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# The Impact of Food Insecurity on Health Outcomes

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# THE IMPACT OF FOOD INSECURITY ON HEALTH OUTCOMES

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## Abstract

*Objective:* This research study aims to investigate how food insecurity in the United States has changed between 2016 and 2022 and its correlation with health outcomes by looking at the percent of reporting fair or poor health. Our study also compares healthy food access and food environment index in the US between 2016 and 2022.

*Research Methods & Procedures:* Paired t-tests compared the levels of food insecurity between 2016 and 2022 and compared food environment index and healthy food access in the United States between 2016 and 2022. A Pearson correlation determined the relationship between food insecurity and the percentage of people reporting fair or poor health in the US in 2022. A stepwise linear regression determined how the food environment index and food insecurity predict the percentage of adults reporting fair or poor health in the US in 2022.

*Results:* The food environment index significantly increased from 6.96% in 2016 to 7.45% in 2022 ($t=34.62$, $p<.001$). A Pearson correlation indicates a significant correlation ($r = .794$, $p < .001$) where, as the percentage of food insecurity increases, the percentage of individuals reporting fair or poor health increases. When investigating how the food environment index and food insecurity predict the percentage of adults reporting fair or poor health in the US in 2022, a stepwise linear regression model demonstrated the best fit model was significant ($F_{2,3103} = 2638.46$, $p < .001$), accounting for 63.0% of the variance in reporting fair or poor health. Food

insecurity contributed most to the model ($B$ = .996, $t$ = 42.35, $p$ < .001) with percent food environment index ($B$ = -.329, $t$ = =-4.32, $p$ <.001).

*Conclusion(s):* The study aimed to identify the impact food accessibility has on health. The food insecurity pandemic is negatively impacting the global population's health, and unless drastic measures are adopted, numbers will steadily increase.

**Introduction:**

Despite the outstanding technological advancements in the past decade, the food insecurity pandemic continues to thrive and appears to be expanding as the world transitions into an income-based dichotomy. In 2021, the USDA reported 33.8 million individuals in the U.S. living in food-insecure households, and 10% of the population globally.[2] Additionally, the Covid-19 pandemic had a major impact on the global supply chain, including food services, causing an additional 150 million reported cases of undernourished individuals worldwide between 2019 and 2022.[9] Our research aims to investigate food shortages and their impact on the population's health in the United States between 2016 and 2022.

The subject of food insecurity is a complicated topic as it is influenced by a number of factors including socioeconomic status, race, employment, and an array of other factors that ultimately determine the nutritional status of different families. In our research, we are studying the correlation between food insecurity and poor health outcomes in a reference period between 2016 and 2022. According to the National Institute of Health (NIH), food insecurity and the lack of access to affordable nutritious food are associated with increased risk for chronic health conditions including diabetes, obesity, and mental health disorders among many other diseases. In 2020, the NIH reported that 15% of the households in the United States were food insecure.[10] The impact of being food insecure, especially during Covid-19, led families to eat less to prolong the amount of food stored. Not getting the necessary daily intake of nutrients can have damaging effects on one's body, such as becoming malnourished, which has its own implications as well. Disrupted eating has also been found to lead to decreased immune capabilities. Moreover, the constant worrying about where the next meal will come from puts individuals in a state of stress

which, coupled with a declining immune system, negatively exacerbates physical, mental and emotional well-being.[11]

The main gap in our research was determining the extent to which food insecurity impacted the population's health as other social determinants of health (SDoH) might have influenced the latter. Current literature supports that health outcomes are not simply determined by one factor, but rather by the interaction of multiple social, economic, and environmental factors. For example, a research study revealed that 9 selected SDOH variables had a statistically significant impact on population health.[8] It should also be noted that food insecurity is also influenced by social and economic measures. In 2021, the NIH reported that 20% of Black/African American households, 16% of Hispanic/Latino households, and 7% of White households were food insecure.[10] These statistics clearly show how the levels of food insecurity are influenced by race. Additional data from the NIH also found that household income is a major factor in food insecurity levels; statistics show that 35.3 % of households with incomes below the federal poverty line being food insecure.[10]

Wanting to further investigate the connection between food insecurity and health outcomes, we decided to look at the levels of food insecurity in the United States and how these numbers correlate with health outcomes. Studying food insecurity and its association with the population's health allows us to shed light on areas that need improvement. It would be also beneficial to compare the rates of food insecurity, healthy food access, and food environment index in the US, considering the significant wave of layoffs due to the Covid-19 pandemic. Having access to all this information allows us to find areas that need improvement in the realms of food insecurity and healthy food access. In doing so, the US has a better chance of decreasing the incidence of chronic illnesses associated with food insecurity, lessening the economic and

social burden associated with these diseases, and improving health outcomes. This would also allow the US to dedicate the resources and healthcare spending to other areas that need improvement.

## Research Questions

In this research, we are going to explore and answer the following questions:

RQ1. How has the food environment index changed between 2016 and 2022 in the United States?

RQ2. How has food insecurity changed between 2016 and 2022 in the United States?

RQ3.How has healthy food access in the United States changed between 2016 and 2022?

