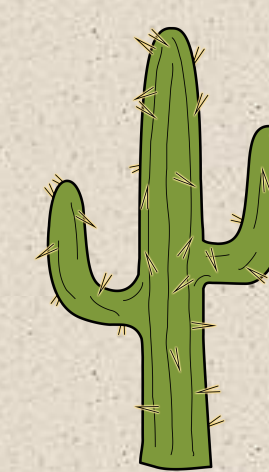


Food Deserts: Hungry For Answers

Lawren Cumberbatch - Graduating December 2021



Faculty Advisor: Professor Susan Mathews Hardy



INTRODUCTION

The USDA defines a food desert as any neighborhood or community with low access to food. I have utilized the 2010 USDA's Food Access Research Atlas which collected data on each census tract. I chose to study all the 1,965 Georgia census tracts. The data represents all 159 counties in Georgia, with each tract representing an optimum of 4000 people. Since the American household has an average of 2.58 people, it is reasonable to assume that each tract represents approximately 1,550 households.

In my research, I classify a census tract as a food desert (FD Tract) when the distance to a grocery store is more than a mile. The variables measured per census tract include percentage of each race living in food desert, percentage of each age group living in a food desert, whether the census tract is classified as a food desert, percentage of households with no vehicle access who live more than a mile from a grocery store, population size, poverty rate, median family income and whether the census tract has at least 67% of the people living in group quarters.

METHODS

- Histograms** of percentage of census tract who are Black and live beyond a mile from a grocery store, as well as the percentage of census tract who are over 65 years old and live beyond a mile from a grocery store.
- Stratified Histograms** were used to contrast median family income for each census tract by whether or not the census tract is classified as a food desert.
- One Sample t-Test** was conducted to compare the average percentage of Black Georgians living in food deserts with the national average percentage of Black people living in food deserts.
- Two-Sample t-Test** was conducted to compare the average median family income for FD Tracts and non-FD Tracts.
- Chi-Square Tests of Independence** were used to investigate the relationship between categorized vehicle access and group quarters, as well as categorized seniors and categorized vehicle access.
- Correlation Plots** were used to display the relationships found in the Chi-Square Tests of Independence.
- K-Sample Permutation Test** was conducted to compare whether the average poverty rate is the same across the groups of population size.
- Tukey HSD Plot** determines which population groups have significantly different poverty rates.

REFERENCES

Food Access Research Atlas (my dataset)
<https://www.kaggle.com/tcrammond/food-access-and-food-deserts>
 Source for number of people per census tract and average number of people per household
<https://www.census.gov/programs-surveys/geography/about/glossary.html>
<https://www.census.gov/library/publications/2012/dec/c2010br-14.html>

