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ASSOCIATION BETWEEN FOOD INSECURITY AND CHRONIC HEALTH CONDITION AMONG ADULTS (18 TO 48)

Prasanth Reddy Guda
California State University - San Bernardino

ASSOCIATION BETWEEN FOOD INSECURITY AND CHRONIC HEALTH CONDITION AMONG ADULTS (18 TO 48)

A Thesis

Presented to the

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in

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by

Prasanth Reddy Guda

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Approved by:

Dr. Benjamin Becerra, Committee Chair

Dr. Conrad Shayo, Committee Member & Department Chair,

Information and Decision Sciences Department

ABSTRACT

Uncertainty or limited access to safe food, known as food insecurity, can affect the health and healthcare needs of individuals with several chronic conditions. During 2022, 12.8 percentage (around 17.0 million) of households in the United States experienced food insecurity. The main objective of this study was to examine the Association between food insecurity and chronic health conditions adults. We collected data from NHIS 2022 sample Adults' Interview (The National Health Interview Survey). The research question asked are: (Q1) Are there certain long term health issues that are more common among adults facing food insecurity age in between the ages of 18 to 48? (Q2) What are the possible connections between food insecurity and chronic health conditions within the age group of 18 to 48? (Q3) Is there a difference between younger adults and older adults' health issues because of food insecurity?

The research questions were analyzed in the Chi-Square test and survey-Weighted logistic regression model and interpreted the results in odds ratios. The findings and conclusion for each question are: (Q1) Asthma among adults facing food insecurity (22.16%) compared to their food secure counterparts (15.96%). Similarly, Hypertension (23.2 %), Cardiovascular conditions (1.44%), COPD (4.82 %), and Diabetes (4.82 %) also show significantly higher frequencies among food insecure individuals compared to food secure individuals (13.45%, 0.49%, 1.31%, 2.72%). These findings imply that adults facing food insecurity aged 18 to 48 are more likely to suffer from these chronic health conditions

compared to their food secure counterparts. (Q2) Asthma, Cancer, Hypertension, Heart Disease, COPD, Diabetes, not having these health conditions are associated with lower odds of food insecurity, with reductions in odds ranging from 21% to 76%. (Q3) hypertension was 77% in older adults compared to young adults' (66%) and COPD was 47% in older adults compared to younger adults (41%). Furthermore, other areas for future studies that appeared from this study includes longitudinal studies and interventions among both young adults and older adults. In addition, Future research could look at medical records or clinical biomarkers to expand on the current study's findings.

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DEDICATION

To Beloved My Family Members and Friends.

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CHAPTER ONE

INTRODUCTION

Brief Background

Uncertainty or limited access to safe food, known as food insecurity, can affect the health and healthcare needs of individuals with several chronic conditions. In the year 2022, 44.2 million people (about twice the population of New York) lived in food-insecure households and 11.7 million adults lived in households with very low food security. Food insecurity households include those with low to very low food security. During 2022, 12.8 percentage (around 17.0 million) of households in the United States experienced food insecurity (U.S. Department Of Agriculture, 2023). There has been recent belief about whether food insecurity causes chronic disease.

Several findings suggest that household food insecurity is associated to chronic disease (Laraia, 2013). In particular, food insecurity, has been highly related with Type 2 Diabetes, even after controlling for multiple covariates (Laraia, 2013). Globally, Food insecurity is significantly associated with adults' poor mental well-being. Some of the recent study analyses have stated or showed that food insecurity was positively related to stress and depression, but not anxiety (Ling et al., 2022). Furthermore, food insecurity has had a stronger influence on depression among older individuals and males than on younger adults and women (Ling et al., 2022).

Public health concerns, which affect the individual and environmental level, include obesity and food insecurity. Obese persons in the United States (one in every three) are at a higher risk of negative health outcomes such as early death, Coronary Heart Disease, Hypertension, Stroke, Type 2 Diabetes, and some types of cancer. (Pan et al., 2012). Obesity and food insecurity are more prevalent among low-income populations. Low-cost, high-energy foods, which can lead to excess energy consumption and obesity, can be relied upon by insecure adults (Pan et al., 2012).

During the stages of the studies, they indicated that adults in the United States experienced an increase in psychological distress symptoms. Additionally, data from a survey revealed that individuals facing food insecurity were more prone to exhibiting signs of depression, anxiety, and stress (Sundermeir et al., 2021). According to limited research on food insecurity among young adults aged 24 to 32 years , 14% of young women and 9% of young males in the United States experience food insecurity (Nagata et al., 2019). Young adulthood is a critical stage of development that differs from adolescence and old age. Young adults have a higher frequency of chronic diseases and are less likely to eat breakfast, exercise, and have regular medical and dental exams than teenagers (Nagata et al., 2019). In 2021, 5.9% of adults who were 18 years old and above resided in households that faced food insecurity within the month. Notably, the

prevalence of food insecurity was greater among women, at 6.5%, compared to men, at 5.2%.

It is proven that food insecure adults suffered from higher obesity than food secure adults (Pan et al., 2012). Adults who consume food insecurity leads to poor nutrition and increase risks of chronic disease over a period of time (Pan et al., 2012). Food insecurity affects 50 million individuals (about twice the population of Texas) in the United States, making it the country's biggest problem with nutrition and health. Food insecurity has a negative correlation with conditions including obesity, diabetes, asthma, high blood pressure, and problems with mental and physical health. Both the prevalence of chronic diseases and food insecurity are decreased by SNAP (Stuff et al., 2004). Research indicates that in many people worldwide, one-third of them may encounter health challenges, like depression, anxiety, and somatic symptom disorder, at some point in their lives. Factors such as food insecurity could potentially contribute to the growth of these disorders through several body mechanisms. Food insecurity may provoke a stress response in the human body that may cause depression and anxiety (Jones, 2017).

Families living in poverty face risks of dealing with both mental health challenges. Limited access to services in some areas exacerbates the situation. The significant presence of health conditions and food insecurity suggests a connection between food insecurity and health (Stuff et al., 2004). Food

insecurity disproportionately affected lower-income households during the pandemic, leading to negative short- and long-term effects, including poor mental health. Existing health disparities based on race/ethnicity and socioeconomic status, including those connected with food insecurity, were exacerbated during the COVID-19 epidemic. Many individuals, those with incomes who are already more vulnerable to food insecurity and mental health challenges, have experienced a worsening of their mental well-being due to factors like stay-at-home directives, social isolation, economic instability, and limited access to healthcare. This has led to heightened levels of distress, depression, and anxiety among this group (Sundermeir et al., 2021).

Problem Statement

The understating of the intricate link between chronic diseases and food insecurity and the disproportionate burden faced by younger adults, makes it important to conduct further study influenced by factors such as age, race, ethnicity, gender, and socioeconomic status, among individuals, particularly the adults.