RQ4. What is the correlation between food insecurity and the percentage of adults reporting fair or poor health in the United States in 2022?

RQ5. How do the food environment index and food insecurity predict the percentage of adults reporting fair or poor health in the US in 2022?

## Methods

### *Data Collection*

We used data collected from the County Health Ranking's (CHR) website. The data came from different health journals including, but not limited to, the American Diabetes Association, Journal of Nutrition, and Social Science and Medicine. The Food Insecurity measure is modeled with the Core Food Insecurity Model, employing data collected from the Community Population Survey, Bureau of Labor Statistics, and American Community Survey. The model is a statistical measure that uses the populations with limited access to food to lead a healthy and active life as

the numerator, and the total county population as a denominator. The CHR also included data from Map the Meal Project in 2011. This project collected data on the severity of food insecurity at the local level. Moreover, limited access to healthy foods information was collected from the United States Department of Agriculture (USDA). The three main categories included food choices, health and well-being, and community characteristics. The years in which the data was collected spanned the years 2016- 2022.[7] Our variables were based on literature reviews of prior studies on food insecurity; these variables were broken down for measurement and analysis. As for the food environment index measure, our data was collected using the annual USDA Food Security Survey which models the relationship between food insecurity and various variables at the state level. The food environment index is a scaled index that ranges from 0 (worst) to 10 (best) using two indicators of the food environment: limited access to healthy food and food insecurity. Furthermore, data on limited access to healthy foods was collected from the USDA Food Environment Atlas. Limited access to healthy food is a measure of the percentage of the population that is low-income and does not have grocery stores located close. Percentage is calculated using a fraction that has low-income people as the numerator and the U.S. population as the denominator. All the states in the US were included in this research. Exclusion Criteria included data that was missing from these variables.

### *Data Analysis*

To answer RQ1, we used a paired t-test and food environment index as the variable. For RQ2, we used a paired t-test and food insecurity as the variable. For RQ3, we used a paired t-test and healthy food access as variable. To answer RQ4, we used a Pearson correlation test. Finally, for RQ5, we used a regression analysis.

## Results

Comparing the food environment index in the United States between 2016 and 2022 (RQ1), we discovered that the index significantly increased from 6.96% in 2016 to 7.45% in 2022 (t=34.62, $p<.001$) (Table 1)

**Table 1:** Food Environment Index in the United States

| Year | n | Mean | SD |
|---|---|---|---|
| 2016 | 3102 | 6.96 | 0.022 |
| 2022 | 3102 | 7.45 | 0.020 |

Abbreviation: SD, Standard Deviation

[a]statistically significantly different from 2016 ($p < .001$)

When reviewing the changes of food insecurity between 2016 and 2022 (RQ2), we found that food insecurity decreased from 15.05% in 2016 to 13.10% in 2022 (t=-43.20, $p<.001$) (Table 2)

**Table 2:** Food Insecurity Prevalence in the United States

| Year | n | Mean | SD |
|---|---|---|---|
| 2016 | 3134 | 15.05 | 0.070 |
| 2022 | 3134 | 13.10 | 0.066 |

Abbreviation: SD, Standard Deviation

[a]statistically significantly different from 2016 ($p < .001$)

When reviewing the prevalence of healthy food access between 2016 and 2022 (RQ3), we found that healthy food access increased from 8.40% in 2016 to 8.51% in 2022 (t=1.03, $p<.001$) (Table 3)

**Table 3:** Healthy Food Access in the United States

| Year | n | Mean | SD |
|---|---|---|---|
| 2016 | 3102 | 8.40 | 0.146 |
| 2022 | 3102 | 8.51 | 0.132 |

Abbreviation: SD, Standard Deviation

[a]statistically significantly different from 2016 ($p < .001$)

