A SYSTEMIC APPROACH TO THE FOOD INSECURITY PROBLEM IN THE US

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The US Department of Agriculture (USDA) defines the term "food insecurity" as "the lack of access to enough sustainable food to maintain a healthy, active lifestyle"[1] in their 2020 report. While determining the level of food access, three major criterions were used: "Accessibility to sources of healthy food, as measured by distance to a store or by the number of stores in an area," "individual-level resources that may affect accessibility, such as family income or vehicle availability," and "neighborhood-level indicators of resources, such as the average income of the neighborhood and the availability of public transportation."[2] In this report, by examining specific aspects of the food insecurity problem under the lenses of systemic differentiations in these large categories, it was wished to provide well-thought and in-dept analysis of the phenomena observed in the US.

A. Demographics of food access.

To be able to answer more specific questions related to food insecurity, first a general depiction of the problem provided by answering the question "What proportion of people overall in the United States are food insecure?" In USDA's 2020 report, it's been stated that approximately 10.5 percent of the households in the US were estimated to be food insecure through 2020, corresponding to around 38.3 million people across the US[3]. These numbers were used as expected values for further analysis of Food Access Research Atlas Data. To determine the proportion of food insecure people in the US, columns including the exact number of people from low-access and low-income backgrounds were used. At this point, how being food insecure is defined posed great importance. So, using two of the criteria provided by USDA--the individual-level resources and the accessibility to sources--as our constructs, those constructs operationalized into low access and low-income population columns in the data. The reason why the number of people across these categories was used instead of the number of households as in the original report was to eliminate the uncertainties caused by the household capacity. There may be a relationship between the number of people living in a household and their income levels, and using the actual number of people instead of households can give us a better estimate of the overall proportion. Moreover, the data provides the distinguishment between the rural and urban areas (beyond 1 mile for urban areas and 10 miles for rural areas from sources), as well as the total low-income / low-access populations. Therefore, to visualize the proportions and to show the comparisons between the locational categories, a combination of bars and stacked bars were preferred. It was expected that the Total Low Access column will give an accurate estimation of the overall proportion, as it is the actual access category that combines both locations.

In *Figure 1*, the proportion of the total low access population (LAPOP1_10) was ~22% while total low-income population's (LALOWI1_10) proportion was ~6%. For urban areas, the same proportions were ~40% (lapop1) and ~11% (lalowi1) respectively, while they were ~2% (lapop10) and ~1% (lalowi10) for rural areas, reflecting a clear lack of data for rural areas, considering there are approximately 60 million people living in rural[4]. The proportions were not consistent with our expected value, ~10.5%, which is almost half the total low access US proportion.

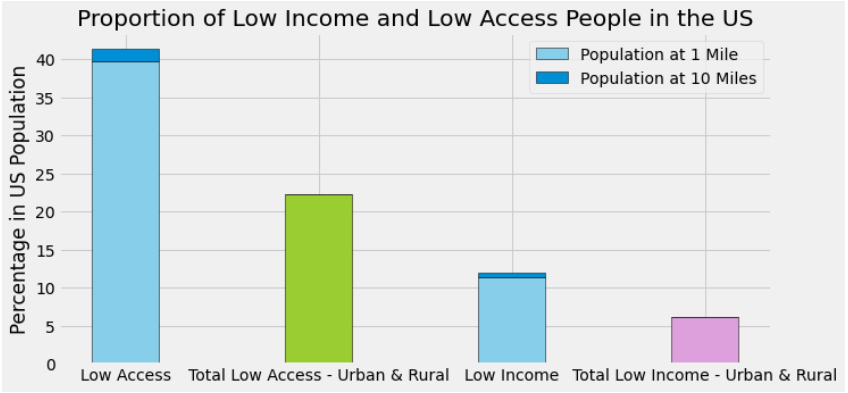


Figure 1 . Proportions of Low Income and Low Access People in the US by location

Instead of trying to find data that match with the calculated proportions, the reason of the mismatch was investigated, as it was unexpected to see such differences between the original food insecurity proportion in the US and two of the food insecurity categories provided by USDA.

