connection between African Americans and how their economic status can affect their ability to get fresh produce.

Other sources have used these databases to conduct research such as the study from the source, Exploring the Relationship Between Farmers' Markets, Food Assistance Programs, Food Deserts and Diet-Related Diseases in Texas Census Tracts in 2017 by Colleen Burkhardt et. al. This source did a study researched the need for food markets in food deserts and explored possible solutions to the problem such as home grown gardens. They also researched the relationship between how accepting food assistance programs at food markets could also help the food desert communities. However, the research did not include the economic statuses of these certain communities, which can be considered a gap in the field (Burkhardt et. al, 2020).

Procedure

First off, the researcher started the process by researching the areas that were considered food deserts in a county in Southeastern Tennessee and which ones they would be able to pull data from. The researcher included 12 randomly selected census tracts that were considered to be food desert areas in this county by the USDA Food Access Research Atlas, as shown on the map (see Appendix A).

To acquire the data for these census tracts, the researcher used datasets for each value collected that were provided by the United States Census Bureau website, (U.S. Census

Bureau., n.d.). The datasets were able to provide data on the status of the economics in the different areas along with the concentration of ethnicity groups. The information is updated with every census which is taken every 4 years. Three sets of values were taken from this source for each census tract.

The first set of values was titled “Median Income in the Past 12 Months” (see Appendix B). This set provided data on the median income based on age, family households, and non-family households. It also gave information on the median household income (MHI) for multiple races. For the purposes of this study, however, the researcher only focused on the median household income data for the section of Black or African Americans.

The second set of values was titled “Poverty Status in the Last 12 Months” (see Appendix C). This set provided the poverty rates sorted by different categories such as age, gender, race, employment status, and work experience. The data that was required and needed to be collected for this study only included the percent of African Americans that were below the poverty level.

The third and final set of values was titled “Race” (see Appendix D). This dataset was able to provide the information of how many African Americans are in each tract and how many people were in each tract in total. The researcher was then able to take those values and create a percentage by dividing the total number of African Americans by the total number of people in each tract in order to make calculations more efficient. It also provided this data for other races but the only one that was required was the African American data.

The other source that was used to collect data was a map that was titled, “Number of Grocery Stores per Census Tract” (see Appendix E). This data source was compiled from multiple data points such as the United States Geological Survey (USGS) and the Food and Agriculture Organization of the United States (FAO). This map provided less than or equal values for each tract for the amount of grocery stores that were recorded for each census tract being studied.

After obtaining all of the required data, the researcher gathered all of these values into a Google Sheet document. They used the values gathered to find a correlation between the percent of African Americans and the other observed values along with the connection between the incomes and amount of grocery stores. These observations would be able to lead the researcher to a conclusion for the previously stated question.

Analyzing the Data

To conduct the data analysis for a qualitative ex post facto study, the researcher found the data values for the percent of African Americans living in the area, median household income, and percentage of African Americans in poverty for each of the 12 census tracts. The values for each tract can be found in Figure 1.

Figure 1: The values for the percent of African Americans, the percent that were in poverty, the MHI, and the amount of grocery stores that were found for each tract.

Tract Number	% of African Americans in the tract	% of African Americans in poverty	Median Household Income	Amount of Grocery stores
#1	47.2%	40.8%	$35,833	≤ 0
#2	63.4%	39.8%	$18,750	≤ 1
#3	82.1%	30.0%	$25,236	≤ 5
#4	19.8%	32.2%	$46,541	≤ 3
#5	37.7%	57.4%	$25,489	≤ 3
#6	44.1%	33.9%	$32,051	≤ 1
#7	75%	24.9%	$32,566	≤ 3
#8	92.1%	11.1%	$55,745	≤ 3
#9	76.8%	19.9%	$41,582	≤ 1
#10	10%	8.5%	$41,582	≤ 5
#11	59.4%	32.6%	$39,069	≤ 1
#12	13.4%	30%	$29,722	≤ 0