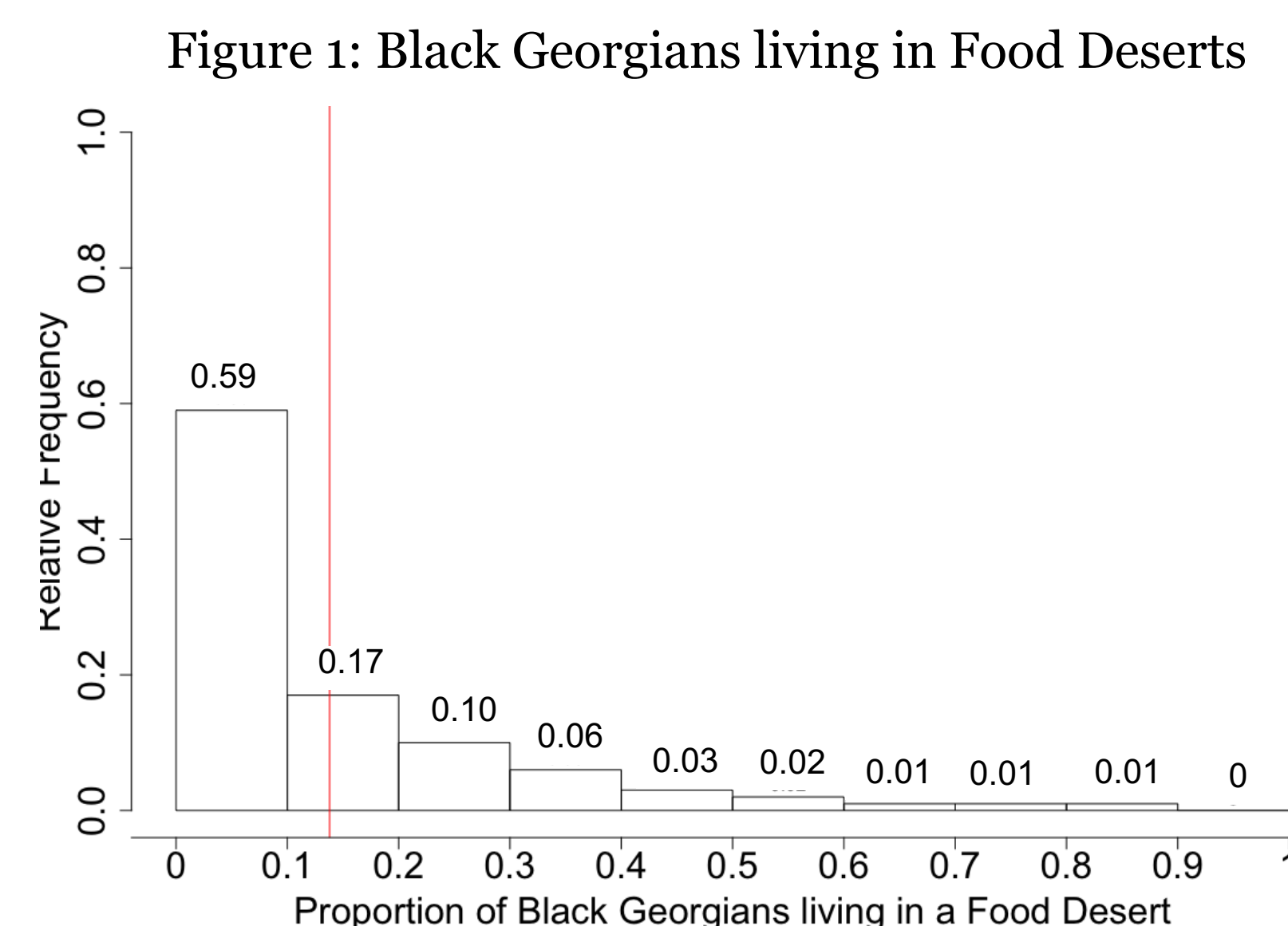


Table 1: One Sample t-Test for Black People living in Food Deserts

One Sample t-test

```
data: foodaccess2$lblack1share
t = 3.3182, df = 1956, p-value = 0.0004613
alternative hypothesis: true mean is greater than 0.1253
95 percent confidence interval:
 0.1319979      Inf
sample estimates:
mean of x
0.1385878
```