The most prominent suggestion can be that the proportions of people included in specific categories are not representatives of the food insecurity individually. In *Figure 1*, it is seen that when the addition of low-income criteria made upon the low access criteria, the proportion of people decreases (22% to 6%). It can be suggested that there isn't

[1] https://www.ers.usda.gov/webdocs/publications/102076/err-298.pdf?v=9973.8
[2] https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/
[3] https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics/#children
[4] https://www.census.gov/library/stories/2017/08/rural-america.html

a clear overlap of low-income and low access people. So, with additional categories (such as the officially used criteria like neighborhood, unemployment, and SNAP participation[5]), the actual proportion of people who are food insecure may vary greatly. Even though the individual categories that were tried to be used did not meet the official value, by presenting the individual proportions of low-income and low access people across the country, they draw convenient boundaries for the possible proportion that can count as food insecure.

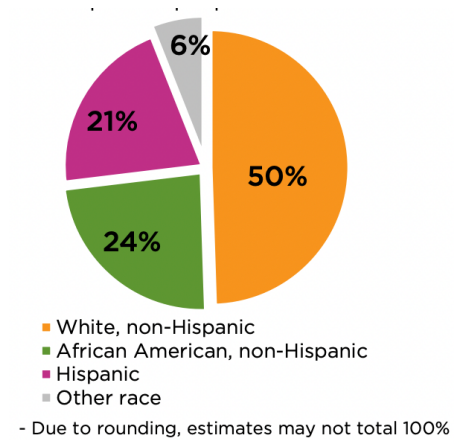


Figure 2 Races that are food secure in the US

These overall results show that with each individual categorization made upon people in risk of being food insecure, there seem to be different proportions across the US and, also, across the target population. Therefore, a comparative race study upon the data may shed light on different food insecure proportions. While calculating the proportions of races that are food insecure in the US by looking at the race demographics of the data, it's been realized that the samples chosen among races were uneven (and sometimes underrepresented) in relation to their sizes, presenting that white people constitute almost half of the food insecure people in the US, as can be seen from the *Figure 2*[6].Therefore, instead of looking at the overall proportions across the US, a second calculation referring to the food insecure people within their done because there are additional factors that should be investigated such as "although half of food-insecure households are White, they represent 1 in 11 White households in the U.S. compared to nearly 1 in 5 African American and 1 in 6 Latino households who are food insecure."[7] Even though at first, food insecure White people contained ~33% , Black people ~4%, and rest of the races approximately 8% of the people in the US, as can be seen from the *Figure 3,* when divided across races, a more clear picture of food insecurity proportions across different races can be seen. Then it can be suggested that, given the samples of the races in the data, in-group food security is the highest in the American Indian and Alaska Native population (which was surprisingly close to zero in the overall data), and lowest in the Asian population. Investigating the individual group removed a possible paradox that might have caused by overall group's effect.

