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Association Between Food Insecurity and Influenza Outcome in the United States.

Sabrina Fiona Pink
Walden University

Walden University

College of Health Professions

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Sabrina Pink

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Sue Subocz, Ph.D.

Walden University
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Abstract

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by

Sabrina Pink

MSPH, Southern New Hampshire University, 2018

BS, Mercy College, 2017

Dissertation Submitted in Partial Fulfillment

Of the Requirement for the Degree of

Doctor of Philosophy

Public Health- Epidemiology

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Abstract

The influenza virus is one of the most commonly occurring respiratory viral infections in the world. The outer capsule of the virus contains 18H proteins and 11N proteins, which allows the virus to reform in over 100 different strands and outperform the vaccine. Despite efforts to improve access to care and reduce vaccine inequities; the Center for Disease Control and Prevention estimates 9-45 million documented influenza-related illnesses, 140,000 to 810,000 hospitalization, and 64,000 deaths yearly.

The purpose of this study is to investigate whether food insecurity, access to care and other social determinants of health such as age, race, and sex adversely affect influenza outcomes in the United States. Existing scientific literature suggests poor nutrition causes a reduction in serum albumin levels. In addition, serum albumin is a known biomarker in animal trials that block the replication of the influenza virus when present. This study was developed with a quantitative approach that utilized 1,282 eligible participants from the (2012) Health Interview Survey. The Health Belief Model was used to explain how recommended health behaviors can be achieved if stakeholders are knowledgeable of how their health is personally affected.

This study's results showed that influenza was common among individuals that experienced food insecurity. The majority of the study population had no trouble finding a doctor and influenza cases were more closely linked to food insecurity than access to care. Social factors also played a critical role as women were more likely to contract the influenza virus than males. Racial and ethnic groups that experienced higher levels of food insecurity also experience greater instances of the influenza virus. In conclusion, the finding suggests food insecurity is a risk factor for contracting the influenzas virus.

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Dedication

I dedicate this dissertation to the lives lost to the influenza virus globally. I promise to be relentless until I positively impact how the world prepares for and responds to future influence epidemics. The goal is to discover factors outside of vaccination that worsen influenza outcomes and provide an alternative to those who may not respond well to or experience difficulty using current preventative methods.

Acknowledgment

I wish to thank my mother, who died in 2009, and left behind a legacy that allowed me to pursue the highest education attainable level. I want to make a special mention of my daughter, who made the most significant sacrifice for my academic journey. I will never forget the tears we shared, and time spent apart to make this dream a reality. Last but certainly not least, I would like to thank my chair Dr. Davis, committee member Dr. Melea as well as Walden University Academic Resource Personnel. I was blessed with an incredibly talented team, who are supportive, understanding, and genuinely invested in my academic success. They have been great commanders during this process. This dissertation is made possible because of their continued commitment to support doctoral students on their journey to make this world a better place.

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Chapter 1: Introduction to The Study

Background

The influenza virus is among the most common preventable illnesses responsible for 250,000 to 500,000 yearly deaths worldwide (World Health Organization [WHO], 2019). The virus derives from one of two major groups, influenza A or influenza B. Influenza A is most common in humans and comprises of 18H proteins and 11N proteins. On the other hand, influenza B has two subgroups Yamagata and Victoria. Although this linage is most dominant in swine and birds, it is lethal when detected in humans (CDC, 2019). These characterizations and distinct outer protein alignments enable the virus to form and reform more than 100 different strands. The versatility also allows the influenza virus to outperform the vaccine and pose a direct threat to the health and wellbeing of every American annually during the influenza season (CDC, 2018).

For more than 50 years in the fight against the virus, an egg-based vaccine containing an inactive form of the most prominent strand of the influenzas virus has been administered (CDC, 2019). To make this prediction, scientists observe the circulating strand of the influenza virus in the southern hemisphere winter to accurately match the strands that may appear in the northern hemisphere next. The most significant limitation to this approach is that mutations may occur, and strands often appear later in the season that were not included in the vaccine. These uncovered strands leave individuals vulnerable to contracting the virus even if they had become vaccinated. Rare strands also reduce the vaccine's ability to provide broad-spectrum protection against the flu. Other factors, such as allergic reaction, accessibility, cost, health, and religious beliefs, have also been associated with reducing vaccine uptake and increase community transmission.

The World Health Organization (WHO) defines influenza viruses (A and B) as seasonal pandemics that annually circumnavigate the globe. According to the Centers for Disease Control and Prevention (CDC; 2019), the virus negatively contributes to respiratory illnesses and fatalities observed in the United States. The CDC views influenza vaccination compliance as a significant factor for worsened health outcomes connected to the seasonal flu. Currently, vaccination ranges from 48% to 60%. This pattern has also been consistent with the data collected over the last ten years (CDC, 2019). Adherence is heavily influenced by how well the vaccine can protect against the circulating strand of the virus. In most cases, a well-matched vaccine or a universal vaccine is challenging to develop because the virus has 18H protein and 11N proteins that allow it to reform in multiple strands not covered in the vaccine. When the vaccine is potent, residents experience 10% to 60% protection against influenza after vaccination (CDC, 2019). The existential gap between compliance and effectiveness highlights the need for additional intervention in collaboration with vaccination to protect residents during high prevalent seasons.

Serum albumin is one of the most abundant proteins in the body that primarily repairs tissues and has provided some protection against the influenza virus in wild-type mice clinical trials (Mu et al., 2018). Adequate albumin is achieved and sustained through sufficient nutrition (Moonen et al., 2020). According to the 2019 Bloomberg Healthiest Country Index, The United States ranks 35th out of 169 countries regarding its health. The United States is the 11th wealthiest nation globally and is developmentally behind countries of lesser economic wealth, such as Cuba ranked 30, Canada ranked 16, and Chile/ Costa Rica tied for 33 (Deffarges, 2019). The abundance of low-quality food and Americans' lifestyle choices has profoundly influenced their overall health and exposure to comorbidities, among the leading causes of deaths worldwide.

Nutrition plays a critical role in immune support and the development of hypertension, heart disease, stroke, diabetes, and high cholesterol. The overconsumption of food with little to no nutritional value causes greater susceptibility to irreversible diseases that complicates exposure to the influenza virus. Foods with insufficient protein decrease serum albumin levels in the blood, which may make it easier for humans to contract the influenza virus; as recent studies suggest, the presence of albumin blocks influenza replication in animals (Mu et al., 2016; Yang et al., 2018; Zhao et al., 2017). Further, Zhao et al. (2017) was one of the first to discover that albumin operates as an inhibitor for the influenza virus. In addition, Mu et al. (2016) investigated the effects of albumin vaccination (human serum albumin), finding that the vaccine stimulates immune response and has the potential to reduce the threat of an influenza outbreak. This was followed by Yang et al.'s (2018) study that investigated ways to increase albumin, and the results showed that the most common way to increase albumin is through nutrition. The body absorbs protein, directly impacting the albumin level present in the blood which is the building block for sustaining innate immunity (Moonen et al., 2020).

Innate immunity is defined as a nonspecific defense mechanism that immediately activates within hours of an antigen's appearance in the body (Moonen et al., 2020). The innate immune system is the first line of defense. It comprises of the skin, white blood cells, and immune system cells that attack foreign pathogens identified in the body. The second line of defense is adaptive immunity, the body's learned defense against invading pathogens, including influenza viruses (Yang et al., 2018). Though both are biological functions, social inequalities, including economics, education, sanitation, and access to healthcare, can negatively affect the development of innate immunity and create favorable conditions for the influenza virus to thrive. Massimo et al. (2016), examined the differences in demographic characteristics, socio-economic conditions, and health-services utilization to explain in part how influenza-associated illnesses were 2.5 times more likely among impoverished immigrants than citizens in a comparative international study.

Problem Statement

According to the Economic Research Services at the United States Department of Agriculture, approximately 10% of households in the United States reported food insecurity at one point during 2019. In 7.1% of families with children, only adults experienced food insecurity (United States Department of Agriculture [USDA], 2020). Addressing this gap is essential as adults often suffer the worst fate related to the influenza virus and have a high likelihood of insufficient nutrition in a family setting. The data collected by the CDC reports that greater than 86,000 influenza-related hospitalizations were among adults between the ages of 18 and 49 during the 2019-2020 influenza season. Elderly adults aged over 65 represented 43% of the adult hospitalization population and 62% of deaths, emphasizing the low recovery rate observed within this population (CDC, 2020). For children under 18, there were approximately 52,000 influenza hospitalizations and 434 associated deaths during 2019-2020 (CDC, 2020).

The CDC's national data highlights the need for additional mitigation strategies for adults in the United States to improve their influenza outcomes. Currently, influenza infection in the United States was approximately 45 million in 2018, 40 million in 2019, and greater than 56 million in 2020 (CDC, 2020). The development of pre-existing conditions has exponentially grown, with over 29 million Americans infected with the novel coronavirus that causes severe and lifelong respiratory illnesses (CDC, 2020). If left untreated, death associated with the influenza virus will continue to surpass previous years as comorbidities are among the leading causes of complex influenza cases.

The most prominent measure to help prevent influenza focuses on making the vaccine more widely available at no cost to citizens with an inability to pay. This approach's greatest challenge is poor vaccination compliance and strand mutation, which increases fatalities associated with the influenza virus. The most significant advantage of building innate immunity is the body's ability to provide broad-spectrum protection against all invading strands naturally; however, the literature does not directly address the role nutrition plays in influenza prevention nor has lower levels of albumin been explored as a risk factor as it relates to food insecurity and influenza infections. If proven true, this could revolutionize influenza mitigations as less skepticism and side effects are associated with nutrition and diet changes in comparison to vaccination.

Impoverished regions are often suitable targets for viral infections and diseases. Health systems within these populations are limited, and natural immunity is often compromised (CDC,2020). The hypothesis is that food insecurity could contribute to contracting the influenza virus as data from animal trials suggest serum albumin, which is obtained through adequate nutrition, operates as an influenza inhibitor (Goutard et al. 2017; Hagiwara et al. 2020; Mu et al. 2018). The finding implies that populations with food insecurity could have lower albumin levels and may be at greater risk for influenza. This study's primary goal was to evaluate the association between food insecurity and seasonal influenza outcomes, which could provide new knowledge on lowering the risk of contracting the virus. Investigating nutritional intake and exposure to influenza offers additional insights into other factors that can help determine whether poor influenza outcomes are more closely associated with nutrition or access to care.

Purpose of the Study

The aim was to investigate risk factors for contracting the influenza virus. Albumin is a known influenza inhibitor in animals (Mu et al., 2018). In humans, albumin predicts protein intake for the past 14 days, which can help determine if malnutrition is present. Using albumin as a biomarker for nutrients allows for a comprehensive analysis that takes a closer look at how poor nutrition affects influenza outcomes; as previous clinical trials show, lower levels of albumin may create greater susceptibility for contracting the influenzas virus (Zhao et al., 2017). Variables for this analysis include if participants were able to find a doctor in the last 12 months, received a flu vaccine/nasal spray within the last 12 months, lost weight because of no money to buy food, food insecurity raw score, age, race, and income of participants (independent variables). Participants' exposure to the influenza within the last 12 months will function as the study's dependent variable. Classifying the data by age, race, and sex can highlight the subgroup most affected and may reveal to what extent. Examining whether residents have had greater difficulty gaining access to care or inability to provide food can help inform future decisions on how to decrease influenza prevalence ahead of the season.

Schimid et al. (2017) investigated associations of poor influenza outcomes with vaccination non-compliance, personal beliefs, past medical history, and adverse events. Zhao et al. (2017), prepared a multivalent Zanamivir (ZA) finding that ZA inhibition conjugate had some inhibitory activity, supporting the conclusion that serum albumin operates as a potent influenza neuraminidase inhibitor. In their study, Mu et al. (2016) explored whether a recombinant fusion protein linking influenza M2e protein to human serum albumin (HSA) served as protection against the influenza A virus. M2 protein, also known as M2e of influenza A, had limited immunogenicity on its own but had greater efficacy when combined. The results revealed that HSA/M2e defined above could induce strong anti-M2e specific humoral immune responses (Mu et al., 2016). In addition, HSA/M2e reduced viral load in mice's lungs and protected mice against the influenza A virus (Mu et al., 2016). The discovery that albumin as a clinical trial using mouse models suggests that human susceptibility may lie in what they eat and how much their consumption impacts innate immunity.

Research Questions and Hypothesis

RQ 1: What is the association between food insecurity and influenza cases among the test population?

H_0 There is no association between food insecurity and influenza cases among the test Population.

H_1 There is an association between food insecurity and influenza cases among the test Population.

RQ 2: What is the association between access to care and influenza cases among the test population?

H_0 There is no association between access to care and influenza cases among the test Population.

H_1 There is an association between access to care and influenza cases among the test population.

RQ 3: What is the association between socio-economic factors (age, race, sex) and influenza cases among adults in the United States?

H_0 There is no association between socio-economic factors and influenza cases among adults in the United States.

H_1 There is an association between socio-economic factors and influenza cases among adults in the United States.

Theoretic Framework

The health belief model (HBM) will be used in this study to explain how knowledge about nutrition, influenza virus, and health care resources can shape how Americans view their health and prepare for future influenza season. The HBM is a social psychological health behavior change model developed to explain and predict health-related behaviors associated with health services uptake (Fall et al., 2017). Gaining knowledge about vaccines, groups most affected and raising awareness of the role food plays in health outcomes may help shape the perception of one's health and how one is personally affected by one's choices. This approach was selected because of its ability to add structure to this quantitative analysis, illustrate the meaningfulness of the findings and explain how desired health actions can be achieved if stakeholders know how they are personally affected. (Goutard et al., 2007).

Fall et al. (2017) used the HBM and the self-determination theory to predict influenza vaccination and vaccination intention. Deploying this model will help deepen our understanding of how residents' health actions and psychosocial beliefs can worsen their influenza outcome. For example, conceptually, lower levels of earning potential may trigger an inability to provide healthy nutritious meals. Therefore, it supports the idea that higher influenza rates may be more closely associated with a lack of adequate nourishment in low-income populations, which causes suppression of the immune system leading to greater susceptibility to the influenza virus (Bohannan et al., 2020).

Nature of the Study

The methodology of this study was quantitative. This method is consistent with tracing the epidemiologic movement of viral infection within a well-defined target population. This study's primary focus was to measure the variables and assess their impact on influenza outcomes. The National Health Interview Survey (ICPRS 36146) was converted to Statistical

Package software (SPSS) from the Inter-university Consortium for Political and Social Research (ICRPS). In addition, an ecological quantitative study was developed that examined the effects of access to care, nutrition, income, and age on influenza outcomes. The findings can help determine which subgroup experiences more significant immune deficiencies and has a greater need for resources, prevention, and intervention.

Definitions

Due to the categorical nature of most variables in the analysis, a Chi-Square and binary logistic regression test will be the most appropriate operation to analyze the data. The tests selected will be used to investigate how variables such as participants ability to find a doctor in the last 12 months, received a flu vaccine within the last 12 months, received the flu nasal spray within the last 12months, lost weight because of no money to buy food, raw food insecurity score, age, race, and sex of participants (independent variables) and participants exposure to the influenza within the last 12months as the dependent variable. The findings can shape the public health response to future influenza season, providing residents with the resources needed to boost innate immunity.

Variables

Age
Level of measurement: Categorical

1=18-30 years old

2=31-51 years old

3=52-63 years old

4=65 and above

5= refused

Rationale: This exposure variable will be coded as a continuous variable and was regrouped categorically. This regrouping allowed me to manipulate the age of participants to show the strength and significance of age groups most affected by food insecurity and the influenza virus. Age is a critical variable when assessing influenzas outcome; using it in this study gave additional insight into whether albumin food insecurity is a risk factor for susceptibility in various age groups.

Sex

Level of measurement Nominal Dichotomous

1=male

2=female

Rationale: Gender has played a role in several factors that influence poor influenza outcome such as joblessness, lower levels of earning potential, and intentionally avoiding care. Looking at the data by sex could potentially find gender gaps that made one gender more vulnerable than another.

Race

Level of measurement Nominal

1=White

2= Black African American

3=Indian American/Alaskan Native

4= Asian Indian

5= Chinese

6=Filipino

7=Other Asian

8=Primary race not releasable

9=refused

10=multiple races, no primary race selection

Rationale: Pacific Islanders, Hispanics, and Black/African Americans represent the group that primarily makes up severe influenza illnesses. Stratifying this data by race helped understand how albumin level varies across races and determine if it is a risk factor for increased fatalities across different races.

Hispanic Ethnicity

Level of Measurement Nominal (Independent Variable)

1= Multiple Hispanic

2= Puerto Rico

3= Mexican

4=Mexican American

5= Cuban/ Cuban American

6=Dominican (Republic)

7= Central of South American

8= Other Spanish

12= Not Hispanic/ Spanish Origin

Had influenza within the last 12 months

Level of Measurement Nominal (Dependent Variable)

1=yes

2=no

7=refuse

8=not ascertained

9=don't know

Rationale: Whether a participant has had influenza in the last 12 months is an important variable because the vaccine is only potent for one season, and if someone was exposed to the virus after being vaccinated greater than 12 months ago, they will need to be identified and excluded from the study.

Trouble finding a doctor in the past 12 months

Level of measurement Nominal (independent variable)

1=yes

2=no

7=refuse

8=not ascertained

9=don't know

Rationale: Public health policy makers and stakeholder continue to increase access to care and availability of the vaccine nationally to lower the rates of infection and deaths associated with contracting the influenza virus. Deploying this variable provides additional insights if residents are having challenges accessing resources and how it impacts their exposure to the influenza virus.

Detailed family level food insecurity

1=High food insecurity

2= Marginal food insecurity

3=Low food insecurity

4=Very low food insecurity

9= Unknown

Rationale: This is a critical variable as it helps to understand if an association exist between food insecurity and the influenza virus. It scores residents based on their level of food insecurity at the time of survey counting back to 1 year.

Lost weight because of no money to buy food

Level of measurement Nominal (independent variable)

1=yes

2=no

7=refuse

8=not ascertained

9= don't know

Rationale: Malnutrition in most cases is not voluntary, and an inability to afford food is a crucial indicator for poor nutrition. This also negatively affects the innate immunity needed for an additional layer of protection against the influenza virus. Losing weight and failure to thrive is a critical indication that there is a lack of adequate nutrition, especially when weight loss is triggered by a lack of money to buy food.

Terms & Definitions

Antigen: An antigen is a substance that causes the body's immune system to react, especially by producing antibodies that attack harmful bacteria and viruses (Cambridge Dictionary, 2020).

Cytokines: A cytokine is a small protein produced by cells in the nervous and immune system that affects what happens between cells (Cambridge Dictionary, 2020).

Fucosyllactose (2'FL): 2′FL is an oligosaccharide neutral trisaccharide composed of L-fucose, D- galactose, and D-glucose units. It is the most prevalent human milk oligosaccharide (Xiao et al., 2018).

Glycoconjugate: Glycoconjugate is the general classification given to carbohydrates (Berti & Adamo, 2018). H Protein: 18 hemagglutinin (H) forms as an outer layer protein of the influenza virus (CDC, 2020).

Interferons (IFN's): Interferons (IFNs) are a group of signaling proteins made and released by host cells in response to the presence of several pathogens, such as viruses, bacteria, parasites, and tumor cells (creative diagnostics, 2020).