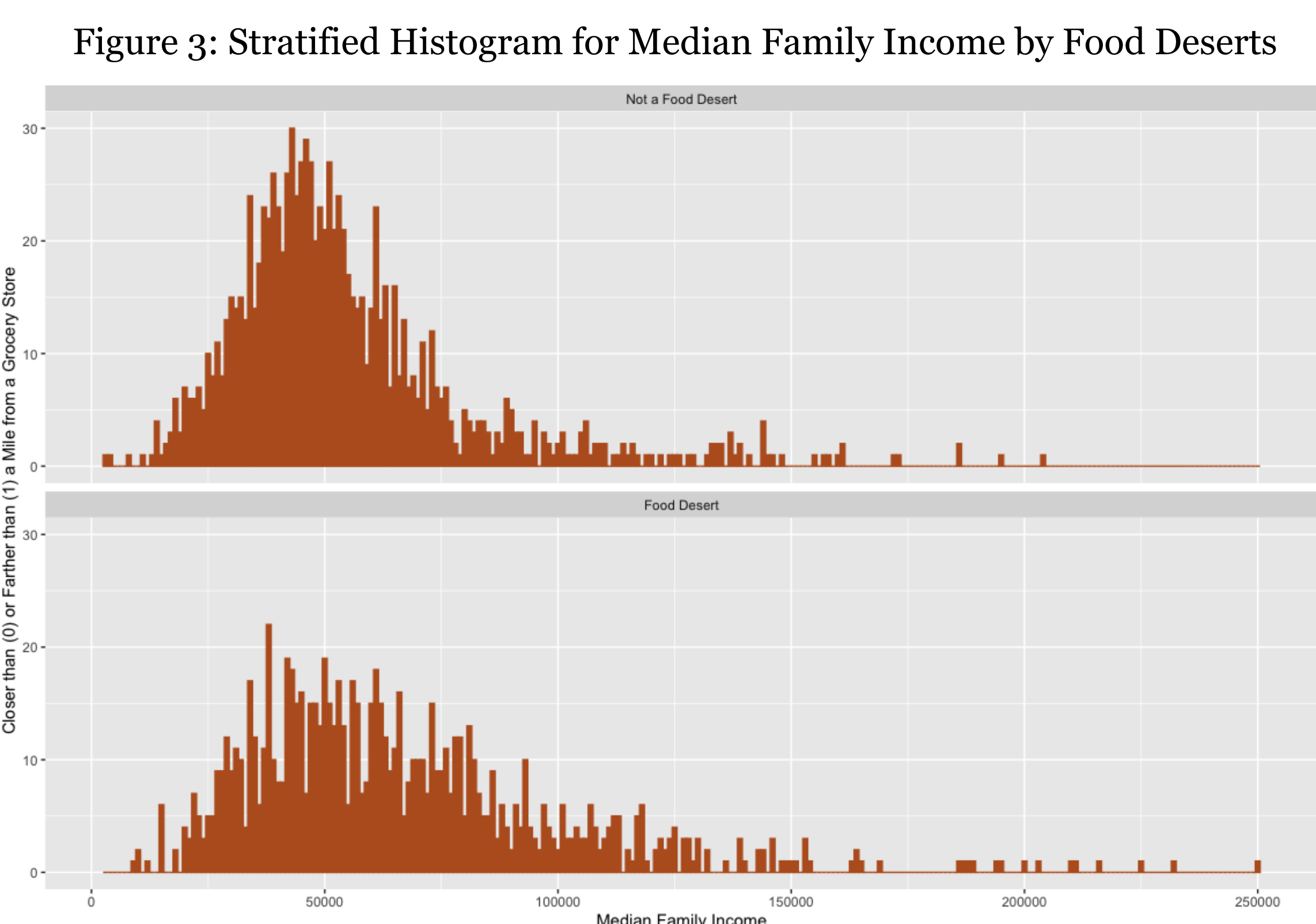
