Food Insecurity in the United States

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Abstract

Food insecurity (1) affects at least 6.1 percent of the U.S. population. Using data provided by the USDA (2), I will discuss food insecurity as it relates to U.S. demography (3), geography (4), and income (5). To conclude, a proposed policy to alleviate food insecurity will be offered (6).

1 Introduction

Even in the United States, a developed country with the largest economy in the world, food insecurity is still a problem. Food insecurity, holistically defined by the USDA, refers to the inability to live a healthy, active life due to limited access to healthy and affordable food.

1.1 Definitions

There have been many ways by which food insecurity has been measured, but I will define the following terms for my analysis. An individual in an urban census tract is *food-insecure* if he is of a *low income* household (defined by the U.S. government) and he has *low access at 1 mile* (living one or more miles away from the nearest supermarket). Similarly, an individual in a rural census tract is food-insecure if he is of a low income household and he has *low access at 10 miles* (living ten or more miles away from the nearest supermarket).

2 Data and Methods

The data used for analysis in this paper has been provided by the U.S. Department of Agriculture, as part of the Food Access Research Atlas project. Population data, including race, age, and ethnicity, are from the 2010 Census. Urban and rural designation comes from the 2019 urbanized area geographies. Income data are from the 2014-18 American Community Survey. Distances from the nearest supermarket, grocery store, or superstore date to 2019. See (1) for the data.

2.1 Validity and Assumptions

The forthcoming analysis likely underestimates the number of food-insecure people for several reasons. First, population data is from 2010, when the total U.S. population was around 309 million, compared to 329 million in 2021. Second, a significant number of tracts have missing data, especially among data involving low access at 10 miles. Third, the global COVID-19 pandemic has exacerbated food insecurity due to increased financial insecurity. Thus, I will assume that the results provide a lower bound for the number of food-insecure people in the United States. Since income and supermarket proximity data are more recent, I will assume that analyses dealing with proportions of food-insecure people are close to that of the present.

3 Demographics of Food Insecurity

The race and age data provided by the USDA do not break down income, so this section will focus on food access at 1 mile and 10 miles.

Distance from Supermarket	Low Access (Number of People)	Low Access and Income (Number)
Total	308,745,538	308,745,538
1mi+	122,826,152	35,187,961
10mi+	5,144,697	1,940,796
1mi+ (urban), 10mi+ (rural)	68,611,398	18,834,033

Distance from Supermarket	Low Access (Percentage of People)	Low Access & Income (Percentage)
1mi+	39.78	11.4
10mi+	1.67	0.63
1mi+ (urban), 10mi+ (rural)	22.22	6.1

Figure 1: Overview of low access and food insecurity.

Column two of Figure 1 shows that 68.6 million people, or 22.22 percent of the U.S, have low access to food by the 1 and 10 mile definition. It is clear that low access cannot be the only measure of food insecurity; for example, many people living in wealthy suburbs are more that one mile away from a supermarket, but cannot be holistically characterized as food-insecure. By the definition in Section 1.1, column three shows that 18.8 million people, or 6.1 percent of the U.S, are food insecure.

3.1 Age Groups

Between seniors, adults, and kids, food access is very similar. Per Figure 2, around 40 percent of each age group experiences low access at 1 mile, and around 1.75 percent experiences low access at 10 miles.

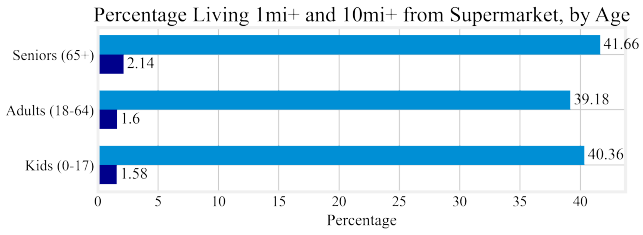

Figure 2: Low access by age.