IFN-stimulated genes: IFNs are secreted cytokines that activate a signal transduction cascade leading to the induction of hundreds of interferon-stimulated genes (Chen et al., 2018).

N Protein: 11 neuraminidase (N) form as an outer layer of protein for the influenza virus (CDC,2020).

L. Rhamnosus: It is a short Gram-positive heterofermentative facultative anaerobic non-spore-forming rod that often appears in chains (Tonetti et al., 2020).

Longum Infantis CCUG 52486: These are novel Probiotics (Yaqboo, 2017)

Memory cells: A memory cell is a cell in the immune system that, when exposed to an invading pathogen, replicates itself and remains in the lymph nodes searching for the same antigen, resulting in a more efficient and rapid response to any subsequent attack (Dictionary.com, 2020).

Phagocytic cells: A phagocytic cell is a type of cell in the body that can surround things and swallow them, especially a white blood cell that protects the body against infection by destroying bacteria (Cambridge Dictionary, 2020).

Yamagata & Victoria: These are the 2 major subgroups for influenza B (CDC, 202019

Assumption

Yang et al. (2018), Yu et al. (2020), Zhang et al. (2019) and Zhao et al. (2017), examined the role albumins play as an inhibitor against influenza viruses. The studies concluded that higher levels of albumin increase innate immunity against the influenza virus. This is essential as higher albumin levels are achieved through nutrition, which is a continuous challenge for 10% of Americans. Given that albumin is confirmed to be an inhibitor for influenza virus in wild-type mice, the assumption is that a higher incidence of influenzas may be more closely associated with lower albumin levels due to poor nutrition than low vaccination uptake due to health disparities. The virus predominantly affects minority communities. These communities are often stricken by poverty, which could help to understand increased susceptibility to the virus within these communities.

Scope and Delimitations

Challenges surrounding improving immunity against the influenza virus are an ongoing international concern (WHO, 2019). The United States is a developed industrialized nation but has experienced severe challenges in protecting residents from the influenza virus with more resources at its disposal than neighboring countries in the region. This was the first indicator that factors outside of vaccination contributes to poor influenza outcome in the United States. The study will explore the role nutrition plays and determine if it is a risk factor for poor influenza outcomes. Albumin operates as an inhibitor but has never been studied concerning influenza cases and poor nutrition. The hypothesis tested determined whether food insecurity was observed in individuals with influenza. Future researchers can conduct a double-blinded placebo control study that monitors one cohort of patients with adequate nutrition and another without, the other with lower levels of albumin, and monitor their influenza outcome over a pre-defined influenzas season. These findings can help identify influenza cases in the United States that may be higher due to poverty and malnutrition, than poor access to vaccines.

Eligible candidates for this study included adults over the age of 18 that completed the National Health Interview Survey and contracted influenza within 12 months of conducting the survey. This target population was selected as they are the hardest hit with fatalities and deaths associated with the influenza virus yearly. Even though children are among the most vulnerable, they usually recover faster with fewer hospitalizations and fatalities and will be excluded. The study explored socioeconomic status, education, and race as these factors play a crucial role in health decisions, access to care, and health literacy.

Limitation

1. The data may have missing variables that need to be adjusted for.

2. The data may not reflect an accurate population sample.

3. Medical mistrust may cause patients to omit vital information on the survey because of how they may be perceived by the data collector or physician.

Significance

The WHO champions the causes to develop new strategies to fight the influenza virus globally. According to WHO (2019), the influenza virus is one of the most frequently occurring and easily transmitted viruses. The agency estimates approximately 290,000 to 650,000 influenza-related respiratory deaths worldwide (WHO, 2020). Though the United States is in a more affluent position with resources to limit the virus's impact, from October 1, 2019, to April 4, 2020, there were between 39 and 56 million influenza and 410,000 to 740,000 hospitalizations reported by the CDC (2020). These cases resulted in approximately 24,000 to 62,000 deaths from influenza (CDC, 2020). For the 2019-2020 influenza season, 52% of the U.S. population got vaccinated (CDC, 2020). This increases from the 45% recorded in 2018-2019; however, influenza cases increased by greater than 10% (CDC, 2020).

The influenza season vaccine was 45% effective against 2019-2020 seasonal influenza A and B viruses (CDC, 2020). The lack of total immunity propels researchers to explore factors outside of vaccination to improve influenza-related health outcomes. One such exploration has led researchers to examine closer glycoconjugates, which are carbohydrates that are covalently linked with other chemical species such as protein or lipids (Berti & Adamo, 2018). Glycoconjugate vaccines are obtained by the chemical linkage of a carbohydrate antigen to a protein that is a part of routine vaccinations in many countries (Berti & Adamo, 2018). Yu et al. (2020), used glycoconjugate and build upon its ability to capture influenza virion as natural mucin. This finding supports the theory that glycoconjugate can be used as an influenza neuraminidase inhibitor (Yu et al., 2020).

This study can contribute to the existing body of scientific literature by identifying whether an association exists between nutrition, access to care, and influenza outcomes. This is essential, as many Americans become severely ill due to avoidable fatalities induced by the influenza virus. A tailored approach permits a comprehensive evaluation of new mitigation strategies and creates positive social change. National projection continues to predict an increase in fatalities annually, regardless of increased vaccination within the population. Glycoconjugates are carbohydrates that are covalently linked with other chemical species such as protein or lipids (Berti & Adamo, 2018).

This is essential, as Americans consistently present with the highest rates of newly reported cases (CDC, 2019). Based on the annual influenza incidence and prevalence recorded nationally, there is an urgent need for an individualized approach to alleviating the health burden associated with influenza and improve the wellbeing residents during the influenza season. The other determinants are critical to investigate as a comprehensive approach allows for new mitigation strategies to emerge that create positive social change. Increased knowledge about these factors can also impact how Americans prepare for future influenza seasons through nutrition. If what we eat can change how our immune system responds to influenza, residents will be more compelled to make that commitment when they believe it directly impacts their health and wellbeing.

Significance to Theory

The influenza virus's challenges have evolved as the population and knowledge about the virus change over time. Access to care and the cost of the vaccine has been at the forefront of public health initiatives to ensure vulnerable communities have equal access to the resources needed to prevent the spread of the influenza virus. This study's key role is to raise awareness about how nutrition could be a risk factor for why some people respond poorly to the influenza virus than others. The findings build on existing knowledge about innate immunity's role and its importance in reducing influenzas cases in communities that experience food insecurity. Low vaccine uptake has been commonly cited as the main reason for the influenza virus's health burden in the United States. This study provides additional insight into other factors outside of vaccination, contributing to the compound effect, increased incidence, and prevalence of the influenza virus.

Significance to Practice

Suppose the hypothesis is correct and influenza is more closely associated with food insecurity access to care. In that case, public health stakeholders can increase health literacy regarding nutrition in underserved communities and provide appropriate food services in communities that are more likely to have residents with financial challenges that head to an inability to afford food. This would also be a pivotal moment for residents as the perception of their health actions may change in response to a cause that directly affects their health. Residents have been skeptical about the vaccine, its potency, and its adverse effects. Eating healthier to include more protein to boost the albumin level will be more widely accepted, as nutrition is crucial for survival.

Significance to Social Change

Positive influenza outcome is heavily dependent on the health actions of the individuals affected. The HBM has been used to predict health uptake based on the stakeholder's perception of whether they are directly affected. This study's findings enrich the body of existing literature and move us closer to reducing the health and economic burden of influenza nationally. Achieving this goal would be a milestone for positive social change, as improved nutrition has an overall benefit to other preventable diseases influenced by poor diet including, but not limited to diabetes, hypertension, heart disease, high cholesterol, and stroke that are leading causes of death locally and internationally.

Summary and Transition

The influenza virus is one of the most frequently occurring viruses (WHO, 2019). The outer protein enables the virus to reform in over 100 different strands that are often not covered in the vaccine. This ultimately reduces the overall potency of the vaccine and its ability to prevent influenza infection. Vaccination compliance in the United States is approximately 48%

to 60%. Nevertheless, the CDC estimates that anywhere between 9 and 45 million residents contract the virus each year that are both vaccinated and unvaccinated (CDC, 2019). The virus typically thrives in cold climates and impoverished neighborhoods. Cheaper living quarters have forced low-income earners to migrate to specific regions, creating community clusters of how low-income earners and increased healthcare needs. (Health NY, 2019). Federal legislation has allowed pharmacists to administer the influenza vaccine for free to anyone over the age of 24 months to alleviate the health burden in vulnerable communities (CDC, 2019).

A recent study confirmed that the vaccine's consensus has evolved as 86% of adults currently recognize that the influenza vaccine is safe and effective, and 83% believe it helps prevent the influenza virus (Lutz et al., 2020). Nevertheless, the incidence remains elevated, indicating that factors outside of vaccination are responsible for poor influenza outcomes in the region. The study's objective was to assess the role nutrition plays in protecting residents against the influenza virus. Album level measure protein intakes over the past two weeks, which will give additional insight for patients who tested positive with influenzas where poor nutrition was a factor for contracting the virus. This discovery can inform future public health decisions and position nutrition as a higher priority to help fight influenza in impoverished neighborhoods.

Chapter 2: The Literature Review

Introduction

The influenza virus poses a health and economic burden to all developing and industrialized nations (WHO, 2019). In 2017, the WHO conducted a study that compiled influenza-associated respiratory mortality across 31 countries (Paget et al., 2019). The researchers extrapolated the influenza burden experienced by 193 regions and territories between 2002 and 2011 using multiple imputations and a mixed linear regression model. The goal was to identify factors associated with high seasonal influenza mortality and understand the influenza virus's global implications (Paget et al., 2019). The results of previous studies revealed that the influenza virus burden is substantially higher than reported and could range between 290,000 and 650,000 influenza-associated deaths from respiratory illnesses as cases reported are often just the cases that require medical attention (Paget et al., 2019). The CDC agrees that the influenza burden is significantly greater than current reporting and cited other barriers such as compliance across local jurisdictions and under-reporting of the influenza virus as barriers for improved outcomes. Some local jurisdictions do not classify influenza cases as a mandatory reporting, which negatively impacts stakeholders' ability to capture the region's true influenza burden (CDC, 2019).

The under-reporting from some states and local municipalities also makes it more difficult to calculate the virus's prevalence and regions most affected accurately. Transparency is crucial when making public health decisions, and non-reporting regions essentially impede containment efforts, as one county that reports their cases and receives resources may share a borderline with a city or town that does not report their cases. As commuter travels bring residents across each border or state line, it becomes more challenging to contain the influenza virus resulting in continuous or localized re-exposure. Nationally, under-reporting also reduces the validity and generalizability of the data collected. Therefore, forcing the CDC to make a general estimation of the influenza virus. Current estimates predict the impact of between 9 million and 45 million illnesses, between 140,000 – 810,000 hospitalizations, and between 12,000 and 61,000 deaths annually since 2010 (CDC, 2020). As the burden increases and vaccination administration/compliance waivers, the demand for additional prevention becomes paramount to successfully reduce the influenza virus's impact nationally.

For the 2019-2020 influenza season approximately 170, million vials of vaccine were administered in the United States; however, illnesses and fatalities associated with the virus has not significantly improved over the last 10 years, which makes it essential to determine if resource needs to be redistributed to achieve a more desirable outcome (CDC, 2020). The greatest challenge for influenza containment is the virus's ability to mutate and transmits more rapidly in communities stricken by poverty and food insecurities. The perception of the vaccine's safety and importance has risen to 86%; nevertheless, the virus's incidence and prevalence have not benefited from these improvements. This indicates that factors outside of perception play a crucial role in reducing the influenza virus's impact on vulnerable communities (Lutz et al., 2020). The purpose of this study was to examine if an association exists between food insecurity and influenza cases. A secondary endpoint was to examine if influenza cases are more strongly associated with access to care/vaccine or food insecurity. This study's results can make an impactful contribution to the existing body of literature and deepen the understanding of the role adequate nutrition plays in helping to prevent the influenza virus.

The following chapter will include literature that explains the history and evolution of the influenza virus. This is important as the virus's epidemiologic movement explains which regions are more heavily affected and the risk factors most cited within those regions, such as age, race, and socioeconomic status. The literature review will also include some of the global challenges with the vaccine and discuss how this shortcoming can be improved in other areas, such as building innate immunity. The review will examine the role albumin play when nutrition is optimal and examine racial disparities that may also operate as risk factors contributing to adverse influenza outcomes.

Literature Search Strategy

The scope of this study included previous publications that investigate albumin as an inhibitor for the influenza virus, the impact of influenza in poverty-stricken communities, and social inequities that operate as risk factors for contracting the influenza virus. I selected peer-reviewed articles published globally that explored wild-type mice, birds, swine, human influenza clinical trials, and observational studies. The search was very inclusive as most influenza prevention trials start in animals expecting similar results in trials with human participants. Google Chrome was the search engine used for this literature review, and the search includes peer-reviewed scholarly publications within the last 5 years. Databases searched included, The Walden University database, National Center of Biotechnology Information, The New England Journal of Medicine, Pub med, Google Scholar, Plos One, Science Direct, The Journal of Immunology, Current Opinion in Virology, Journal of Global Health, Journal of Allergy and Clinical Immunology, HHS Public Access, The Journal of Infectious Diseases, Journal of Virological Methods, Elsevier Journal, Journal of Public Health and The Journal of Carbohydrate Chemistry. I used relevant search terms such as influenza, albumin, protein, influenza, influenza and albumin, influenza prevention, influenza in the United States, nutrition and influenza, influenza vaccine, diet and influenza, food insecurity and influenza. Albumin is not frequently associated with influenza; only 20% of articles generated were associated with the subject being studied.

· CDC (3)

· WHO (1)

· Influenza and Albumin (6)

· Influenza and Protein (5)

· Influenza vaccine perception (4)

· Influenza Statistics (3)

· Influenza Epidemic (20)

· Influenza Prevention (30)

· Influenza and Nutrition (4)

· Nutrition and Albumin (7)

· Innate Immunity (5)

· Racial Disparities (4)

Criteria for Inclusion

A source or literature articles were included based on the following;

1. Sources were peer-reviewed and published between 2015 and 2020

2. Sources explored factors that connect albumin as an inhibitor for influenza.

3. Sources explored influenza trials in animals that explain the etiology of influenza

4. Sources used a conceptual and quantitative approach.

5. Sources were derived from citations in other influenza-related research studies.

Criteria for Exclusion

A source or literature articles were excluded based on the following;

1. Sources that were scholarly written but not peer-reviewed.

2. Sources that were old, outdated, or had no date.

3. Sources that were qualitative.

4. Sources that focused on other health conditions outside of influenza.

5. Sources that were inconclusive.

Theoretic Foundation

The HBM was developed in the 1950s by social scientists to understand better why people failed to adapt to disease prevention recommendations (Lamorte, 2019). Pre-screening and early detection of disease are critical to increasing a patient's survival rate. The model's constructs suggest that patients will be called to action if the perceived risk poses a direct threat to their health and well-being (Kan & Zhang, 2018). This essentially means the more individuals know about their health, the more agreeable they will be towards positive change in their health actions. The willingness to change in the presence of evidence-based knowledge is essential, as an adaption to health action often requires highlighting risk factors that directly impact the stakeholders. Social scientist uses the HBM to show how the personal threat of an illness, paired with perception can influence individuals to adapt to the necessary change to improve their health outcomes (Kan & Zhang, 2018).

The model is grounded in two theories, a psychological component, and health behavior. The first theory explains the desire to avoid illness, and the second talks about the belief that a specific action can prevent the illness or function as a cure. For this study, influenza is the health outcome we are trying to avoid. The data will help determine if residents' perception of their health shaped their response and how nutrition benefits in the fight against influenza change overall response in communities adversely affected by influenza. The HBM is grounded in six guiding constructs that explain how health behavior can improve health outcomes.

1. Perceived susceptibility refers to the risk of acquiring the illness.

2. Perceived severity refers to a person's seriousness for contracting the illness.

3. Perceived benefits refer to the benefit that an individual can gain from the

recommended health action.

4. Perceived barriers refer to personal conflicts that can pose a barrier to the recommended health action.
5. Cue to action; is one of the essential constructs as individuals are in the decision-making process for achieving positive health changes.
6. Self-efficacy refers to individuals' ability to main the recommended health change.

In the past, nutrition has not been a well-studied risk factor for influenza. Therefore, individuals may not have perceived it to a contributing factor to worsening influenza outcomes. Kan and Zhang (2018) utilized the HBM in a meta-analysis that included 1927 articles in influenza research to explore influenza vaccination behavior factors using the HBM. The results showed that behavior connected to influenza vaccination was associated with health promotion and knowledge about the vaccine. This model was chosen for this study because external factors such as race, religion, education, socioeconomic status, and personal belief shape the perception of influenza and the vaccines developed to mitigate the virus. The HBM has the potential to explain health behaviors through the six-step construct. The format shows the evolution of behavior needed to achieve positive social change. The most significant benefit of utilizing this approach is the ability to incorporate evidenced-based research into practice, as the approach allows researchers to build the pathway for which learning and in-depth understanding of behaviors can be achieved. The approach embodies creativity and is widely used in quantitative influenza research to explain behaviors associated with health services uptake (Kan & Zhang, 2018).

Influenza History & Health Burden

The year 2018 marked the centennial anniversary of one of the world's deadliest influenza pandemics that infected over 500 million people globally (WHO, 2019). The virus's impact was extensive and decreased life expectancy in the United States by 12 years (Potter, 2001). This was not the first wave of influenza that devastated lives globally, as the influenza pandemic of 1510 had similar impacts on the number of cases and lives lost (Knobler et al., 2020). The influenza virus was discovered and isolated in pigs in 1931 and in humans in 1933 (History.com, 2020). This discovery occurred after the great Spanish flu pandemic in 1918 that killed over 100 million people worldwide and 675,000 in the United States (CDC,2019). Paget et al. (2019) conducted a study at the Netherland Institute of Health that examined the health burdens of influenza much like the WHO (2019) study and challenged the integrity of the actual data collected, estimating that the burden was much greater than what was reported globally citing the inability for a more impoverished nation to perform surveillance and collect data accurately.

The findings revealed that a lower level of socio-demographic development and A(H3N2) dominance was associated with higher influenza mortality in adults ≥65 years and the 2017 model was the most accurate when assessing and calculating the true burden of influenza (Paget et al., 2019). Eric et al. (2019) conducted a similar study that used an observational approach to assess influenza prevention, diagnoses, treatment, and health burden. The researchers concluded that the virus creates greater susceptibility among individuals with compromised respiratory systems and pre-existing conditions. Lower/upper respiratory illnesses such as asthma, COPD, lung cancer, pneumonia, and bronchitis are chronic comorbidities that place an economic burden on the country's workforce, income, and health infrastructure. The foundations for developing these diseases are often associated with environmental issues and can sometimes be traced back to poor nutritional decisions.

The lack of long-term immunity has allowed the influenza virus to have recurring effects within the same population. The host in these regions often experiences exposure to different strands, which increased susceptibility and influenza-related fatalities (Corbey & Henslay, 2017). Like most viruses after influenza exposure, the host may develop antibodies; however, researchers discovered that B-shaped cells do not recognize the virus during second encounters, allowing recurring infections during the same influenza season. (Corbey & Henslay, 2017). The influenza virus's history and economic burden are the propelling forces behind universal vaccination and improving immunity. Using past pandemics as a playbook for future response aids in improving the speed at which additional measures are developed as a historic pandemic provides the blueprint for the virus's epidemiologic movement.