The values that were tested together to determine if there was a correlation included the percent of African Americans in the area and the MHI, the percent of African Americans in an area and the percent of them that were considered to be in poverty, and the amount of grocery stores compared to the MHI. The percent of African Americans in each area was considered the independent variable in the correlations. The research found the Pearson correlation coefficient and r-squared value of each of the pairing of values. The Pearson correlation coefficient, also known as the r value, is denoted as a value between negative one and one and represents if there is a linear relationship between two variables. When the given r value is a positive number it means that there is a positive linear relationship between the two variables. When the r value is negative it represents that the relationship is negative and linear. A linear relationship means that as one variable increases so does the other or as a variable decreases then the other decreases as well. The closer to zero that a r value is, the weaker the relationship is, while the

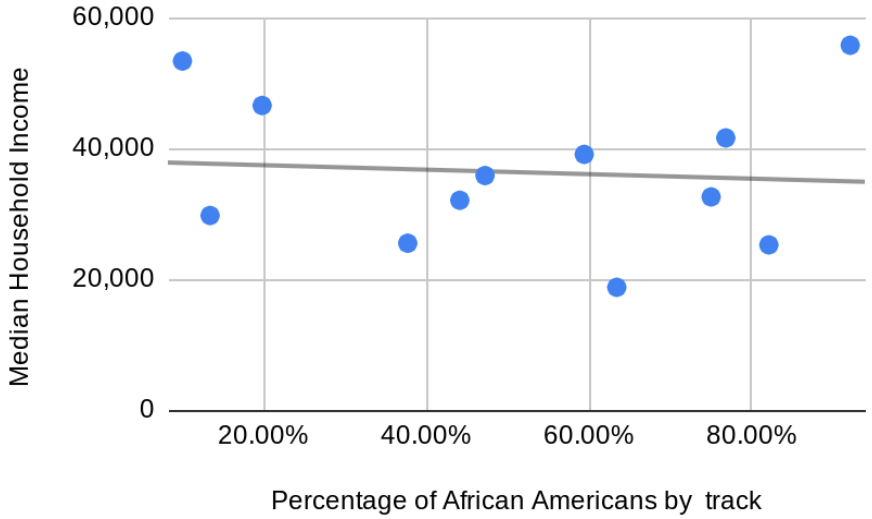
closer the value is to negative one or one, then the stronger the correlation will be (STATS-U, 2020).

The r-squared value is considered a variable that is able to tell the variance between an independent and dependent variable along with how well a regression model fits the data. The value tells if and how the variance of the independent variable can explain the variance of the dependent variable. The r-squared value gives a number anywhere from 0 to 1. If the values are closer to 0 then the effect on the variances is not considered to be very high, however, if the number is closer to 1 then the variances most likely have a much greater effect on each other (Fernando, J., 2023).

Findings

For the first data comparison, which was the MHI and the amount of African Americans in each tract, the r value was -0.083. This value is negative, which means that the relationship is a negative linear one. However, the number is also in a range that is closer to 0 than it is to 1. This value shows that there is a weak relationship between the two variables that were analyzed. The r-squared value was 0.007. This value depicts the fact that there is a weak effect between the variations of the independent (percent of African Americans) and the dependent (Median Household Income) variables. The graph for the correlation between the two variables is depicted in Figure 2.