Research Questions

There are three main questions which this study will answer:

RQ1: Are there certain long term health issues that are more common among adults between the ages of 18 to 48 facing food insecurity ? (Leung et al., 2020)

RQ2: What are the possible connections between food insecurity and chronic health conditions within the age group of 18 to 48? (Leung et al., 2020)

RQ3: Is there a difference between younger adults and older adults' health issues because of food insecurity? (Leung et al., 2020)

Objective

The overall goal is to advance knowledge of the intricate connection between chronic illnesses and food insecurity and to provide guidance for policies that can enhance community and individual health outcomes as well as food security.

Organization of this Project

Chapter 1 provides an overview and introduction of this culminating experience project. Chapter 2, reviews past literature and related works that generated the research questions. Chapter 3 covers the research methods and data collection that will be used to answer the research questions. Analysis and findings of the research results are covered in chapter 4. A discussion of the findings, conclusions and recommendations for a future study will be provided in chapter 5.

CHAPTER TWO

LITERATURE REVIEW

Food insecurity affects people of all ages around the world. This research examines how the challenge of food insecurity among young adulthood is impacted by factors such as age, ethnicity, gender, and economic status among adult populations.

RQ1: Are there certain long term health issues that are more common among adults facing food insecurity age 18 to 48?(Leung et al., 2020)

The COVID-19 pandemic has had a devastating influence on global health, as well as social and economic factors. During the pandemic, young adults in the United States have been struggled with food insecurity. This study explores how racial disparities affect the experiences of adults and their risk of food insecurity. Food insecurity among youth is an issue that impacts their human rights and well-being during a critical stage of development. It is linked to consequences throughout their lives. Research on adults and college students has revealed connections between food insecurity and health issues such as diabetes, hypertension, obesity, unhealthy eating habits, stress, depression, substance abuse, risky behaviours, and academic struggles (Daniels & Morton, 2023).

Many research studies have revealed that young adults, who experience food insecurity are more likely to face long term health concerns. Studies suggest that this group has an increased chance of developing obesity and related conditions, like Type 2 Diabetes and Heart disease (Seligman et al., 2010). People, particularly young adults who lack access, to food sometimes end up eating calorie low nutrient foods, which can lead to gaining weight and disruptions in their metabolism (Drewnowski & Specter, 2004). Moreover, experiencing food insecurity is associated with health issues, like depression and anxiety which can have lasting effects, on one's overall health and wellness (Berkowitz et al., 2013) .

The long-term pressure of not having food can also make inflammatory reactions worse leading to a chance of developing autoimmune diseases and other inflammatory issues as time goes on (Gundersen et al., 2012). Furthermore, the lack of access, to a food supply is linked to nutrition and insufficient intake of essential nutrients. This can result in deficiencies in micronutrients and weakened immune system functions making individuals more susceptible to illnesses and various health issues (Gundersen & Ziliak, 2015). (Leung et al., 2020) conducted a study examining the prevalence and determinants of food insecurity among older adults. They found that food insecurity among young adulthood and older adults is a significant issue and identified it as an important area for further study. This suggests that there is a

need for more research and interventions to address food insecurity among all age's populations.

RQ2: What are the possible connections between food insecurity and chronic health conditions within the age group of 18 to 48? (Leung et al., 2020)

Food budget adjustments, decreases in food intake, and changes to the sort of food offered are common household responses to limited food supplies (Seligman et al., 2010). The variety of foods is declining, and the consumption of energy dense food is increasing. The nutritional quality of these energy dense foods, e.g. Refined grain, additive sugars and saturated fats, as well as the cost per calorie for calories compared with alternatives, is poor but less costly than alternative products (Seligman et al., 2010). People in the United States who don't have food to eat may not get all the nutrients they need, such as vitamin B complex, magnesium, iron, zinc, and calcium. They tend to eat portions of fruits, vegetables, and dairy products weekly. They may have lower levels of essential micronutrients. These dietary behaviours are linked to an increased risk of ailments such as high blood pressure, high cholesterol, and diabetes (Seligman et al., 2010).

A scarcity of food options can result in individuals resorting to calorie low nutrient foods, which can lead to increased weight and metabolic imbalances (Drewnowski & Specter, 2004). Additionally, when people don't have food, they

might turn to binge eating when they can which could make them more likely to develop obesity and other health issues (Becker et al., 2017).

Additionally experiencing a lack of access to food can result in strain leading to fluctuations and inflammatory reactions that may play a role in the onset of long-term health conditions (Berkowitz et al., 2013). Moreover, people who struggle with food insecurity might encounter challenges in getting the healthcare they need which can result in delays in diagnosing and treating long term health issues (Bhattacharya & Currie, 2001).

RQ3: Is there a Difference between younger adults and older adults' health issues because of food insecurity? (Leung et al., 2020)

Food insecurity is commonly acknowledged as a health issue. Various studies focusing on adults in the United States have indicated that food insecurity is linked to Obesity, Diabetes, Hypertension, High cholesterol levels, and Heart-disease. Compared to those who are food secure, adults facing food insecurity are also at risk of experiencing health challenges and depression. Despite recognizing food-insecure adults, the detailed causal pathways through which food insecurity leads to health consequences still need to be understood (Ding et al., 2015).

In the United States, 10% of households faced food insecurity in 2019, with one in five having an elderly person as a household member. Low-income

households are more likely to struggle with food insecurity, and older adults with income face risk due to issues like social isolation, transportation challenges, disabilities, and health problems. Dealing with food insecurity can lead to malnutrition difficulties, in managing diseases, and increased risk of mortality from all causes. Therefore, the overall health of this population could be improved if food insecurity were reduced (Hill et al., 2023).

When it comes to food insecurity, it impacts on the health of young adults differs from that of older adults. Studies indicate that young adults facing food insecurity may face a risk of deficiencies, which can affect their growth, development and overall well-being (Cook & Frank, 2008). Younger adults might struggle to maintain a diet because of resources, which could result in a higher chance of developing obesity and other chronic illnesses like diabetes and heart disease (Kirkpatrick & Tarasuk, 2008).

As people grow older and struggle with not having food, they might face a risk of malnutrition. This can lead to issues like muscle loss, weaker immune systems and problems with thinking abilities (Lee & Frongillo, 2001). Furthermore, older individuals might suffer from health issues that worsen due to nutrition resulting in increased hospitalizations and mortality rates (Ziliak & Gundersen, 2017).

CHAPTER THREE

RESEARCH METHODS

This chapter provides the research methods used to answer the research questions for this culminating experience project. We will start with the data collection and then followed by methods used for answering the research questions.