Epidemiology/ Evolution of Influenza

Singh et al.'s (2019) study looked at the epidemiological movement of the influenza virus and associates its contagious nature and droplet transmission as a risk factor for the virus's ability to evolve faster than current mitigation strategies. The mutation and rapid re-assortment of the virus genome is primality responsible for the annual pandemic worldwide. The zoonotic and human to human transmission has resulted in astronomical losses (Shao et al., 2018). The influenza virus has a predictable pattern in both the northern and southern parts of the world. The outbreaks of influenza occur mainly in winter, while in areas around the equator, outbreaks may occur at any time of the year (Shao et al., 2018). Three main characteristics which contribute to the rapid evolution of these viruses: large populations, short generation times, and high mutation rates. Densely populated cities were human-to-human interaction in public shared spaces frequently allows for higher rates of droplet infection and mutation (Shao et al., 2018).

Hagiwara et al. (2020) conducted a related study that looked at the evolution of the influenzas virus and investigated protein in birds to mitigate migratory transmissions, and concluded that its presence decreases susceptibility to the influenza virus. Mx protein expression and antiviral function was observed in 3D structure of four species. The results suggested that the amino acid sequence in rock dove species might represent relatively high antiviral activity agreeing with the evolving theory that the presence of protein alters influenza outcomes (Hagiware et al. 2020; Mu et al. 2018). Civilization has been to our advantage and disadvantage as we have more resources to fight the virus in the 20th century, but the virus has the ability to exceed these measures due to mobility from global migration and travel by air.

Influenza Vaccine Challenges and Success

Even with optimistic indications from animal trials that seek to improve immunity, the world is still more vulnerable to the next influenza pandemic, possibly even more than the 1918 outbreak (Knobler et al., 2020). Humans and animals' ability to circumnavigate the globe freely in considerably less time than in the 18th century makes global exposure and containment tenuous to achieve. There is also an overwhelming number of lessons learned from past pandemics that can strengthen defenses against future threats (Knobler et al., 2020). Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases, in collaboration with Paules and McDermott (2019), describes the successes and challenges of our current seasonal vaccine approach in combatting the influenza virus (Paules et al., 2019). The authors discussed the importance of immunity and its ability to drive efforts towards a universal vaccine. A universal vaccine has not yet been developed as scientists must account for more strands of the virus while meeting national safety and efficacy standards.

In Lu et al. (2019), study the authors agreed that universal vaccination is critical in reducing mortality and associated the vaccine's sub-optimal performance as one of the factors associated with the increased risk of fatalities among adults with pre-existing respiratory conditions (Lu et al., 2019). The study's primary end goal was to assess influenza vaccine trends among adults to help improve survival. Vaccination coverage was stratified by race and ethnicity using multivariate logistic regression and predictive marginal levels. The models were also manipulated to examine the interaction between socio-demographic disparities, such as access to care and how it affects influenza outcome (Lu et al., 2019).

The findings revealed that vaccination coverage among adults increased steadily by at least 1.3% per year between 2010 and 2011. According to the findings from the study between 2011-2015, coverage was stable among adults over the age of 65 with only a -0.1 to 9.9 percentage points for all examined ethnic subgroups (Lu et al., 2019). The dynamic shifted in the years that followed, and in 2015–2016 the coverage across age equaled; 70.4% for adults aged ≥65 years, 46.4% for those aged 50–64 years, and 32.3% for those aged 18–49 years; 47.9% for people aged 18–64 years with high-risk conditions; 64.8% for healthcare personnel; and 50.3% for pregnant women (Lu et al, 2019). The overall findings support the idea that adults are more susceptible and often experience a decline in coverage during some of the worst influenza seasons. These results were stratified by ethnicity, which led to the discovery that coverage was significantly lower among non-Hispanic blacks and Hispanics than non-Hispanic whites (Lu et al, 2019).

The virus's most common form of entry into human host is via the upper respiratory canal, Hasegawa (2020), study investigated the impacts of a nasal influenza vaccine as an alternative to delivering a more effective prevention method. Most vaccines are currently administered intramuscularly or subcutaneously. The greatest challenge with this approach is that little is known regarding the role local mucosal response plays that leads to actual prevention compared to the nasal vaccine (Haswgwa, 2020). Nasal vaccines contrast routine injectable vaccines as their mechanism of action mimics natural influenza infection. Nasal vaccines offer protection against a broader spectrum of influenza viruses by inducing the mucosal immune response found in secretory IGA antibodies (Haswgwa, 2020).

Tonetti et al. (2020), study corresponded with Hasgwa's (2020) findings that a nasal intervention would be just as effective as intramuscular since the virus primarily attacks via the upper respiratory system. In Tonetti et al. (2020), study the primary focus was to investigate if nasal priming with immunobiotic lactobacilli improves the adaptive immune response against the influenza virus (Tonetti et al., 2020). The experiment was carried out using wild-type mice, which is relatively common for influenzas research. Nasal priming using lactobacillus rhamnosus (CRL505) was administered to determine the influenza virus's immune response's potential benefit. The results concluded that CRL505 could improve both humoral and adaptive immunity. In addition, higher levels of IgA, IgG, as well as IFN-y antibodies were found in the respiratory tract of mice treated with CRL505 after the challenge was complete (Tonetti et al., 2020).

The researchers believed the differential balance of inflammatory and regulatory cytokines induced by L. rhamnosus CRL1505 contributed to protecting against the influenza virus, therefore concluding that Non-viable CRL1505 was effective at improving the antiviral respiratory adaptive immune response. (Tonetti et al., 2020). Ivory et al. (2017), achieved a similar outcome after conducting a double-blinded placebo control study to determine if selenium can improve immunity against the influenza virus. Six individual groups were set up and given daily capsule yeast enriched with selenium. Two groups received meals containing onions, the flu vaccine was administered at week 10, and parameters were reassessed at week 12 for all participants. The results revealed selenium to be both beneficial and detrimental as they were able to observe improved immunity in mice trials but failed to achieve the same or similar results in human trials (Ivory et al., 2017). Though there had been promising findings, overall animal trials have been more successful, which remains one of the most significant vaccine development challenge for trials with human participants.

In an effort to create greater stability and explore more effective types of vaccination Braathen et al. (2020), evaluated the benefits of a DNA vaccine that encodes antigen-presenting cell-specific heterodimeric protein to assess the vaccine's ability to protect against cancer and influenza. The researchers hypothesized that the immunogenicity of the DNA vaccine could be manipulated to encode secreted homodimeric. The heterodimeric protein can permit four different fusions within a single molecule; however, the study fell short as vaccinated mice were challenged after receiving a single vaccination intramuscular, and groups of anesthetized mice were infected intrinsically (Braathen et al., 2020). Conclusively, the challenges that prohibit the development of a universal vaccine are also factors that highlight the need for additional ways to improve immunity in conjunction with vaccination and reduce the impact of yearly influenza pandemics.

Alternative Ways to Improve Immunity

Over the past decade, scientists explored alternative ways to prevent influenza due to numerous vaccine failures. Though the CDC endorses the vaccine as the best prevention method, only 48%-60% of the population is seasonally compliant, and a small percentage still gets the flu after being vaccinated. The lack of compliance and guaranteed immunity leaves approximately half of the population entirely exposed to the influenza virus. This exposure to the influenza virus is often either by negligence, allergic reactions, poor access to care or violates personal beliefs (CDC, 2019). Vitamins and supplements had been studies to bridge the gap between non-compliance and protect against the influenza virus in the past. Bzura (2018), study explored whether vitamin D was prevention or therapy for the influenza virus. The working hypothesis theorized that there is less sunlight in the northern hemisphere during the winter months, reducing the amount of vitamin D absorbed. The number one source of vitamin D in humans comes from the sun; therefore, making the immune system more susceptible in colder seasons when there is less sunlight and frigid temperatures (Bzura, 2018).

Vitamin D had been thought to offer both innate and adaptive immunity, which is crucial in the fight against the influenza virus. Though vitamin D cannot replace vaccination, the study concluded that its presence had beneficial results as data was gathered between 1980-2000 and found that high numbers of winter influenza and pneumonia deaths in Norway were related to low Vitamin D levels. Bzura (2018), also mentioned promising and encouraging results from a double-blinded placebo-controlled study that found that influenza A occurred in 18 out of 167 participants that took 1200 IU of vitamin D3 daily and 31 out of 167 in the placebo group. In final, the researcher believed that more extensive studies were needed to determine the validity and reliability of vitamin D in providing a broad-spectrum activity that positively contributes to the immune response to respiratory viral infections.

Sedeyn and Saelens (2019); Fallon et al. (2017), also explored prevention outside of vaccination in their studies. Both were citing the importance of biomarkers as they used digestive enzymes and monoclonal antibodies to discover alternate prevention methods. Human milk was instrumental in developing the infant's immune system and protecting against pathogens (Xiao et al., 2018). The complex structure of long and short chains of oligosaccharides is one of the most prominent anti-infective capacity components in human milk (Xiao et al., 2018). This preliminary knowledge of the benefit human milk adds to the immune response to invading pathogens such as the influenza virus. The aim of Xiao et al. (2018), study is to determine the effect of Fucosyllactose (2′FL) oligosaccharides vaccination responsiveness to both innate and adaptive influenza vaccination model. This was accomplished by administered a dose of 0.25–5% (w/w) dietary 2′FL was provided to 6-week-old female mice two weeks before primary and booster vaccination until the end of the experiment (Xiao et al., 2018). The data confirms with $p<0.05$ statistical significance that dietary intervention with 2′FL improves both humoral and cellular immune responses to vaccination in mice, which might be attributed in part to the direct effects of 2′FL on immune cell differentiation the incorporating 2′FL into daily diet improves both humoral and cellular immune responses to vaccination in mice (Xiao et al., 2018).

Alternative ways to improve immunity and prevent influenza had also been studied in pre and probiotics. Probiotics modulate innate and adaptive immunity in the elderly and reduce infection length in children and adults (Lei et al., 2017). Prebiotic substances stimulate the metabolism and facilitate bacteria's growth that benefits the host by fighting harmful pathogens. Pre and probiotics improve digestion and stabilize the gastrointestinal tract, which promote good bacteria and fungi (Lei et al., 2017).

In the above listed and following study Yaqboo (2017) and Lei et al. (2017), wanted to assess their ability to prevent influenza. Diet and Health Research Industry Club (DRINC) conducted an immunoregulatory study looking into a novel probiotic (B. longum infantis CCUG 52486). The finding showed that immune response to this and other probiotics was highly dependent on the age of the donors as members of the elderly community lower response to influenza vaccination than young subjects (Yaqboo, 2017). Even though pre-and probiotics did not improve the response, there were trends for differential effects of the probiotic in young and older subjects, indicating that pre/probiotics can aide in preventing influenza infections; however, this protection reduces significantly with age. This is a direct result of the declining immune system of older adults. This idea was grounded in the foundations of Lei et al. (2017), study as they were able to gather more data in the form of a meta-analysis which showed that individuals who took prebiotics or probiotics showed significant improvements in the H1N1 strain of the influenza virus across all age groups with an odds ratio of 1.83 and a 95% confidence interval.

Lei et al. (2017), meta-analysis study had rigorous inclusion criteria in order to preserve data integrity, and articles were extracted from scholarly publications only from its inception to 2017. This study is the first of its kind, a total of 20 randomized clinical trials were collected, which comprised of 1979 adults; however, only nine trials with 623 participants met the criteria of the meta-analysis (Lei et al., 2017). During the analysis, the researchers found that the supplementation of influenza vaccines with probiotics or prebiotics before vaccination increased the immunogenicity to specific influenzas viral strains, such as H1N1, H3N2, and B strains (Lei et al., 2017). This is a revolutionary finding because it offers hope to individuals who are allergic to the current egg base vaccine, forego the initial influenzas vaccine, or have difficulty developing innate immunity. Alternatives to vaccination are essential to offset the severity of the illness in underserved and unvaccinated populations. Alternatives designed to prevent influenza are widely accepted as the stigma associated with vaccination is not detected when stakeholders' health can be improved through nutrition. Food choices directly impact innate immunity, which may play a key role in inhibiting the replication of the influenza virus in the body.

Importance of Innate Immunity

Innate immunity is defined as a non-specific defense mechanism that is the first to be deployed when the body detects an invading pathogen. Influenza A viruses (IAVs) are the most contagion variation of the pathogens responsible for severe respiratory infection in humans and animals worldwide (Chen et al., 2018). Once detected, the body's natural defense systems attempt to defend and clear the viral infection. The innate immune system consists of physical barriers called mucus, phagocytic cells, a group of cytokines, interferons (IFNs), and IFN-stimulated genes. The body's second line of defense is known as adaptive immunity mediated by

B cells and T cells (Chen et al., 2018). Both cells are characterized with antigen-specific memory cells, capturing, and neutralizing the pathogen.

According to Cobey et al. (2017), severe infection and reinfection become possible when naïve B cells do not recognize the virus on a second encounter. The study focused on antibody responses that failed to protect against mutated viral strains. This idea was also evident in Biondo et al. (2019), study where researchers referred to the 1918 influenza pandemic as a handbook for a future influenza pandemic and learned from the incredible inflammatory response from the innate immune defense systems. Though active, the immune response was not strong enough to combat the virus proving that no two encounters are alike, and our bodies will not develop lifetime immunity due to the body's inability to recognize the virus on second encounters (Biondo et al., 2019). This finding propelled researchers to look at the virus's movement from the point of contact to develop better mitigation strategies. The findings helped investigators to determine that the first few days are critical after contracting the influenza virus and, a highly functional immune system that can detect the presence of pathogens quickly, the virus would spread from the initial focus in the upper respiratory tract to the lower airways and pose a direct threat to vulnerable hosts.

According to Ramos et al. (2019), the innate immune response of influenza A virus in humans operates on a single cellular level with a specified focus on respiratory epithelial cells. The primary target cells needed for influenza A virus replication are the epithelial cells in the respiratory epithelium. The cellular innate immune responses are critical for defense against the virus, and it is pivotal to distinguish between the virus and the host cells (Ramos et al. 2019). The findings suggest that respiratory epithelial might determine the outcome of an influenza infection depending on whether they are present in the host (Ramos et al., 2019).

The influenza virus nonstructural protein (NS1 protein) is one of the viral antagonists of host innate immune responses (Ramos et al., 2019). Most of the viruses that infect humans have developed strategies to counteract the innate immune system by diverse mechanisms, making it necessary to prepare your immune system to fight off pathogens when the gatekeeper epithelial cells cannot fully prevent viruses from replicating (Ramos et al., 2019). Biondo et al. (2019), shared similar findings on how the body's innate system can fail as his findings also concluded that Innate responses are the only weapons that the host can use to prevent or slow down viral replication early during infection as adaptive immunity comes into play approximately five days after infection. The influenza virus selectively affects people lacking protective antibodies due to mutations of the infecting viral strand (Bionde et al., 2019).

A robust immune response to the influenza virus is essential because different strands of the virus replicate at different speeds, and overall impact may vary from mild to severe illness, causing hospitalization or death (CDC, 2019). Cao et al. (2017), studied global gene expression changes and detailed innate immune system responses in human and avian hosts. This investigation primarily focused on H1N1, H3N2, H5N1 HALo mutant, and H7N9 influenza infections (Cao et al., 2017). The researchers examined these various subtypes of influenza A viruses by collecting self-generated transcriptome sequencing data from human bronchial epithelial (HBE), human tracheobronchial epithelial (HTBE), and A549 cells (Cao et al., 2019).

The findings concluded that each strand of the virus has a different response to influenza's different subtypes. The investigators also found the influenza viruses, which induced more robust innate immune responses to replicate slower than those induced weaker innate immune responses (Cao et al., 2019). These results provide additional insights into the existing differential innate immune responses from a host and the pathogenicity/ virulence of different subtypes of influenza A viruses in a host. These results explain why each person's experience with the virus is similar or vastly different from each other. Though more aggressive strands of the virus replicate at different speeds like Ramos (et al. 2019); Biondo (et al.2019); and Cao (et al. 2019), agree that innate immunity is the first line of defense against the influenzas virus and concluded that improve innate immunity will shape how well someone responds to the influenza virus when exposed.

Bohannon et al. (2020), explored how the influenza virus suppressed the adaptive immune response, leaving a host more vulnerable to influenza and other respiratory pathogens such as pneumonia. The study was influenced by previous findings that suggest influenza can target innate responses and damage affected tissues, allowing for secondary infections (Bohannon et al., 2020). In this study, the researchers examined the mechanism of action and better understood how the influenza virus targets innate immune responses and adaptive responses, specifically activated B cells, T cells, and NKT cells (Bohannon et al., 2020).
The study focused on infection with influenza virus, adaptive responses to prior influenza vaccination, and other respiratory pathogen vaccinations in humans and mouse models. This is accomplished by a viral hijacking of the normal immune responses, which takes advantage of elevated expression of sialic acid receptors on activated lymphocytes to infect and kill immune responders preferentially. The results show a novel mechanism for the high incidence of secondary respiratory infections is primarily associated with bacteria and other viruses and vaccine failures (Bohannon et al., 2020). Recognizing the role innate immunity plays in the fight against the influenza virus is the first step to changing health behaviors surrounding nutrition that improves innate immunity. This vital biomarker that improves influenza outcome is albumin, which primarily functions as an inhibitor for influenza virus in previous animal trials.

Albumin & Influenza

Research associated with albumin has been among the most groundbreaking at improving innate immunity. The goal is to provide an added layer of protection against the influenza virus during high prevalence season. Albumin is a protein made by the liver. The main function of albumin is to help keep fluid in your bloodstream and prevent it from leaking into other tissues. Albumin also carries various substances throughout your body, including hormones, vitamins, and enzymes. Low albumin levels can indicate the presence of malnutrition. The body absorbs protein, which directly impacts serum albumin levels in the blood. This serum albumin level constitutes more than half the protein in the blood that carries vital nutrients and hormones throughout the body, contributing to sustaining innate immunity (Moonen et al., 2020). Albumin has not widely been studied in humans in relation to the influenza virus, but several animal trials indicate that the presence of protein through nutrition operates as an influenza inhibitor Mu et al. (2018) & Tang et al. (2017), study examined Zinc as an antiviral protein and found it to be an inhibitor for specific viruses. The findings suggest a form of the protein that promotes the influenza virus's degradation in the live host and blocks the virus's ability to bind or replicate (Tang et al., 2017).

Mu et al. (2018); Yang et al. (2018); Yu et al. (2020); Zhang et al. (2019), and Zhao et al. (2017), conducted studies that aimed to further understand how the presence of protein could be beneficial in reducing the replication of influenza virus in a host. Mu et al. (2018), confirmed that the extracellular domain of M2 protein has limited immunogenicity on its own; however, potent influenza inhibition was observed when a recombinant fusion protein vaccine was created. The vaccine was able to reduce the viral load of influenza present in mice lungs and provide significant protection against lethal challenge with an H1N1 or an H3N2 virus compared to the control cohort. The most advantageous finding is the potential the vaccine possesses to prevent the threat of an influenza outbreak (Mu et al., 2018). In Yang et al. (2018), a mouse model clinical trial, tested the synthesis of a multivalent oleanolic acid protein conjugate as an entry inhibitor for the influenza virus. This study was also the first of its kind to synthesize esterification of carboxylic acid, which is further grafted onto the human serum albumin and signaled that antivirals could be successfully developed and used to slow the spread of influenza virus in vulnerable communities (Yang et al., 2018).