3.2 Race

Figure 3 demonstrates that the highest percentage of Native Americans live far away from supermarkets. This fact is unsurprising, given that many Native Americans live on reservations, where supermarkets are relatively sparse (only 13 grocery stores on the Navajo Reservation (3)). Most noticeably, 10.25 percent of Native Americans live ten or more miles away, over five times the percentage of White Americans, the next highest group in that category.

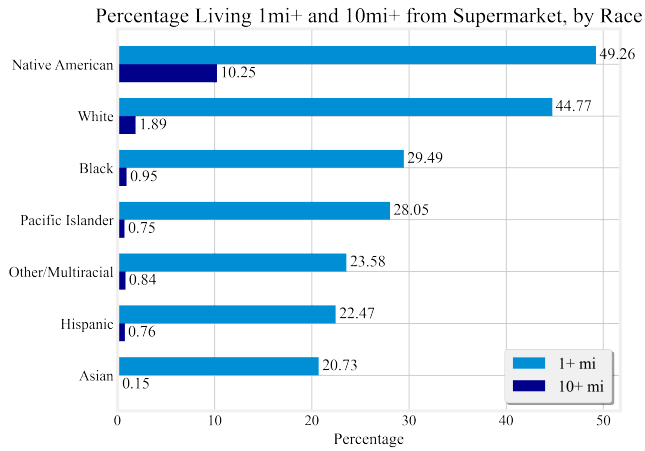

Figure 3: Low access by race.

Besides the significance of the Native Americans, not much information about food insecurity can be gleaned from Figure 3. White Americans have the second highest percentage of low access, but this may be simply because other a higher percentage of other groups live in cities as opposed to suburbs, where buildings, including supermarkets, are more densely placed.

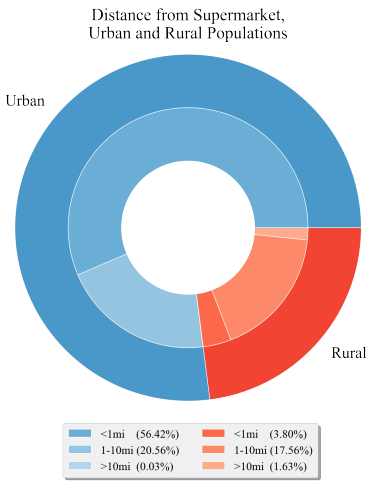

Figure 4: Pie graph breaking down the entire U.S population.

3.3 Rural and Urban

The breakdown of urban and rural food access is highlighted in Figure 4. The rural U.S population makes up 22.99 percent of the total, while the urban population makes up the other 77.01 percent. Despite this, the percentage of the rural population and the urban population living between 1-10 miles from a supermarket differs by only 3 percent. The majority of urban folk dwell within one mile of a supermarket, while the majority of rural folk dwell between 1-10 miles of a supermarket.

3.4 Moving Forward

While interesting, it is evident that low access to food does not tell the full story. From here on, I will use the definition of food insecurity from Section 1.1 in my analysis. Thus, whenever "food-insecure" or "food insecurity" is mentioned, refer back to that definition.

4 Statewide Food Insecurity

Grouping the tracts by state, I summed the number of low income urban residents living one or more miles away from the nearest supermarket and the number of low income rural residents living ten or more miles away from the nearest supermarket. Figure 5 shows the results.

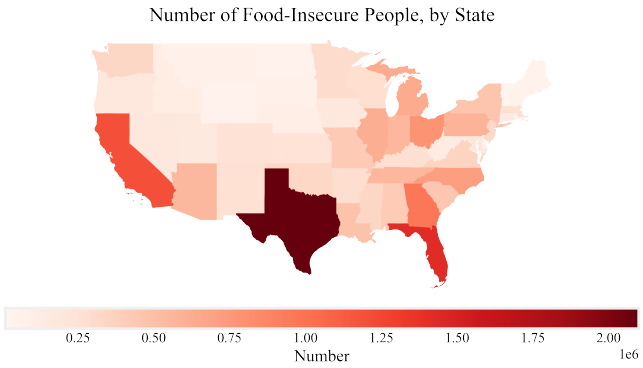

Figure 5: Not pictured: Alaska (55,886), Hawaii (72,882).