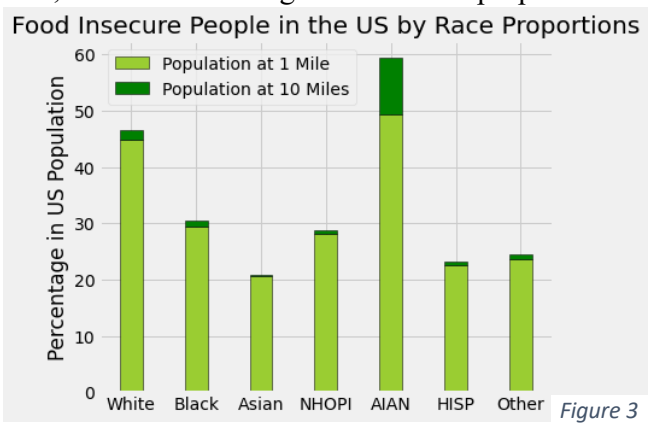


Figure 3

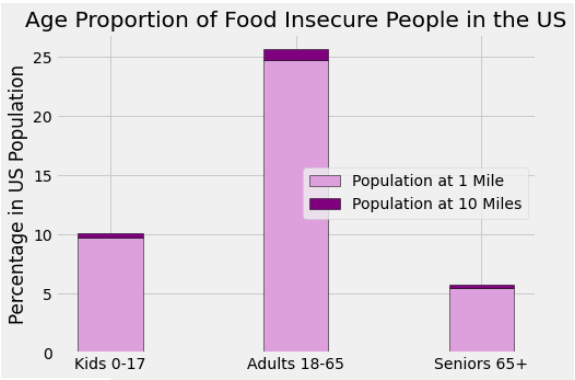


Figure 4

After conducting the same operations over different age groups provided by the data, we see a similar paradox occurring. As can be seen from the *Figure 4,* most of the food insecure people across the US are from the adult group (age 18-65) with almost 25% of the US population, followed by kids (age 0-17) with around ~10%, and lastly by seniors (age 65+) which include ~5.5% of the US population. Although, the result was relatively consistent with what USDA provided in its website, concluding that in all households, households with kids <18 composed a ~14.8%[8] and households with a senior in it a ~3%, the samples of the groups vary in number. So, when given the provided tract population of kids, adults, and seniors, it can be seen that (*Figure 5*), across all individual age groups, the proportion of food insecure individuals within an age group hold the same proportion. However, for both the race and the age comparisons, only the low-access data was provided in the atlas. So, unlike the first question, the food insecurity meant only being low access in these calculations.

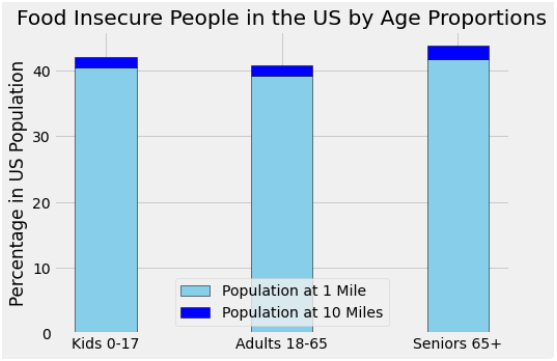


Figure 5

[5] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf
[6] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf
[7] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf
[8] https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics/#children

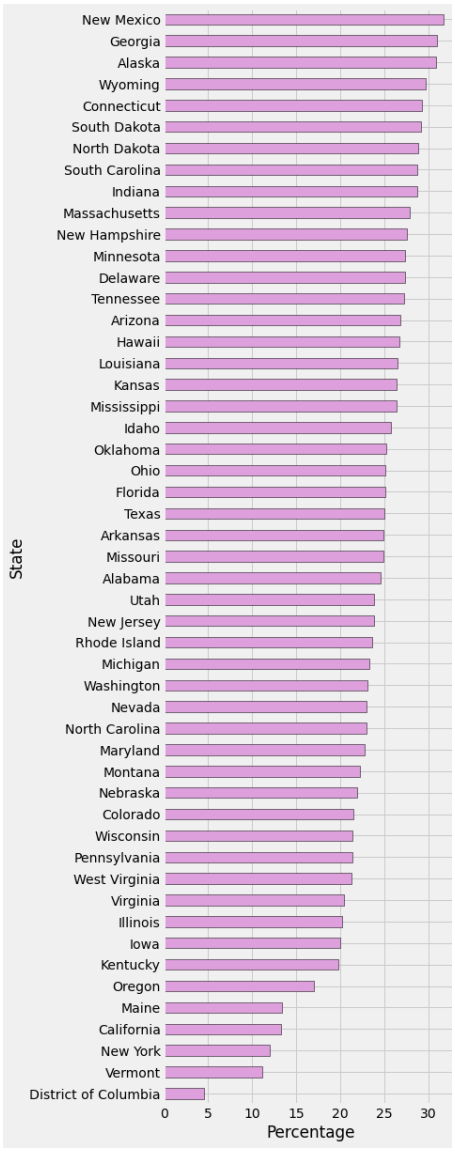
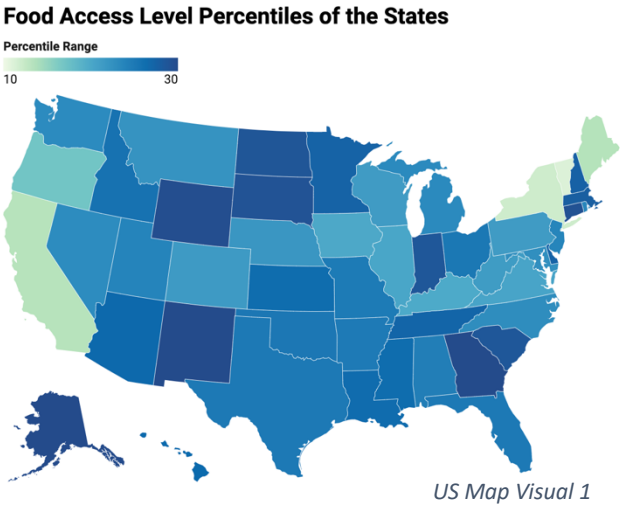