Similarly, Mu et al. (2018) and the study conducted by Zhong et al. (2020), experimented with a multivalent amide sialoside human serum albumin as a bio-shield against influenza. The findings were successful and provided foundations for developing antiviral drugs and viral absorbent material (Zhong et al., 2020). The investigators utilized a conceptual approach to explain how albumin operates as an influenza inhibitor in animals, which can be beneficial if studied in human trials. The studies also used the concept to explain the connection between the conversion of protein to increase albumin levels, ultimately prevents influenza virus from replicating, causing severe influenza infection. Sing et al. (2019), looked at the epidemiological movement of influenza and used its versatility and easily transmittable nature to explain how it continues to be a pandemic each year with more severe outcomes as the virus evolves faster than current measures to prevent or treat the virus by investigating the effects nutrition on influenza outcome.

Nutrition and Influenza

Nutrition plays a crucial role in preventing influenza infection, as this is the primary body source of vitamins, protein, and other nutrients that fuel the body. Adequate nutrition is also listed as the number one source for improving serum albumin levels in the blood. Malnutrition is often associate with poverty. During a pandemic, the most impoverished populations suffer most because of these vulnerabilities intensifying food insecurities (Okland & Mamelund, 2019).

Americans living in vulnerable communities have a higher incidence of comorbidities, fewer healthy options for nutritious meals, and fast-food giants have seen steady growth in new chains added to the region (Cohen et al., 2020).

Poor food choices are often supported by low earning potential. These foods are generally high in calories and deteriorate the health of Americans. Some families justified unhealthy food options as better than providing no food at all, according to a study conducted in one of New York's most vulnerable communities (Gonzalez, 2017). This practice becomes even more detrimental to residents' health and well-being as pre-existing conditions and a weakened immune system cause residents to succumb in more significant numbers to influenza infection compared to other residents in affluent communities. To assess how low-income earners decide what to eat, Cohen et al. (2020), used a google street view time machine to validate retail data from 2007 to present. The investigators developed a cross-sectional study that focused on hotspots that need food retail change, shaping the way Americans improve their health through nutrition. The hotspot analysis captured bodegas and dollar stores clusters in areas of low-income residents with higher rates of diet-related diseases (Cohen et al., 2020).

The data revealed numerous emerging trends that affect food access and resident's overall health. These include but are not limited to increased numbers of food retailers, and the cost of their products is significantly less than healthier options (Cohen et al., 2020). Gonzalez (2017) also cited this influx of fast-food and retail chains as the main reason poor quality food is consumed in low-income neighborhoods. The overconsumption of this quality food has been directly associated with increase comorbidities of the already fragile health systems in underserved communities. (Gonzalez, 2017). The growth of dollar stores and numerous openings of other retail chains had negative impacts on Americans. The hotspot analysis suggests that replacing these chains with healthier options is beneficial to the community as the areas with clusters of new dollar stores and bodegas have faced elevated diet-related diseases (Cohen et al., 2020).

To further assess how Americans are surrounded by poor food choices that contribute to the depletion of their health, Adjoian et al. (2017), and Dannefer et al. (2016), conducted a study assessing the impacts of health checkouts in Bronx Supermarkets and shopping patterns of Bronx residence. According to Adjoian et al. (2017), consumers spend a considerable amount of time waiting at the checkout, often flooded with sugary and high-calorie snacks. For this analysis, consumer purchasing behaviors were observed in three South Bronx supermarkets for two weeks in 2015 (Adjoin et al., 2017). The observation targeted shoppers who were eighteen years or older that paid for their groceries at a specific checkout lane. Two checkout lanes were selected in each supermarket. One was converted to a healthy checkout lane, and the other remained stocked with unhealthy snacks and carbonated beverages (Adjoin et al., 2017).

The findings revealed that only 4% of consumers purchase items from the snacks stand while waiting to check out. Approximately 56% of consumers who were in line at the healthy checkout purchased an item from the snack stand. In contrast, only 20% of consumers on the unhealthy checkout made a purchase (Adjoin et al., 2017). This is a breakthrough finding as it suggests if healthier foods are available, resident's purchase increased. The population is open to transferring their consumption but have minimal opportunities to transition because their communities are flooded with poor quality food options. Dannefer et al. (2016) also tested the same hypothesis by creating a study that examined Americans Food shopping behaviors (Dannefer et al., 2016). The investigation was carried out by intercepting shoppers on the streets in the Spring of 2012 and included 505 participants with a median age of 45 years (Dannefer et al., 2016). The sample was 59% Hispanic, 34% black, and 7% mixed or other races. From an academic standpoint, 34 % of the population had less than a high school diploma, 30% had a high school diploma, and 36% attended a college of some sort (Dannefer et al., 2016).

The survey included questions about general food shopping preferences and mode of transportation to supermarkets. The data showed 84% of residents shopped at a supermarket in their neighborhood, and 16% of residents travel outside of the borough to shop in other affluent neighborhoods. The data also revealed that 95% of residents shopped at a bodega, and 65% did so at least once per day. Bodegas are convenient stores that provide high sugar, cholesterol, and carbonated beverages. The most remarkable findings in these studies are the role of access to different types of food plays in consumer patterns. Americans have the potential to make a healthier choice when possible, as 16% of the population is willing to travel outside of their neighborhood to ensure they are providing healthy food for their families. The widespread availability, easier access, and inexpensive, unhealthy foods contribute to poor health outcomes in Bronx communities (Dannefer et al., 2016 & Adjoian et al., 2017).

The connection between nutrition and influenza lies within the comorbidity's residents develop from poor eating habits that make them more susceptible to the influenza virus. Ramaraju et al. (2018), focused on serum albumin- globulin ratio and how its reversal predicts morbidities in patients hospitalized with influenza A (H1N1). The study was retrospective and included influenza infections between the 2016-2017 influenzas season. Common morbidities were diabetes, hypertension, and coronary artery disease. These were also risk factors for extended hospitalization and poor influenza outcome. Serum albumin/ globulin reversal was also associated with prolonged hospital stays, ICU admissions, and ventilator use. These finding highlights serum AG reversal as a single predictor for all morbidity outcomes and makes an impactful contribution to developing strategies to better manage subsequent outbreaks by improving nutrition and reducing diet-related diseases that increase influenza complications.

Racial Disparities

The influenza virus's ability to be transmitted via droplets and contact with an infected person/animal has caused the virus to affect every race. Adult with comorbidities is the most susceptible across most studies investigating how race and pre-existing conditions complicate influenza exposure. Racial divide existed in influenza outbreaks since the 1918 pandemic when results from Oakland and Mamelund (2019), show that the black population had lower mortality but higher case fatalities than the white population. The following study's objective is to advance our understanding of vaccine behavior among high-risk adults of all races (Bleser et al. 2017; Hall et al. 2020 & Quinn et al. 2017). Education levels vary across race, and so does knowledge, trust, and literacy about the influenza vaccine. According to Bleser et al. (2017); Hall et al. (2020) & Quinn et al. (2017), vaccination compliance is heavily dependent on how much the patient knows about the vaccine and their perception of its importance. The greatest challenge to reducing the prevalence of the virus lies in population compliance with vaccination measures. Gender, age, education, income, insurance status are all factors that varied across race. Quinn et al. (2017), study found that adults with affluent social status were more likely to get vaccinated; however, this added layer of protection has a greater need in more vulnerable communities contributing to increased fatalities each year. Medical mistrust was also more prominent in vulnerable communities, indicating that fatalities associated with influenza may not improve by solely relying on the vaccine (Quinn et al., 2017).

Medical mistrust also transcends into government mistrust, which negatively influences the spread of influenza through vaccination. Jamison et al. (2018), explained in their study that confidence in a vaccine is heavily dependent on trust in the product and the company that makes them. Data for the study was collected between 2012 and 2014, utilizing a mixed-method approach with 119 participants. Most participants distrusted pharmaceutical companies because they believe the companies place profits over patients (Jamison et al., 2018). Trust in government varied, and White participants were more trusting of federal institutions but questioned their competency. African Americans were more doubtful of practical and government agency motives (Jamison et al., 2018). If albumin is proven to give an added layer of protection, it would be a breakthrough for racial and ethnic groups that struggles with vaccination compliance and access to the vaccine. In addition, presenting a nutritional alternative to address the severity of influenza pandemics may more widely be accepted and poses an added benefit as residents will now be introduced to foods that don't increase their comorbidities risk. Though everyone has an equal chance at contracting the virus when exposed, Hispanics, Blacks, and Pacific Islanders primarily make up the population most affected (Bleser et al., 2016 & CDC, 2019).

Hall et al. (2020) studied the main objective to assess demographic, clinical, and geographic disparities by using data from fee for service between 2015-2016. The study examined vaccine uptake among adults of different races to better understand what makes one group more susceptible than another (Hall et al., 2020). The study results revealed that non-whites living in rural communities and were economically disadvantaged were less likely to receive the influenza vaccine. Elderly Americans with one or more comorbidity accounted for higher vaccination uptake. However, poor access to ambulatory care, food insecurity, and a more fragile immune systems account for rising health care costs, which are estimated at 17.9% of the gross domestic product or $3.5 trillion (Hall et al., 2020). A higher dose of influenza vaccine was created to provide more protection among vulnerable adults; however, it was mostly consumed by Whites in the study population despite an improved understanding of the risks of influenza among all adults. The higher dose and better vaccines for older patients have not created an uptick in vaccination rates and demonstrate significant racial and ethnic disparities (Bleser et al., 2020; Hall et al, 2020).

One of the most significant challenges in reducing influenza's impact is that each person experiences the virus differently, which could be associated with racial disparities such as the prevalence of wealth or education among one race that is scarce in another. While these sustainable development goals can be met as a long-term goal, there is still an urgency to explore alternative ways to improve immunity and reduce influenza-related illness/ deaths. Vuputurri et al. (2020), conducted a study using the Oaxaca-Blinder method to calculate factors contributing to influenza vaccinations' racial disparities. This is an essential topic to explore as higher mortalities in adults are observed across the globe in nonwhites. The study included participants over the age of 18 as of 05/01/2014 to 4/30/2015, participants who denied their race as either black or white and received the influenza vaccine during the 2014-2015 flu season (Vuputirri et al., 2019). The results indicated that among adults, only 44% were vaccinated. Stratifying the data by race revealed that 55% were Black, and 45% were White. Even though Blacks were slightly higher than Whites in total numbers vaccinated, Black members have 42% lower odds of vaccination than White members suggesting greater perceived barriers among Blacks than their white counterparts in obtaining the vaccine. Vuputirri et al. (2019), suggested that equalizing average covariate values in Blacks and Whites could reduce the racial disparity in influenza vaccination by 29%. The health system can also improve their vaccine campaigns, register their patient portals, and create a center for residents without access to the portal to get the vaccine with no out-of-pocket cost (Vuputirri et al., 2019).

Outside of social inequities, racial and ethnic discrimination in healthcare has been hypothesized to cause individuals to avoid care, distrust the medical system and their providers' intentions (Bleser et al., 2016). Therefore, exploring nutrition's association with preventing influenza is essential as individuals are more likely to forego a vaccination than healthier food choices voluntarily. The Bleser et al. (2016), study utilized a 2011–2012 dataset from the Aligning Forces for Quality Consumer Survey on health and healthcare (n=8,127). They also used the logistic regression marginal effects examined the relationship between race/ethnicity and influenza vaccination (Bleser et al., 2016). It is challenging to understand the circumstances surrounding discrimination in a healthcare setting. Bleser et al. (2016), recognizes these devastating effects in their study and classifies the division as a hindrance prohibiting racial and ethnic groups. Racism and racial discrimination are associated with higher mortality, high blood pressure, increased body mass index, weight gain, worsening mental health, poor diabetes care, and other unmet healthcare need.

Quinn et al. (2017), examined psycho-social determinants among black and white adults. The data was collected using online surveys in March 2015 utilizing international research firm GfK's knowledge Panel for a nationally representative sample of Black and White adults (≥18, USA). The study included a limited analysis of adults with high-risk influenza-related complications. A two-way ANOVA was used to evaluate the demographic, racial, and psycho-social predictors across vaccine uptake in the past five years across racial groups (Quinn et al., 2017). The results suggest that psycho-social predictors are significant factors in the influenza vaccine uptake among high-risk adults with a pre-existing condition. The study also proved with statistical significance that Blacks with pre-existing conditions in the high-risk category are less likely than Whites in the same category to become vaccinated, which helps explain why fatalities are higher among blacks (Quinn et al., 2017). The multiple challenges faced by racial groups' immune response to the influenza virus can be remedied if we get a signal from this study that nutritional intake to increase albumin has a proven benefit of blocking the influenza virus's replication.

Summary & Transition

The influenza virus has been a global health concern since the 1915 and 1918 pandemic that claimed over 50 million lives, respectively. The virus is even more of a challenge to manage as migration happens at a much faster speed than a century ago. Though travel is not common among the world's most impoverished population, they are often the most affected as fragile health infrastructure and compromised immune systems make the virus more lethal when transmitted in underserved communities. The Influenza burden is widely felt in communities where members of the population have one or more pre-existing conditions that can complicate their exposure. The influenza virus aggressively attacks the immune system by extending the speed of recovery or the body's ability to fight off the virus naturally.

The influenza vaccine is defined as one of the best ways to lower the risk of contracting the flu or mitigate the severity of the illness. The vaccine is inexpensive and widely available, but side effects, personal beliefs, and the inability to provide 100% immunity are among the major challenges faced in the fight to reduce the worldwide impact of the virus. Researchers investigated numerous ways to prevent influenza outside of vaccination, which includes but is not limited to selenium, vitamin D, increase albumin through protein consumption, oligosaccharides pre or probiotics as scientist still heavily rely on the body's natural immune system to recognize the invading pathogen and produce a natural response. Increasing levels of albumin in wild-type mice trials have proven to inhibit the replication of the influenza virus.

The goal is to develop additional ways outside of vaccination to reduce influenza fatalities as residents are more likely to make changes to their diet than their beliefs on a vaccine. This study's data can also call to action the other reason we should pay attention to nutrition and allow public health officials to make informed decisions on proving quality food in high-risk neighborhoods could potentially reduce fatalities associated with the influenza virus. According to previous studies, members of the most vulnerable population are likely to contemplate health choices that directly affect their health (Chen, 2020). Using the health belief model to explain previous behaviors and create a platform to compare residents' beliefs with their health actions and provide the health education and the resources needed to reduce the infection rate and slow the spread of the influenza virus.

Chapter 3: Research Method

Introduction

The purpose of this study was to investigate if an association exists between food insecurity and influenza outcome. The study also provides additional insight into the benefits of improving innate immunity and how food insecurity, sex, age, access to care, and the ability to provide nutritious meals shapes the health outcomes of individuals infected with the influenza virus. For more than half a century, we have solely relied on the egg-based influenza vaccine to provide broad-spectrum protection against the influenza virus. However, cultural, economic, religious, and political views have caused individuals to forego vaccination and risk exposure. These barriers have become the focus of stakeholders as influenza rates have steadily increase regardless of investments to improve healthcare access surrounding the influenza virus nationally.

The HBM is the most appropriate theoretic framework as it facilitates more profound knowledge about why people boycott disease prevention strategies designed to improve health outcomes. The model suggests that if a person believes that an illness is a personal threat and trust that the recommendation is sufficient, they will likely adopt the behavioral change needed. The health belief of an individual is grounded in psychological and behavioral theory of health action. The desired change must be warranted to avoid illnesses or engage stakeholders in health action to prevent life-threatening illnesses. This desired goal is achieved and sustained through the model's six steps where an individual perceives susceptibility, perceive the severity of the illness for which they are potentially exposed, understand the perceived benefit of the health action, think of barriers, be determined to act and maintain the health changes through self-efficacy.

In order to improve influenza outcomes, changes in mitigations and health actions are essential; previous studies show that higher albumin levels in wild-type mice have favorable results in stopping the replication of the influenza virus in an infected house (Mu et al., 2018). In human's albumin is sustained through nutrition. The influenza virus predominantly overwhelms residents' immune systems in poverty-stricken areas where food insecurity and access to care are scarce. This study's primary goal was to look at the association between food insecurity and influenza outcome to understand if changing the way Americans eat can directly benefit in the fight against influenza virus as indicated in animal trials.

Research Design and Rationale

This study meets the criteria of a quantitative analysis, as it used national data to trace the social and biological barriers that affect influenza outcomes. The main objective is to investigate whether influenza outcome was more closely associated with poor nutrition or insufficient access to care using the HBM. The 2012 National Health Interview Survey (NHIS) was conducted in the United States and collected data from individuals of different races, socio-economic and educational backgrounds.

The NHIS has been used to monitor Americans' health since 1957 on a broad range of health concerns. The survey is one of the nation's most reputable health information statistics because it collects data by holding personal household interviews. This approach differs from the standard method in which patients in a healthcare setting participate in a health survey. The most significant disadvantage is under-representation for members of the population who did not enter the care system when the data were collected. The NHIS survey has a large sample, with limited exclusions, allowing the data to represent the population it serves accurately. The results from NHIS have provided immeasurable contributions towards the United States achieving its national health objectives and identifying the most significant health barriers. According to the CDC, the flu is a high priority virus with urgent needs for evolving mitigation strategies that meet the population's needs; as the data suggest, the virus will affect more than 50% of Americans at some point in their lifetime.

The variables selected contributed to the existing body of scientific literature by describing the effects of poor nutrition on influenza and its comparison to access to care. This study's dependent variable is influenza exposure within the last 12 months from data collection. The independent variables are; received flu vaccine in the last 12 months, received flu nasal spray in the last twelve months, age, race, sex, worried about food insecurity, trouble finding a doctor in the last 12 months and raw food insecurity score from the food insecurity index. The dependent variable is whether someone contracted the influenza virus within the last 12 months or has a history of influenza. The HBM was utilized to explain health behaviors associated with the influenza virus. The method is most appropriate as it was designed to facilitate research that seeks to explain how health behaviors affect health outcomes and how an individual's physical response can change over time if they are at personal risk of contracting a disease.

Methodology

The National Health Survey was originally collected in 2012 and last updated in 2016. The survey data is available with children, adults, or a blend of both. The adults only version of the data was analyzed using SPSS, as the adults mostly make up the population that suffers the worst fate when infected with the influenza virus. Cases with missing or incomplete variables were excluded; the goal is to extract data that captures vaccination status, food insecurity, and economic status to determine if an association exists between these factors to help stakeholders prepare for future influenza pandemics, while reducing the health and economic burden of the virus.

Population

The sample population was limited to adults over the age of 18 with completed entries. Children were excluded because they are often more resilient and overcome the virus with minor symptoms. Adults are labeled more susceptible because of co-morbidity and inadequate immune response that intensifies with age and exposure to the virus. The goal was to randomly select a minimum of 1282 cases that meets all inclusion and exclusion criteria with no missing fields.

Sampling and Sampling Procedures

Cases that meet eligibility were extracted and data cleaning was performed to ensure that all age groups, races, and socio-economic levels are captured based on overall participants. All cases with missing data on age, race, sex, influenza exposure, or blank response to whether they experience food insecurity were excluded for not meeting eligibility criteria on one or more subject areas. The exclusion helped maintain data integrity and ensure that the data collected answers the research question to prove or disprove the hypothesis.