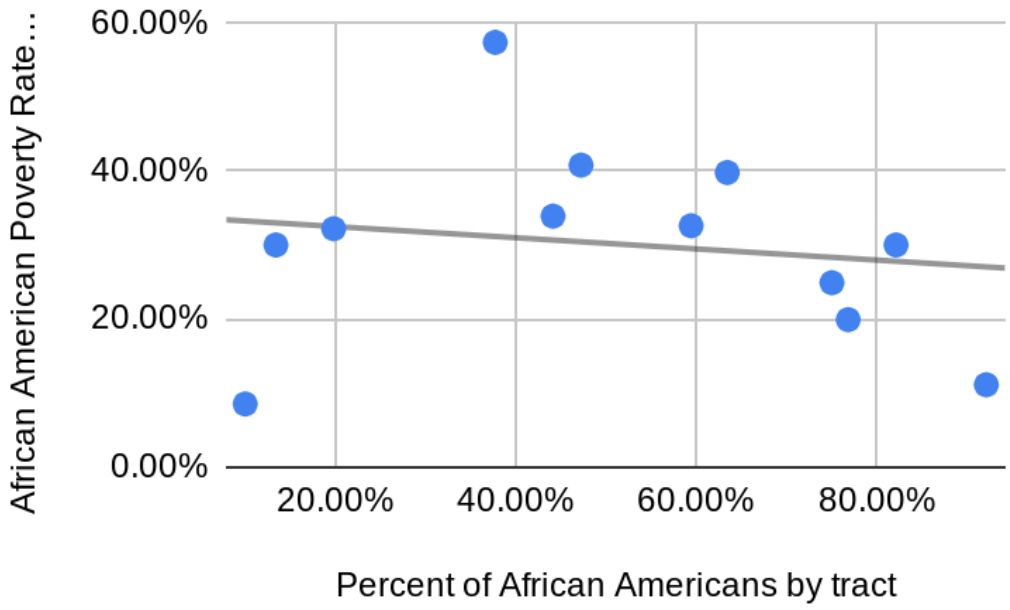
Figure 2: Graph for the correlation between the MHI and percent of African Americans by tract



For the second data comparison, the percent of African Americans in poverty and the amount of African Americans in each tract, the r value was -0.158. This value is negative once again, so

therefore the variables have a negative linear relationship. Still, the number is also in a range that is closer to 0 than it is to 1. That represents once more that there is a weak relationship between the two variables. The r-squared value was 0.025. Even though this value is greater than the last r-squared value, it still depicts the fact that there is a weak effect between the variations of the independent (percent of African Americans) and the dependent (percent of African Americans in poverty) variables. The graph for the correlation between the two variables is depicted in Figure 2.

Figure 3: Graph for the correlation between the percent of African Americans in poverty and percent of African Americans by tract



On the third data comparison, which was the Median Household Income and the amount of grocery stores that was recorded in each tract, the analyzing had to be done by observation by the researcher. This was due to the fact that the values are used to get the Pearson correlation coefficients and the r-squared values need to be on a continuous scale. The values that were given for the amount of grocery stores, however, were in values that were not continuous because they were in values that were less than or equal to certain numbers. In Figure 4, a table is depicted with just the values of the amount of grocery stores and the MHI of the tracts.

Figure 3: Graph for the correlation between the percent of African Americans in poverty and percent of African Americans by tract

	# of Grocery Stores	Household Income
Tract #1	≤ 0	$35,833
Tract #2	≤ 1	$18,750
Tract #3	≤ 5	$25,236
Tract #4	≤ 3	$46,541
Tract #5	≤ 3	$25,489
Tract #6	≤ 1	$32,051
Tract #7	≤ 3	$32,566
Tract #8	≤ 3	$55,745
Tract #9	≤ 1	$41,582
Tract #10	≤ 5	$53,337
Tract #11	≤ 1	$39,069
Tract #12	≤ 0	$29,722

The researcher expected there to be a common trend among the data. This trend was that for each tract the access or number of grocery stores for each area would be dependent on the amount of median household income. Therefore, the more income that a household has the more access they would have, or the more grocery stores they would have in their surrounding areas. However, when taking a closer look at the gathered data, the researcher noticed that the trend that they expected was not the overall results. For example, for Tract #2 and #12, they both have relatively low household incomes along with a low amount of estimated grocery stores with the amounts being less than or equal to one and less than or equal to zero. The expected trend can also be observed in Tract # 10, where the median household income is relatively high compared to the others and had an estimated grocery store amount of less than or equal to 5.

On the contrary, the majority of the tracts do not follow this trend. For example, in Tract #8 and #9, they both have a relatively high amount for their median household income, however, their amount of grocery stores in the area are relatively low with the amounts of less than or equal to three and less than or equal to one. This also happens in Tract #3 but the median

household income is generally lower than the others with it being $25,236, however, the amount of grocery stores is very high compared to the others with it being less than or equal to 5.

