



Food Deserts: Hungry For Answers

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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 the census tract is classified as a food desert or not.
- **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.

RESULTS

BLACK GEORGIANS AND SENIOR GEORGIANS: 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.

BLACK GEORGIANS VS. THE NATION: Comparing the p-value of 0% to the 5% alpha in Table 1, 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 12.5%. **Georgia has a higher percentage of Black people living in food deserts compared to the nation.**

MEDIAN INCOME VS. FOOD DESERTS: In Table 2, there is a 0% chance of observing the sample average median income of a Food Desert Tract (\$66,395) being \$12379.75 higher than a non-Food Desert Tract (\$54,015), when there is no difference in median incomes for the two groups. We can conclude that the **median income for Food Desert Tracts is greater than non-Food Desert Tracts**. In Figure 3, the stratified histograms confirm the significant hypothesis test in Table 2. They show that the median family incomes for Food Desert Tracts are higher (\$66,395) than non-Food Desert Tracts (\$54,015). In addition, the fact that the top non-Food Desert Tract's histogram's height is taller than the Food Desert Tract, conveys that the majority (53%) of the census tracts are non-Food Desert Tracts.

SENIOR GEORGIANS VS. THE NATION: In 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**.

POPULATION SIZE VS. POVERTY RATE: 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**.

SENIOR GEORGIANS VS. VEHICLE ACCESS: 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 in Figure 6 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.

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> and <https://www.census.gov/library/publications/2012/dec/>
- **Source for Census Tract Identifier** https://tigerweb.geo.census.gov/tigerwebmain/Files/tab20/tigerweb_tab20_tract_ga.html