Instrumentation and Operationalization of Constructs

SPSS is a software package developed and acquired by IBM in 2009 to analyze large complex data sets in social science research. The program is commonly used in public health practice to solve existential health barriers. The program is provided by Walden University and is compatible with the ICRPS data source. In 2016 Jyoti Bala published an abstract in the International Journal of Advanced Research in Computer Science, which focused on the revolutionary contributions of SPSS in social research. SPSS enables researchers to measure statistical tests that describe complex analyses using histograms, scatter plots, and other tools (Bala, 2016). The package reduces the requirement for complicated computations that can cause type one or type two errors in data collection and analysis. The SPSS system is designed to calculate massive quantities of information from surveys, experiments, and different observational studies (Bala, 2016). The software package is continually updated and improved, so with each major revision comes a new version of that package. This has made the program popular among universities and research entities. The program is flexible and allows researchers to combine files, split files, and sort files. You can modify existing variables and create new ones without compromising the data's integrity (Alili & Drstev, 2019).

The G* power analysis is the second instrument to be used for this study. It plays a critical role in research because it helps to determine the sample size needed for the study to make a generalized conclusion about the target population. The G* power is considered effective at providing results for distribution and design-based input. For this study, I will conduct a propri-analysis which is one of the five frequent analysis conducted using the software. The goal is to estimate an appropriate sample size and effect size for the results of the study to be reputable with a ninety-five percent confidence interval. A chi square and binary logistic regression are the best statistics to measure for the analysis as most variables are collected categorically (Statistic solutions, 2021). An effect size of 0.3 equals 62% percent of the control group would be below average and 0.56 probability of accuracy selecting the experimental group (Statistics solution, 2021). With an error probability of 0.05 and a confidence interval of 0.95, the analysis suggested a sample size of 641 for the study group and 641 for the control group which will determine if a difference in influenza infection exists in participants that experienced food insecurity in comparison to others who did not cite any decline in food insecurity or weight loss associated to inability to afford food. The error of probability and confidence interval margin will support the integrity of the data and its ability to predict with 95% accuracy that the conclusions of the studies are accurate and representative of the population.

Variable Operationalization

Research Question 1 was posed to identify if an association exists between food insecurity and influenza outcome in the United States. In order to answer this question, influenza within the last 12 months and history of influenza variables functioned as the outcome dependent variable and whether individuals lost weight because of an inability to afford food and their rank on the food insecurity index scale were the independent variables. A binary logistic regression and chi-square was selected for the analysis because of the data for these variables were collected categorically.

Research Question 2 was developed to answer if there is a greater association between trouble find a doctor and influenza outcome or food insecurity and influenzas outcome. Influenza outcome functioned as the dichotomous dependent variable and trouble finding a doctor /food insecurity functioned as the dependent variable. A chi-square and binary logistic regression were selected to analyze these variables' results because of their categorical level of measurement.

Research Question 3 focuses on analyzing the effects of social determinants of health and influenza outcome. Age, sex and race were selected as the independent variable and influenza/food insecurity were selected as the dependent variable. A chi-square and binary logistic regression were used to determine if higher food influenza cases are observed among the same race, age, and sex of individuals who also experience high levels of food insecurity. The variables were collected categorically and meets the assumption for using chi-square and binary logistic regression.

Age

Level of measurement: Categorical

1=18-30 years old

2=31-51 years old

3=52-63 years old

4=65 and above

Sex

Level of measurement Nominal Dichotomous

1=male

2=female

Race

Level of measurement Nominal

1=White

2= Black African American

3=Indian American/Alaskan Native

4= Asian Indian

5= Chinese

6=Filipino

7=Other Asian

8=primary race not releasable

9=refused

10=multiple race, no primary race selection

Hispanic Ethnicity

Level of Measurement Nominal (Independent Variable)

1= Multiple Hispanic

2= Puerto Rico

3= Mexican

4=Mexican American

5= Cuban/ Cuban American

6=Dominican (Republic)

7= Central of South American

8= Other Spanish

12= Not Hispanic/ Spanish Origin

Had influenza within the last 12 months

Level of Measurement Nominal (Dependent Variable)

1=yes

2=no

7=refuse

8=not ascertained

9=don't know

Trouble finding a doctor in the past 12 months

Level of measurement Nominal (independent variable)

1=yes

2=no

7=refuse

8=not ascertained

9=don’t know

Detailed family level food insecurity

1=High food insecurity

2= Marginal food insecurity

3=low food insecurity

4=very low food insecurity

9= unknown

Lost weight because of no money to buy food

Level of measurement Nominal (independent variable)

1=yes

2=no

7=refuse

8=not ascertained

9= don’t know

Data Analysis Plan

For this study, SPSS was the primary data software for interpreting if an association exists between the variables. The main hypothesis seeks to investigate if influenza occurrence may be more closely associated with nutrition than access to the vaccine's care and availability. The existing body of literature narrates the influenza virus's epidemiologic movement and finds that it was more lethal in impoverished communities. Often communities where food insecurity may be present, along with lower levels of education and earning potential. Animal trials have made promising discoveries explaining how albumin can inhibit the influenza virus by blocking replication from the site of infection. Albumin is achieved and maintained through adequate nutrition, strengthening the idea that food insecurity may be a key component for why some communities have more devastating influenza outcomes than others.

Research question 1 investigated if an association exists between food insecurity and influenza cases. Exploring these variables helped to identify the role poor nutrition plays in protecting against the influenza virus. Research question two ties into question number one because it examines the association between access to care and influenza outcome. In the United States, the influenza vaccine had been deemed the best way to mitigate the virus, nevertheless case fatalities have steadily increased over the last decade; however, access to care can limit residents' ability to obtain the vaccine. This allows us to see the direct association between both conditions and determine whether influenzas cases are more strongly connected to food insecurity or access to the vaccine.

In addition, a chi-square test and binary logistic regression was conducted to measure influenza occurrence as an independent variable and vaccination status as the dependent variable. These tests were chosen because they align with the measurement level by which the data was collected and meets the assumption for using the statistical analysis. The chi-square, and binary logistic regression was also be used to examine if an association between social determinants of health and factors such as age, race, and sex with influenzas cases. Influenza outcome was the dependent variable, while age and race will be the independent variables. This portion of the analysis compared the study's socio-economic factors and deepened our understanding of which subgroup was most affected, which is vital in improving innate immunity and fighting the virus internationally. This achievement can inform future public health policy stakeholders of the types of resources needed to reduce the virus's severity in communities that face food insecurity and economic instability.

The Chi-Square and binary logistic regression primary function was to show if an association exists between two categorically collected variables. Using these tests and selecting influenza as the dependent variable and food insecurity as the independent variable. The results can help to confirm the true impact insufficient nutrition has on influenza severity within the population. How influenza impacted individuals of various social-economic classes was an essential factor as income largely determines whether a family can prevent food insecurity and the quality food they can provide to improve innate immunity. The goal was to seek any indicators suggesting advantages within one class over another related to the influenza virus. This finding is critical -toward improving influenzas mitigation as we would have additional knowledge as to where influenza is more strongly associated with poor access to health care or an inability to afford food. The chi-square and binary logistic regression test's primary function was to show an association between nominal variables of normal distribution. These were preferentially selected for this study because it enabled researchers to observe the expected frequency between categorical objectively. A similar approach was used to assess socio-economic factors associated with influenza. This method was appropriate as it allowed variables to be compared alongside each other to assess severity.

Threats to Validity

External Validity

The National Health Interview Survey has been used to monitor the nation's health since 1957 (CDC, 2020). The survey is conducted by engaging in house-to-house interviews in the United States. The collected data was analyzed and published by the CDC. The data set was a summary of health statistics that health status, conditions, health behaviors, activity limitations, health insurance coverage, and access and utilization of health care. Survey results have been instrumental in providing data to track health status, health care access, and progress toward achieving national health objectives (CDC,2020). This study will be relatively easy to replicate and analyze by jurisdiction or at a national level because it has a large and inclusive sample population.

Internal Validity

The data collection method of this survey helped to re-assure its internal validity. Health Interview surveys are usually conducted in a healthcare setting during a patient visit to the doctor's office or hospital setting. This survey was conducted on the ground within communities across the United States to capture data from individuals who may not have equal access to health care. The only foreseeable challenge was that some ethnic and religious groups are less compliant with research efforts, which may affect the study's ability to capture the true extent of the health and human services needed in these communities. To offset this limitation the sample population was vetted to be representative of the general population.

Construct Validity

The goal of the study was to measure the impact of nutrition on influenza outcomes. The variables capture whether individuals can afford food but may exclude people who can afford nutritious meals and lose weight due to other illnesses that could make them susceptible to influenza. To address the participants with an illness that affects nutrition was excluded.

Ethical Procedures

The National Health Interview Survey was collected and analyzed by the CDC. Consent was obtained by the agents conducting the survey. The data was de-identified, and there was no imminent risk to the participant or their health; therefore, allowing the use of the data to be no greater than minimal risk for individuals involved. The Walden University Institutional Review Board reviewed the proposal to ensure all ethical concerns were resolved and approved the study.

Summary & Transition

This study is a quantitative analysis that deployed the HBM to predict how social health-related behaviors affected health actions. The study also brought awareness and explained how nutrition might impact influenza outcomes and captured the attention of individuals who views themselves as directly affected by their inaction. The study also examined the role of access to care and compare it to the influenza cases due to food insecurity. This factor was explored as previous studies focused on improving access to care and the influenza vaccine to mitigate the influenza virus; however, innate immunity plays a critical role that could be adversely manipulated by poor nutrition.

The variables will explore if individuals have lost weight due to an inability to afford food or ran out of food before they could afford more. Their exposure to influenzas will be measured in comparison to individuals without food insecurities to assess the impact of food insecurity on influenza outcome. Access to care will be measured in comparison to food insecurity as a measure to guide future public health policy as to whether the investment in access to food sources is an appropriate redirection of resources in the fight against influenza. The findings provided additional guidance on whether access to care/ the vaccine may not be the only factor that affects outcome health stakeholders on resources needed to reduce fatalities associated with the virus. The results also provide evidence for improving health education on the role nutrition play in preventing influenzas.

Chapter 4: Results

Introduction

The purpose of this study was to determine if poor nutrition is a risk factor for the influenza virus. The assumption is that inadequate nutrition leads to lower levels of serum albumin in the blood, which increases susceptibility to the influenza virus. The study also investigated the extent to which food insecurity or difficulty finding a doctor functions as a greater barrier for Americans vulnerable to the flu. This is important to investigate as the influenza virus is considered a preventable illness that causes over a billion influenza cases worldwide (WHO, 2019). The United States is among the G20 nations that meet sustainable development goals; however, there are approximately 9 million to 45 million influenzas cases each year, in addition to 140,000 to 810,000 hospitalizations and between 12,000 to 64,000 deaths annually.

The influenza vaccine has been the most useful tool to prevent the influenza virus for the last 50 years (CDC,2019). However, the results have been mixed due to vaccine hesitancy and inconsistent potency that heavily relies on the vaccine being well-matched with the circulating strand of the virus to be effective. Current data and epidemiologic patterns of the influenza virus suggest there is an unfulfilled need for prevention outside of vaccination to offset the health and economic burden to American's health and well-being. This chapter will explain the timeframe of the data being used in this analysis and preview a pilot study that uses artificial intelligence from a global patient registry. This is important as it can provide additional insight into whether the selected variables can produce the desired outcome with statistical significance. Each data table will display each research question's results and include a detailed description of the findings.

Pilot Study

The unexplored association between food insecurity and influenza outcome became a subject of interest after several animal trials produced favorable results that suggest a serum albumin a nutritional biomarker can inhibit the replication of the influenza virus. Before deciding to assess the impact of nutrition on influenza and determine if it was a more significant barrier than access to care and the vaccine, I used artificial intelligence from a publicly available data registry through the CDC. The registry collects data from participating health institutions. Since the United States was the specific location for this study, the data was stratified by location, and the results suggest that greater than 24,000 individuals who contracted a severe case of the influenza virus in the United States experience malnutrition (CDC,2021). That may not seem like a large number since there are between 9 and 45 million cases of the flu in the United States each year (CDC,2019). However, that number becomes critical when measured against the 64,000 people who die from the influenza virus (CDC,2019). The greatest disadvantage to this dataset is that the information being used is only from the patient that is entered into care at a participating facility of the registry. This barrier is eliminated in the original study as the National Health Interview Survey was conducted by going house to house in communities where individuals who don't have access. The data collection method for the survey was inclusive and more representative data set than claim data or surveys conducted in a health care setting. The pilot study's purpose was to determine if there was any statistical significance in the variables being explored and determine if they would likely prove or disprove the hypothesis. The pilot study also helped to assess the goals of the study and its feasibility. The results of the sample population mirror the results of the entire data set with a +/-5% standard deviation.

Data Collection

This study's data were collected and made available through the Inter-University Consortium for Political and Social Research (ICRPS). The National Health Interview Survey 2016 (ICPRS 36146) was downloaded and converted to SPSS. Data cleanup was performed before the analysis was completed to ensure participants meet eligible criteria. Participants were randomly selected from a list of completed cases until 1282 cases were extracted, which met the minimum number of participants needed for the results to bear statistical significance. The data were stored on my hard drive and backed up using my personal I-cloud service. The data were later transferred from SPSS to the chapter for interpretations and discussions of the findings. The National Health Interview Survey has been used for solving health disparities in the United States for over 50 years and is considered one of the most reputable sources of health information because it crosses barriers and reaches members of the population that may not have the means to establish care at a facility, which is where most other health information and observational research data is collected (CDC,2020).

Demographics

The National Health Interview Survey is inclusive and collected health information from participants of all races, ages, sex, educational backgrounds, religions, and socioeconomic status. The data used for the study is of normal distribution and has almost an equal number of male and female participants. This range of the data became more deviant across race as the majority of individuals willing to participate were Whites. Hispanics ethnicity was extracted as a separate variable to distinguish between Hispanic Whites and Non-Hispanic Whites. Blacks/African Americans were also less likely to participate than their White counterparts.

This study aims to gain additional insight into the role nutrition plays in influenza outcomes and how it compares to American's ability to gain access to care. According to the

CDC, approximately 10% of Americans contract the influenza virus per year. The CDC also hypothesizes that the influenza virus will affect at least 50% of Americans at least once in their lifetime (2019). This study's results have similar projections as influenzas virus was observed in approximately 20%-50% of the sample population as either a first instance or a resident's who have a history of influenza. This data includes participants that may not have access to health care and never attempted to established care at any facility. The data will focus on influenza activity captured within the last 12 months of the survey. Retrospective data will also be used to strengthen the argument for food insecurity's true impacts on residents with a history of influenza virus.

Table 1

Summary Statistics

	Sex	Age	Flu12m	Food Insecurity	Race	Hispanic	Flu_History	Trouble_DR	Age_1
N Valid	1282	1282	1282	1282	1282	1282	1282	1282	1282
Missing	0	0	0	0	0	0	0	0	0

This table shows that the appropriate sample size is used across all variables and there is no missing data.

Table 2

Sex of Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	617	48.1	48.1	48.1
	No	665	51.9	51.9	100.0
	Total	1282	100	100	

This table shows that male participants who are represented as =1 and female participants =2 is approximately the same, with 48.1% males and 51.9%female participants.

Table 3

Influenza Within 12months

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	547	42.7	42.7	42.7
	No	735	57.3	57.3	100.0
	Total	1282	100.0	100.0	

This table explains the distribution of influenzas within the stud population. Approximately 42.7% has experience one instance of influenza within the last 12 months and 57.3% has not had any instance of influenza within the last 12 months.

Table 4

Food Insecurity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High Insecurity	1064	83.0	83.0	83.0
	Marginal Insecurity	70	5.5	5.5	88.5
	Low Insecurity	96	7.5	7.5	95.9
	Very Low Insecurity	51	4.0	4.0	99.9
	Refused	1	.1	.1	100.0
	Total	1282	100.0	100.0	

This table explains the occurrence of food insecurity within the population. 83% of participants experienced high levels of food insecurity, 5.5% experienced marginal food insecurity, 7.5% experienced some levels of food insecurity, and 4% of the population experienced low to no food insecurity.

Table 5

Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	1089	84.9	84.9	84.9
	Black/African American	131	10.2	10.2	95.2
	Indian Amer./Alaskan Native	14	1.1	1.1	96.3
	Asian	7	.5	.5	96.8
	Chinese	7	.5	.5	97.3
	Filipino	7	.5	.5	97.9
	Others Asian	21	1.6	1.6	99.5
	Primary Race not released	5	.4	.4	99.9
	Multiple races/ no primary race selection	1	.1	.1	100.0
	Total	1282	100.0	100.0	

This table represents race distribution in the sample population. The majority of participants are White (Caucasian or Hispanic) 84.9%, Blacks were 10%, Indian and Alaskan Native 1.1%, and Asian/Mixed races combined equal 4% of the sample population.

Table 6

Hispanic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Refused	1	.1	.1	.1
	Multiple Hispanic	21	1.6	1.6	1.7
	Puerto Rico	34	2.7	2.7	4.4
	Mexican	30	2.3	2.3	6.7
	Mexican American	8	.6	.6	7.3
	Cuban/ Cuban American	2	.2	.2	7.5
	Dominican Republic	13	1.0	1.0	8.5
	Other Hispanic	9	.7	.7	9.2
	Non-Hispanic	1164	90.8	90.8	100.0
	Total	1282	100.0	100.0	

Hispanics in the sample population were as follows 1=multiple Hispanic1.6%, 2= Puerto Rican 2.7%, 3=Mexicans 2.3%, 4=Mexican Americans 0.6%, 5=Cuban/Cuban Americans 0.2%, 6=Dominican Republic1%,8= Other Spanish 0.7%, 12=Non-Hispanic 30.8%.

Table 7

Flu History

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1282	100.0	100.0	100.0

100% of the sample population has had at least one instance of influenza in their lifetime.

Table 8

*Trouble_DR*Flu 12m*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	30	2.3	2.3	2.3
	No	1250	97.5	97.5	99.8
	Refused	2	.2	.2	100.0
	Total	1282	100.0	100.0	

The chart displays participants that had trouble finding a doctor 1 =2.3 % of the population have trouble finding a doctor and 97.5% does not have trouble finding a doctor.

Table 9

Age _1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.1	.1	.1
	18-31	435	33.9	33.9	34.0
	32-	336	26.2	26.2	60.2
	53-64	367	28.6	28.6	88..8
	>65	138	10.8	10.8	99.6
	Refused	1	.1	.1	99.7
	Unknown	4	.3	.3	100.0
	Total	1282	100.0	100.0	

This chart demonstrates the age distribution within the population. 33.9% is between 18-30, 26.2% is between 31-51 years old, 28.6% is 52-63 years old, and 10.8% is 65 and above.

Table 10

Lost Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1178	91.9	91.9	91.9
	No	104	8.1	8.1	100.0
	Total	1282	100.0	100.0	

This table illustrates the percentage of the population that lost weight because of an inability to afford food. 91.8 % said yes and 8.1% said no.

Study Results

RQ 1. What is the association between food insecurity and influenzas within the test population?

H_1 There is an association between food insecurity and influenza cases among the test population.

H□ There is no association between food insecurity and influenza cases among the test population.