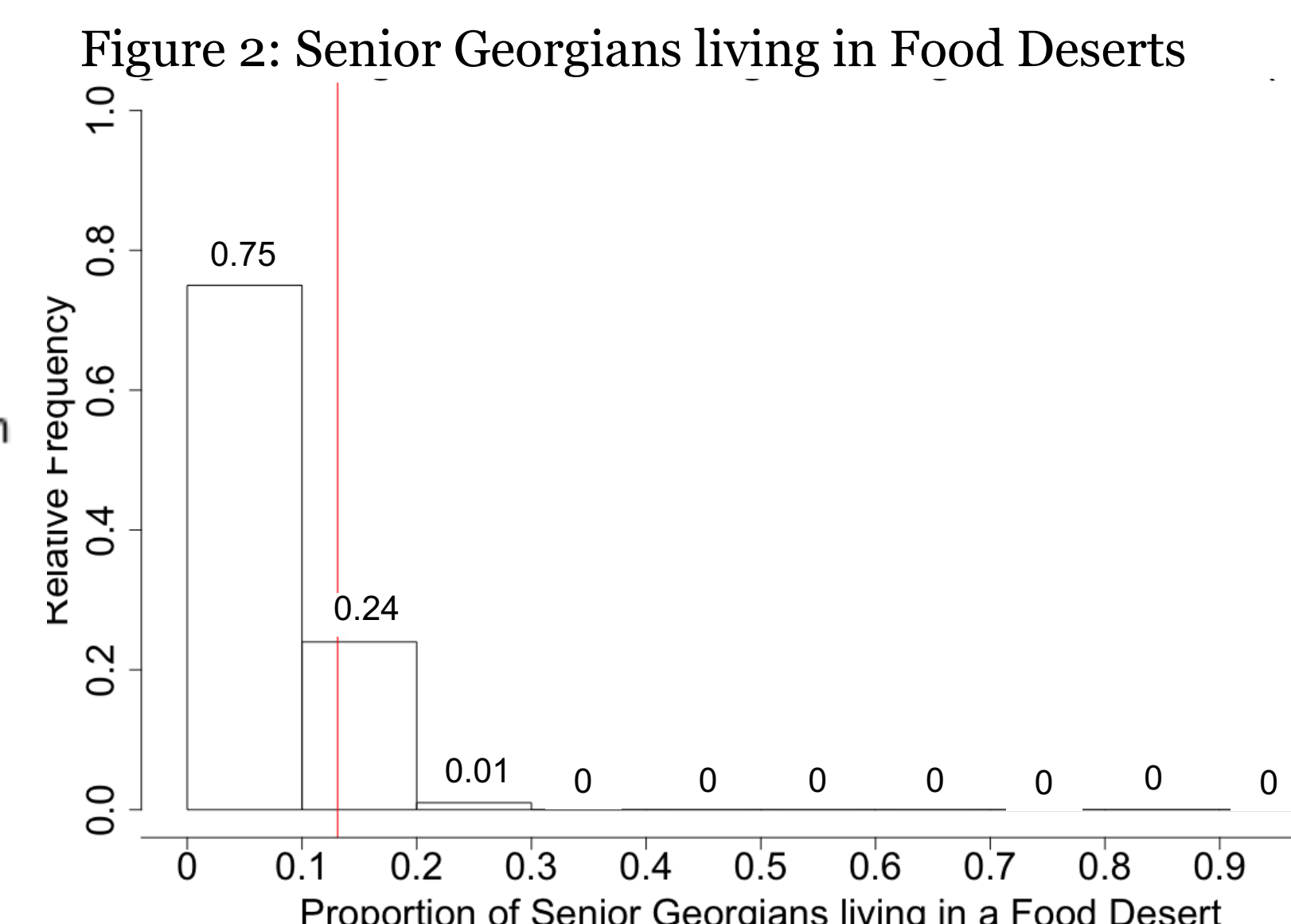