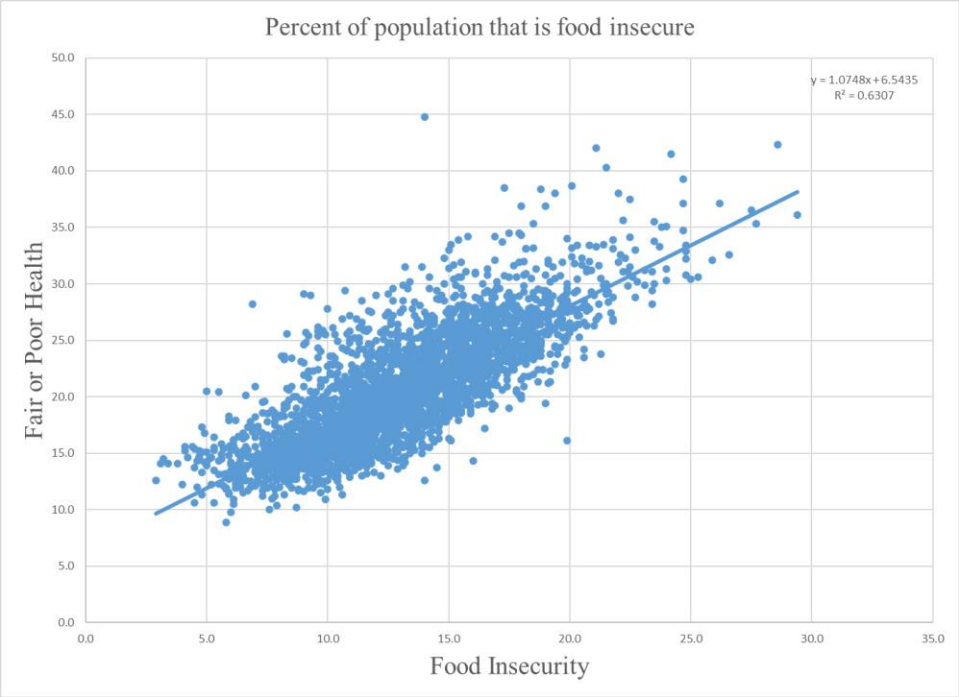


**Figure 1:** Correlation Between Food insecurity and Percent of people reporting fair or poor health in the US (n=3139)

A Pearson correlation indicates a significant correlation ($r$ = .794, $p$ <.001) where, as the percentage of food insecurity increases, the percentage of individuals reporting fair or poor health increases. (RQ4)

Lastly, for RQ5, we investigated how the food environment index and food insecurity predict the percentage of adults reporting fair or poor health in the US in 2022. A stepwise linear regression model demonstrated the best fit model was significant ($F_{2,3103}$ = 2638.46, $p$ < .001), accounting for 63.0% of the variance in reporting fair or poor health. Food insecurity contributed the most to the model ($B$ = .996, $t$ = 42.35, $p$ < .001) with percent food environment index ($B$ = -.329, $t$ = =-4.32, $p$ <.001) also significantly contributing.

## Discussion

The research study identified key factors that contribute to the direct health impacts of food accessibility. Our results indicated a significant correlation between food insecurity and poor health outcomes, which has been corroborated by previous research[5]. The compilation of food

insecurity and low food environment index both contribute to chronic health illnesses. Not only does the uncertainty of regular access to food insecurity, but also the stressors of not being able to provide a balanced diet due to budgeting issues is problematic for one's health[5]. Often, families are frequenting food pantries to provide meals for their households because of lack of income[5]. Our data indicates that from the years 2016 to 2022, there was a significant increase in the food environment index in the United States. The food environment index relates to the combination of proximity to healthy foods and income for accessing healthy foods[7]. Therefore, it could be postulated that the impact of increased food assistance programs during the COVID-19 pandemic could have helped in increasing the food index environment nationwide. Furthermore, healthy food access increased between 2016 and 2022, which also can be an indicator of COVID-19 food assistance programs that aided in providing healthier food options for families in distress.

More specifically, in Ohio, a study by Sanchez illuminated the factors affecting food insecurity which included education and location[6]. Education, related to increased income opportunities as well as access to quality insurance, contributes to variances in food insecurity[6]. Not everyone has higher education and therefore contributes to the varying levels of food insecurity. Our investigation demonstrates how food insecurity significantly decreased from 2016 to 2022. Publicly funded assistance programs can lower food insecurity, including during times of economic hardship which circumstances parallel those of the COVID-19 pandemic[2]. On the other hand, there was data that suggests the increase in food insecurity during these times that lead to decreased food diversity[3]. The lack of balanced food options could therefore contribute to poorer health outcomes.

Research has shown that food insecurity has been linked to increased healthcare expenditures[1]. People having to choose between their next meal and longitudinally expensive medications due to lack of insurance more often than not leads to individuals choosing the former. Research shows a significant correlation between food insecurity and the percentage of adults reporting poor health. It is apparent that if adults cannot afford their medications during economic hardship, then their health will suffer. During this time of 2016-2022, COVID-19 induced economic hardship that could have contributed to many people having to choose between meals and medications[1]. Again, showcasing the fact that in times of increased financial expenditures, maintaining one's health may not be a priority.

The limitations in our study were split into design and research limitations. In a longitudinal study on the impact of food insecurity on health outcomes, participants drop out, which impacts the research's results. Also, our research looks at health outcomes in relation to one factor, food insecurity. In reality, however, the population's health is influenced by various factors. A greater sample size should be chosen to address these limitations in the future. Also, our research should include more variables that contribute to health outcomes.

As for research limitations pertaining to the core food insecurity model, the model changes from year to year, and the study is measured over six years. Additionally, for information on limited access to healthy foods measurement, data is not updated annually, and our study is measured over various years. A future direction for both limitations would be to use the food environment Atlas instead since it is updated annually. Also, regarding the food environment index, county progress cannot be tracked because of the scaled nature of the measure. To address this limitation in the future, composites measures that make up the index (Food insecurity, healthy food access) can be used to track progress.

## Conclusion

The purpose of this study was to identify key factors that contribute to the health impacts of food accessibility. The food insecurity pandemic, as discussed previously, is negatively impacting the global population's health, and unless drastic measures are adopted, these numbers will keep rising. Basic human rights, including food security, should not be a privilege for certain minorities. However, identifying and studying health barriers is the first step toward a solution. As future physicians, we aspire not only to eradicate illnesses, but also social and economic injustices that have a major impact on global health outcomes.

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