The following tables shows data on Americans who lost weight because of an inability to afford food and participants that experienced marginal to high levels of food insecurity around the time they were exposed to the influenza virus. According to the analytics, 43% of the population lost weight because of an inability to afford food and 93% of participants who the participants that said yes to this weight loss had influenza within the last 12months of the survey. The detailed family level food insecurity index captures data on families that experienced food insecurity using the 30day cross-tabulation scale. This analysis indicated that 83% of the sample population experienced high levels of food insecurity. Americans who contracted the influenza virus within the last 12 months or have a history of influenza virus represented approximately 40% of the entire food insecure population—and greater than 86.8% of families that experience marginal to high food insecurity said yes to having influenza within the last 12 months.

The data remains consistent when looking at participants with a history of influenzas and food insecurity beyond the 12-month window. One in three households, which is just above 30% of food-insecure families/ individuals, experience at least one instance of influenza during the time period they experienced that food insecurity. This ratio increases, as an estimated 88% of individuals who reported multiple instances of influenza ranged between marginal or high level of food insecurity.

Table 11

Case Processing Summary

	Valid		Case Processing		Total	
	N	Percent	N	Percent	N	Percent
Flu12m*food insecurity	1282	100%	0	0.0%	0	100%
Flu12m*lost weight	1282	100%	0	0.0%	0	100%

This table shows there are no missing data in the variables being explored in this crosstabulation.

Table 11.1

Crosstabulation Food Insecurity Flu 12m*

	High Insecurity	Marginal Insecurity	Low Insecurity	Very Low Insecurity	Refused	Total
Yes Count	440	34	44	38	1	547
Expected Count	454.0	29.9	41.0	21.8	.4	547.0
%within flu 12m	80.4%	6.2%	8.0%	5.1%	0.2%	100.0%
%within food_insec.	41.4%	48.6%	45.8%	54.9%	100.0%	42.7%
% of total	34.3%	2.7%	3.4%	2.2%	0.1%	42.7%
No Count	624	36	52	23	0	735
Expected Count	610	40.1	55.0	29.2	.6	735.0
%within flu 12m	84.9%	4.9%	7.1%	3.1%	0%	100.0%
%within food_insec.	58.6%	51.4%	54.2%	45.1%	0%	57.3%
% of total	48.7%	2.8%	4.1%	1.8%	0%	57.3%
Total Count	1064	70	96	51	1	1282
Expected Count	1064.0	70.0	96.0	51.0	1.0	1282.0
%within flu 12m	83.0%	5.5%	7.5%	4.0%	0.1%	100.0%
%within food_insec.	100%	100 %	100%	100%	100 %	100%
% of total	83.0%	5.5%	7.5%	4.0%	0.1%	100%

This table shows the association between food insecurity among individuals who said yes and no to having at least once instance of influenza within the last twelve months.

Table 11.2

Chi-Square Test

	Value	df	Asymptomatic Significance (2-sided)
Pearson Chi-Square	6.606a	4	.158
Likelihood	6.913	4	.141
Linear-by-Linear	5.479	1	.019
N of Valid Cases	1282		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is .43.

Table 11.3

*Flu*Lost Weight Crosstabulation*

			Lost Weight Yes	No	Total
Flu 12m	Yes	Count	512	35	547
		Expected Count	502.6	44.4	547.0
		%within flu 12m	93.6%	6.4%	100.0%
		%within lost weight	43.5%	33.7%	42.7%
		% of total	39.9%	2.7%	42.7%
	No	Count	666	69	735
		Expected Count	675.4	59.6	735.0
		%within flu 12m	90.6%	9.4%	100.0%
		%within lost weight	56.5%	66.3%	57.3%
		% of total	52.0%	5.4%	57.3%
Total		Count	1178	104	1282
		Expected Count	1178.0	104.0	1282.0
		%within flu 12m	91.9%	8.1%	100%
		%within lost weight	100.0%	100.0%	100.0%
		% of total	91.9%	8.1%	100.0%

This table shows the percentage of the sample population that lost weight because of inability to buy food and how it compares to individuals who had influenza within the last twelve months.

Table 11.4

Chi-Square Test

	Value	df	Asymptomatic Sig. (2 sided)	Exact Sig. (2 sided)	Exact Sig. (1 sided)
Pearson Chi-Square	3.759a	1	.053		
Continuity Correction b	3.369	1	.066		
Likelihood Ratio	3.843	1	.050		
Fisher's Exact Test				.062	.032
Linear-by-Linear Association	3.756	1	.053		
N of Valid Cases	1282				

a. 0 cell (0.0%) have expected count less than 5. The minimum expected count is 44.37.
b. Computed only for a 2x2 table

Table 11.5

Case Processing Summary

Unweighted cases a		N	Percent
Selected Cases	Included in Analysis	1282	100.0
	Missing Cases	0	0
Unselected Cases		0	0
Total		1282	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 11.6

Classification Table a, b

			Predicted		
			Flu 12m		
Observed			Yes	No	Percentage Correct
Step 0	Flu12m	Yes	0	547	.0
		No	0	735	100.0
	Overall Percentage				57.3

a. Constant is included in the model. B. the cut value is .50

Table 11.7

Variables in the Equation

	B	S.E.	Wald.	Df.	Sig.	Exp(B)
Step 0 Constant	.295	.056	27.370	1	.000	1.344

The variable in equation confirms that there is statistical significance between the association of food insecurity and influenza outcomes with a p-value of .000

Table 11.8

Variables not in the Equation

		Score	df	Sig.
Step 0 Variables	Lost_weight	3.759	1	.053
	Food_insecurity	5.483	1	.019
Overall Statistics		8.418	1	.015

This data output confirms the degree of statistical significance for each variable. Which is overall below the threshold of 0.05 to reject the null hypothesis.

Table 11.9

Omnibus Test of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	8.455	2	.015
	Block	8.455	2	.015
	Model	8.455	2	.015

This Step 1 block model coefficient shows statistical significance between the variables.

Table 11.10

Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1741.106a	.007	.009

a. Estimated terminated at literation number 3 because parameter estimates change by less than .001.The R Square percentage that can be explained in the predictor variable which is 7%.

Table 11.11

Classification Table a

			Predicted		
			Flu 12m		
Observed			Yes	No	Percentage Correct
Step 1	Flu12m	Yes	29	518	5.3
		No	23	712	96.9
	Overall Percentage				57.8

a. The cut value is .500

This classification table displace the predictable correct percentage of influenza cases observed within 12months of the data collection period.

Table 11.12

Variables in the Equation

		B	S.E.	Wald.	Df.	Sig.	Exp(B)
Step 1a	Lost_weight	.371	.217	2.931	1	.087	1.449
	Food_insecurity	-.150	.070	4.579	1	.032	.861
	Constant	0.96	.265	.130	1	.719	1.100

a. Variable (s) entered on step 1: Lost_weight, food_insecurity.

RQ 2. What is the association between access to care and influenza cases among test population?

H_1 There is an association between access to care and influenza cases among the test population.

H□ There is no association between access to care and influenza cases among the test population.

Access to care has been labeled as one of the most significant barriers for people living in the U.S. (CDC, 2021). The United States spends more than five times the amount of its northern neighbor Canada on health care for the last 5 years (CDC, 2021). In 2017, $812 billion dollars was spent improving access to health care which equals an estimated $2,497USD per American. The cost of health care had significantly increased in 2019, reaching $3.8 trillion or $11,582 per person. Approximately 11.7% of GDP account for healthcare spending; however, the United States has not positively benefited from outspending other nations. The country ranks last among health care in 11 industrialized nations and according to the 2019 Bloomberg Healthiest Country Index, the U.S. ranks 35th out of 169 countries in overall health (Deffarges, 2019).

The data collected from the National Interview Survey indicated that greater than 95% of Americans have a place to go when they are sick, and the majority enter into care once every six months. On a large scale, the data suggested that only 2%-6% of individuals reportedly have trouble finding a doctor or accessing care. These values hold true retrospectively, as approximately 2%-4% of people who had a history of influenza or influenza within the last 12 months had trouble finding a doctor within the twelve months of completing the survey.

On a more granular level, the findings which suggest that more than half of the 3.8% of households reported trouble finding a doctor has one or more incidence of the influenza virus within 12 months of being unable to find a doctor. This indicates that access to care goal is being met in the community, but individuals with influenza is disadvantaged in these communities as well. To further test the significance of this finding binary logistic regression was done. The finding revealed that a with 95% confidence interval and p-value of .523 that there is likely no statistically significant relationship between age and trouble finding a doctor within the population.

Table 12

Case Processing Summary

	Valid		Case Missing		Total	
	N	Percent	N	Percent	N	Percent
Flu12m*trouble_DR	1282	100%	0	0.0%	0	100%

This table shows that there were no missing cases within the variables being tested in this analysis.

Table 12.1

Flu 12m Trouble_DR*

			Yes	No	Refused	Total
Flu 12m	Yes	Count	21	525	1	547
		Expected Count	12.8	533.3	.9	547.0
		%within flu 12m	3.8%	96.0%	0.2	100%
		%within Trouble_DR	70.0%	42.0%	50.0%	42.7%
		% of total	1.6%	41.7%	0.1%	42.7%
	No	Count	9	725	1	735
		Expected Count	17.2	716.7	1.1%	735.0
		%within flu 12m	1.2%	98.6%	0.1%	100.0%
		%within Trouble_DR	30.0%	58.0%	50.0%	57.3%
		% of total	0.7%	56.6%	0.1%	57.3%
Total		Count	30	1250	2	1282
		Expected Count	30.0	1250.0	2.0	1282.0
		%within flu 12m	2.3%	97.5%	0.2%	100%
		%within Trouble_DR	100.0%	100.0%	100.0%	100.0%
		% of total	2.3%	97.5%	0.2%	100.0%

This table shows the cross tabulation for individuals who have trouble finding a doctor and their influenza status within the last twelve months. 42.7% of the population said yes to having one instance of the influenza virus within the last twelve months and 57.3% said no. Overall 97.5% of the population have no trouble finding a doctor and 2.3% does.

Table 12.2

Chi-Square Test

	Value	*df*	*Asymptomatic Significance (2-sided)*
Pearson Chi-Square	9.433a	2	.009
Likelihood	9.406	2	.009
Linear-by-Linear	2.151	1	.148
N of Valid Cases	1282		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count .85.

Table 12.3

Case Processing Summary

Unweighted Cases a		N	Percent
Selected Cases	Included in Analysis	1282	100.0
	Missing Cases	0	0
	Total	1282	100.0
Unselected Cases		0	0
Total		1282	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 12.4

Variables in the Equation

	B	S.E.	Wald.	Df.	Sig.	Exp(B)
Step 0 Constant	.295	.056	27.370	1	.000	1.344

This variable in equation table demonstrates the statistical significance between trouble finding a doctor and influenza occurrence within the last twelve months.

Table 12.5

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	TROUBLE DR	9..433	2	.009
		TROUBLE DR (1)	9.381	1	.002
		TROUBLE DR (2)	9.127	1	.003
Overall Statistics			9.433	1	.009

This variable in not equation table shows the score the statistical significance between trouble finding a doctor and influenza occurrence within the last twelve months.

Block 1: Method = Enter

Table 12.6

Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1741.154a	.007	.010

a. **Estimated terminated at literation 3 because parameter estimates changed by less than .001.**

Table 12.7

Classification Table a

Observed			Predicted		
			Flu 12m		
			Yes	No	Percentage Correct
Step 1	Flu12m	Yes	21	526	3.8
		No	9	726	98.8
	Overall Percentage				58.3

b. The cut value is .500

This classification table illustrates the predicted vs observed percentages of influenza within the last twelve months in the study population.

Table 12.8

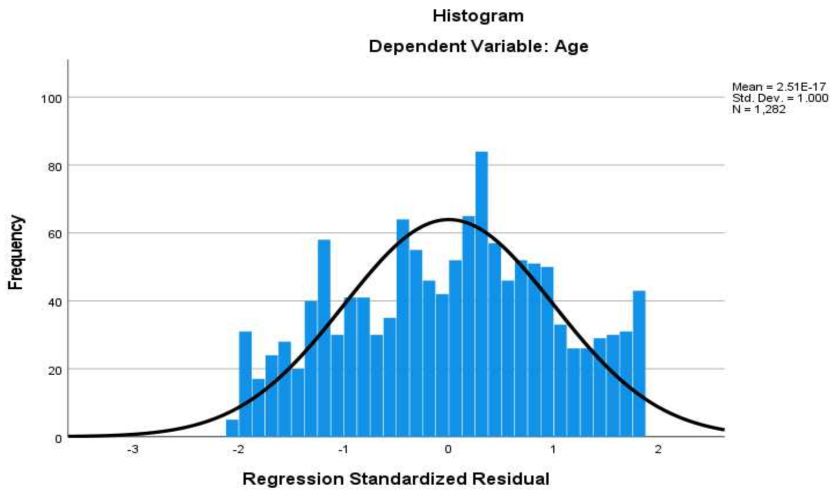
Variables in the Equation

		B	S.E.	Wald.	Df.	Sig.	Exp.(B)	*95% C.I. for EXP.(B)* Lower	Upper
Step 1a	TROUBLE DR			8.495	2	.014			
	TROUBLE DR (1)	-.847	1.469	.333	1	.564	.429	.024	7.632
	TROUBLE DR (2)	.323	1.415	0.52	1	.820	1.381	.086	22.128
	Constant	.000	1.414	.000	1	1.000	1.000		

This table show the upper and lower bound of individuals who said yes or no as whether they have trouble finding a doctor.

Table 12.9

*Trouble Finding a Doctor * Age Histogram*



This histogram shows the distribution of access to care across age and shows no gap in access to care based on age.

RQ 3. What is the association between socio-economic factors (age, race, sex) and influenza cases within the test population?

H_1 There is an association socio-economic factors and influenza cases among the test population.

H_0 There is no association socio-economic factors and influenza cases among the test population.

Social determinants of health have profound influence on health status in the United States. Health disparities historically have a higher impact in rural areas or communities with low earning potential. To improve influenza outcomes, exploring the social impact that significantly affects this population can provide additional insight into lowering the influenza virus incidence and prevalence in those subgroups. From the data, output race plays a critical role in food insecurity across the United States. In addition, races with the highest incidence of food insecurity also had the highest incidence of influenza. Residents who experienced food insecurity and influenza include White, Hispanics and Blacks/African American, representing, 94% of the influenza population in the study. The multivariate analysis did not show any difference in statical finding, which is not coincidental as the same pattern remains consistent when looking at residents who have a history of influenza and food insecurity. Whites, including Caucasians and Hispanics, were more likely to contract the influenzas virus, followed by Blacks and Asians. Within the Hispanic community Mexican, Mexican American, Puerto Ricans, and Central American Hispanics were the most affected by influenza and food insecurity. Other social factors such as sex and age also showed negative correlations women were more likely to contract the influenza virus than males. This study focused on the adult population as adults between the age of 18 to 64 are often faced the worst health outcomes in relation to influenza exposure (CDC, 2019). The same hold true for this study as this age group has the highest incidence of influenzas and food insecurity. They are highlighted as groups 2 and 3. The 32-64, age group is 50% of the food insecure population and 70% of the influenza population in the United States. Results from the binary logistic regression suggest that there has been weight loss from inability to afford food and there is statistical significance in between age groups that experience influenza and food insecurity with a p-value .004 in the United States.

Table 13

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Flu12m*Sex	1282	100%	0	0.0%	0	100%
Flu12m*lost weight	1282	100%	0	0.0%	0	100%
Flu12m* Hispanic	1282	100%	0	0.0%	0	100%
Flu 12m* Age_1	1282	100%	0	0.0%	0	100%
FluHistory* Sex	1282	100%	0	0.0%	0	100%
FluHistory* Race	1282	100%	0	0.0%	0	100%
FluHistory*Hispanic	1282	100%	0	0.0%	0	100%
FluHistory* Age_1	1282	100%	0	0.0%	0	100%

This case processing summary shows that there are no missing or incomplete entries used in this analysis.

Table 13.1

Flu 12m Sex*

			Sex		
			Males	Females	Total
Flu 12m	Yes	Count	35	512	547
		Expected Count	263.3	283.7	547.0
		%within flu 12m	6.4%	93.6%	100.0%
		%within sex	5.7%	77.0%	42.7%
		% of total	2.7%	39.9%	42.7%
	No	Count	582	153	735
		Expected Count	353.7	381.3	735.0
		%within flu 12m	79.2%	20.8%	100.0%
		%within Sex	94.3%	23.0%	57.3%
		% of total			
Total		Count	617	665	1282
		Expected Count	617.0	665.0	1282.0
		%within flu 12m	48.1%	51.9%	100.0%
		%within Sex	100.0%	100.0%	100.0%
		% of total	48.1%	51.9%	100.0%

This table shows a cross tabulation between males and females as well as their influenza status within 12 months of data collection. The table shows 51.9% of the population is females 48.1% males. However, females were 93.6% of the influenza population in comparison to males who were 6.4%.

Table 13.2

Chi-Square Test

	Value	df	Asymptomatic Sig. (2sided)	Exact Sig. (2 sided)	Exact Sig. (1 sided)
Pearson Chi-Square	665.490a	1	.000		
Continuity Correction b	665.577	1	.000		
Likelihood Ratio	763.360	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	664.971	1	.000		
N of Valid Cases	1282				

a. 0 cell (0.0%) have expected count less than 5. The minimum expected count is 263.26.
b. Computed only for a 2x2 table.

Table 13.3

Chi-Square Test

	Value	*df*	*Asymptomatic Significance (2-sided)*
Pearson Chi-Square	21.749a	8	.005
Likelihood	22.329	8	.004
Linear-by-Linear	10.704	1	.001
N of Valid Cases	1282		

a. 2 cells (55.6%) have expected count less than 5. The minimum expected count .43.

Table 13.4

Flu 12m Race Crosstabulation*

			1.00	*2.00*	*3.00*	*9.00*	*10.00*	*11.00*	*15.00*	*16.00*	*17.00*	*Total*
Flu 12m	Yes	Count	443	68	5	6	5	2	14	3	1	547
		Expected Count	464.7	55.9	6.0	3.0	3.0	3.0	9.0	2.1	.4	547.0
		%within flu 12m	81%	12.4%	0.9%	1.1%	0.9%	0.4%	2.6%	0.5%	0.2%	100.0%
		%within race	40.7%	51.9%	35.7%	85.7%	71.4%	28.6%	66.7%	60.0%	100%	42.7%
		% of total	34.6%	5.3%	0.4%	0.5%	0.4%	0.2%	1.1%	0.2%	0.1%	42.7
%												
	No	Count	646	63	9	1	2	5	7	2	0	735
		Expected Count	624.3	75.1	8.0	4.0	4.0	4.0	12.0	2.9	.6	735.0
		%within flu 12m	87.9%	8.6%	1.2%	0.1%	0.3%	0.7%	1.0%	0.3%	0.0%	100.0%
		%within race	59.3%	48.1%	64.3%	14.3%	28.6%	71.4%	33.3%	40%	0.0%	57.3%
		% of total	50.4%	4.9%	0.7%	0.1%	0.2%	0.4%	0.5%	0.2%	0.0%	57.3%
Total		Count	1089	131	14	7	7	7	21	5	1	1282
		Expected Count	1089.0	131.0	14.0	7.0	7.0	7.0	21.0	5.0	1.0	1282.0
		%within flu 12m	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%
		%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6 %	0.4%	0.1%	100%

This cross tabulation captures Race and Influenza status within the last twelve months. 1=Caucasian 81%, 2=Blacks 12.4%, 3=Indian American/Alaskan Native0.9%, 9= Asian Indian 10= Chinese 0.9%, 11=Filipino 0.4%, 15=Other Asian 2.6%, 16=Primary Race not releasable 0.5%, 17=refused 0.2%.