Figure 6- Food Access Percentiles of the States

B. Geography

When deciding on which states have the most and least access the food, looking at the results of the *Figure 1*, it's been decided that using only the Total Low Access column (LAPOP1_10) may give sufficient information regarding the food access rates. This may be due to the fact that lapop1 column does not specify if the tract stated is 1 mile from an urban or a rural area. This may cause low access columns to include all the 1-mile borders (from rural and urban centers), which may be the reason of very high proportion of low access people in the first bar of *Figure 1*. Considering this, and also the fact that rural data contains a very small proportion of the whole data set (less than ~10%), while structuring the metric, only the food access percentiles of the states within their own state populations were calculated, instead of a weighted combination of 1-10 miles data. From the *Figure 6*, it can be seen that the highest percentile of state low-access population count beyond 1 mile for urban areas or 10 miles for rural areas from supermarket across the in-state population was New Mexico, with ~32% of people getting classified as low-access group, and the lowest was the District of Columbia, with ~5% rate. Also, the overall distribution of the same data from *Figure 6* over the US map can be observed in *US Map Visual 1*[9]. This visual provides a better depiction of the food access percentages in actual geographical means.



US Map Visual 1

These results do conflict with the official statistics provided, which state that Mississippi hosted the most low-access group (33.5 out of 50) while Iowa was the least (12.3 out of 50) [10]. However, this metric was using an eight-factor scale with a highest score of 50, with factors such as "existing food insecurity, unemployment rates, and percentage of students receiving free and reduced-price lunch, and other factors to be secondary or tertiary in importance to the issue."[11] This proposes a more in-depth analysis of the food insecurity issue with factors that may affect the relationship indirectly.

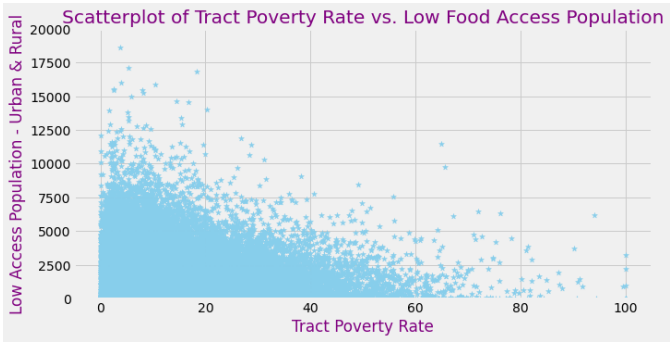


Figure 7

C. Poverty

To see if there is a correlation between tract poverty rate and/or median family income and food access, it's been decided to use scatterplots, as they lay the ought relationships between given variables. The expectation was to find a strong-negative correlation between poverty rate and food access levels, and to find strong-positive correlation between median family income and food access levels. However, the results provided very weak (close to zero) correlations. When plotting, both the overall tract poverty rate / median family income data and their state vise means used.

In *Figure 7,* it can be seen that the correlation between the tract poverty rate and low access population numbers has weak strength.

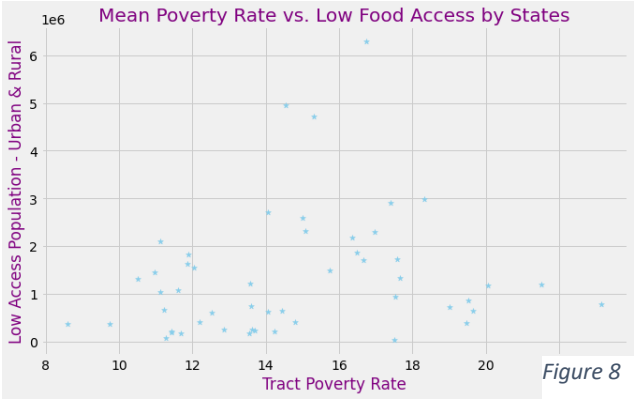


Figure 8

[9] Created by DataWrapper

[10] https://unitedwaynca.org/stories/food-insecurity-statistics/

[11] https://unitedwaynca.org/stories/food-insecurity-statistics/

The large density around the zero level is followed by an almost limit-like pattern along the vanishing points. From that limit, it may be seen that very large populations tend to be observed in tracts with less poverty rate and smaller populations tend to be observed in high poverty rates. However, these relations can also be in the reverse direction, and these patterns are observed only in the limit-like edge of the scatterplot. In relationship to *Figure 7, Figure 8* also shows a weak correlation between the state mean tract poverty rate and low access mean population numbers. There seems to be no relationship observed between the two variables, just like in *Figure 7.*

