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Predictors of Nutritional Status Among U.S. Adults

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The purpose of this study was to more fully understand the reasons underlying poor nutritional status among adults in the United States (US) and to provide research findings that can be used to develop programs and policies to help improve nutritional status in the US. The National Health and Nutrition Examination Survey (NHANES) dataset and the correlational quantitative study design were used to explore the associations between food security, household smoking, and demographics and nutritional status. The social ecologic theory, specifically the social ecology of health as it relates to interventions, was used as the study's theoretical framework. The results of the regression analyses conducted found statistical significance with respect to the effect of food security on nutritional status. In addition, significant moderation of the relationship by the demographic variable race/ethnicity was found using additional regression models, which incorporated interaction effects. Additionally, correlational analysis was conducted between independent and dependent variables in order to determine whether multicollinearity was present, and strong multicollinearity was found with food security but not with living in a smoking house. Public health professionals should focus on these findings when creating new programs and policies. Doing so may help to improve the nutritional status of the U.S. population.

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Chapter 1: Introduction to the Study

Introduction

Poor nutrition continues to be an important problem in the United States, with adverse health outcomes a common finding in research studies. According to Healthy 2020 most Americans need to improve some aspect of their diet and should avoid unhealthy and nutritious poor diet to avoid the risks for many health conditions (healthypeople.gov, 2017) .I conducted this study to explore the factors underpinning nutritional status. The specific aim of this study was to more fully understand the reasons for poor nutritional status and provide research findings that could be used to develop programs and policies to improve nutritional status in the United States adults.

In this chapter, I present information on the scope of, and rationale for, the current study, as well as the gap in knowledge I hoped to fill. The research problem is presented, along with the purpose of this study and the research questions and hypotheses. The theoretical and conceptual framework are also discussed, along with the nature of the study; the definitions of the independent and dependent variables included within the study; and the assumptions, scope and delimitations, and limitations of the study. The chapter concludes with a discussion of the overall significance of the study and a summary of key points.

Background

About half of all American adults, related to unhealthy eating patterns and have nutritionally deficient diet, food insecurity, and inadequate physical activity (health.gov, 2017). According to food research & action center (2017), poverty and food insecurity,

other conditions such as where people live, learn, work and play, social, and economic status influence their health. In addition, poor or low-income residents often have fewer resources that promote good health; for example, full-service grocery stores that offer affordable and nutritious foods, recreational facilities, and poor housing conditions such as living in a smoking house or lead exposure that harm health (Bell, J., Mora, G., Hagan, E., Rubin, V., & Karpyn, A., (2013); ,Mowen, A.,J., (2010); ,Evans, G., W., & Kantrowitz, E., (2002); Collins, M.B., Munoz, I., & JaJa, J., (2016))

Several researchers findings showed that food insecurity led to significantly nutritionally deficient food choices that eventually increase the risk for number of health issues for example diabetes, heart disease, stroke, obesity, depression, disability, poor oral health and premature mortality rates (Beckles, G., L., & Chou, C. (2016); Ogden, C.,L., Lamb, M.M., Carroll, M.,D., & Flegal, K. M., (2010); , Pratt, L. A. & Brody, D.J.(2014); Courtney- Long, E. A., Carroll, D. D. , Zhang, Q.C., Stevens, A. C., Griffen-Blake, S., Armour, B.S., & Campbell, V.A., (2015)

Also, those living in poverty have higher rates of cigarette smoking, inadequate micronutrient intake and physical inactivity (American Heart Association Statistics Committee and Stroke (2015); Bailey, R.L., Akabas, S. R., Paxson, E. E., Thuppal, S.V., Saklani, S., & Tucker, K., L (2017) . Some previous studies have found significant racial/ethnic differences in eating behaviors that are not related to socioeconomic status (SES) such as African American and Hispanics may face more negative chronic health conditions because of lack of awareness of nutrition-related health risk as compared to their Whites counterparts (Wang, Y., & Chen, X. (2011).

Furthermore, nationally representative data show large disparities across ethnic, income, age and socioeconomic status groups regarding many chronic diseases that directly relates to poor nutrition diet and living conditions (Wang, Y., & Xiaoli, C., 2011). The determinants of health disparities among the US adults are still poorly understood, and there are many controversies present, and eliminating health disparities is a national priority (Wang, Y., & Beydoun, MA, 2007; Agency for Health care Research, 2010; & US Department of Health 2010).

I performed my analyses using a sample of the adult U.S. populace drawn from the National Health and Nutrition Examination Survey (NHANES, 2015) dataset. In this section, although there have been researches on the predictors of nutritional status, much is still unknown. In the current study, I focused on the predictors of nutritional status, which have been minimally examined in previous studies conducted in the area.

Problem Statement

Despite the many medical advances of the past few decades, poor nutritional status remains an important problem within the context of global health (McEniry, 2013). Poor nutritional status is an important concern because it leads to overweight and obesity as well as to other significant health problems (Jaime & Lock, 2009; Adair, Popkin, & Ng, 2012). These problems include non-communicable diseases such as cancer, cardiovascular disease, and diabetes, which are overburdening health systems (Fanzo, 2015). The current nutritional status of individuals in the United States is poor, according to Dong et al. (2014). The prevalence of overweight has been increasing in recent years

in the United States, and approximately 35% of the U.S. population is currently considered overweight (Hruby & Hu, 2015). Overweight is defined as having a body mass index (BMI) greater than or equal to 25 while obesity is defined as a BMI greater than or equal to 30 (World Health Organization, 2016).