Table 13.5

Chi-Square Test

	Value	*df*	*Asymptomatic Significance (2-sided)*
Pearson Chi-Square	13.951a	8	.083
Likelihood	15.122	8	.057
Linear-by-Linear	3.489	1	.062
N of Valid Cases	1282		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is .43.

Table 13.6

*Flu*Age Crosstabulation*

			.00	*1.00*	*2.00*	*3.00*	*4.00*	*5.00*	*8.00*	*Total*
Flu 12m	Yes	Count	0	93	194	187	72	0	1	547
		Expected Count	.4	185.6	143.4	156.6	58.9	.4	1.7	547.0
		%within flu 12m	0.0%	17.0%	35.5%	34.2%	13.2%	0.0%	0.2%	100.0%
		%within age_1	0.0%	21.4%	57.7%	51.0%	52.2%	0.0%	25.0%	42.7%
		% of total	0.0%	7.3%	15.1%	14.6%	5.6%	0.0%	0.1%	42.7%
	No	Count	1	342	142	180	66	1	3	735
		Expected Count	.6	249.4	192.6	210.4	79.1	.6	2.3	735.0
		%within flu 12m	0.1%	46.5%	19.3%	24.5%	9.0%	0.1%	0.4%	100.0%
		%within age_1	100%	78.6%	42.3%	49.0%	47.8%	100%	75.0%	57.3%
		% of total	0.1%	26.7%	11.1%	14.0%	5.1%	0.1%	0.2%	57.3%
Total		Count	1	435	336	367	138	1	4	1282
		Expected Count	1.0	435.0	336.0	367.0	138.0	1.0	4.0	1282.0
		%within flu 12m	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100.0%
		%within age_1	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100%

This Crosstabulation demonstrates the Influenza occurrence within 12 months across age. Group 1 represents ages 18-31, group2= 32-52, group 3=53-64, group 4=65 and over.

Table 13.7

Chi-Square Test

	Value	*df*	*Asymptomatic Significance (2-sided)*
Pearson Chi-Square	129.182a	6	.000
Likelihood	136.186	6	.000
Linear-by-Linear	58.141	1	.000
N of Valid Cases	1282		

a. 6 cells (42.9%) have expected count less than 5. The minimum expected count .43.

Table 13.8

*Flu History*Sex Crosstabulation*

			Sex		
			Male	Female	Total
Flu History	Yes	Count	617	665	1282
		Expected Count	617.0	665.0	1282.0
		%within flu 12m	48.1%	51.9%	100.0%
		%within sex	100.0%	100.0%	100.0%
		% of total	48.1%	51.9%	100.0%
Total		Count	617	665	1282
		Expected Count	617.0	665.0	1282.0
		%within flu 12m	48.1%	51.9%	100.0%
		%within Sex	100.0%	100.0%	100.0%
		% of total	48.1%	51.9%	100.0%

This crosstabulation shows the distribution of influenza occurrence in residents' medical history across sex. Women and men were almost equal with males representing 48.1% and female 51.9% of the sample population.

Table 13.9

Chi-Square Test

Pearson Chi-Square	Value	a
N of Valid Cases	1282	

a. No statistics are computed because Flu History is a constant

Table 13.10

Flu History Race Crosstabulation*

			1.00	*2.00*	*3.00*	*9.00*	*10.00*	*11.00*	*15.00*	*16.00*	*17.00*	*Total*
Flu 12m	Yes	Count	1089	131	14	7	7	7	21	5	1	1282
		Expected Count	1089.0	131.0	14.0	7.0	7.0	7.0	21.0	5.0	1.0	547.0
		%within flu 12m	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%
		%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%
Total		Count	1089	131	14	7	7	7	21	5	1	1282
		Expected Count	1089.0	131.0	14.0	7.0	7.0	7.0	21.0	5.0	1.0	1282.0
		%within flu 12m	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%
		%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6 %	0.4%	0.1%	100%

This table displays a crosstabulation of Race and influenza history among. The results show that 1=Caucasian 84.9%, 2=Blacks 10.2%, 3=Indian American/Alaskan Native 1.1 %, 9= Asian

Indian 0.5%, 10= Chinese 0.5%, 11=Filipino 0.5%, 15=Other Asian 1.6 %, 16=Primary Race not releasable 0.4 %, 17=Refused 0.1%.

Table 13.11

*Flu History*Hispanic Crosstabulation*

			.00	*1.00*	*2.00*	*3.00*	*4.00*	*5.00*	*6.00*	*8.00*	*12.00*	*Total*
Flu History	Yes	Count	1	21	34	30	8	2	13	9	1164	1282
		Expected Count	1.0	21.0	34.0	30.0	8.0	2.0	13.0	9.0	1164.0	1282.0
		%within flu 12m	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0%	0.7%	90.8%	100.0%
		%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0%	0.7%	90.8%	100.0%
Total		Count	1	21	34	30	8	2	13	9	1164	1282
		Expected Count	1.0	21.0	34.0	30.0	8.0	2.0	13.0	9.0	1164.0	1282.0
		%within flu 12m	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0%	0.7%	90.8%	100.0%
		%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		% of total	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0 %	0.7%	90.8%	100.0%

This table shows a cross tabulation for influenza history across Hispanic ethnicity. 1= Multiple Hispanic 0.1%, 2= Puerto Rico 1.6%, 3= Mexican 2.7%, 4=Mexican American 2.3%, 5= Cuban/ Cuban American 0.6%, 6=Dominican (Republic) 0.2%, 8= Other Spanish 1%, 12= Not Hispanic/ Spanish Origin 90.8%.

Table 13.12

Chi-Square Test

Pearson Chi-Square	Value	.a
N of Valid Cases	1282	

a. No Statistics are computed because history is constant

Table 13.13

*Flu History*Age Crosstabulation*

		.00	*1.00*	*2.00*	*3.00*	*4.00*	*5.00*	*8.00*	*Total*
Flu History Yes	Count	1	435	336	367	138	1	4	1282
	Expected Count	1.0	435.0	336.0	367.0	138.0	1.0	4.0	1282.0
	%within flu 12m	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100.0%
	%within age_1	100%	100%	100%	100%	100%	100%	100%	100%
	% of total	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100%
Total	Count	1	435	336	367	138	1	4	1282
	Expected Count	1.0	435.0	336.0	367.0	138.0	1.0	4.0	1282.0
	%within flu 12m	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100.0%
	%within age_1	100%	100%	100%	100%	100%	100%	100%	100%
	% of total	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100%

This Crosstabulation demonstrates the distribution of influenza history stratified by age. Group 1 represents ages 18-31, group2= 32-52, group 3=53-64, group 4=65 and over.

Table 13.14

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Food Insecurity* Sex	1282	100.0%	0 0.0%	1282	1282	100.0%
Food Insecurity*Race	1282	100.0%	0	0.0%	1282	100.0%
Food Insecurity* Hispanic	1282	100.0%	0	0.0%	1282	100.0%
Food Insecurity*Age	1282	100.0%	0	0.0%	1282	100.0%

This case processing summary shows that there are no missing cases for the variables used in this analysis.

Table 13.15

*Food insecurity*Sex Crosstabulation*

		Sex		
		Male	Female	Total
Food Insecurity (High)	Count	600	464	1064
	Expected Count	512.1	551.9	1064.0
	%within food insecurity	56.4%	43.6%	100%
	%within sex	97.2%	69.8%	83.0%
	% of total	46.8%	36.2%	83.0%
(Marginal)	Count	5	65	70
	Expected Count	33.7	36.3	70.0
	% within food insecurity	7.1%	92.9%	100%
	%within Sex	0.8%	9.8%	5.5%
	% of total	0.4%	5.1.%	5.5%
(Low)	Count	11	85	96
	Expected Count	46.2	49.8	96.0
	%within food insecurity	11.5%	88.5%	100
	%within sex	1.8%	12.8%	7.5%
	% of total	0.9%	6.6%	7.5%
(Very Low)	Count	1	50	51
	Expected Count	24.5	6.5	51.0
	% within food insecurity	2.0	98.0	100.0%
	%within Sex	0.2	7.5	4.0
	% of total	0.4%	5.1.%	5.5%
Total	Count	617	665.0	1282.0
	Expected Count	617.0	665.0	1282.0
	%within food insecurity	48.1%	51.9%	100.0%
	%within Sex	100%	100%	100%
	% of total	48.1%	51.9%	100%

This crosstabulation shows food insecurity across gender. The results revealed that on average 56% of men experienced the highest level of food insecurity in comparison to 44% of women. However, women represented 92% of individuals who experience marginal insecurity in comparison to 8% of males.

Table 13.16

Chi-Square Test

	Value	df	Asymptomatic Significance (2-sided)
Pearson Chi-Square	172.377a	4	.000
Likelihood	203.627	4	.000
Linear-by-Linear	144.008	1	.000
N of Valid Cases	1282		

a. 6 cells (20.0%) have expected count less than 5. The minimum expected count .48.

Table 13.17

Food Insecurity Race Crosstabulation*

		1.00	2.00	3.00	9.00	10.00	11.00	15.00	16.00	17.00	Total
Food Insecurity (High)	Count	907	112	9	4	4	6	19	3	0	1064
	Expected Count	903.8	108.7	11.6	5.8	5.8	5.8	17.4	4.1	.8	1064.0
	%within food in.	85.2%	10.5%	0.8%	0.4%	0.4%	0.6%	1.8%	0.3%	0.0%	100%
	%within race	83.3%	85.5%	64.3%	57.1%	57.1%	85.7%	90.5%	60.0%	0.0%	83.0%
	% of total	70.7%	8.7%	0.7%	0.3%	0.3%	0.5%	1.5%	0.2%	0.0%	83.0%
(Marginal)	Count	56	7	3	1	0	1	1	1	0	70
	Expected Count	59.5	7.2	.8	.4	.4	.4	1.1	.3	.1	70.0
	%within food in.	80.0%	10.0%	4.3%	1.4%	0.0%	1.4%	1.4%	1.4%	0.0%	100.0%
	%within race	5.1%	5.3%	21.4%	14.3%	0.0%	14.3%	4.8%	20.0%	0.0%	5.5%
	% of total	4.4%	0.5%	0.2%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%	5.5%
(Low)	Count	81	9	1	2	2	0	0	0	1	96
	Expected Count	81.5	9.8	1.0	.5	.5	.5	1.6	.4	.1	96.0
	%within food in.	84.4%	9.4%	1.0%	2.1%	2.1%	0.0%	0.0%	0.0%	1.0%	100.0%
	%within race	7.4%	6.9%	7.1%	28.6%	28.6%	0.0%	0.0%	0.0%	100%	7.5%
	% of total	6.3%	0.7%	0.1%	0.2%	0.2%	0.0%	0.0%	0.0%	0.1%	7.5%
(Very Low)	Count	44	3	1	0	1	0	1	1	0	51
	Expected Count	44.3	5.2	.6	.3	.3	.3	.8	.2	0	51.0
	%within food in.	86.3%	5.9%	2.0%	0.0%	2.0%	0.0%	2.0%	2.0%	0.0%	100.0%
	%within race	4.0%	2.3%	7.1%	0.0%	14.3%	0.0%	4.8%	20.0%	0.0%	4.0%
(Refused)	Count	1	0	0	0	0	0	0	0	0	0
	Expected Count	.8	.1	.0	0	0	0	0	0	0	0
	%within food in.	100%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	%within race	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
	% of total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
(Total)	Count	1089	131	14	7	7	7	21	5	1	1282
	Expected Count	1089.0	131.0	14.0	7.0	7.0	7.0	21.0	5.0	1.0	1282.0
	%within food in.	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%
	%within race	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	% of total	84.9%	10.2%	1.1%	0.5%	0.5%	0.5%	1.6%	0.4%	0.1%	100.0%

This crosstabulation show food insecurity across race. 1=Caucasian 84.9%, 2=Blacks 10.2%, 3=Indian American/Alaskan Native 1.1%, 9= Asian Indian This table shows Influenza 10= Chinese 0.5%, 11=Filipino 0.5%, 15=Other Asian 0.5%, 16=Primary Race not releasable 1.6%, 17=refused 0.1%.

Table 13.18

Chi-Square Test

	Value	df	Asymptomatic Significance (2-sided)
Pearson Chi-Square	43.742a	32	.000
Likelihood	30.382	32	.000
Linear-by-Linear	1.048	1	.000
N of Valid Cases	1282		

a. 32 cells (71.1%) have expected count less than 5. The minimum expected count .00.

Table 13.19

Food Insecurity Hispanic Crosstabulation*

		.00	*1.00*	*2.00*	*3.00*	*4.00*	*5.00*	*6.00*	*8.00*	*12.00*	*Total*
Food Insecurity (High)	Count	1	16	25	28	7	0	10	8	969	1064
	Expected Count	.8	17.4	28.2%	24.9%	6.6	1.7	10.8	7.5	966.1	1064.0
	%within food in.	0.1%	1.5%	2.3%	26.3%	0.7%	0.0%	0.9%	0.8%	91.1%	100.0%
	%within Hispanic	100.0%	76.2%	73.5%	93.3%	87.5%	0.0%	76.9%	88.9%	83.2%	83.0%
	% of total	0.1%	1.2%	2.0%	2.2%	0.5%	0.0%	0.8%	0.6%	75.6%	83.0%
(Marginal)	Count	0	0	1	0	0	0	2	1	66	70
	Expected Count	.1	1.1	1.9	1.6	.4	.1	.7	5	63.6	70.0
	%within food in.	0.0%	0.0%	1.4%	0.0%	0.0%	0.0%	2.9%	1.4%	94.3%	100%
	%within Hispanic	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	15.4%	11.1%	5.7%	5.5%
	% of total	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%	0.1%	5.7%	5.5%
(Low)	Count	0	1	4	2	1	1	1	0	86	96
	Expected Count	.0	1.6	2.5	2.2	.6	.1	1.0	.7	87.2	96.0
	%within food in.	0.0%	1.0%	4.2%	2.1%	1.0%	1.0%	1.0%	0.0%	89.6%	100%
	%within Hispanic	0.0%	4.8%	11.8%	6.7%	12.5%	50.0%	7.7%	0.0%	7.4%	7.5%
	% of total	0.0%	0.1%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	6.7%	7.5%
(Very Low)	Count	0	4	4	0	0	1	0	0	42	51
	Expected Count	.0	.8	1.4	1.2	5.5	.3	.1	5	46.3	51.0
	%within food in.	0.0%	7.8%	7.8%	0.0%	0.0%	2.0%	0.0%	0.0%	82.4%	100%
	%within Age_1	0.0%	19.1%	11.8%	0.0%	0.0%	50.0%	0.0%	0.0%	3.6%	4.0%
	% within of Total	0.0%	0.3%	0.3%	0.0%	0.0%	0.1%	0.0%	0.0%	3.3%	4.0%
(Refused)	Count	0	0	0	0	0	0	0	0	1	1
	Expected Count	.0	.0	.0	.0	.0	.0	.0	.0	.9	1.0
	%within food in.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	100%
	%within Hispanic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	% of total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
(Total)	Count	1	21	34	30	8	2	13	9	11	64
	Expected Count	1.0	21.0	34.0	30.0	8.0	2.0	13.0	9.0	1164.0	1282.0
	%within food in.	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0%	0.7%	90.8%	100%
	%within Hispanic	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	% of total	0.1%	1.6%	2.7%	2.3%	0.6%	0.2%	1.0%	0.7%	90.8%	100.0%

This table displays level of food insecurity across Hispanic ethnicity. This study focuses on high levels of food insecurity which revealed 1= Multiple Hispanic 0.1%, 2= Puerto Rico 1.5%, 3= Mexican 2.3%, 4=Mexican American 0.7%, 5= Cuban/ Cuban American 0%, 6=Dominican (Republic) 0.9%, 8= Other Spanish 0.6%, 12= Not Hispanic/ Spanish Origin 91.1%.

Table 13.20

Chi-Square Test

	Value	df	Asymptomatic Significance (2-sided)
Pearson Chi-Square	47.107a	32	.041
Likelihood	36.724	32	.259
Linear-by-Linear	3.101	1	.078
N of Valid Cases	1282		

a. 35 cells (77.8%) have expected count less than 5. The minimum expected count .00.

Table 13.21

Food Insecurity Age_1 Crosstabulation*

		.00	*1.00*	*2.00*	*3.00*	*4.00*	*5.00*	*8.00*	*Total*
Food Insecurity (High)	Count	1	397	267	280	114	1	4	1064
	Expected Count	.8	361.0	278.9	304.6	114.5	.8	3.3	1064.0
	%within food in.	0.1%	37.3%	25.1%	26.3%	10.7%	0.1%	0.4%	100.0%
	%within Age_1	100.0%	91.3%	79.5%	76.3%	82.6%	100.0%	100.0%	83.0%
	% of total	0.1%	31.0%	20.8%	21.8%	8.9%	0.1%	0.3%	83.0%
(Marginal)	Count	0	6	25	34	5	0	0	70
	Expected Count	.1	23.8	18.3	20.0	7.5	.1	.2	70.0
	%within food in.	0.0%	8.6%	35.7%	48.6%	7.1%	0.0%	0.0%	100%
	%within Age_1	0.0%	1.4%	7.4%	9.3%	3.6%	0.0%	0.0%	7.5%
	% of total	0.0%	0.5%	2.0%	2.7%	0.9%	0.0%	0.0%	7.4%
(Low)	Count	0	23	27	34	12	0	0	96
	Expected Count	.0	32.6	25.2	27.5	10.3	.1	.3	96.0
	%within food in.	0.0%	24.0%	28.1%	35.4%	12.5%	0.0%	0.0%	100.0%
	%within Age_1	0.0%	5.3%	8.0%	9.3%	8.7%	0.0%	0.0%	7.5%
	% of total	0.0%	1.8%	2.1%	2.7%	0.9%	0.0%	0.0%	7.5%
(Very Low)	Count	0	9	17	19	6	0	0	51
	Expected Count	0	17.3	13.4	14.6	5.5	.0	.2	51.0
	%within food in.	0.0%	17.6%	33.3%	37.3%	11.8%	0.0%	0.0%	100.0%
	%within Age_1	0.0%	2.1%	5.1%	5.2%	4.3%	0.0%	0.0%	4.0%
	% within of Total	0.0%	0.7 %	1.3%	1.5%	0.5%	0.0%	0.0%	4.0%
(Refused)	Count	0	0	0	0	1	0	0	1
	Expected Count	.0	.3	.3	.3	.1	.0	.0	1.0
	%within food in.	0.0%	0.0%	0.0%	0.0%	100%	0.0%	0.0%	100%
	%within Hispanic	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.1%
	% of total	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
(Total)	Count	1	435	336	367	138	1	4	1282
	Expected Count	1.0	435.0	336.0	367.0	138.0	1.0	4.0	1282.0
	%within food in.	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	0.7%
	%within Hispanic	100%	100%	100%	100%	100%	100%	100%	100%
	% of total	0.1%	33.9%	26.2%	28.6%	10.8%	0.1%	0.3%	100%

This crosstabulation displays age and levels of food insecurity in each subgroup. Group 1 represents ages 18-31, group2= 32-52, group 3=53-64, group 4=65 and over.