Data Collection

To answer all the research questions, we took data from NHIS 2022 sample Adults' Interview (The National Health Interview Survey). The National Health Interview Survey (NHIS) stands as the longest running health survey in the United States. It serves as a data collection initiative of the National Center for Health Statistics (NCHS). NHIS keeps tabs on the wellbeing of the institutionalized U.S. population by gathering and analyzing data on various health related subjects. One notable aspect of this survey is its capacity to present these health insights based on socioeconomic factors (*NHIS - 2022 NHIS*, 2023). Researchers and policy experts widely rely on NHIS data to monitor patterns in sickness, disability, health insurance coverage, healthcare utilization and progress, toward meeting health goals (*NHIS - 2022 NHIS*, 2023).

The NHIS is a survey representing the nation covering around 40,000 households in the U.S. It includes health data for every individual residing in these households (Black, Hispanic, and Asian), with detailed information gathered from one adult chosen randomly from each household. The surveys are conducted face to face (*NHIS - 2022 NHIS*, 2023). I have focused on the details provided by the selected adult participant, who answers all health-related inquiries for themselves. Information regarding adults may be provided by an adult living in the same household (*NHIS - 2022 NHIS*, 2023). NHIS 2022 dataset consists of 27651 observations and 637 variables.

A cluster variable signifies a collection of households or individuals who are surveyed together. Clustering is commonly carried out for reasons as it is more effective to sample groups, than individual entities. Clusters are usually defined by borders, such as census tracts or neighbourhoods. In our dataset we utilized PPSU as the variable to denote Primary Sampling Units (clusters) which are units sampled together and often defined geographically. And this variable was provided by NHIS as the cluster variable.

Stratum refers to a subset within the population that shares characteristics. Within NHIS stratification is frequently based on factors such as location, race/ethnicity, age groups or household income. The variable PSTRAT represents strata which are subsets within the population sharing traits. Stratification helps ensure representation of each subgroup in the sample.

The weight variable in NHIS indicates the weight assigned to each survey participant to account for variations in sampling probabilities and non-responses. WTFA_A serves as the weight variable containing weights assigned to survey participants. These weights adjust for differences, in sampling probabilities and non-responses facilitating estimates of the population.

Programming Languages:

R programming was used to load the data. R programming is a popular open-source programming language and software environment that focuses on statistical computation, data analysis, and graphical visualization. R programming provides a complete set of built-in functions and packages for performing a variety of statistical studies, such as hypothesis testing, regression analysis, time series analysis, clustering, and more. R programming supports a variety of data structures, including vectors, matrices, data frames, and lists, making it suited for dealing with a wide range of data types. For data manipulation and analysis, We have used common tools such as tidy verse and Sqldf (“R (Programming Language),” 2024).

Data Cleaning

Data cleaning is a key step in developing a high-quality predictive or inferential model. As we previously stated, the data set from NHIS 2022 (The National Health Interview Survey) has numerous broken characters, missing values, and symbols (@ and #), which can skew the results and analysis. However, the data set is vast, it is hard to undertake basic cleaning with the naked eye, and it is incredibly time-consuming. Before cleaning the datasets, the first five rows were viewed using the head() function to see how the data is presented without having to look at the entire csv file. We used some R programming function na.omit(data) or (is.na) to remove the (NAs) .If we look at current dataset which I have loaded in R , it has missing values like(NAs) to remove those values from the dataset and data frame we used this function. na.omit() this function is useful for working with datasets that include missing values (*How to Use Na.Omit in R?*, 2020).

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RQ1: Are there certain long term health issues that are more common among adults facing food age between 18 to 48?

To answer this question, I will use Chi-square test. Chi-Square test is used to determine whether there is a significant association between two categorical variables. In simple terms it will only test whether two variables are associated

with each other or not. It will not tell us how closely they are associated (Das et al., 2023). Chi-square, a non-parametric test of significance, is useful when the data is in the form of frequency counts occurring in two or more mutually exclusive categories (nominal variables). It helps us to judge on the basis of sample if (1) a particular set of counts (or frequencies) statistically match some known or predicted set, or (2) two or more categories are statistically independent (Thukral et al., 2023). There are three types of chi-square tests that are often employed in research studies: (1) chi-square test of goodness of fit, (2) chi-square test of independence, and (3) chi-square test of proportions. A thorough understanding of the chi-square test will assist researchers undertake categorical data studies and improve accuracy in result interpretation (Thukral et al., 2023).

Chi-square analysis was performed to examine the statistical significance of food security status and the sociodemographic and outcome factors (Ramsey et al., 2012). The chi-square test was performed to determine whether some of the study's independent variables had an effect on households food security. This was done to test the general null hypothesis, which states that household food security status is independent of the categorical variable of interest. The broad alternative hypothesis proposes that households food security status is not independent of the categorical variable of interest (Kolog et al., 2023). Bivariate analyses were conducted between food insecurity and each potential health issue variable using survey-weighted chi-square analyses and, we have also

used survey-weighted crosstab with row percentages for this analysis. For all statistical analyses in this study, the level of significant was set to 0.05.

RQ2: What are the possible connections between these two factors like food insecurity and chronic health conditions age group of 18 to 48?

To answer this question, we will use Survey-weighted logistic regression, it is a form of regression. Simple linear regression is a method for estimating the value of a dependent variable (often the variable of highest interest) using the value of the independent variable (Cipher, 2017). A survey-weighted logistic regression model was used to investigate the relationships between food security status and the health outcomes under study (Leung et al., 2020).

Logistic regression was employed to uncover connections with health outcomes like health status, Diabetes, Hypertension, High Cholesterol levels being significantly overweight, obesity and obstructive airway disease, as the factors that were influenced by food insecurity (Nagata et al., 2019). In this study, we have utilized Survey-weighted logistic regression to examine the relationship between food insecurity and various factors such as gender, age and more. These factors serve as indicators of food insecurity. By conducting regression analysis, we aimed to investigate how chronic health conditions impact food insecurity within an age group. The analysis provides summary statistics and odds ratios for understanding. We have used svyglm () the function from survey packages to fit a survey weighted logistic regression model. Understanding the

coefficients of the regression model helps in deciphering the connections, between food insecurity, chronic health issues and other related variables.

RQ3: Is there a Difference between younger adults' and older adults' health issues because of food insecurity?

Previous research studies have pointed out the issue of food insecurity in the United States during the COVID 19. A recent report by the U.S. Department of Agriculture, Economic Research Service (Economic Research Report No. 246) used a method called stratified logistic regression to study how food insecurity relates to health outcomes across different demographic groups, such as age categories. The report revealed differences in how food insecurity impacts health problems among older individuals emphasizing the importance of taking age specific factors into account (Coleman-Jensen et al., n.d.).

A previous study employed stratified logistic regression to examine the impact of food insecurity on various health outcomes, including chronic diseases, among different age groups. The findings indicated that the association between food insecurity and health issues varied by age with distinct patterns observed among younger and older adults (Gundersen & Ziliak, 2015).