Poor nutritional status also contributes to other health problems among adults in the United States (Combs & McClung, 2016; Nestle, 2007). For example, researchers have found that more than 20% of individuals in the United States have metabolic syndrome, which can lead to diabetes (Ford, Giles, & Dietz, 2002), Ford et al. (2002) also found important associations between poor nutrition and the prevalence of heart disease and diabetes among U.S. adults. They noted that improved nutrition would likely serve to substantially reduce the incidence of these diseases (Ford et al., 2002).

A better understanding of the predictors of nutritional status might allow for the development of programs that might improve the nutritional status and health of individuals in the United States (Peter et al., 2015). According to Szabolcs et al., 2014, not enough is being done to improve nutrition among the U.S. population. Furthermore, a gap in the literature existed in relation to what measures impact nutritional status among adults in the United States. Although predictors of nutritional status have been examined in previous literatures mentioned above, Peter et al., 2015; Szabolcs et al., 2014 & Ford et al., 2002, many of the predictors have not yet been thoroughly examined within the context of sampling that would allow for greater generalizability and would produce results with an acceptable level of external validity. Additionally, the ways in which predictors or potential predictors of nutritional status might be moderated by

demographic factors such as an individual's gender, race/ethnicity, age, and socioeconomic status have also not been well examined in the previous literatures.

The aim of this study was to add to this body of literature by examining food security and living in a smoking household as predictors of nutritional status. I also examined the potential moderating effects of demographic factors, namely gender, race/ethnicity, age, and socioeconomic status. I performed my analyses using a sample of the adult U.S. populace drawn from the National Health and Nutrition Examination Survey (NHANES, 2015) dataset. In this section, although there has been research on the predictors of nutritional status, much was still unknown. In the current study, I focused on the predictors of nutritional status, which have been minimally examined in previous studies conducted in the area.

Additionally, there is a paucity of literature focusing specifically on the impact of respondent demographics as significant moderators of the relationship between potential predictors of nutritional status and nutritional status itself (Centers for Disease Control and Prevention [CDC], 2014). The use of random sampling by the NHANES program allowed for generalizability and high external validity (Kukull, W. A., & Ganguli, M. (2012).

In addition, the large sample size provided for high statistical power to perform statistical analyses. Serious health conditions are currently rife in the United States. By better understanding what measures affect nutritional status, researchers and policy makers should have a more complete grasp of the factors, which relate to one of the most important precursors of health. With this knowledge, they may be able to improve the

health status of individuals by developing public policy and programs related to individual and family health decisions. Additionally, the examination of demographic measures as additional predictors would provide a more comprehensive understanding of nutritional status. This information would also allow for the creation of programs and recommendations that were highly tailored to an individual's demographics based on this study's findings. The application of the results of this study could help to reduce the incidence of serious medical conditions, including heart disease, diabetes, and cancer, among the U.S. population in general.

Purpose of the Study

The purpose of this study was to improve understanding of the predictors of nutritional status. I performed my analyses using the NHANES dataset. NHANES contains data that can be used to examine the health and nutritional status of adults and children in the United States (CDC, 2014); the data combine interviews with physical examinations. The NHANES program began in the early 1960s. Researchers have examined a nationally representative sample of approximately 5,000 individuals each year since the program began (CDC, 2014). The NHANES interview includes questions on respondent demographics and socioeconomic factors, as well as diet and health. The physical examination includes medical, dental, and physiological components (for example LDL or HDL, and BMI), along with laboratory tests that are administered by medical professionals (CDC, 2014).

Through an analysis of NHANES data, I sought to obtain a better understanding of the predictors of nutritional status, including the moderating role of respondent

demographics (gender, race/ethnicity, age, and socioeconomic status). Specifically, I examined the associations between the independent variables of food security, household smoking, and the moderating variable demographics, the dependent variable, and nutritional status. According to the CDC (2014), reduced food security is the state of not having reliable access to a sufficient quantity of affordable, nutritious food. Reduced food security is associated with poorer nutritional status; researchers surmise that reduced food security makes individuals more likely to choose less expensive and unhealthier food options, leading to poor nutritional status (Peter et al., 2015; Szabolcs et al., 2014 & Ford et al., 2002). They also hypothesize that household smoking is associated with reduced nutritional status, on the basis that smokers are likely to choose less healthy choices in other areas of life. By determining the predictors of nutritional status, it should be possible to gain a better understanding of what might lead to poor nutritional status and related disease, as nutritional status has already been established as an important factor in the contracting of serious medical conditions (Campbell & Campbell, 2006).

Research Questions and Hypotheses

The research questions developed for this study were the following:

Research Question 1: Is food security associated with good nutritional status?

Research Question 2: Is living in a smoking household associated with poor nutritional status?

Research Question 3: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status?

Research Question 4: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status?

The alternative and null hypotheses were, as follows:

Hypothesis 1_A: Food security is associated with good nutritional status.

Hypothesis 1_0: Food security is not associated with good nutritional status.

Hypothesis 2_A: Living in a smoking household is associated with poor nutritional status.

Hypothesis 2_0: Living in a smoking household is not associated with poor nutritional status.

Hypothesis 3_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status.

Hypothesis 3_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between food security and nutritional status.

Hypothesis 4_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status.

Hypothesis 4_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between living in a smoking household and nutritional status.