Table 2: Two Sample t-Test for Food Deserts by Median Family Income

Two Sample t-test

```
data: foodaccessnozero$MedianFamilyIncome by foodaccessnozero$LATracts1
t = -8.6629, df = 1949, p-value < 0.000000000000000022
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-14746.008 -9301.836
sample estimates:
mean in group 0 mean in group 1
54588.95      66612.87
```

Table 3: One Sample t-Test for Seniors living in Food Deserts

One Sample t-test

```
data: foodaccess$laseniors1share
t = -52.3, df = 1964, p-value < 0.000000000000000022
alternative hypothesis: true mean is less than 0.131
95 percent confidence interval:
-Inf 0.06625655
sample estimates:
mean of x
0.06415318
```

Figure 4: Tukey HSD for Poverty Rate by Population Size Group

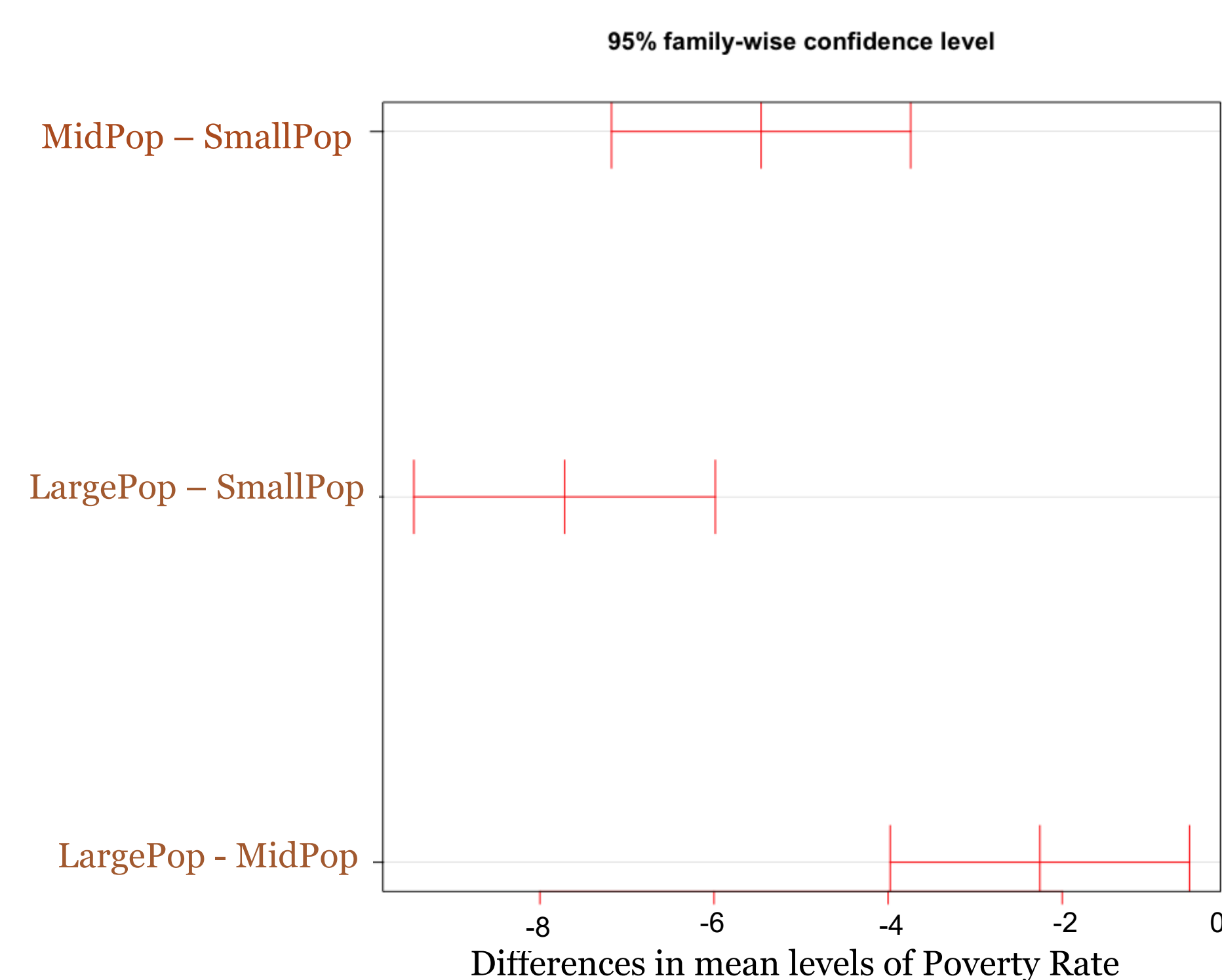


Table 4: K-Sample Permutation F Test

```
data: foodaccess2$PovertyRate by foodaccess2$PopulationCat
Chi Square = 118.79, df = 2, p-value < 0.0000000000000022
```

K-Sample Exact Permutation Test Estimated by Monte Carlo

```
data: foodaccess2$PovertyRate by foodaccess2$PopulationCat
p-value = 0.0009999
```

p-value estimated from 10000 Monte Carlo replications
 99 percent confidence interval on p-value:
 0.000000000 0.0005296914

Figure 5: Chi-Square Correlation Plot for Seniors Living in a Food Desert by Vehicle Access