The top five states by total number of food-insecure people were, from greatest to least, Texas, California, Florida, Georgia, and Ohio. Unsurprisingly, these are some of the most populous states, ranking 2, 1, 3, 8, and 7 in total population, respectively. Of the ten most populous states, only New York (4) was not in the top ten for number of food insecure people; it was replaced by Tennessee, the 15th most populous state.

4.1 Rankings

In this section, I will rank the states from most to least food-insecure using the definition of food-insecurity in Section 1.1. I took the number of food-insecure people in each state, as computed in Section 4, and divided the sum by the state's population. New Mexico tops the ranking at 13.04 percent food-insecure, followed by Mississippi, Georgia, Louisiana, and Arkansas,

all of which are above 10 percent food-insecure. The District of Columbia possesses the lowest percentage of food-insecurity at 1.61 percent, followed by New York, Vermont, California, and Maine.

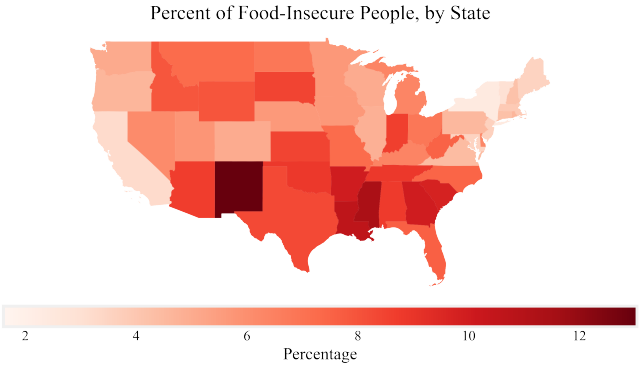

Figure 6: Not pictured: Alaska (7.87%), Hawaii (5.36%).

On a larger geographical scale, a glance at the choropleth map in Figure 6 shows that the southeast and southwest appear to be the two most food-insecure regions of the United States. On the other hand, the northeast appears to be the least food-insecure, with six of the ten lowest states on the rankings being from that region. A full ranking can be found in the Jupyter Notebook under "Geography."

5 Income and Food Insecurity

5.1 Median Family Income

One would expect that as median family income increases within a tract, the percentage of food-insecure people decreases. There is an obvious negative correlation since being low-income is one of two factors in measuring food insecurity. This phenomenon is displayed, to some extent, in Figure 7. The sheer number of data points, each one representing one of 72,531 census tracts, explains how the variability of food-insecurity is so high.

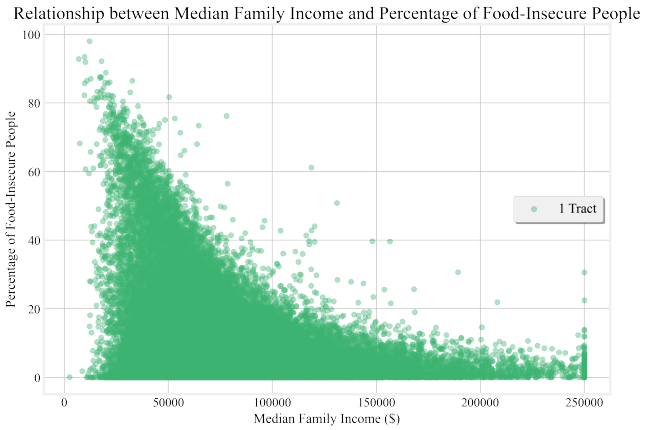

Figure 7: Income-insecurity correlation on the tract level.