Food security was measured as an index composed of the following three items: whether the respondent was worried that his or her food would run out before obtaining money to buy more, whether the food bought would not last and there was not enough money to buy more food, and whether the respondent could not afford to eat balanced meals. The statistical measures used to determine food security also included

- Whether in the past 12 months the respondent ever cut the size of his or her meals or skipped meals because there was not enough money for food and how often this happened;
- Whether in the past 12 months the respondent ever ate less than he or she felt that he or she should because there was not enough money for food;
- Whether in the past 12 months the respondent was ever hungry but did not eat because there was not enough money for food;
- Whether the respondent lost weight because there was not enough money for food;
- Whether the respondent ever did not eat for a whole day because there was not enough money for food and how often this happened;
- Whether the respondent received Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits in the past 12 months;
- And whether the respondent currently received Supplemental Nutrition Assistance Program (SNAP) benefits or food stamps.

With respect to smoking within the household, the respondent was asked if anyone smokes inside the home. With regard to the outcome measure included in this

study, the dependent variable of nutritional status was based on the following information derived from NHANES questions: how healthy the respondent felt that his or her overall diet was, and how many meals the respondent ate in the past 7 days that were prepared away from home in places such as restaurants, fast food places, food stands, and grocery stores, or which came from vending machines. As discussed in later chapters 2, & 3, I also assessed additional outcomes consisting of the number of meals that the respondent got from a fast food or pizza place.

Theoretical Framework for the Study

The theoretical framework for this study was based on social ecologic theory, specifically the social ecology of health as it related to interventions. Specifically, sets of five important factors had been identified, which consists of the following: intrapersonal factors, interpersonal processes, and primary groups, institutional factors, community factors, and public policy (Sallis, Owen, & Fisher, 2015). Intrapersonal factors incorporate knowledge, attitudes, behavior, self-concept, skills, and developmental history, while interpersonal processes and primary groups incorporated formal and informal social networks and social support systems, which included family and friends as well as coworkers. Institutional factors incorporated social institutions with organizational characteristics, along with formal and informal rules and regulations. The population health depended on environmental factors such as employment, income security, educational opportunities, public health policy, engaged and active communities and community factors (Lantz & Pritchard, 2010). Within this model, behavior remained the outcome of interest, with behavior viewed as being determined on the basis of all of

these factors. Within the context of this proposed study, these factors were all deemed to be important in influencing individual health behavior.

Additionally, the framework used in the study was based on Evans et al.'s (2001) model of the social production of disease, which helps to explain how health inequalities begin and are maintained in societies. Within the context of the current study, it was expected that large health inequalities will exist in the US population, and that class differences will impact measures that then impact nutritional status, explaining some of the variations in the disparities in the outcomes.

Nature of the Study

The study was a correlational quantitative study examined the relationship between a number of variables and the outcome of nutritional status. According to Curtis, E, Comiskey, C. & Dempsey, O (2016), findings from the correlational research could be used to determine prevalence and relationships among variables and to forecast events from current data and knowledge. Furthermore, findings generated from the correlational research could be used to inform decision- making, and to improve or initiate health-related activities or change. A quantitative method was required for the purposes of hypothesis testing, which was an important component of the present study.

With regard to data analysis, initially, a series of descriptive statistics were calculated on these data in order to illustrate the distribution of responses for the variables of interest included within this study, as well as to present an initial illustration of the participants included within the proposed dataset. These descriptive statistics consisted of frequency tables in the case of categorical measures, with the sample sizes and

percentages of responses reported for every response category, and measures of central tendency and variability for the continuous measures of interest included within this study.

The measures of central tendency used here were consist of the mean and median, with the measures of variability calculated and reported consisting of the standard deviation, minimum and maximum scores, and range. Following this, a series of regression analyses were conducted seeking to test the hypotheses of this study. The method of regression used was determined on the basis of the level of measurement of the dependent variable in question and was consist of linear regression in cases where the dependent variable was a continuous and logistic regression in cases where the dependent variable was dichotomous. Moderation was tested for by first standardizing, which was rescaling the variable of all of the independent variables included within these analyses, and then calculating interaction effects as the products of these standardized variables. These standardized predictors, as well as the calculated interaction effects, was included in a series of regression models, and with significance relating to these interaction effects serving to signify significant moderation by the demographic variables of interest included within these analyses.

Definitions

The dependent variable in the study was nutritional status while the independent variables were food security, living in a smoking household, and moderating factor demographics. Study-specific definitions for these variables follow:

Food security: The state of having reliable access to a sufficient quantity of affordable, nutritious food (CDC, 2016).

Living in a smoking household: Inhalation of the smoke of burned tobacco or some chemicals such as nicotine occasionally or habitually (Aurelio, L. Leone, A. & Landini, L, 2010). Cigarette smoking has been linked to poor nutrition (Mlčochová, 2013). Specifically, smokers have been found to have less healthy eating habits, eating more fried foods as well as fewer vegetables and fruits (Mlčochová, 2013). Furthermore, previous researchers have indicated that an increase of cigarette smoking results in a decrease in healthy food consumption; researchers have also found an inverse relationship between the frequency of eating fast food and cigarette smoking in Black individuals, with this relationship being direct in the case of White individuals (Pereira et al., 2005).

Demographics: The statistical characteristics of human population such as gender, age, race/ethnicity, or income (Merriam- Webster dictionary, 2018). Previous researchers have found based on statistical data that males to consume more fast food, and females to have more positive dietary attitudes (Yon, Han, & Hyun, 2008). Concerning the relationship between age and fast food consumption, the likelihood of eating fast food has been found to decrease as age increases (Bowman & Vinyard, 2004; Satia, Galanko, & Siega-Riz, 2004). About the level of education and income, previous researchers have found high socioeconomic status to be associated with obesity (Drewnowski et al., 2014), with higher household income associated with higher consumption of fast food (Bowman

& Vinyard, 2004). Regarding race/ethnicity, Blacks have been found to consume more fast food than other racial groups (Bowman & Vinyard, 2004).