Summary of Findings

The Pearson correlation coefficient for the first and second data comparisons were both negative and very close to zero. Again, this translates that the data for both comparisons had a negative correlation. Therefore, when the independent variable decreases so will the dependent variable. However, since both of the values were closer to zero than to one this signifies that the negative correlation is a weak one and the variables barely, if at all, affect each other. The r-squared values for both of the comparisons were also both very close to zero rather than one. This portrays that the data variance for the independent variables do not have a high influence on the variance of the dependent variable. The findings of this study indicate that the economics of African Americans and their surrounding areas in food deserts do not have a correlation with the amount of grocery stores that are in the designated census tract.

Limitations

There were a few limitations for this study that can be considered. One of these was that the data that was collected for the data comparison between the percentage of African Americans in each tract, the median household income, and the percentage of African American in poverty were collected from the United States Census Bureau resources that were collected from the most recent census, which took place in 2020. While this is fairly recent, many could debate that the time that has passed between the time that the census was taken and the time that this study was conducted, could affect the accuracy of the results of the study. Another limitation that could be considered is the amount of tracts that were sampled for the study. Some would argue that the sample size did not correctly portray a wide enough range of data because it didn't have a bigger number of census tracts that were observed. Lastly, another element that could be viewed as a limitation of the study would be the formatting of the grocery store data. The data that was provided for the amount of grocery stores per census tracts was in a formatting of less than or equal to values. However, the data for the first two data comparisons was in a continuous form of data. Since the data for the grocery stores was not continuous it could be considered a limitation since it was not consistent with the other data sets that were gathered. The data for the grocery stores also did not include other forms of locations that could provide fresh produce. There are places such as food banks and other small convenience stores that are able to provide people with certain fresh products that were not reflected in the data. This could affect the data by not properly showing how much access African Americans have to fresh produce items as a whole.

Implications

The research that was conducted during this study was successfully able to answer the question: What is the correlation between African Americans' access to grocery stores and the economic status of food deserts? The data that was gathered to find the answer to this question found that the Pearson correlation coefficient for all the multiple comparisons that were done were negative, meaning that as one of the variables decreased then the other decreased as

well. However, the comparisons also had very low r-squared values, which indicates that the variables did not have a strong effect on the variances that happened. The analysis and observation of the grocery store data also showed a low correlation between the two variables.

These conclusions can help with the finding of a solution to the problems that have occurred because of food deserts. Since the conclusion of this study was that there was not a correlation between the variables studied that means that there is no connection between the variance of the variables. Therefore, there is not a solution to the causation of the effects of food deserts from the results of this study. This study, however, can help initiate the research into finding where the problem starts for food deserts and how to propose the best solutions since this study was not able to find a contributor to the problems.

Another possible implication that could come from this study is the awareness of how few grocery stores there are in tracts that are considered food deserts. The research that concerns the amount of grocery stores brought into light just how few grocery stores there are for populations that are around 1,000 residents. This is an effect of living in a food desert and having less access to grocery stores and this study brought awareness to just how few there are which could surprise many.

Future Studies

One of the future studies that could be based on this research would be using the method in order to analyze a bigger sample size of census tracts. This would allow for a wider range of data to be able to be collected and the effect would be able to be observed better. Also along these lines, a study could be done on how the economics of food deserts affect the access to grocery stores for multiple races and not just African Americans. This would provide another wide range of data that could further investigate if there is a correlation between these variables for everyone that lives in a food desert.

Another future study that could be done based on this research would be to incorporate how access to transportation (personal or public) would affect the correlation between these variables. This is because while there has been research done on how transportation affects African Americans food accessibility, such as in “Bridging the desert: The impact of public transportation on urban food accessibility” by Robert Huang, it has not been aligned with economics in depth. Huang researched how public transportation would be able to help more grocery stores expand out deeper into food deserts and how it would help people access healthier foods overall. However, he did not examine how the economics of the surrounding areas could affect these proposed solutions (Huang, R., 2022). Therefore, another study can investigate further into how economics can effect and correlation with transportation in food deserts.