The area under the curve is filled with data points, meaning that near every income, the percentage of food-insecure people will range between zero and some maximum. Looking at the maximum percentages, however, a trend appears: the maximum percentages decrease as median family income increases. At a median family income of around $50,000, very few tracts have over 60% food insecurity, around $100,000, very few tracts have over 20% food insecurity, and around $200,000, very few tracts have over 10% food insecurity.

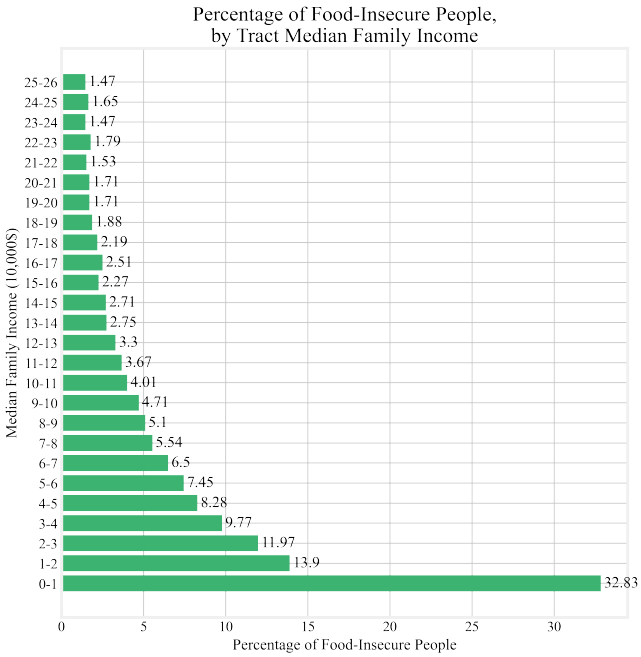

Figure 8: Grouping tracts by median family income intervals.

To clear up the data from Figure 7, I grouped the tracts by median family income ranges. Each range spans $10,000, starting from $0-$10,000 and going up to $250,000-$260,000, covering every tract. Among the tracts in each bracket, the total number of food-insecure people was divided by the total population in those tracts. A similarly shaped bar graph (when the axes are flipped) is the result, as seen in Figure 8. In tracts of median family income $0-$10,000, 32.83 percent of people are food-insecure. As the income bracket increases, this percentage decreases at a decreasing rate until around $190,000-$200,000, when the percentage of food-insecure people levels off at around 1.5-1.7 percent.

5.2 Poverty Rate

By a similar method as employed in 5.1, I plotted each tract's poverty rate against its percentage of food insecure people. One would expect a positive correlation between the two variables. This phenomena is somewhat displayed in Figure 9, with the problem being the large variability in tracts, similar to Figure 7. Near each poverty rate, tracts can range from 0 percent food-insecure to some maximum.

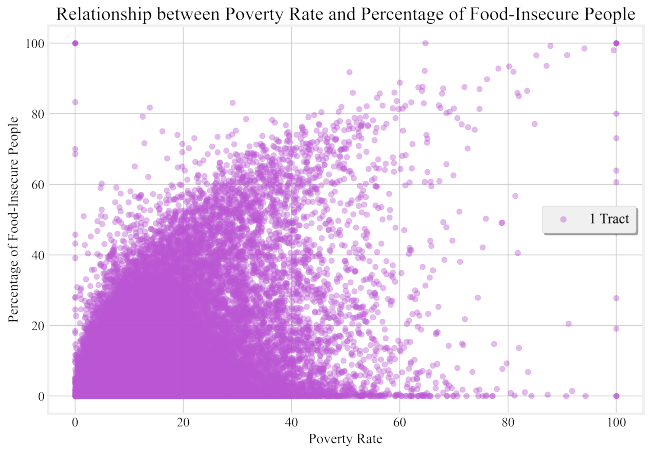

Figure 9: Poverty-insecurity correlation on the tract level.

Again, we can gain some information by looking at the maximums, which show a positive correlation with poverty rate. Note that there are some clear errors in the data, such as the data point at (0, 100), since if a tract has no low-income residents, none of its residents should be food-insecure by our metric.