Nutritional status: The health condition of a person that is influenced by the intake of and utilization of nutrients in different parts of the body (CDC, 2017).

Assumptions

All studies made some assumptions, which were aspects of the study that were believed to be true but could not be definitively determined to be true. Since the current proposed study focused upon the analysis of survey research, it was assumed that respondents answered truthfully. Due to the fact that anonymity and confidentiality were assured in the administration of the NHANES, and because the participants in the study were volunteers who were able to withdraw from the study at any time without ramifications; it is believed that the possibility of respondents having provided untruthful answers was very slight.

Because the surveys were conducted anonymously and that the respondents did not give socially desirable answers, want to appear better than they were, they didn't want to give the answer they believe would help or please the researcher & they could influence the outcome of the research in their favor. It is also assumed that respondents understood the directions from the individual administering the survey. These assumptions were necessary to make in the context of this study as it was impossible to determine whether respondents responded truthfully and whether they understood the directions.

Scope and Delimitations

The scope of this study was explicitly limited to the outcome of nutritional status, which had been defined in greater detail elsewhere in this proposal. This specific scope was chosen due to the growing problems of poor health and poor nutrition among the American population. A closer analysis of the factors that served to impact nutritional status would help to provide additional insight as to what could be done to improve these important outcomes.

Concerning internal validity, there was always the possibility that some unknown or unmeasured confounding variable may explain an apparent relationship between some predictor and some outcome. To reduce this possibility, a strong series of demographic variables were included for analysis in this study. The results relating to any specific predictor on the outcomes focused upon within the study were calculated using a regression methodology as a control for all demographic variables included in the analysis.

The study population was composed of individuals living within the U.S population. For external validity, since representative sampling was used in NHANES, the results of the analysis could be generalized to the U.S. adult population, again excepting the small percentage of individuals and groups that were excluded from this population initially by NHANES.

Limitations

Any study conducted would have certain limitations. One limitation of the current study was that the results could not be generalized to the specific groups within the U.S.

that were excluded from the population sampled and to those outside of the U.S. Additionally, these data were collected at a particular point of time and were therefore dependent upon the conditions present at that time, and this might limit the external validity of the study, which means that results of this study could not be generalized. A final limitation consists of the fact that causality could not be determined in the current study.

With regard to potential biases, due to the use of representative sampling by NHANES, selection bias, reporting bias, exclusion bias, and attrition bias were not felt to be of substantial concern here. Similarly, because this study simply involved the use of a survey, it was also not felt that observer bias would be an important concern. Furthermore, the NHANES researchers did not have a financial investment or gain for the survey that this study used; thus, it is less likely to be biased. Recall bias was a potential problem in that respondents might not correctly remember specific events or report them accurately. However, since the respondents were asked about recent events, recall bias was not felt to be a very substantial problem concerning these current NHANES (2015) survey data. Additionally, while social desirability bias could be an issue with survey research, the types of questions asked did not relate to sensitive topics (i.e., asking about sexual behavior, criminal history, etc.); therefore, this bias was also not felt to be an essential concern within the context of the present study.

Significance

This study hoped to expand the understanding of the factors that impact nutritional status among adults in the U.S. While previous research had determined that

the U.S. was currently rife with poor nutrition, there existed a gap in the literature as to what factors served to impact this critical outcome. The knowledge that would be obtained from this study would help to expand our understanding of this area and would help determine what could be done to help improve nutritional status among Americans, both about this study as well as concerning public policy. The results of this study could be used by schools, parents, individuals, and the government to help improve the nutritional status and overall general health of adults in the U.S.

Summary

This chapter introduced this study as well as its purpose. The background and problem statement were presented, along with the research questions and proposed hypotheses, the theoretical and conceptual framework for the study, the nature of the study, along with definitions, assumptions, the scope and delimitations, limitations, and the significance of the study. The following chapter would discuss previous studies conducted in this area, both with regard to studies focusing on nutritional status, as well as studies using the theoretical framework used within this study.

Chapter 2: Literature Review

Introduction

The purpose of this study was to improve understanding of factors that have an impact on the nutritional status of the U.S. adult population, focusing specifically on the following predictors of nutritional status: food security and living in a smoking household. Additionally, I examined whether the demographic factors of gender, race/ethnicity, age, and socioeconomic status were moderators of the relationships between these three predictors and nutritional status. By providing a better understanding of factors that relate to nutritional status, this study could fill the gap in the literature and potentially be used to improve nutritional status through public policy and individual and family health decisions.

This chapter begins with a presentation of the literature search strategy I used. Following this review is an overview of the theoretical foundation that underpinned the study. The literature review section that follows includes a discussion of previous quantitative research relevant to the present study. A summary of findings from the review is presented at the end of the chapter.

Literature Search Strategy

I used Google Scholar to search the literature. Google Scholar includes books and journal articles, as well as other publications such as conference presentations. The key search terms and combinations of search terms that were used as part of this literature search included the following: *nutritional status* (the dependent variable) and *age*, *gender*, *race/ethnicity*, *food security*, and *smoking* (the independent variables). In

searching for literature, I focused upon peer-reviewed journals published between 2000 and 2017. The search terms used to develop the study's theoretical foundation included *health* and *theory* along with *nutrition* and *theory*. The literature search produced approximately 100 studies. I reviewed and categorized these studies based on their methodology and relevance to the current study; this review produced a total of 15 studies that directly related to the research questions used in this study. Studies that were not relevant international studies were not included if relevant U.S.-based studies could be found. I only selected U.S. studies. An analysis of the 15 studies conclusively established that there is a gap in knowledge relative to the ability to predict nutritional status. My aim in conducting this study was to help fill this important gap in the literature.