In this study, to compare young adults' and older adults' health issues because of food insecurity, we have created two domains with different age groups. One is for younger adults between the ages of 18 to 48 and the second one is for those older than 49 and above.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

This chapter describes the analytical procedure utilized to provide insights to the questions discussed in the previous chapter. The analysis was performed on R programming language with the NHIS 2022 sample adults interview dataset described in earlier chapters. This project produced the following results from the Chi-Square test, survey-weighted logistic regression and stratified logistic regression is presented below in a tabular format. The main objective of this chapter is to give an explanation to the three research questions:

RQ1: Are there certain long term health issues that are more common among adults aged between 18 to 48 facing food insecurity?

As shown in the (table 1), the prevalence of Asthma is significantly higher among food insecure individuals compared to food secure individuals ($p < 0.001$). This suggests that Asthma may be more common among adults facing food insecurity within the specified age range 18 -48 (Table 1). There is a significant association between hypertension and food security status ($p < 0.001$). The prevalence of hypertension is higher among food insecure individuals compared

to food secure individuals, indicating a potential link between food insecurity and hypertension in this age group (Table 1).

Food insecure individuals present a significantly higher frequency of cardiovascular conditions compared to their food secure counterparts ($p < 0.001$). This suggests that cardiovascular conditions may be more frequent among adults facing food insecurity aged 18 to 48 (Table 1). The frequency of COPD is significantly higher among food insecure individuals ($p < 0.001$). This shows that COPD may be more common among adults experiencing food insecurity within this age range (table 1). Food insecure individuals show a significantly higher percentage of Diabetes compared to food secure individuals ($p < 0.001$). This indicates that Diabetes may be more prevalent among adults facing food insecurity aged 18 to 48 (Table 1).

Various health conditions (Asthma, Cancer, Hypertension, Cholesterol, Cardiovascular conditions, COPD, Diabetes, Sleep Disorders) show statistically significant associations with food security status ($p < 0.05$). In general, individuals

reporting these health conditions are more likely to be food insecure compared to those who do not report them.

The percentage of males is higher in the food secure group compared to the food insecure group, while the percentage of females is higher in the food insecure group. Non-Hispanic White individuals have the highest proportion of food insecurity at 56.83%, whereas Non-Hispanic Black/African American individuals have a lower prevalence at 11.62%. Hispanic individuals fall in between with a prevalence of 21.13%. (Table 1). Those with lower education levels (High School Graduate or less) are more likely to be food insecure compared to those with higher education levels (Table 1).

Table 1: Characteristics of study population by food security status.

Variable	Food Secure %	Food Insecure %	P-Values
Age[a] (18-48):	32.72	33.05	**0.393**
Sex[b]			**<0.0002**
Male	50.52	43.17	
Female	49.47	56.82	
Race/ethnicity[b]			**<0.001**

Table 1 continued:

Hispanic	21.13	26.98	
Non-Hispanic White only	56.83	43.41	
Non-Hispanic Black/African American only	11.62	20.6	
Other or multiple races, non-Hispanic	10.41	8.99	
Education[b]			**<0.001**
High School Graduate or less	34.45	56.09	
Undergraduate or some college	55.33	42.02	
Master's degree	10.2	1.879	
Marital status[b]			**<0.001**
Married	43.82	27.47	
Living with a partner together as an unmarried couple	12.43	18.68	
Neither	43.74	53.84	
Health Insurance[b]			**<0.001**
Not Covered	13.55	22.89	
Covered	86.44	77.1	
SNAP: SNAP participation in last 12 months[b]			**<0.001**
Yes	13.24	40.43	
No	86.75	59.56	
Employment: Worked for pay last week[b]			**<0.001**
Yes	77.41	63.3	
No	22.58	36.69	
Asthma[b]			**<0.001**
Yes	15.96	22.16	
No	84.03	77.83	
Cancer[b]			**0.034**
Yes	2.02	3	
No	97.97	96.99	
Hypertension[b]			**<0.001**
Yes	13.45	23.2	
No	86.54	76.79	

Table 1 continued:

Cholesterol[b]			**0.59**
Yes	11.4	12.02	
No	88.59	87.97	
Cardiovascular Conditions[b]			**<0.001**
Yes	0.49	1.44	
No	98.68	95.17	
Diabetes: Ever had diabetes[b]			**<0.001**
Yes	2.72	6.09	
No	97.27	93.9	
Sleep Disorder[a]	7.09	6.76	**<0.001**

Note: [a] Data Presented as mean standard deviation and analyzed by T-test; [b]Data presented as number (%) and analyzed by chi-square test.

RQ2: What are the possible connections between these two factors like food insecurity and chronic health conditions age group of 18 to 48?

We have used survey-weighted logistic regression analysis to examine the association between various demographics and health issue related factors and the odds of experiencing food insecurity. We have provided the odds ratios and interpretation for each variable. Below are the odds ratio interpretation results for all the variables which are statistically significant. As shown in the table 2, All asterisk (*) symbols represent statistically significant.

In this model, we have used food insecurity as dependent variable and sex, age consider as independent variables.

Table 2: Survey weighed regression results and odds ratios.

Variables	odd ratios	Std. Error	t value	Pr(>|t|)	
		0.590602	2.342	0.019547	*
Sex-Female vs male	1.3	0.087711	2.996	0.00286	**
Age	1.02	0.005788	2.703	0.007082	**
Asthma -Yes vs NO	0.79	0.101081	-2.383	0.017529	*
Non-Hispanic White only	0.83	0.105255	-1.818	0.069639	.
Non-Hispanic Black/African American only	1.21	0.132039	1.46	0.144866	
Non-Hispanic Asian only	0.93	0.181309	-0.418	0.675916	
Undergraduate or some college	0.63	0.089662	-5.202	2.78E-07	***
Master's degree	0.2	0.225873	-7.023	6.43E-12	***
Living with a partner together as an unmarried couple	1.93	0.140097	4.701	3.29E-06	***
Neither	1.76	0.100772	5.623	2.99E-08	***
Cancer- Yes vs NO	0.76	0.238376	-1.148	0.251555	
Hypertension- Yes vs No	0.66	0.111908	-3.653	0.000284	***
Cholesterol-Yes vs No	1.18	0.120158	1.346	0.178804	
Cardiovascular Conditions- Yes vs No	0.73	0.383836	-0.828	0.407753	
CPOD- Yes vs No	0.41	0.208753	-4.299	2.03E-05	***
Diabetes-Yes vs No	0.74	0.18154	-1.661	0.097296	.
Employee	1.34	0.097804	3.022	0.002625	**
Health Insurance	0.65	0.103681	-4.113	4.50E-05	***
SNAP- Yes VS No	0.38	0.094011	-10.427	< 2e-16	***
Sleeping disorder	0.84	0.03495	-4.838	1.70E-06	***

odds rations interpretation results for each variable, which are statistically significant.