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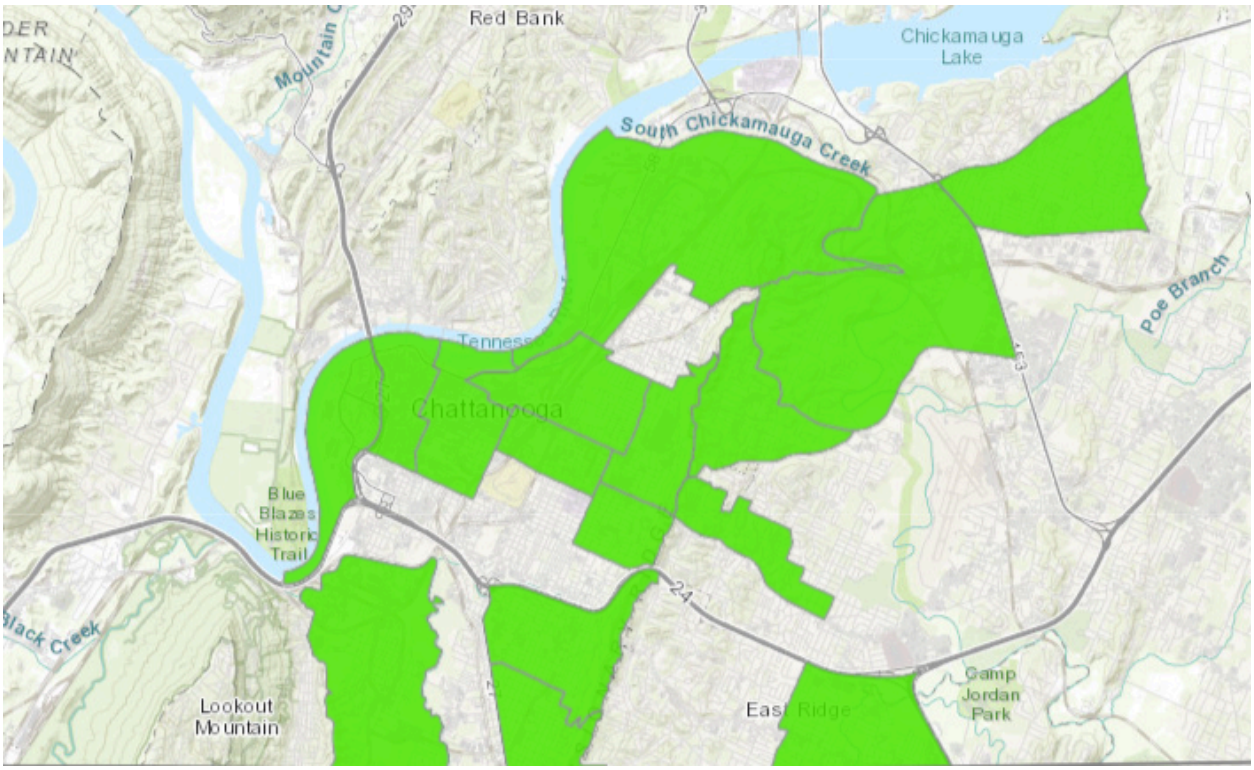
Appendices

Appendix A: Tracts in selected county from the Food Access Research Atlas from the USDA