Theoretical Foundation

The theoretical framework for this study was based on social ecologic theory (Bronfenbrenner, 1970) specifically the social ecology of health as it relates to interventions. According to Healthy 2020, the social ecological model can assist health care professionals to understand how layers of influence of network to shape a person's food and physical activity choices. A diagram illustrating the model is shown in Figure 1. Reprinted from Centers for Disease Control, 2014)

According to the social ecological theory (1970), intrapersonal factors incorporate knowledge, attitudes, behavior, self-concept, skills, and developmental history while interpersonal processes and primary groups incorporate formal and informal social networks and social support systems, which include family and friends as well as coworkers. Institutional factors encompass social institutions with organizational characteristics, along with formal and informal rules and regulations. Population health gains depend on environmental factors such as employment, income security, educational opportunities, public health policy, and engaged and active communities (Lantz & Pritchard, 2010). Within social ecologic model, behavior remained the outcome of interest, because with behavior viewed as being determined on the basis of all of these factors. Within the context of this study, the social ecologic factors that include intrapersonal, interpersonal, institutional, population and community factors were all important in influencing individual health behavior.

For the framework, I also incorporated Evans et al.'s model of the social production of disease, which helps to explain how health inequalities begin and are maintained in societies (Evans et al., 2001). Within the context of the current study, I expected that large health inequalities would exist in the U.S. population, and that class

differences would affect measures that would then have an effect on nutritional status, explaining some of the variations in the disparities in the study's outcome.

Literature Review Related to Key Variables and/or Concepts

The literature was conducted to determine what is already known about predictors of nutritional status. Initially, I reviewed studies whose authors had broadly examined the influence of anthropometric variables, which is a measurement of the different parts of human body on nutritional status. In one such study, the authors predicted nutritional status among children in Ethiopia (Markos, Doyore, Yifiru, & Haidar, 2014). In another study, smoking was found to be associated with poorer nutritional status, suggesting that living in a smoking household would likewise be associated with poorer nutritional status (McEniry, 2013). Nestle (2007) identified a number of important links between demographics and nutritional status. In conclusion, living in a smoking house increases the risk of poorer health as compared to living in a non-smoker house.

Food Security

Food insecurity was the main cause of inadequate nutrition (von Braun, 1999). A recent study found that 14.3% of households were food insecure at least one point during 2013, with 5.6% having very low food security, defined as the food intake of at least one household member was reduced, with their eating patterns were disrupted due to the lack of money or other resources (Coleman-Jensen, Gregory, & Singh, 2015). While a rampant problem in low-income countries, food insecurity also impacted those living in changing or unstable economic conditions as well as some people in wealthy countries

(von Braun, 1999). However, the impact of food insecurity on nutritional status among adults in the U.S. had been understudied in the literature.

Food being available did not necessarily mean that adequate nutrition could be achieved, as there were large variations in the nutritional quality of food (Lawrence, Lyons, & Wallington, 2013). As the cost of food increased, individuals increasingly purchased a greater quantity of cheaper food of reduced nutritional quality. In particular, cheaper foods tend to have greater amounts of sugar, fat, and salt. Similarly, as the costs of food rose, and during times when the global economy worsened, individuals spent less money on organic food, which might be more nutritious, than other food (for example fast food). This suggested a relationship between food security and nutritional status (Lawrence et al., 2013; Gundersen & Ribar, 2011; Armar-Klemesu, 2001). An increase in food prices decreased the purchasing power of poor individuals, leading to poorer nutritional status as their diet worsened and their food consumption decreased (Global Monitoring Report, 2012).

A study by Guillen and Rivas (2006) examined the nutritional status and household food security among women in Venezuela, focusing upon economic, social, demographic, and nutritional conditions. It was found that nutritional status could be predicted by right middle-arm circumference, household food security level, and supplementation with vitamins and/or minerals.

Living in a Smoking Household

Cigarette smoking had been linked to poor nutrition (Mlčochová, 2013). Specifically, smokers had been found to have less healthy eating habits, eating more fried

foods as well as fewer vegetables and fruits (Mlčochová, 2013). Also, previous research has indicated that an increase of cigarette smoking resulted in decrease healthy food consumption, an inverse relationship between the frequency of eating fast food and cigarette smoking in black individuals, with this relationship being direct in the case of white individuals (Pereira et al., 2005). Other research had identified a "cluster" of negative health behavior, which consist of smoking, poor nutrition, excess alcohol, and physical inactivity suggesting the smokers tend to also have poor nutrition, among other negative health behaviors (Noble, Paul, Turon, & Oldmeadow, 2015).

Other research had confirmed that smokers tend to have worse eating habits and behaviors as compared with non-smokers, being more likely to eat and crave sweet foods, while non-smokers understanding that they must strive to control their own health behaviors for the purposes of improving their general health (Yun, Kim, Jeong, & Joo, 2017). Non-smokers were also more likely than smokers to drink water as compared with other beverages and were also less likely to consume healthy food or balanced nutritional diet (Yun et al., 2017).

Overall, this research suggested poorer nutritional status among smokers. However, a direct link between passive smoking and nutritional status had not yet been identified (Committee on Scientific Evaluation of WIC Nutrition Risk Criteria, 1996). This study hoped to fill this important gap in the literature. Some research had indicated that passive smoking has anti-nutrient effects (Shils & Shike, 2006), though whether this extends to the measures of nutritional status used in this present study remained to be seen.