Figure 1: Black Georgians Living in Food Deserts

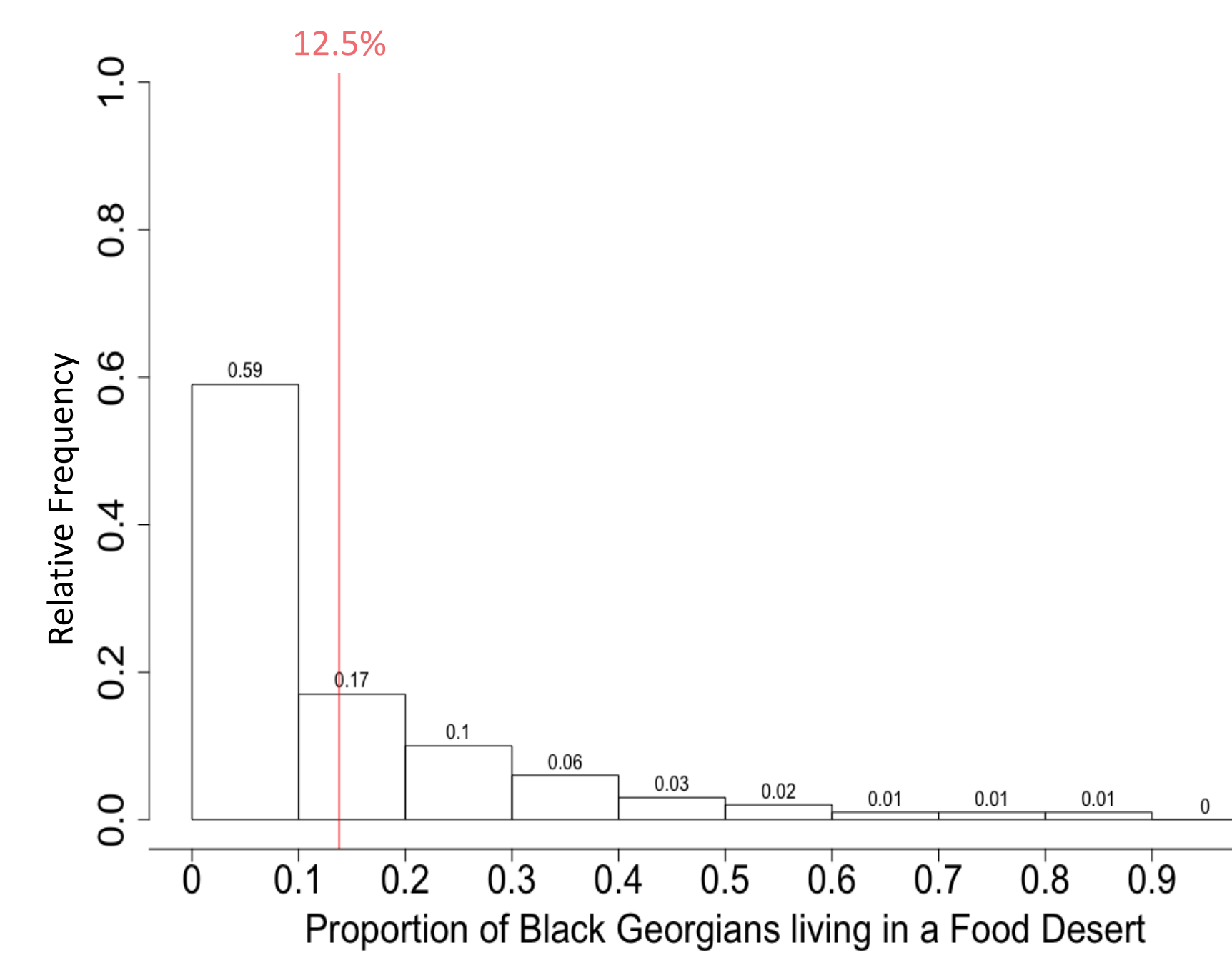


Table 1: One Sample t-Test Black People Living in Food Deserts

One Sample t-test
 data: foodaccess2\$black1share
 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