Table 13.22

*Chi-Square Test Age*Food Insecurity*

	Value	df	Asymptomatic Significance (2-sided)
Pearson Chi-Square	52.961a	24	.001
Likelihood	54.835	24	.000
Linear-by-Linear	13.328	1	.000
N of Valid Cases	1282		

a. 19 cells (54.3%) have expected count less than 5. The minimum expected count .00.

LOGISTIC REGRESSION

Table 12.23

Case Processing Summary

Unweighted Cases a		N	Percent
Selected Cases	Included in Analysis	1282	100.0
	Missing Cases	0	0
	Total	1282	100.0
Unselected Cases		0	0
Total		1282	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 13.24

Variables in the Equation

		B	S.E.	Wald.	Df.	Sig.	Exp(B)
Step 0	Constant	.295	.056	27.370	1	.000	1.344

This table shows the statistical significance of the variables being explored in the equation.

Table 13.25

Variables in the Equation

			Score	df	Sig.
Step 0	Variables	Sex	665.490	1	.000
		Race	10.713	1	.001
		Hispanic	3.492	1	.062
		Age_1	58.187	1	.000
Overall Statistics			668.910	4	.000

This table shows the statistical signifiance of the variables sex, race, hispanic ethnicity.

Block 1: Method = Enter

Table 13.26

Omnibus Test of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	770.532	4	.000
	Block	770.532	4	.000
	Model	770.532	4	.000

This Model coefficient shows the statistical signifiance of the block 1 analysis.

Table 13.27

Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	979.029a	.452	.607

a. Estimated terminated at literation 6 because parameter estimates changed by less than .001.

Table 13.28

Classification Table a

			Predicted		
			Flu 12m		
Observed			Yes	No	Percentage Correct
Step 1	Flu12m	Yes	512	35	93.6
		No	153	582	79.2
	Overall Percentage				85.3

a. The cut value is .500

Table 13.29

Variables in the Equation

		B	S.E.	Wald.	Df.	Sig.	Exp(B)	*95% C.I. for EXP (B)* Lower	Upper
Step 1a	Sex	-3.931	.198	392.999	1	.000	.020	.013	029
	Race	-.045	.035	1.642	1	.200	.956	.891	1.024
	Hispanic	.022	.031	.517	1	.472	1.022	.963	.968
	Age_1	-.190	.080	5.574	1	.018	.827	.707	.968
	Constant	6.941	.520	177.869	1	.000	1033.300		

Summary & Transition

The premise of this study was to explore factors outside of vaccination that may contribute to an increased number of influenza cases in the United States. Assessing the impact of nutrition and food insecurity was selected as the study's aim as the influenzas virus frequently had the worst health outcomes in vulnerable communities that are also food insecure. Three research questions were developed to understand the association between influenza occurrence and food insecurity in the United States and see how it compares with access to care being a barrier for residents who contracted the Influenza virus. This comparison between access to care and food insecurity was essential because most of the government's influenza resources are spent on awareness campaigns, improving health insurance for low-income earners, expanding access to care, infrastructure, and making the vaccine free and available (CDC, 2019). The United States outspends all nations on health care and ranks last among industrialized nations and 35th on Bloomberg's world health index (Deffarges, 2019).

The first research question above investigated whether there is an association between influenzas and food insecurity in the United States. The results showed that individuals who had influenza experienced the highest food insecurity rates; The data also demonstrated the consistency of high food insecurity among individuals who contracted influenza within the last

12 months and individuals with a history of influenza. Weight loss because of the inability to afford food was also a contributing factor to higher rates of influenza.

The second question examined whether influenza cases were more closely associated with food insecurity or access to care. This question is essential as it can guide public health policy and the distribution of resources to combat the virus. The results indicated that greater than 95% of the general population has somewhere to go when they are sick. The data also revealed that Americans seek health care once every six months, and individuals who had influenza within the last twelve months or have a history of influenza did not have trouble finding a doctor or accessing care. People who had influenza represented only half of the minuscule population of individuals who could not find a doctor.

In final, the third question seeks to understand social or economic factors that contribute to poor influenza outcomes. The distribution of participants was about equal, but the data showed that women were more likely to contract influenza than their male counterparts and also experienced a higher and marginal level of food insecurity than men historically and within the last 12 months. Race also played a major factor in food insecurity and influenzas occurrence. The study’s data is consistent with the CDC’s data, which shows that Hispanics and Blacks are more likely to get infected with influenza virus. These ethnic, racial groups also experienced a higher level of food insecurity. In Chapter 5, the findings will be utilized to discuss how to promote positive social change from the results of the study.

Chapter 5: Discussion, Conclusion & Recommendations

In this study, I aimed to determine if there is an association between food insecurity and the influenza virus in the United States. Discovering additional means of influenza prevention can positively contribute to social change by lowering the impact of the influenza virus, reducing death associated with the flu, and improving Americans' overall health through healthy nutritional options. The influenza virus is considered preventable (CDC,2019). Adding the findings of this study to the existing body of literature can shape how Americans respond to the virus and create more resilience in underserved and food insecure communities with high influenza cases.

Key findings in this study suggested that food insecurity is a social issue in the United States and agrees with the CDC publication that one in seven adults in the United States can attest to this experience (CDC, 2020). Food insecurity also has an increased presence among individuals who contracted the influenza virus within the last 12 months or have a history of the flu in this study population. The association between food insecurity and influenza occurrence is critical when investigating factors outside of vaccination that impacts influenza outcomes. It can also help inform public health decisions on areas of opportunity to redirect resources and improve food access to change the trajectory of influenza in the United States. The majority of healthcare spending is often directed towards improving access to care and making the influenza vaccine more affordable in vulnerable communities (CDC,2020). This study validates that improving access to nutritious meals also plays a critical role in communities with higher influenza incidences and had a more significant impact than access to care as 96% of this population has a place to go if they are sick and seek routine care at least once every 6 months, even though less than 4% of individuals had trouble problem finding a doctor, only half also had influenza. This issue can be solved by looping individuals into care by providing the resources needed such as health education, transportation, and health insurance, and by delivering culturally competent care.

The results demonstrated that food insecurity negatively affects influenza outcomes across social determinants of health such as race, sex, and age in the United States. Blacks and Whites were more vulnerable to food insecurity and the influenza virus. The data also suggested that women were more likely to contract the influenza virus than males but were just about even in terms of experiencing food insecurity around the same time they contracted the influenza virus. The data also revealed that Americans between the ages of 34 and 64 were at greater risk of contracting the influenza virus and food insecurity within the adult population.

Interpretation of Findings

The finding in this study confirmed what was previously proven in animal studies, which suggested that levels of albumin increase the risk of exposure to the influenza virus. Albumin is achieved and maintained through nutrition, and a lower level of albumin is a biomarker for inadequate nutrition. The results showed the same trends that residents who contracted the influenza virus experienced marginal or high levels of food insecurity within 12 months of the infection which is associated with lower levels of albumin. The findings also expand our knowledge on the advantages of foods high in protein that prevent the influenza virus by increasing serum albumin levels in the blood and blocking viral replication. Linking nutrition to influenza has created an area of opportunity to make positive social change by providing the resources needed to reduce the risk of contracting the influenza virus. This ranges from additional knowledge about nutritional health, to improving access to food, to informing policymakers about the unmet needs of communities at higher risk of contracting the influenza virus.

Access to care is frequently considered the greatest barrier in health inequities; however, this study's data revealed that access to care is not the most significant barrier for Americans susceptible to the influenza virus. The findings of this study also showed that social determinants of health such as age, race and sex influence influenza outcomes in the presence of food insecurity. Americans between the age of 18 and 64 are at greater risk of food insecurity and represent age groups. These three groups represent the highest cases of the influenza virus in the United States. In the elderly population, food insecurity is also low in comparison to other groups. This strengthen the theory that when food insecurity is low, the risk of contracting the influenza virus is also low. To mitigate food insecurity in the elderly population, the United States government currently provides monthly stipends to eligible seniors that can only be used for food purchases. Residents in this age group also have access to free healthcare if they cannot afford their own, a higher dose influenza vaccine and an adjuvanted influenzas vaccine, which improves adaptive immune responses (CDC,2021). These factors explain why the impact of influenza is not as severe in the elderly population as groups 1, 2 and 3 of the investigation. This study's results justify the need for a tailored approach, similar to the mitigation deployed for elderly residents. Extending these resources to Americans between the ages of 18 and 64 that cannot afford food will ultimately improve their response to the influenza virus.

Discovering that women were more likely to contract the influenza virus than their male counterparts is new knowledge as data from the CDC shows women are more likely to enter into care and be aware of their physical health needs than their male counterparts (CDC,2020). Previous studies that investigated gender inequality suggest factors such as education and pay could account for why women are more likely to experience food insecurity, as lower levels of education are associated with lower wages and the inability to provide nutritious meals (WHO, 2021). Outside of gender disparities in healthcare, racial inequities have been at the center of the health barrier for a decade in the United States (CDC, 2020). The findings showed that racial and ethnic groups with the highest number of influenza occurrences also had marginal to high reporting of food insecurity.

As researchers continue to explore gaps that affect health outcomes across races, the findings suggest higher earning potential and education level plays a more significant role towards health actions required to improve health outcomes (2018). The studies' results indicated that minority groups with higher levels of education and wealth are less likely to have declining health than minorities of lesser socio-economic status, demonstrating that external social factors are driving poorer health. (Bleser et al. 2017; Hall et al. 2020; Quinn et al. 2017). According to Bleser et al. (2017); Hall et al. (2020) and Quinn et al. (2017), vaccination compliance is heavily dependent on how much the patient knows about the vaccine and their perception of its importance. Trust in government also plays a critical role in influenza outcomes, and White participants were more trusting of federal institutions but questioned their competency. African Americans were more doubtful of practical and government agency motives (Jamison et al., 2018). Providing underserved communities with opportunities to increase wages, improve health literacy and educational opportunities can promote healthier lifestyles as the more individuals know about how their health is personally affected, the more likely they are to practice the health action required (Kan & Zhang, 2018).

Limitation

The National Health Interview Survey is a questionnaire that is filled out nationally and has helped inform health decisions since the 1950's. The greatest challenge to using this data is handling missing cases. For the purpose of this study an incomplete section on any variable was excluded and recoded as 9999. This action can cause the data to not accurately reflect the population if one group has more missing or incomplete cases than another. From a demographic standpoint, there were more White participants than any other race for this study, which could be related to medical mistrust observed in other ethnic groups across the United States. Medical mistrust was also more prominent in vulnerable communities (Quinn et al., 2017).

Medical mistrust often transcends into government mistrust, which negatively affects vaccination uptake. Jamison et al. (2018), agreed that mistrust can also cause patients to omit vital information on a survey because of how the information may make them look and create stereotyping in their community. In order to prevent an imbalance across groups being explored, demographic queries were done to ensure that the complete cases represented all race, gender, and age groups in similar percentages as the general population.

Recommendation

Eliminating food insecurity has the potential to alter the exponential growth of influenza cases in the United States annually. This was proven when greater than 80% of individuals who experience influenza within the last 12 months/history of influenza at the time of survey also experience marginal or high food insecurity. When tested against access to care, food insecurity was a greater need among individuals who contracted the influenza virus than individuals who had trouble finding a doctor. The literature review shows that albumin level is an essential biomarker for influenza susceptibility (Mu et al., 2018). The study's data supports this theory that higher instances of influenza would be more common in food insecure communities because poor nutrition leads to lower levels of albumin, which weakens the immune system's ability to prevent the replication of invading pathogens such as the influenza virus.

Increasing awareness of the role inadequate nutrition plays as a risk factor for the influenzas virus is the first step of engagement with stakeholders most affected. The willingness to adapt when individuals are personally affected was observed in Lutz et al.'s (2020) study, after the perception of the vaccine's safety and importance increased to 86% when information about the vaccine was shared with stakeholders. Changing the types of food consumed is less likely to undergo the same hesitancy that is observed with vaccination uptake. This willingness to change dietary intake was also proven when alkaline water was introduced with health benefits that showed viruses and diseases could not live in an alkaline environment. According to food and beverage consultancy Zenith Global, global sales of alkaline water are expected to reach $1 billion this year (WebMD, 2021). The same pattern was seen in a Bronx observational study, which showed that when healthier foods are available, individuals will make better food choices, and some are even willing to drive to other areas outside of their neighborhoods for food shopping if they believed had better quality food and was better for their health (Adjoin et al., 2017).

In order to transition Americans to this required health action, a healthcare expense budget that is targeted at improving health equity among women is essential, as they were more likely to contract the influenza than their male counterparts. Creating legislation that ensures women are paid equally in the workplace and compensated for family leave of absence to care for children and elderly dependents would secure monetary means to reduce the likelihood of women becoming food insecure during time spent outside the workforce (Blau, & Winker, 2017). Currently in the United States, it is up to the employer to offer paid time off to an employee. Women are more likely to voluntarily leave the workforce and lose wages and health benefits because of family obligations. (Blau, & Winker, 2017).

According to the results of this study, individuals between the ages of 18 and 64 experience higher instances of influenza both in their medical history and within the last 12 months of the survey. These individuals are also the most vulnerable to food insecurity. The United States has acted on targeted influenza relief, and it has worked in the past. After the CDC discovered that the elderly population was at greater risk of dying from influenza due to their weakened immune system and lower-income source, they developed meals on wheels and other nutritional programs to deliver food to member of the eligible population in need. A higher dose of the influenza vaccine was also developed for this population to provide an added layer of protection. This study suggests that those efforts are effective at adults over the age of 65, which is represented in age group four, have lower levels of food insecurity and influenza cases. The same mitigation can be emulated for the age group most adversely affected. Since higher doses of influenza vaccine and supplemental food programs has already been implemented, expanding access to individuals between the age of 18 and 64 who are members of a vulnerable community and experience food insecurity can improve their influenza outcomes as well.

Implications

This study's results show Americans most vulnerable to the influenza virus and the incurred cost of not meeting the population's needs most affected. The average cost to address food insecurity in the United States is $25 billion; forgoing this approach comes at an opportunity cost of $10 billion in lost wages and $25 to $60 billion in health care expenses. The current CDC model shows that 9 and 45 million Americans will contract the virus, almost 1 million will become hospitalized, and over sixty thousand will die (CDC,2019). The economic and work force loss as well as the priceless loss of life is the central focus for developing new measure that reduces the impact of the influenza virus in the United States. The quality of a country's workforce heavily relies on the health of the nations. Contracting the influenza virus can have long lasting effects that will outweigh the $25 billion it will cost to reduce food insecurity nationally. Conditions such as pneumonia or bronchitis are illnesses that can require a lifetime of treatment long after the virus has left the body. The influenza virus attacks the lungs, nose, and throat. Infected individuals can develop symptoms such as fever, chills, muscle aches, cough, congestion, runny nose, headaches, and fatigue (CDC, 2019). Illnesses such as obesity, malnutrition, cardio-vascular disease, COPD, lung cancer, and immune compromising disease may worsen and lead to death with the exposure of the influenza virus. Incurable and ongoing, chronic diseases affect approximately 133 million Americans, representing more than 40% of the total population of this country. The projected growth is estimated to be 157 million, with 81 million having multiple conditions (CDC, 2019). Failure to address this preventable illness has the potential to reduce the life expectancy of Americans living with a chronic disease and increase the number of deaths associated with the influenza virus due to the increased prevalence of chronic diseases that worsen influenza outcomes. The HBM suggests that an illness's personal threat, paired with the intervention's perception, can influence individuals to adapt to the necessary change to improve their health outcomes (Kan & Zhang, 2018). The most significant implication of this finding is the overall health benefits that Americans will gain by changing the way they eat as a measure to decrease their likelihood of contracting the influenza virus. This change in nutritional intake can also help reduce malnutrition-related diseases, hypertension, stroke, diabetes, and cardiovascular disease, which are all leading causes of death in the United States. An overall reduction in fatalities related to the above listen to disease has tremendous health and economic benefits as the workforce would be less burden and government expense to address diseases that are the leading cause of death is over 1.5 trillion per year (CDC, 2019). Only $25 billion of this amount is needed to cure hunger, and food insecurity in the United States. This investment leaves room for reinvestment in health infrastructure and technology as less of GDP will be needed to secure the nation's health.

One of the most positive findings of this study is how, widely available access to care has become in the United States. Approximately 96% of the population has somewhere to go when they are sick, and of the remaining 4% who had trouble finding a doctor. This is a positive finding as it is often presumed that access to care poses the greatest threat to Americans' health and well-being. The results showed that residents struggle more with food insecurity than access to care. Ruling out access to care as a risk factor for contracting the influenzas virus, allows for more resources to be devoted to improving transportation to care centers, reducing out-of-pocket costs to patients, providing nutritional stipends, and improving health literacy and health education.

In final, this study's findings also revealed that women were disproportionally affected by the influenza virus in comparison to men. Social factors such as inequality in pay and family obligations were associated with why women frequently leave the workforce. This shift often cost loss of wages which can induce stress, weaken the immune system, and increase influenza susceptibility. Women make up almost half of the workforce at approximately 47% (CDC, 2020). Without new policies, women will continue to be disadvantaged in the workplace, which ranges from being paid less for the same job or being deprived of paid time off to honor family obligations. These factors will continue to widen the gap for women to continue to be the most affected by the influenza virus and food insecurity.

Age and race also play a critical role in influenza outcomes in the United States. Blacks and Whites/Latinos were the most affected by the influenza virus and often also fall in the realm of marginal to high food insecurity. Individuals between the age of 18-64 have the highest instances of food insecurity but is also the prime age for members of the workforce. This loss of wage due to influenza illness increases the nation's health burden. Creating an approach tailored to meet the needs of racial and ethnic groups most affected can change the trajectory of health inequities and reinstate the workforce, stimulating the economy and save lives.

Conclusions

The influenza virus has significant implications in communities that are challenged with food insecurity and weakened immune systems. The health and economic burden in the United States is tremendous as there were an estimated 100 million workdays lost during the 2010-2011 flu season, which equals approximately $7 billion in lost wages. Influenza sick calls accounted for two-thirds of the missed workdays were employer-paid sick time (CDC, 2019). $10 billion in wage loss due to the United States Annually (CDC, 2019). The estimated average annual total economic burden of influenza to the healthcare system and society was $11.2 billion ($6.3 to $25.3 billion). Direct medical costs were estimated to be $3.2 billion ($1.5 to $11.7 billion) and indirect costs $8.0 billion ($4.8 to$13.6 billion) (CDC, 2019).

According to Joel Berg (2020), CEO of Hunger Free America, the cost of ending hunger in the United States at $25 billion. This is significantly less than the cost of healthcare and the loss of wages from influenza and the priceless loss of life in the United States each year. The data from this study showed that food insecurity is a pressing need for individuals most susceptible to the influenza virus. Meeting this community's needs can change the influenza virus's footprint and reduce the health and economic burden in the United States each year. Eliminating food insecurity can change the lives of an estimated 9and 45 million Americans that contract the influenzas virus each year, the 140,000 to 810,000 Americans who become hospitalized or 64,000 lives lost annually. Americans have demonstrated their willingness to change their diet if their health is personally affected (Gonzalez 2017). The supermarket study conducted by Adjoin et al. (2017), conducted in one of the United States' most vulnerable community, showed that Americans would make better choices when healthier foods are available. The findings from this study can be used to raise awareness about the role nutrition plays in the presence of the influenza virus and inform healthcare stakeholders about where the greatest needs are and make a positive contribution to social change by improving the response to the influenza virus in the United States.

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