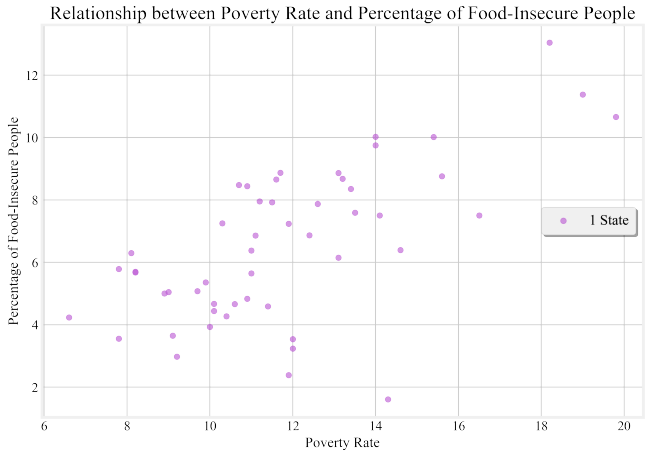

Figure 10: Income-insecurity correlation on the state level.

Statewide poverty rates were obtained from the United States Census Bureau (4) and are from 2017-2018, which overlaps with the years from the existing income data. Grouping the tracts by state greatly clears up the scatter plot and reveals a more obvious positive correlation between poverty rate and percentage of food-insecure people, shown in Figure 10. A clear outlier, however, is the District of Columbia. It has a 14.3 percent poverty rate, yet just 1.61 percent of its population is food-insecure.

6 Solutions to Food Insecurity

To conclude, I will propose a policy to supply government subsidies to build new supermarkets in urban tracts with high food-insecurity. The subsidy will also keep the produce prices low after construction. Revisiting the urban-rural dichotomy from Section 3.3, we see from Figure 11 that urban tracts are disproportionately low access and low income. Food-insecure tracts represent 14.39 percent of all urban tracts, totaling 7,941. If one new supermarket was built in each of those tracts, food insecurity would plummet.

Status	Rural (Percentage of Tracts)	Urban (Percentage)
Low Access	18.35	44.16
Low Income	33.46	44.37
Low Access and Income	7.79	14.39

Status	Rural (Number of Tracts)	Urban (Number)
Total	17,362	55,169
Low Access	3,186	24,362
Low Income	5,810	24,477
Low Access and Income	1,352	7,941

Figure 11: Rural-urban food insecurity.

The reason I am proposing an urban-focused supermarket subsidy is not to neglect rural tracts. However, if the focus must be on one or the other, I believe a greater urgency lies in remedying food insecurity in inner-city areas. Furthermore, it would be easier to target urban areas for construction of new supermarkets, as the population density is high, and one new supermarket would reach many people. Not only would new supermarkets help decrease food insecurity, but new jobs would also be created.

To give an anecdote to complement the data in support of this policy: in 2019, a brand new Jewel Osco opened in the Woodlawn neighborhood on the south side of Chicago, the first grocery store in the neighborhood for 40 years (2). Prior to its opening, Woodlawn residents had to travel two or more miles to buy food. Having lived in Woodlawn in for a summer, I can attest to the impact of that Jewel Osco. Every time I visited, it was bustling with people!

References

[1] Economic Research Service (ERS), U.S. Department of Agriculture (USDA). Food Access Research Atlas, https://www.ers.usda.gov/data-products/food-access-research-atlas/

[2] "Jewel Osco opens Woodlawn neighborhood's new full-service grocery store." *ABC7Chicago.com*, ABC, 7 March 2019.

[3] Kreider, Matilda. "13 Grocery Stores: The Navajo Nation Is a Food Desert." Planet Forward, 10 Dec. 2019.

[4] United States Census Bureau. Income and Poverty in the United States: 2020. 14 September, 2021. https://www.census.gov/library/publications/2021/