As per the odd ratios interpretation Table 2, females have approximately 30% higher odds of experiencing food insecurity compared to male, on average. For every one-unit increase in age there is a 2% increase in the odds of experiencing food insecurity, on average. Individuals without asthma have approximately 21% lower odds of experiencing food insecurity compared to those with asthma, on average.

Individuals with undergraduate or some college education have 37% lower odds of experiencing food insecurity compared to those with a high school education or less. Individuals living with a partner together as an unmarried couple have approximately 93% higher odds of experiencing food insecurity compared to married individuals, on average. Individuals without hypertension have approximately 34% lower odds of experiencing food insecurity compared to those with hypertension, on average.

Individuals without COPD have approximately 59% lower odds of experiencing food insecurity compared to those with COPD, on average. Not participating in SNAP is associated with approximately 62% lower odds of experiencing food insecurity compared to participating in SNAP, on average. For every one-unit increase in sleep hours, there is a 16% decrease in the odds of experiencing food insecurity, on average.

RQ3: Is there a Difference between younger adults' and older adults' health issues because of food insecurity?

We have used survey-weighted logistic regression analysis to examine the association between various factors and food insecurity among different age groups such as younger adults and older adults. We have provided the odds ratio and interpretation for each variable. Below are the odds ratio interpretation results for all the variables which are statistically significant. Comparison purpose we have created two domains. One is for young adults and second one is for older adults.

Table 3: Survey weighed regression results and odds ratios for older adults'.

Variables	odd ratios	Std. Error	t value	Pr(>|t|)	
		0.516074	8.873	< 2e-16	***
Sex-Female vs male	1.24	0.091922	2.338	0.01977	*
Age	0.95	0.00537	-10.095	< 2e-16	***
Asthma-Yes vs NO	0.89	0.114161	-1.045	0.2964	
Non-Hispanic White only	0.5	0.129492	-5.351	1.29E-07	***
Non-Hispanic Black/African American only	0.92	0.15177	-0.585	0.55895	
Non-Hispanic Asian only	0.63	0.243356	-1.868	0.06229	.
Undergraduate or some college	0.57	0.098113	-5.672	2.30E-08	***
Master's degree	0.35	0.245357	-4.285	2.16E-05	***
Living with a partner together as an unmarried couple	1.84	0.204232	2.995	0.00287	**
Neither	1.98	0.097508	6.987	8.24E-12	***
Cancer- Yes vs NO	1	0.128737	0.03	0.97578	

Table 3 continued:

Hypertension- Yes vs No	0.77	0.101624	-2.555	0.01088	*
Cholesterol-Yes vs No	0.96	0.091993	-0.432	0.66586	

Cardiovascular Conditions- Yes vs No	0.65	0.156326	-2.748	0.00619	**
CPOD- Yes vs No	0.46	0.126348	-6.197	1.14E-09	***
Diabetes-Yes vs No	0.73	0.11329	-2.802	0.00526	**
Employee	1.73	0.105651	5.186	3.03E-07	***
Health Insurance	0.49	0.159912	-4.466	9.70E-06	***
SNAP- Yes VS No	0.34	0.105103	-10.136	< 2e-16	***
Sleeping disorder	0.9	0.029163	-3.801	0.00016	***

odds rations interpretation results for each variable, which are statically significant.

Between the age of 18 to 48, females have 30% higher odds of food insecurity compared to males, while between the age of 49 and above, females have 24 % higher odds. Between the age of 18 to 48, for every one-unit increase in age, there is a 2% decrease in the odds of food insecurity, while between the age of 49 and above, there is a 5% increase in the odds of food insecurity.

Between the age of 18 to 48, individuals without hypertension have 34% lower odds of food insecurity, while between the age of 49 and above, this decreases to 23%. Between the age of 18 to 48, individuals without COPD have 59% lower odds of food insecurity, while between the age of 49 and above, this decreases to 54%. Between the age of 18 to 48, individual not participating in SNAP was 62% lower odds of food insecurity compared to participants, while

between the age of 49 and above it was 66% lower odds of food insecurity compared to participants.

CHAPTER FIVE

DISCUSSION, CONCLUSION, AND AREAS FOR FURTHER STUDY

Discussion

The last chapter will discuss the project findings, and provide a conclusion, and area of further study for each of the three questions.

RQ1: Are there certain long term health issues that are more common among adults facing food age between 18 to 48.

Based on Table 1, Firstly, the analysis indicates a notably higher frequency of Asthma among adults facing food insecurity (22.16%) compared to their food secure counterparts (15.96%). This association is statistically important, indicating that Asthma may be more common in individuals with food insecurity at a given age range. Similarly, Hypertension (23.2 %), Cardiovascular conditions (1.44%), COPD (4.82 %), and Diabetes (4.82 %) also show significantly higher frequencies among food insecure individuals compared to food secure individuals (13.45%, 0.49%, 1.31%, 2.72%). These findings imply that adults facing food insecurity aged 18 to 48 are more likely to suffer from these chronic health conditions compared to their food secure counterparts.

Furthermore, disparities in Food Security Status amongst demographic groups emphasize the reciprocity of food insecurity with gender, ethnicity, and education level, as shown in table 1. Females are more likely to experience food

insecurity (56.82%), Hispanics (26.98%), non-Hispanic Black/African American individuals (20.6%), and those with lower education levels (56.09%) underscores the disproportionate burden of food insecurity on vulnerable populations.

When I compare my study Diabetes results (4.82%) with previous research study, In previous research ,Diabetes (5.1 %) also show significantly higher frequencies among food insecure individuals compared to food secure individuals (2.2%) in this study (Nagata et al., 2019).

The conclusion is that the analysis shows a significant correlation between food insecurity and chronic health conditions such as Asthma, Hypertension, Cardiovascular conditions, COPD, and Diabetes. Additionally, disparities in food security status across demographic groups highlight the disproportionate burden on females, Hispanics, non-Hispanic Black/African American individuals, and those with lower education levels. An area of further study includes conducting longitudinal studies to access the casual relationship between food insecurity and include medical records or clinical biomarkers to extend the result of the present study.

RQ2: What are the possible connections between these two factors like food insecurity and chronic health conditions age group of 18 to 48?

The findings from the survey-weighted logistic regression analysis and odd rations provide valuable insights into the possible connections between food insecurity and chronic health conditions among adults aged 18 to 48.

Females have a 30% higher risk of food insecurity than males, on average. This suggests that gender may have a role in food insecurity among those aged 18 to 48, with social and economic factors potentially influencing this. For every one-unit increase in age, there is a 2% increase in the odds of food insecurity, on average. This shows that as individuals within this age range get older, they may face a slightly higher chance of experiencing food insecurity.