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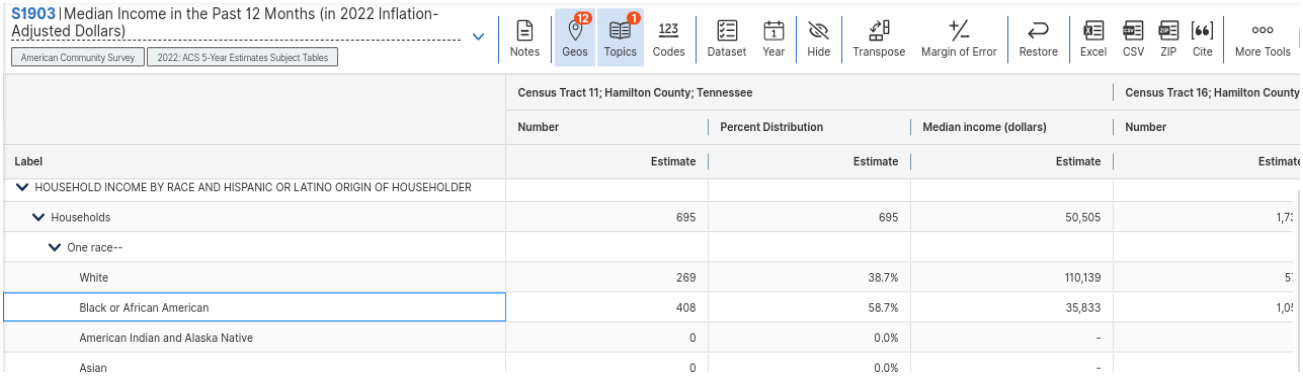
Appendix B: Median Income in the Past 12 Months by the United States Census Bureau



S1903 | Median Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)

American Community Survey | 2022: ACS 5-Year Estimates Subject Tables

Notes | Geos 12 | Topics 1 | Codes | Dataset | Year | Hide | Transpose | Margin of Error | Restore | Excel | CSV | ZIP | Cite | More Tools

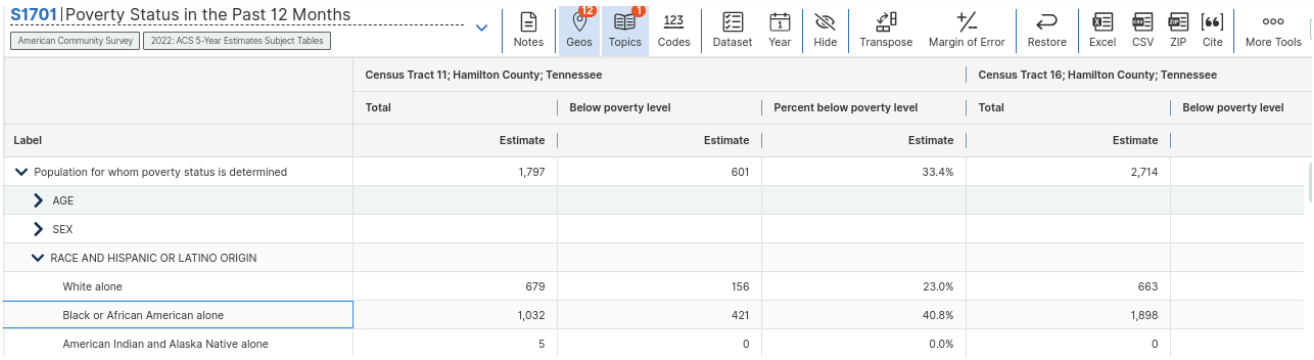
	Census Tract 11; Hamilton County; Tennessee			Census Tract 16; Hamilton County
	Number	Percent Distribution	Median income (dollars)	Number
Label	Estimate	Estimate	Estimate	Estimate
HOUSEHOLD INCOME BY RACE AND HISPANIC OR LATINO ORIGIN OF HOUSEHOLDER				
Households	695	695	50,505	1,7
One race--				
White	269	38.7%	110,139	5
Black or African American	408	58.7%	35,833	1,0
American Indian and Alaska Native	0	0.0%	-	
Asian	0	0.0%	-	

Note: The screenshot is only part of the data that was gathered for the research. The highlighted box is the dataset that was collected from the given data.

https://data.census.gov/table/ACSST5Y2022.S1903?t=Income%20(Households,%20Families,%20Individuals)&g=1400000US47065001100,47065001600,47065001900,47065002400,47065002500,47065002900,47065003200,47065011402,47065011444,47065011600,47065012300,47065012400&moe=false (U.S. Census Bureau, n.d.)