Looking at *Figure 9,* along with a weak correlation, there is a curve-like limit pattern with high density inside the curve. There seems to be no clear relationship between the median family income and low access population; however, when considering that USDA categorizes tracts as low income when "the tract's median family income is

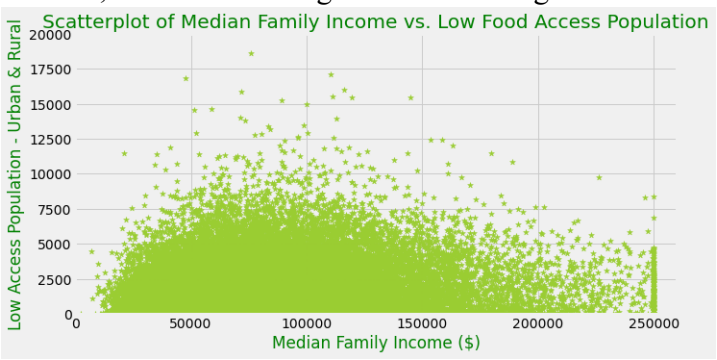


Figure 9

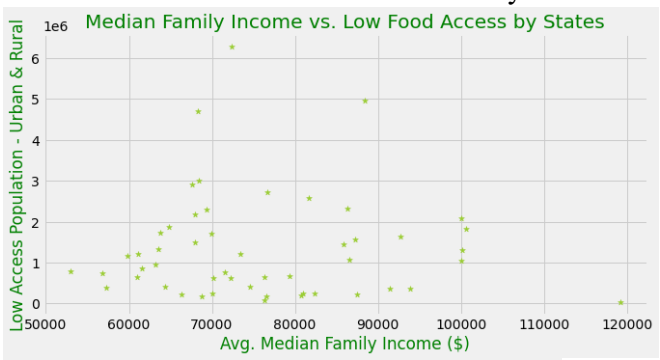


Figure 10

less than or equal to 80 percent of the State-wide median family income"[12] and that the State-wide median family income is around $70,000[13], the reason of the direction change on the curve around the $70,000 median family income levels may be explained. It may be that people with low income and high income do present different behaviors within the low access population. *Figure 10,* on the other hand, do not provide any clear relationship between the average median family income across states and the mean low access population.

Finding no correlations between these two variables and the low access population was unexpected. However, there are reasons that may shed light into this ambiguity. As an example, "food insecurity and poverty are not always experienced by the same families."[14] Stated by the Feeding America, among 40 million people living with the concern of affording food, only 59% earn above-poverty-line incomes; and among 39.7 million people living below poverty line, only 39% of them report being food insecure[15]. This shows that some households living above poverty line with high median incomes may still face food access hardships due to various reasons. The same source states one of many reasons as the eligibility criteria of the federal nutrition assistances, such as SNAP or WIC, where almost 10 million food-insecure people have incomes too high to be eligible for them[16].

D. Suggest

On the light of these analyses, it can be suggested that besides the three main factors of food insecurity stated by USDA (accessibility to sources, individual-level resources, and neighborhood-level indicators of resources), there are many factors that affect possible conclusions. However, among many, this report focused on the systematic factors, such as racial differences and federal support systems like SNAP, which are, in every section, explained with cause-effect relationships to the interest variables. It was also seen that low access, low income, poverty rate… factors individually do not contribute greatly to the overall food insecurity problem. So, a systemic change—a federal change—suggested to be the most convenient solutions to the large-scale problems of race, unemployment, and preventive federal cares. This report suggests that there should be better-organized and more inclusive federal protection projects, education programs, and public services that boost the participation of underrepresented and/or disadvantageous groups such as minorities, seniors, and kids. These projects may be on financial, nutritious, or healthcare topics that can enlight people who need help on useful information that will benefit them when considering their resources when faced with food insecurity.

[12] https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/
[13] https://www.census.gov/library/publications/2021/demo/p60-273.html
[14] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf
[15] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf
[16] https://hungerandhealth.feedingamerica.org/wp-content/uploads/2018/10/Food-Insecurity-Poverty-Brief_2018.pdf