Asthma, Cancer, Hypertension, Heart Disease, COPD, Diabetes, not having these health conditions are associated with lower odds of food insecurity, with reductions in odds ranging from 21% to 76%. This suggests that individuals without chronic health issues are less likely to experience food insecurity, possibly due to lower medical expenses and better employment opportunities.

The odds of food insecurity are reduced by 62% for those who do not participate in the SNAP program. While SNAP provides crucial support for many individuals, these results suggest that reliance on SNAP may still indicate underlying financial challenges leading to food insecurity. For every one-unit

increase in sleep hours, there is a 16% decrease in the odds of food insecurity, on average. Adequate sleep may contribute to better health outcomes and potentially lower the risk of food insecurity within this age group.

In conclusion, gender, age, health conditions, SNAP participation, and sleep hours are all significant factors associated with food insecurity among adults aged 18 to 48. Females face higher odds, while absence of chronic health issues, non-participation in SNAP, and adequate sleep are linked with lower odds. The area of future studies includes medical records or clinical biomarkers to extend the result of the present study.

RQ3: Is there a Difference between younger adults' and older adults' health issues because of food insecurity?

As discussed in the fourth chapter, we had to compare these results with young and older adults. Between the age of 18 to 48, females have 30% higher odds of food insecurity compared to males, while between the age of 49 and above, females have 24 % higher odds. This show that there is a potentially stronger association between females and the food insecurity in the age of 18 to 48.

Between the age of 18 to 48, for every one-unit increase in age, there is a 2% decrease in the odds of food insecurity, while between the age of 49 and above, there is a 5% increase in the odds of food insecurity. This shows that the

relationship between age and food insecurity differs significantly between the two age groups.

Between the age of 18 to 48, individuals without COPD have 59% lower odds of food insecurity, while between the age of 49 and above, this decreases to 54%. These results show that COPD was slightly was slightly high age of 49 and above group (47%) compared to young adults (41%). Between the age of 18 to 48, individuals without hypertension have 34% lower odds of food insecurity, while between the age of 49 and above, this decreases to 23%. This result shows hypertension was slightly high age of 49 and above group (77%) compared to young adults (66%).

Between the age of 18 to 48, individual not participating in SNAP was 62% lower odds of food insecurity compared to participants, while between the age of 49 and above it was 66% lower odds of food insecurity compared to participants. This shows that only older adults' (34%) are participating in SNAP program to avoid food insecurity and health issues.

When I compared my results with previous study results, Females have (56.9%) food insecure compared to male counter parts (Leung et al., 2020). Individuals not participating in SNAP was 68% in this study (Leung et al., 2020). The conclusion is that the relationship between demographics, health conditions and food insecurity is shown to be minutely different between age groups. Compared to older females, females 18 to 48 years of age have a higher association with food insecurity. The impact of age varies, with younger adults

experiencing a slight decrease in their risk of food insecurity compared to older people.

Areas for Further Study

This culminating experience project only touches the surface level of this challenging topic. There is still much more work to be done. For instance, someone must conduct longitudinal studies to track individuals' experiences of food insecurity and its association with demographics and health conditions over time. This could provide a more comprehensive understanding of how these factors interact and evolve across different life stages.

APPENDIX A

CODES

```
# MSIST Project Code file

```{r}
#Loading the data
library(haven)
NHIS2022 <- read_sav("C:/Users/prasa/Downloads/NHIS2022.sav")
View(NHIS2022)
library(caTools)
set.seed(88)
# Install and load the survey package if not already installed
#install.packages("survey")
library(survey)