Appendices

Appendix C: Poverty Status in the Last 12 Months by the United States Census Bureau



S1701 | Poverty Status in the Past 12 Months

American Community Survey | 2022: ACS 5-Year Estimates Subject Tables

Notes | Geos 12 | Topics 1 | Codes | Dataset | Year | Hide | Transpose | Margin of Error | Restore | Excel | CSV | ZIP | Cite | More Tools

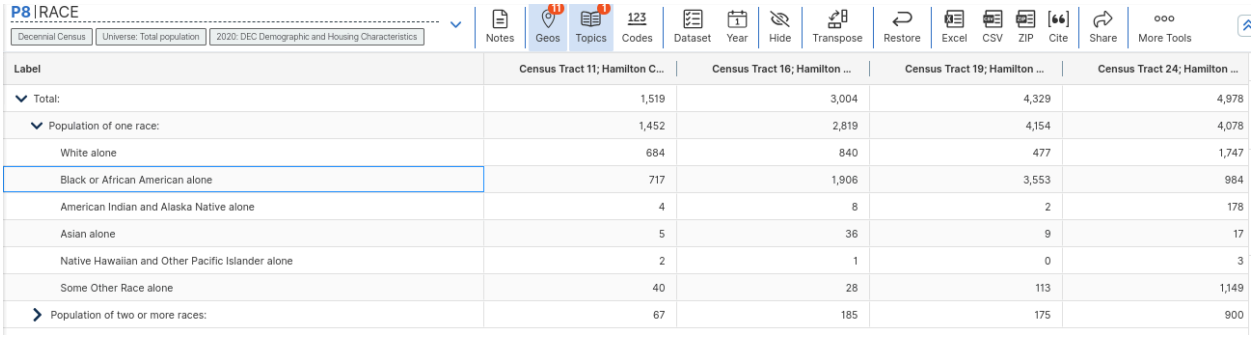
	Census Tract 11; Hamilton County; Tennessee			Census Tract 16; Hamilton County; Tennessee	
	Total	Below poverty level	Percent below poverty level	Total	Below poverty level
Label	Estimate	Estimate	Estimate	Estimate	
Population for whom poverty status is determined	1,797	601	33.4%	2,714	
AGE					
SEX					
RACE AND HISPANIC OR LATINO ORIGIN					
White alone	679	156	23.0%	663	
Black or African American alone	1,032	421	40.8%	1,898	
American Indian and Alaska Native alone	5	0	0.0%	0	

Note: The screenshot is only part of the data that was gathered for the research. The highlighted box is the dataset that was collected from the given data.

https://data.census.gov/table/ACSST5Y2022.S1701?t=Poverty&g=1400000US47065001100,47065001600,47065001900,47065002400,47065002500,47065002900,47065003200,47065011402,47065011444,47065011600,47065012300,47065012400&moe=false (U.S. Census Bureau, n.d.)

Appendices

Appendix D: Race by the United States Census Bureau



P8 | RACE

Decennial Census | Universe: Total population | 2020: DEC Demographic and Housing Characteristics

Notes | Geos | Topics | Codes | Dataset | Year | Hide | Transpose | Restore | Excel | CSV | ZIP | Cite | Share | More Tools

Label	Census Tract 11; Hamilton C...	Census Tract 16; Hamilton ...	Census Tract 19; Hamilton ...	Census Tract 24; Hamilton ...
Total:	1,519	3,004	4,329	4,978
Population of one race:	1,452	2,819	4,154	4,078
White alone	684	840	477	1,747
Black or African American alone	717	1,906	3,553	984
American Indian and Alaska Native alone	4	8	2	178
Asian alone	5	36	9	17
Native Hawaiian and Other Pacific Islander alone	2	1	0	3
Some Other Race alone	40	28	113	1,149
Population of two or more races:	67	185	175	900

Note: The screenshot is only part of the data that was gathered for the research. The highlighted box is the dataset that was collected from the given data.

https://data.census.gov/table?t=Black%20or%20African%20American&g=1400000US47065001100,47065001600,47065001900,47065002400,47065002500,47065002900,47065011402,47065011444,47065011600,47065012300,47065012400 (U.S. Census Bureau, n.d.)

Appendices

Appendix E: Map of Amount of Grocery Stores per Tract by acrgis.com