Demographics

Next, with respect to demographics, previous studies had analyzed gender differences in nutritional status in various populations. Previous research had found males to consume more fast food, and females to have more positive dietary attitudes (Yon et al., 2008). With respect to the relationship between age and fast food consumption, the likelihood of eating fast food had been found to decrease as age increases (Bowman & Vinyard, 2004; Satia et al., 2004). With regard to the level of education and income, previous research had found high socioeconomic status to be associated with obesity (Drewnowski, et al., 2014), with higher household income being associated with a greater consumption of fast food (Bowman & Vinyard, 2004). With respect to race/ethnicity, Blacks had been found to consume more fast food than other racial groups (Bowman & Vinyard, 2004). Never married individuals are also more likely to eat fast food than married couples (Satia et al., 2004).

Another study found demographic and socioeconomic factors, which related to diet quality, to significantly predict nutritional status (Alkerwi et al, 2015). This study focused upon a sample of respondents in Luxembourg and measured diet quality using five dietary indicators, recommendation compliance index, recommended foods score, non-recommended foods score, energy density score, and dietary diversity score.

The Correlated Component regression technique called CCR is that it predicted the dependent variable based on correlated components was used in order to find the importance and magnitude of the association of the predictors with diet quality. The results of this study found that age (over 18 adults), gender (male/female), and

socioeconomic status, specifically living below the poverty line, were the most important factors associated with eating a high-energy-dense diet. Education was found to be an important factor in predicting healthy and adequate food choices, as education improves economic resources that predominates the predictors relating to food diversity and energy density (Alkerwi et al, 2015). Although these studies suggested important links between demographics and nutritional status, no studies were found analyzing these demographics as moderators. This represented an important gap in the literature, which this study hoped to explore.

Summary of the Literature Review

Overall, a review of the studies indicated that very similar methodologies and methods used were consistent with those of the current study. These studies were all empirical, quantitative studies, which used correlational or similar designs. These researchers were found to have approached the problem and the strengths and weaknesses inherent in their approaches by being conservative in their research; for example, by limiting the generalizability of the results obtained as appropriate. The selection of the variables included for analysis in the current study is based partially on this literature review, but also on the researcher's interests. With regard to nutritional status (dependent variable), the independent variables would be analyzed in the current study and the important gap in the literature. However, the inclusion of variables in the current study that was previously studied would help to validate those previous results in a very contemporary sample of adult U.S. respondents.

Summary and Conclusions

Overall, previous research regarding the relationship between the independent variables was analyzed in this study and nutritional status was very limited, with important gaps in the literature found based on the literature review conducted. The following chapter would discuss the methodology for this study, including the research design and rationale, the data analyzed, the operationalization of the variables proposed for study, the data analysis plan, threats to validity, and ethics.

Chapter 3: Research Method

Introduction

The purpose of this study was to improve understanding of factors that have an impact on the nutritional status of the U.S. adult population, focusing specifically on the following predictors of nutritional status: food security and living in a smoking household. Additionally, I examined whether the demographic factors of gender, race/ethnicity, age, and socioeconomic status were moderators of the relationships between these three predictors and nutritional status. Specifically, I sought to examine the associations between the independent variables (food security, household smoking, and demographics) and the dependent variable, nutritional status.

This chapter begins with an overview of the research design and rationale for this study. This overview includes a discussion of the variables included in the study, the research design used, and how this research design related to the research questions tested in this study, as well as time and resource constraints. The subsequent section focuses on research methodology, with discussion of the target population; sampling and sampling procedures; and procedures for recruitment, participation, and data collection. Following this section, the operationalization of the variables is discussed, along with the data analysis plan for this study, threats to validity, and ethical procedures.

Research Design and Rationale

I examined the impact of food security, household smoking, and demographics on nutritional status among adults in the United States. The entire sets of measures included within this study, including dependent, independent, and moderating variables, are

summarized in Table 1. These variables are discussed in further detail later in this section.

Table 1

Summary of Variables Included in the Study

Category	Measure	Description
Dependent Variables		
their	DBQ.700	How healthy the respondent feels that overall diet is
	DBQ.895 G/Q	The number of meals that the
respondent ate		in the past seven days that were
prepared		away from home in places such as restaurants, fast food places, food
stands,		grocery stores, or from vending
machines		
	DBQ.900 G/Q	The number of the meals mentioned question DBQ.895 G/Q
Independent Variables		
Food Security	FSQ.032 A	Whether the respondent was worried
whether		their food would run out before they
got		money to buy more
	FSQ.032 B	Whether the food that they bought
just didn't		last and they didn't have enough
money to		get more food
	FSQ.032 C	Whether they couldn't afford to eat
balanced		meals
	FSQ.041	Whether in the last 12 months the
respondent		ever cut the size of their meals or
skipped		meals because there wasn't enough
money		for food
	FSQ.052	How often this happened (FSQ.041)
	FSQ.061	Whether in the last 12 months the
respondent		ever ate less than they felt they should because there wasn't enough money
for food		
	FSQ.071	Whether in the last 12 months they
were ever		hungry but didn't eat because there
wasn't		enough money for food
	FSQ.081	Whether they lost weight because
there		wasn't enough money for food
	FSQ.092	Whether they ever didn't eat for a
whole day		because there wasn't enough money
for food		
	FSQ.102	How often this happened (FSQ.092)

(table continues)