# Assuming you have a data frame named 'NHIS2022' with variables cluster, stratum, and weight

# Define the survey design object


#install.packages("tidyverse")
library(tidyverse)
#install.packages("sqldf")
library(sqldf)
```
```

```
variables_to_check <- c("AGEP_A", "SEX_A", "ASEV_A", "HISPALLP_A", "EDUCP_A",
                        "MARITAL_A","CANEV_A","HYPEV_A","CHLEV_A","CHDEV_A","COPDEV_A"
                        ,"DIBEV_A","EMPLASTWK_A","NOTCOV_A","FSNAP12M_A","SLPHOURS_A")
agedata=NHIS2022 %>% mutate(sex=ifelse(SEX_A<=3,1*(SEX_A==1)+2*(SEX_A==2)+3*(SEX_A==3),NA),ca
rd=ifelse(CHDEV_A<=2,1*(CHDEV_A==1)+2*(CHDEV_A==2),NA),copd=ifelse(COPDEV_A<=2,1*(COPDEV_A==1
)+2*(COPDEV_A==2),NA),hyp=ifelse(HYPEV_A<=2,1*(HYPEV_A==1)+2*(HYPEV_A==2),NA),can=ifelse(CANE
V_A<=2,1*(CANEV_A==1)+2*(CANEV_A==2),NA),diab=ifelse(DIBEV_A<=2,1*(DIBEV_A==1)+2*(DIBEV_A==2)
,NA),emp=ifelse(EMPLASTWK_A<=2,1*(EMPLASTWK_A==1)+2*(EMPLASTWK_A==2),NA),SNAP=ifelse(FSNAP12M
_A<=2,1*(FSNAP12M_A==1)+2*(FSNAP12M_A==2),NA),health=ifelse(NOTCOV_A<=2,1*(NOTCOV_A==1)+2*(NO
TCOV_A),NA),marg=ifelse(MARITAL_A<=3,1*(MARITAL_A==1)+2*(MARITAL_A==2)+3*(MARITAL_A==3),NA),a
st=ifelse(ASEV_A<=2,1*(ASEV_A==1)+2*(ASEV_A==2),NA),choles=ifelse(CHLEV_A<=2,1*(CHLEV_A==1)+2
*(CHLEV_A==2),NA),race=1*(HISPALLP_A==1)+2*(HISPALLP_A==2)+3*(HISPALLP_A==3)+4*(HISPALLP_A
%in% c(4,5,6,7) ),EDUC=0*(EDUCP_A %in% c(1,2,3,4))+1*(EDUCP_A %in% c(5,6,7,8))+2*(EDUCP_A
>8),domain= ifelse(SLPHOURS_A< 24  & FSNAP12M_A %in% c(1,2) & NOTCOV_A %in% c(1,2)&
EMPLASTWK_A %in% c(1,2) & DIBEV_A %in% c(1,2) & COPDEV_A %in% c(1,2) & CHDEV_A %in% c(1,2) &
CHLEV_A %in% c(1,2) & HYPEV_A %in% c(1,2) & CANEV_A %in% c(1,2) & ASEV_A %in% c(1,2) &EDUCP_A
%in% c(1,2,3,4,5,6,7,8,9) & HISPALLP_A <8  & MARITAL_A %in% c(1,2,3) & SEX_A< 3 & FDSCAT3_A
%in% c(1,2,3)& AGEP_A>=18 & AGEP_A <= 48 & rowSums(is.na(NHIS2022[, variables_to_check])) ==
0,TRUE,FALSE),domainold= ifelse(SLPHOURS_A< 24  & FSNAP12M_A %in% c(1,2) & NOTCOV_A %in%
c(1,2)& EMPLASTWK_A %in% c(1,2) & DIBEV_A %in% c(1,2) & COPDEV_A %in% c(1,2) & CHDEV_A %in%
c(1,2) & CHLEV_A %in% c(1,2) & HYPEV_A %in% c(1,2) & CANEV_A %in% c(1,2) & ASEV_A %in% c(1,2)
&EDUCP_A %in% c(1,2,3,4,5,6,7,8,9) & HISPALLP_A <8  & MARITAL_A %in% c(1,2,3) & SEX_A< 3 &
FDSCAT3_A %in% c(1,2,3)& AGEP_A > 48 & rowSums(is.na(NHIS2022[, variables_to_check])) ==
0,TRUE,FALSE),
                              foodinsecure=1*(FDSCAT3_A %in% c(2,3)))
names(agedata)
is.na(agedata)
agedata %>% select(AGEP_A,FDSCAT3_A,foodinsecure,race,EDUCP_A,MARITAL_A,ASEV_A,CANEV_A,HYPEV_
A,CHLEV_A,CHDEV_A,COPDEV_A,DIBEV_A,FSNAP12M_A,NOTCOV_A,EMPLASTWK_A,
                    SLPHOURS_A,domain) %>% head(20)
agedata=agedata %>%  mutate(across(.cols = c(sex,ast,race,EDUC,
                        marg,can,hyp,choles,card,copd,
                        diab,emp,health,SNAP), .fns = factor))
```

```r
#Compute survey-weighted chi-square tests within each domain
#Sex based results
chi_sq_result <- svychisq(~foodinsecure +sex, design = subset(survey_design, subset =
domain))
#Age based Results
chi_sq_result <- svychisq(~foodinsecure +AGEP_A , design = subset(survey_design, subset =
domain))

t_testresults <- svyglm(AGEP_A~foodinsecure , design = subset(survey_design, subset =
domain))
summary(t_testresults)
#Sleep
t_testresults <- svyglm(SLPHOURS_A~foodinsecure , design = subset(survey_design, subset =
domain))
summary(t_testresults)

# Compute survey-weighted mean
weighted_mean <- svyby(~SLPHOURS_A, ~ foodinsecure, design=subset(survey_design, subset =
domain), svymean)
#Compute survey-weighted standard deviation
weighted_sd <- svyby(~ SLPHOURS_A, ~ foodinsecure, design=subset(survey_design, subset =
domain), svytotal)
# Print results
#Avg age of the table
print(weighted_mean)
print(weighted_sd)

# Compute survey-weighted mean
weighted_mean <- svyby(~AGEP_A, ~ foodinsecure, design=subset(survey_design, subset =
domain), svymean)
# Compute survey-weighted standard deviation
```

```
weighted_mean <- svyby(~AGEP_A, ~ foodinsecure, design=subset(survey_design, subset =
domain), svymean)
# Compute survey-weighted standard deviation
weighted_sd <- svyby(~ AGEP_A, ~ foodinsecure, design=subset(survey_design, subset = domain),
svytotal)
# Print results
#Avg age of the table
print(weighted_mean)
print(weighted_sd)

#Race Hispanic origin
chi_sq_result <- svychisq(~foodinsecure +race , design = subset(survey_design, subset =
domain))

#Education
chi_sq_result <- svychisq(~foodinsecure +EDUC , design = subset(survey_design, subset =
domain))

#Marital
chi_sq_result <- svychisq(~foodinsecure +marg, design = subset(survey_design, subset =
domain))

#Astma-ASEV_A
chi_sq_result <- svychisq(~foodinsecure +ast , design = subset(survey_design, subset =
domain))

#Cancer CANEV_A
chi_sq_result <- svychisq(~foodinsecure +can , design = subset(survey_design, subset =
domain))
```

```r
#Hypertention - High blood pressure.

chi_sq_result <- svychisq(~foodinsecure +hyp , design = subset(survey_design, subset = domain))

##CHLEV_A-high cholesterol
chi_sq_result <- svychisq(~foodinsecure +choles, design = subset(survey_design, subset = domain))

##CHDEV_A-Coronary heart disease
chi_sq_result <- svychisq(~foodinsecure +card , design = subset(survey_design, subset = domain))

#COPDEV_A- .Chronic Obstructive Pulmonary Disease, C.O.P.D
chi_sq_result <- svychisq(~foodinsecure +copd , design = subset(survey_design, subset = domain))

#DIBEV_A -Diabetes
chi_sq_result <- svychisq(~foodinsecure +diab, design = subset(survey_design, subset = domain))
#Employee-EMPLASTWK_A
chi_sq_result <- svychisq(~foodinsecure +emp, design = subset(survey_design, subset = domain))
#Health Insurence-NOTCOV_A
chi_sq_result <- svychisq(~foodinsecure +health , design = subset(survey_design, subset = domain))
#SNAP-FSNAP12M_A
chi_sq_result <- svychisq(~foodinsecure +SNAP , design = subset(survey_design, subset = domain))
```

```r
#Sleep order-SLPHOURS_A
chi_sq_result <- svychisq(~foodinsecure +SLPHOURS_A , design = subset(survey_design, subset = domain))


# Print the chi-square results
print(chi_sq_result)

# Compute survey-weighted crosstab with row percentages
#Sex
weighted_crosstab <- svytable(~SEX_A+foodinsecure, design = subset(survey_design, subset = domain))

#Age
weighted_crosstab <- svytable(~AGEP_A+foodinsecure, design = subset(survey_design, subset = domain))

#Race
weighted_crosstab <- svytable(~race+foodinsecure, design = subset(survey_design, subset = domain))

#Education
weighted_crosstab <- svytable(~EDUC+foodinsecure, design = subset(survey_design, subset = domain),drop.unused.levels = TRUE)

#Marital
weighted_crosstab <- svytable(~MARITAL_A+foodinsecure, design = subset(survey_design, subset = domain))

#ASEV_A
weighted_crosstab <- svytable(~ASEV_A+foodinsecure, design = subset(survey_design, subset =
```

```r
# Cancer CANEV_A
weighted_crosstab <- svytable(~CANEV_A+foodinsecure, design = subset(survey_design, subset = domain))

# High Blood Pressure -HYPEV_A

weighted_crosstab <- svytable(~HYPEV_A+foodinsecure, design = subset(survey_design, subset = domain))

#CHLEV_A-high cholesterol
weighted_crosstab <- svytable(~choles+foodinsecure, design = subset(survey_design, subset = domain))

#CHDEV_A-Coronary heart disease

weighted_crosstab <- svytable(~CHDEV_A+foodinsecure, design = subset(survey_design, subset = domain))

#COPDEV_A- .Chronic Obstructive Pulmonary Disease, C.O.P.D
weighted_crosstab <- svytable(~COPDEV_A+foodinsecure, design = subset(survey_design, subset = domain),drop.unused.levels = TRUE)

#DIBEV_A-Diabetes
weighted_crosstab <- svytable(~DIBEV_A+foodinsecure, design = subset(survey_design, subset = domain),drop.unused.levels = TRUE)

#NOTCOV_A-Health Insurence
weighted_crosstab <- svytable(~NOTCOV_A+foodinsecure, design = subset(survey_design, subset = domain))

#FSNAP12M_A-SNAP
weighted_crosstab <- svytable(~FSNAP12M_A+foodinsecure, design = subset(survey_design, subset
```

```r
# Define the survey-weighted logistic regression model
weighted_logit <- svyglm(foodinsecure~sex+ AGEP_A+ast+race+EDUC+
                         marg+can+hyp+choles+card+ copd+
                         diab+emp+health+SNAP+SLPHOURS_A,
                         design = subset(survey_design, subset = domain),  family = binomial)



# Print the model summary including p-values and odds ratios
summary(weighted_logit)

weighted_logit %>% coef() %>% exp() %>% round(2) %>% as.data.frame()