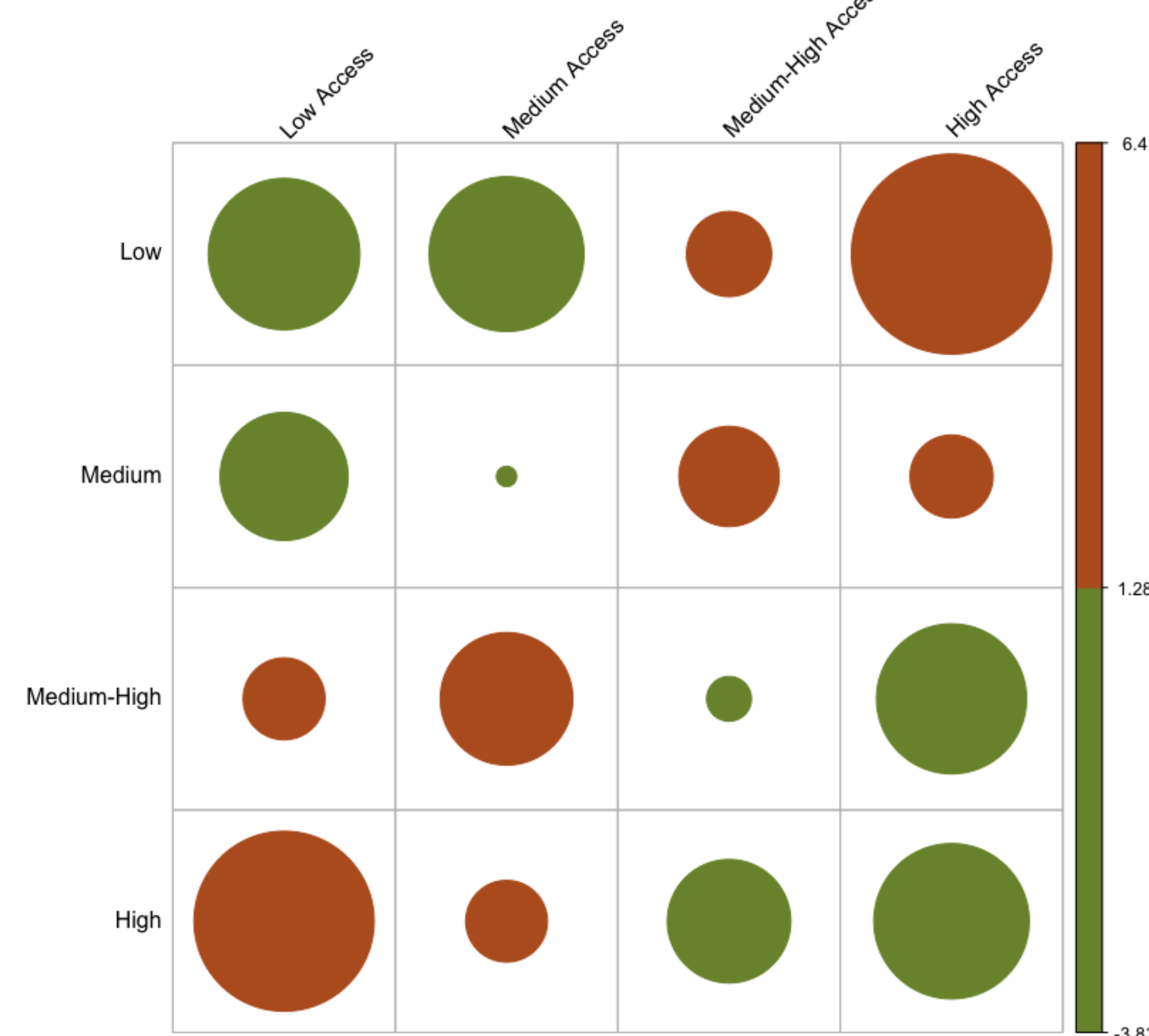


Table 5: Chi-Square Test of Independence

Pearson's Chi-squared test

```
data: dt_foodaccess2
X-squared = 151.98, df = 9, p-value < 0.0000000000000022
```

RESULTS

Figure 1 and Figure 2: The first bar in Figure 1 conveys that 59% of the Georgia census tracts have 10% or fewer Blacks living more than 1 mile from a grocery store. Using the 4000-optimum size, we can estimate that up to 329,000 Black Georgians live in food deserts. Similarly, Figure 2 conveys that in 75% of the census tracts, less than 10% of the senior citizens live in food deserts, resulting in an estimate of up to 495,000 Georgian Seniors live in food deserts. The red lines are the national percentages of Black people (13.8%) and seniors (13.1%) living in a food desert.

Table 1: Comparing the p-value of 0% to the 5% alpha, it is unlikely to get a sample average of 13.8% Black Georgians who are living in FD Tracts when the true average percentage is the same as the national average of 12.53%. Georgia has a higher percentage of Black people living in food deserts compared to the nation.

Table 2: There is a 0% chance of observing the sample average median income of a FD Tract (\$66,395) being \$12379.75 higher than a non-FD Tract (\$54,015), when there is no difference in median incomes for the two groups. We can conclude that the median income for FD Tracts is greater than non-FD Tracts.

Figure 3: The stratified histograms confirm the significant hypothesis test in Table 2. They show that the the median family incomes for FD Tracts are higher (\$66,395) than non-FD Tracts (\$54,015). In addition, the fact that the top non-FD Tract histogram's height is taller than the FD tract, conveys that the majority (53%) of the census tracts are non-FD tracts.

Table 3: Our p-value of 0% demonstrates that it is unlikely to get a sample average of 6.4% senior citizens living in FD Tracts if Georgia census tracts are like the national average percentage of 13.1%. We are 95% confident that less than 6.6% of the people in Georgia census tracts are senior citizens.

Table 4 and Figure 4 : In Table 4, K-Sample Permutation Test is used instead of ANOVA because poverty rates are not normally distributed for the three population groups. The test conveys there is a difference in the poverty rates for the three groups. Figure 5 shows all of the Tukey HSD bars to the left of 0, conveying that the poverty rate for large populations is less than midsize populations, and both large and midsize populations have poverty rates less than small populations. Thus, larger population census tracts are associated with lower poverty rates.

Table 5 and Figure 5 : Table 5 shows that there is a relationship between the percentage of seniors who live in a food desert and the percentage of households without vehicle access. Red circles of the correlation plot indicate that a higher percentage of seniors living in a food desert is associated with households lacking vehicles. Similarly, a lack of seniors living in a food desert in the census tract is associated with households having high vehicle access.