Figure 2: Senior Georgians Living in Food Deserts

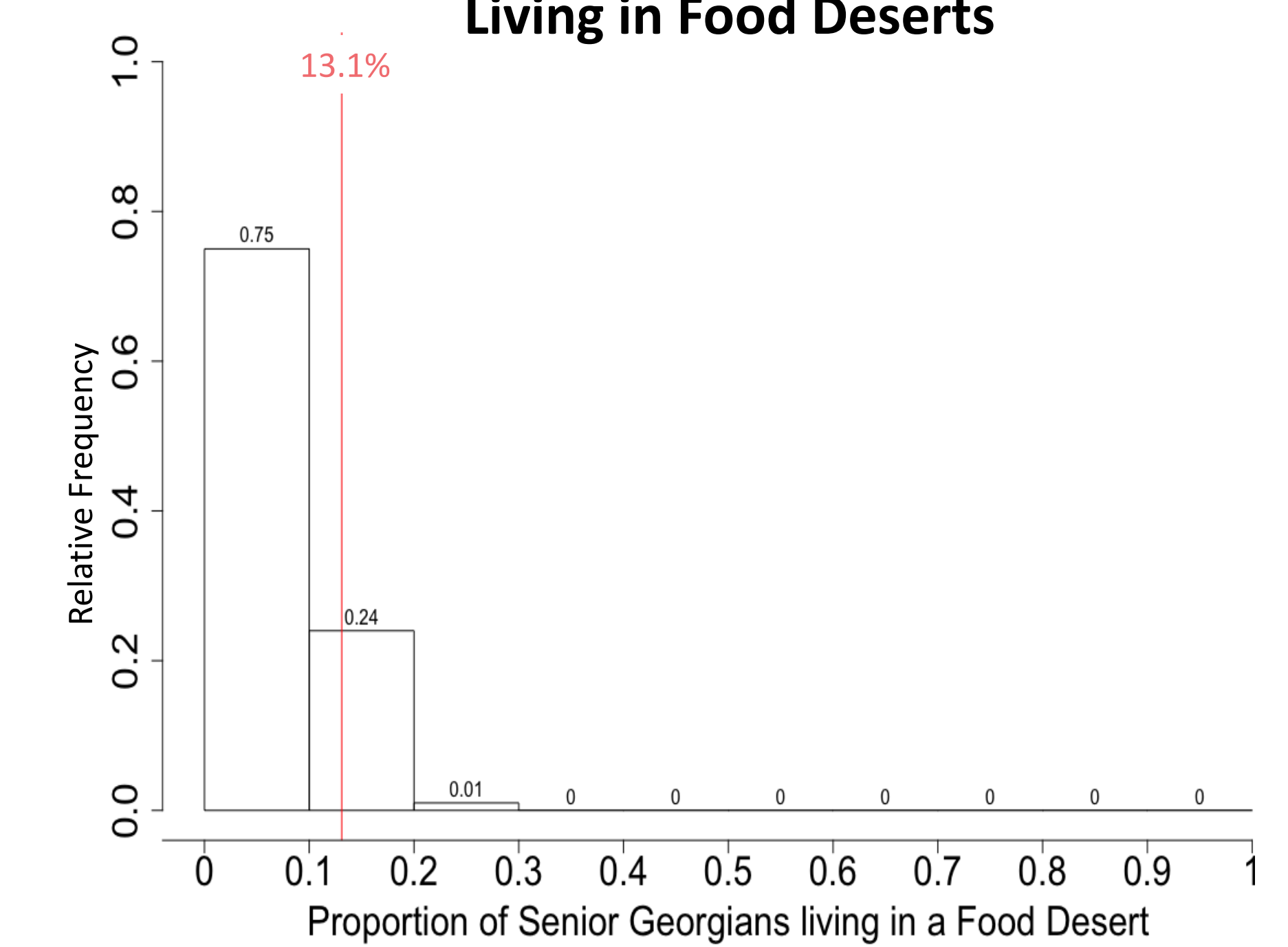


Figure 3: Stratified Histogram for Median Family Income by Food Deserts

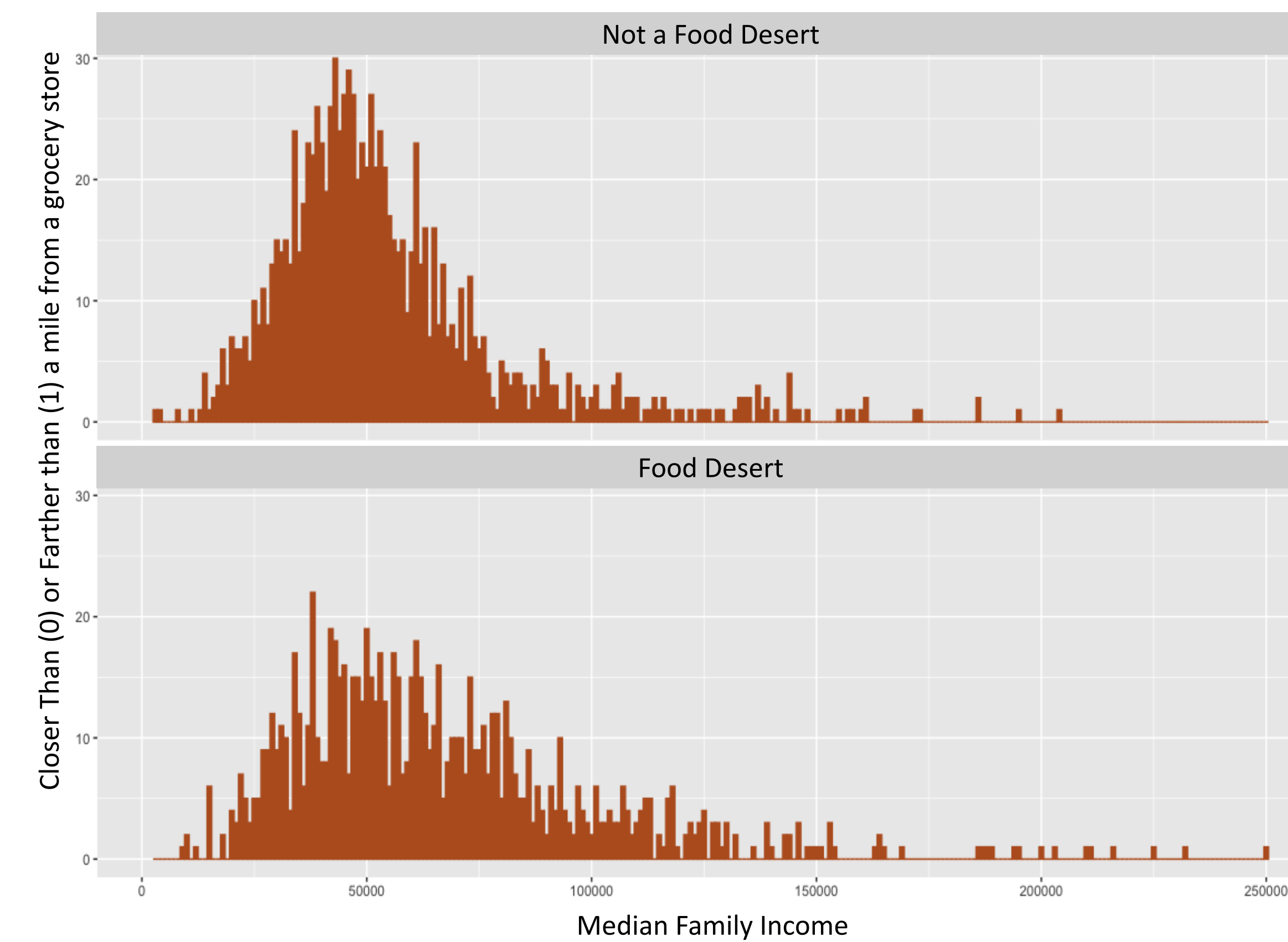


Table 2: Two Sample t-Test for Food Deserts by Median Family Income

Two Sample t-test
 data: foodaccessnozero\$MedianFamilyIncome by foodaccessnozero\$LATracts1
 t = -8.6629, df = 1949, p-value < 0.0000000000000022
 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 Food Deserts