	FSQ.162	Whether they received WIC benefits in the past 12 months
	FSQ.755	Whether they currently get SNAP or Food Stamps
Smoking	SMQ.470	The number of people who live in the respondent's residence who smoke cigarettes, cigars, little cigars, pipes, water pipes, hookah, or any other tobacco product inside the home
	SMQ.480	The number of days in the past seven days that someone smoked inside the respondent's home
Moderating Variables	DMQ.020	Gender
	DMQ.010	Age
	DMQ.263	Race/Ethnicity
	DMQ.141	The highest grade or level of school completed or the highest degree received
	INQ.200	Total income in the last calendar year

Category	Measure	Description

I measured the outcome or dependent measure of nutritional status in three ways using the following set of variables included in the NHANES dataset: how healthy the respondents feels that their overall diet is (DBQ.700), the number of meals that the respondent ate in the past 7 days that were prepared away from home in places such as restaurants, fast food places, food stands, grocery stores, or from vending machines (DBQ.895 G/Q), and the number of meals mentioned in question DBQ.895 G/Q (restaurants, food stands, grocery stores, or from vending machines) that the respondent got from a fast food or pizza place (DBQ.900 G/Q).

The independent variables consisted of food security, household smoking, and moderating factor demographics. With respect to food security, the index consisted of the following three items: whether the respondents was worried that their food would run out before they got money to buy more (FSQ.032 A), whether the food that they bought just didn't last and they didn't have enough money to get more food (FSQ.032 B), and whether they couldn't afford to eat balanced meals (FSQ.032 C). Measures also included for analysis would be whether in the last 12 months the respondent ever cut the size of their meals or skipped meals because there wasn't enough money for food (FSQ.041), how often this happened (FSQ.052), whether in the last 12 months the respondent ever ate less than they felt they should because there was not enough money for food (FSQ.061), whether in the last 12 months they were ever hungry but did not eat because there wasn't enough money for food (FSQ.071), whether they lost weight because there wasn't enough money for food (FSQ.081), whether they ever didn't eat for a whole day because there wasn't enough money for food (FSQ.092), how often this happened (FSQ.102), whether they received WIC benefits in the past 12 months (FSQ.162), and whether they currently get SNAP or Food Stamps (FSQ.755) in the survey questionnaire.

The measurement used for smoking in the household was the number of people who live in the respondent's residence who smoke cigarettes, cigars, little cigars, pipes, water pipes, hookah, or any other tobacco product inside the home (SMQ.470), along with the number of days in the past 7 days that someone smoked inside the respondent's home (SMQ.480). Respondent demographics included the following measures: gender (DMQ.020), age (DMQ.010), respondent race/ethnicity (DMQ.263), and socioeconomic

status, which was measured as the highest grade or level of school completed or the highest degree received (DMQ.141) along with total income in the last calendar year (INQ.200).

With regard to this study's research design, this study would incorporate a quantitative methodology and would implement a correlational research design. A quantitative methodology was selected for the present study, as this is necessary for the purposes of hypothesis testing, which was a crucial aspect of this study. The correlational study design determined the relationship between two variables that appeared to be related and that it opened up a great deal of further research to other scholars. Finally, it allowed researchers to determine the strength and direction of a relationship so that later studies can narrow the findings down and if possible, determine the causation experimentally.

A correlational design was proposed as the focus of this study as the relationship between the predictors proposed for analysis and the outcomes of health and nutritional status as this study aimed to help future scholars for further research as well as a change in policy making in present time.

Using archival data, this study does not incorporate any time or resource constraints, while a review of the literature presented in Chapter 2 indicates that the research design choice proposed for the current study is consistent with those used in previous studies.

Methodology

Population

The NHANES uses a nationally representative sample of the resident, civilian, non-institutionalized U.S. population. It excluded individuals that were in supervised care or custody in institutional settings, all active-duty military personnel, active-duty family members living overseas, and any other U.S. citizens that reside outside of the 50 states and the District of Columbia. Non-institutional group quarters are included within the sample. The current U.S. population is close to 320 million, which is a little higher than the population base for the NHANES due to the individuals and groups omitted from NHANES.

Sampling and Sampling Procedures

The methodology used by NHANES incorporates a four-stage sample design, with the first stage consisting of selecting Primary Sampling Units (PSUs) from all U.S. counties (CDC, 2014). These PSUs were selected with probabilities that were proportionate to a measure of size. The second stage of selection included a sample of area segments, which were comprised of census blocks or combinations of blocks. The purpose of the sampling methodology was to produce approximately equal sample sizes in each PSU. The third stage of sample selection consisted of dwelling units, which included noninstitutional group quarters, such as dormitories.

Within each PSU, a listing of all dwelling units was prepared, with a subsample of these then determined for screening to identify potential sample participants. Subsampling rates were determined in order to produce a national, approximately equal

probability sample of households. With respect to the fourth stage of sample selection, this consisted of persons within dwelling units. This included all eligible members within a household, with subsamples of these individuals being selected based upon demographic measures, including sex, age, race/ethnicity, Hispanic origin, and income.

Archival data: With respect to NHANES, procedures for recruitment and participation included a series of steps. First, the sampling procedures were implemented, with the final result consisting of a list of households being identified for inclusion in the NHANES sample. At this point, a letter was mailed to the address of each household informing the occupant or occupants that an NHANES interviewer would visit that residence. The household interview component consists of Screener, Sample Person, and Family interviews, with each of these interviews being associated with a separate questionnaire. Trained household interviewers administer all three of these questionnaires, with the interview setting generally consisting of the survey participant's residence.