```

SEX:1.30 If Odds Ratio >1: (female) has (30%) higher odds of (food insecurity) than (male), on average.

AGE: 1.02 If Odds Ratio \>1: For every 1 increase in (age), there is (2%) (increase) in odds of (food insecurity), on average.

Asthma: 0.79 If Odds Ratio <1: (No) has (21%) lower odds of (food insecurity) than (Yes), on average.

cancer:0.76 If Odds Ratio <1: (No) has (24%) lower odds of (food insecurity) than (Yes), on average.

Hypertension:0.66 If Odds Ratio <1: (No) has (34%) lower odds of (food insecurity) than (Yes), on average.

cholesterol:1.18 If Odds Ratio >1: (No) has (18%) higher odds of (food insecurity) than

```
cholesterol:1.18 If Odds Ratio >1: (No) has (18%) higher odds of (food insecurity) than (Yes), on average.

 heart disease :0.73 If Odds Ratio <1: (No) has (27%) lower odds of (food insecurity) than (Yes), on average.

COPD2:0.41 If Odds Ratio <1: (No) has  (59%) lower odds of (food insecurity) than (Yes), on average.

diabetes:0.74 If Odds Ratio <1: (No) has  (26%) lower odds of (food insecurity) than (Yes), on average.

employee:1.34  If Odds Ratio >1: (No) has (34%) higher odds of (food insecurity) than (Yes), on average.

health insurance:0.65 If Odds Ratio <1: (covered) has  (35%) lower odds of (food insecurity) than (Not Covered), on average.

SNAP:0.38 If Odds Ratio <1: (No) has  (62%) lower odds of (food insecurity) than (Yes), on average.

race2:0.83 If Odds Ratio <1: (Non-Hispanic White only) has (17%) lower odds of (food insecurity) than (Hispanic), on average.

race3:1.31 If Odds Ratio >1: (Non-Hispanic Black/African American only) has (31%) higher odds of (food insecurity) than (Hispanic), on average.

race4:0.93 If Odds Ratio <1: (Other or multiple race, Non-Hispanic) has (7%) lower odds of (food insecurity) than (Hispanic), on average.
```

```
# Define the survey-weighted logistic regression model
weighted_logit <- svyglm(foodinsecure~sex+ AGEP_A+ast+race+EDUC+
                         marg+can+hyp+choles+card+ copd+
                         diab+emp+health+SNAP+SLPHOURS_A,
                         design = subset(survey_design, subset = domainold),  family = binomial)
# Print the model summary including p-values and odds ratios
summary(weighted_logit)

weighted_logit %>% coef() %>% exp() %>% round(2) %>% as.data.frame()
```

SEX:1.24 If Odds Ratio >1: (female) has (24%) higher odds of (food insecurity) than (male), on average.

AGE: 0.95 If Odds Ratio <1: For every 1 increase in (age), there is (5) decrease in odds of (food insecurity), on average.

Asthma: 0.89 If Odds Ratio <1: (No) has (11%) lower odds of (food insecurity) than (Yes), on average.

cancer:1.00 If Odds Ratio <1: (No) has (0%) lower odds of (food insecurity) than (Yes), on average.

Hypertension:0.77 If Odds Ratio <1: (No) has (23%) lower odds of (food insecurity) than (Yes), on average.

cholesterol:0.96 If Odds Ratio >1: (No) has (4%) higher odds of (food insecurity) than (Yes), on average.

```
278
279 heart disease :0.65 If Odds Ratio <1: (No) has (35%) lower odds of (food insecurity) than
    (Yes), on average.
280
281 COPD:0.46 If Odds Ratio <1: (No) has  (54%) lower odds of (food insecurity) than (Yes), on
    average.
282
283 diabetes:0.73 If Odds Ratio <1: (No) has  (27%) lower odds of (food insecurity) than (Yes),
    on average.
284
285 employee:1.73  If Odds Ratio >1: (No) has (73%) higher odds of (food insecurity) than (Yes),
    on average.
286
287 health insurance:0.49 If Odds Ratio <1: (covered) has  (51%) lower odds of (food insecurity)
    than (Not Covered), on average.
288
289 SNAP:0.34 If Odds Ratio <1: (No) has  (66%) lower odds of (food insecurity) than (Yes), on
    average.
290
291 race2:0.50 If Odds Ratio <1: (Non-Hispanic White only) has (50%) lower odds of (food
    insecurity) than (Hispanic), on average.
292
293 race3:0.92 If Odds Ratio <1: (Non-Hispanic White only) has (8%) lower odds of (food
    insecurity) than (Hispanic), on average.
294
295 race4:0.63 If Odds Ratio <1: (Other or multiple race, Non-Hispanic) has (37%) lower odds of
    (food insecurity) than (Hispanic), on average.
296
297 marg2:1.84 If Odds Ratio >1: (Living with a partner together as an unmarried couple ) has
    (84%) higher odds of (food insecurity) than (Married), on average
298
```

```
299 marg3:1.98 If Odds Ratio >1: (Neither) has (98%) higher odds of (food insecurity) than
    (Married), on average
300
301 EDUC1:0.57 If Odds Ratio <1: (any under grad  experience ) has (43%) lower odds of (food
    insecurity) than (high school or less education), on average.
302
303 EDUC2:0.35 If Odds Ratio <1: (grad school experience) has (65%) lower odds of (food
    insecurity) than (high school or less education), on average.
304
305 SLPHOURS_A:0.90 If Odds Ratio <1: For every 1 increase in (sleep hours), there is (10%)
    decrease in odds of (food insecurity), on average.
```

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