One Sample t-test
 data: foodaccess\$laseniors1share
 t = -52.3, df = 1964, p-value < 0.0000000000000022
 alternative hypothesis: true mean is less than 0.131
 95 percent confidence interval:
 -Inf 0.06625655
 sample estimates:
 mean of x
 0.06415318

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

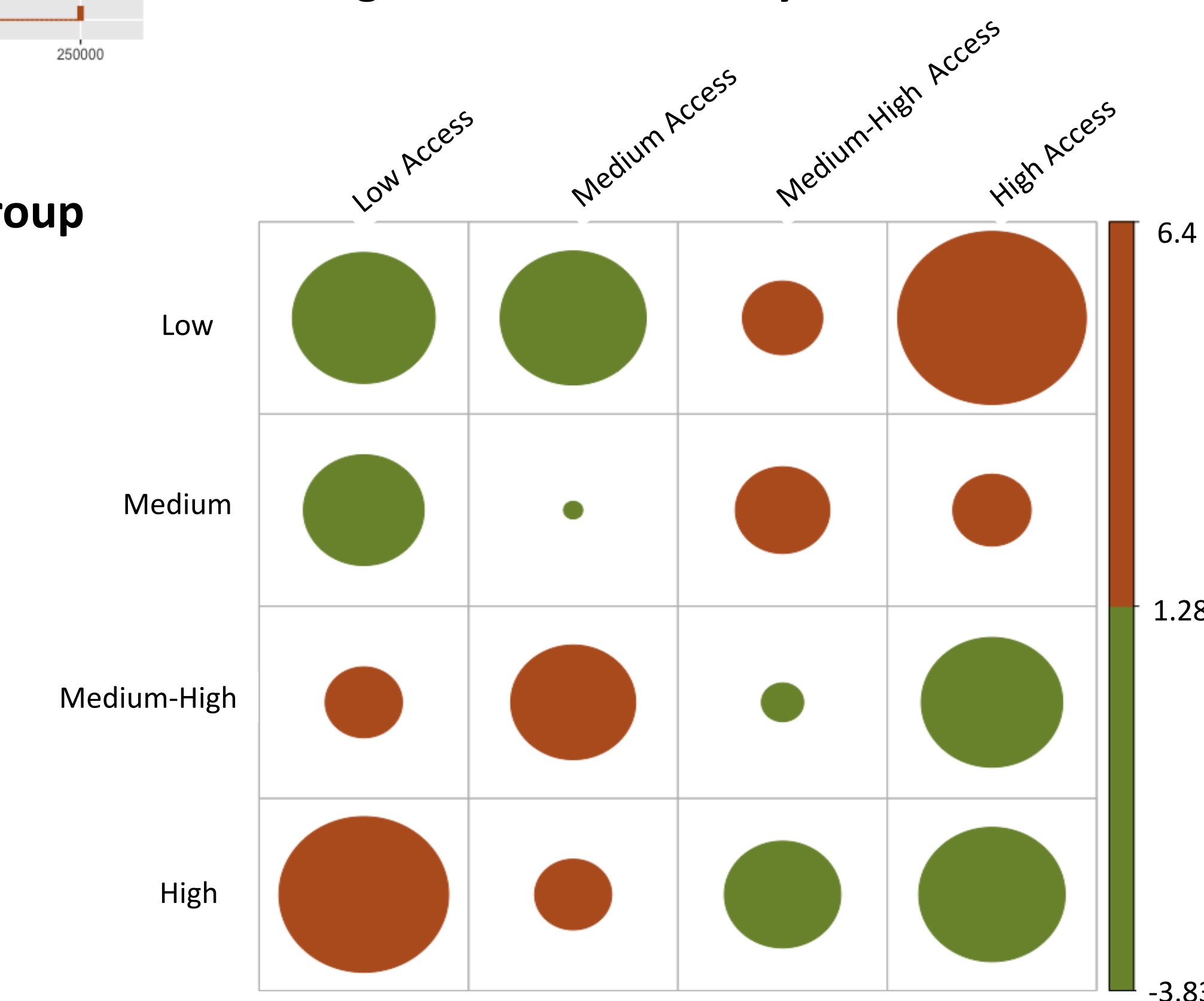


Figure 4: Tukey HSD for Poverty Rate by Population Size Group

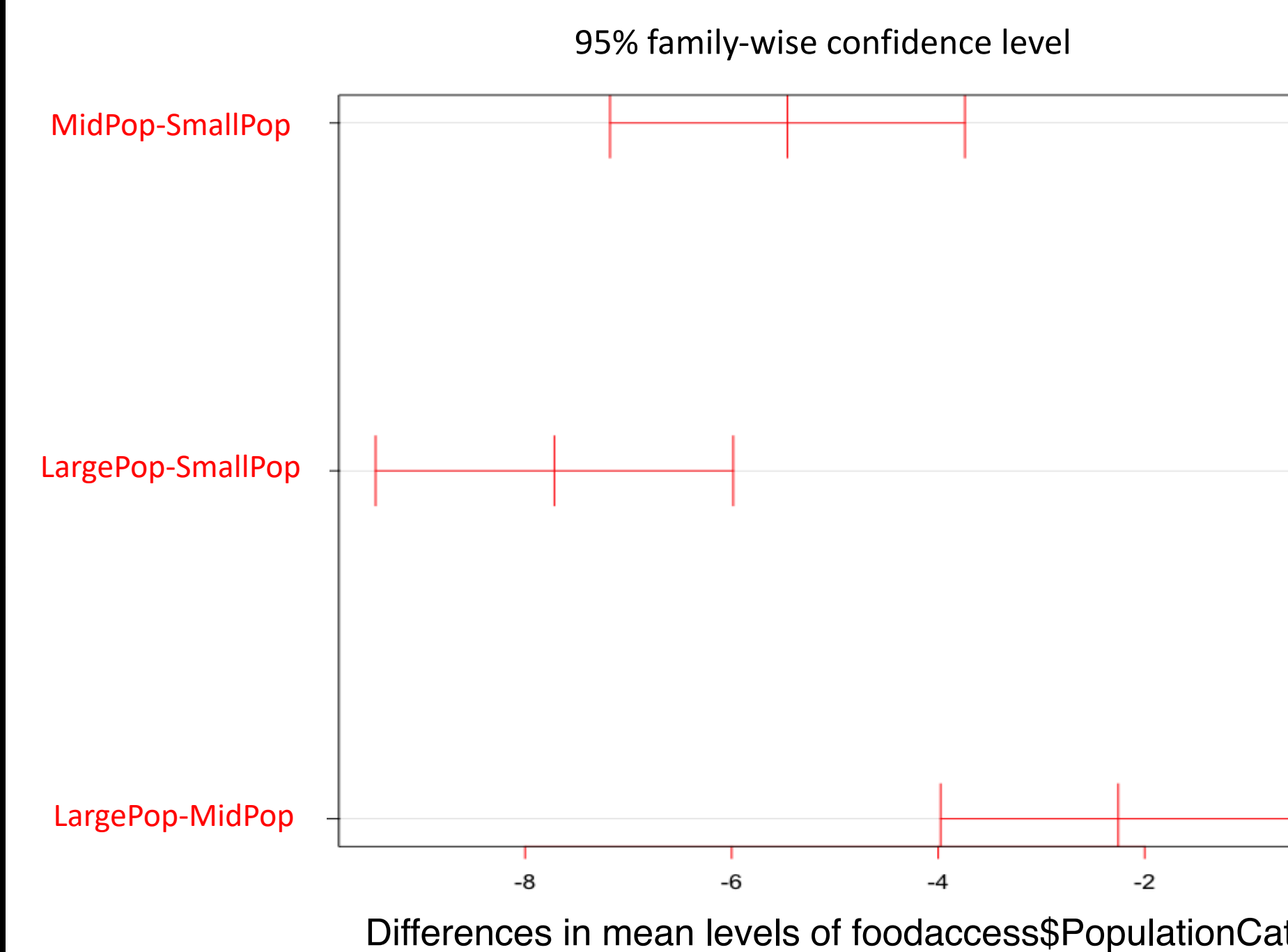


Table 4: K Sample Permutation F Test

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 = 0.00009999

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

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