With respect to data collection, interview data were recoded using a Blaise format computer-assisted personal interview (CAPI) system, a statistical computer program for commonly and often used for recording survey questionnaire responses. When arriving at the respondent's home, the interviewer presents his/her official identification badge and briefly explains the purpose of the survey. If the respondent had not seen the letter that was sent out, a copy of it was given to the respondent by the interviewer to review. The interviewer then requested that the respondent answer a brief questionnaire, which served to determine whether he/she is eligible to participate in NHANES. The interviewer then

attempted to recruit each eligible individual as a respondent for the survey. The interviewer also explained the household questionnaires to all eligible participants who were above the age of 16, informs potential respondents of their rights, and provides assurances relating to confidentiality.

Most household interviews were conducted when the interviewer initially arrived at the respondent's residence, though when necessary, an appointment was made to administer the household interview questionnaires at a later time. Household interviews for minors under the age of 16 were conducted with a proxy, which is usually the minor's parent or guardian. If no individuals in the household were above the age of 16, participants under the age of 16 could self-report. Interviewers also requested participants to sign an interview consent form, which stated that the participant agreed to participate in the household interview portion of the survey. A parent or guardian would sign for participants who are 16 or 17 years of age.

Following the completion of the household interview, the interviewer would review a second informed consent brochure with the participant, which contained information relating to the NHANES health examination component. All individuals that were interviewed were asked to complete this component of the survey, and all who agreed were asked to sign additional consent forms for this component of the survey.

At this time, the interviewer then telephones the NHANES field office in order to schedule an appointment for the examination. The interviewer then informed participants that they could receive remuneration and reimbursement for transportation and childcare expenses.

I gained access to this data set through the NHANES website, as these data were publicly and freely available online. No additional permissions were required in order to gain access to these data.

Instrumentation and Operationalization of Constructs

Operationalization and measurement/manipulation of the study variables along with how they were calculated, and what scores represented, are largely derived from how they were measured within the NHANES study.

Nutritional status. Nutritional status would be focused upon as the outcome measure of interest within this study. Nutritional status would be measured using the following variables: DBQ.700: "Next I have some questions about {your eating} habits. In general, how healthy is {your/his/her} overall diet? Would you say…" DBQ.895 G/Q: "Next I'm going to ask you about meals. By meals, I mean breakfast, lunch, and dinner. During the past 7 days, how many meals {did you/did SP} get that were prepared away from home in places such as restaurants, fast food places, food stands, grocery stores, or from vending machines?"; and DBQ.900 G/Q, "How many of those meals {did you/did SP} get from a fast-food or pizza place?"

The response categories for DBQ.700, how healthy the respondent's diet is, are "Excellent", "Poor", "Refused", and "Don't know". For the purposes of analysis, the response categories of "Refused" and "Don't know" will be recorded as missing. The remaining response categories will not be recoded, with this measure being measured on a five-point Likert scale, with "Excellent" having a code of "1", and "Poor" being coded as "5". Next, with regard to DBQ.895 G/Q and DBQ 900 G/Q, valid data for these

questions consisted of a two-digit whole number representing the exact number of instances relating to this question. Additional response categories are “None“, “Refused”, and “Don’t know”. The response category of “None“ will be recoded as zero for the purposes of analysis, with the remaining two additional response categories being recorded as missing.

Demographics. The independent variables included in this study would consist of measures relating to food security, living in a smoking household, and demographics. The moderating factors demographics would consist of the following measures: DMQ.020, which measures respondent gender as verification of the respondent’s gender; DMQ.010, which measures respondent age: “Verify or ask date of birth and age”; DMQ.141: “What is the highest grade or level of school {you have/SP has} completed or the highest degree {you have/s/he has} received?”; INQ.200: “Now I am going to ask about the total income for {you/NAME(S) OF OTHER FAMILY/you and NAMES OF FAMILY MEMBERS} in {LAST CALENDAR YEAR}, including income from all sources we have just talked about such as wages, salaries, Social Security or retirement benefits, help from relatives and so forth. Can you tell me that amount before taxes?”; and DMQ.263: “Please look at the categories on this card. What race or races {do you/does SP} consider {yourself/himself/herself} to be? Please select one or more.”

I coded gender as a dummy variable where females are coded “1”, and males coded “0”. Age is simply coded as the respondent’s age measured as a whole number. This measure will not be recoded for the purposes of analysis. Level of education has the following response categories: “Never attended/kindergarten only”, “1stgrade” through

"12th grade, no diploma", "High school graduate", "GED or equivalent", "Some college, no degree", "Associate degree: occupational, technical, or vocational program", "Associate degree: academic program", "Bachelor's degree (example: BA, AB, BS, BBA)", "Master's degree (example: MA, MS, MEng, MEd, MBA)", "Professional school degree (example: MD, DDS, DVM, JD)", "Doctoral degree (example: PhD, Ed.D)", "Refused", and "Don't know". For the purposes of analysis, the response categories of "Refused" and "Don't know" will be recoded as missing. Additionally, for the purposes of analysis, the responses will be recoded in the following way: Less than high school, High school degree, Associate degree, Bachelor's degree, Master's degree, and Professional school degree or Doctoral degree. Numerical coding will begin with "1" for the category of "Less than high school", and will increase by 1 with each additional recoded response.

Income is the total dollar amount, measured as a whole number. This measure will not be recoded for the purposes of analysis, with the exception of the response categories of "Refused" and "Don't know" being recoded as missing. Race/Ethnicity has the following response categories: "American Indian or Alaska Native", "Asian", "Black or African-American", "Native Hawaiian or Pacific Islander", "White", "Other", "Don't know", and "Refused". The responses of "Don't know" and "Refused" will be recoded as missing for the purposes of analysis, with no other changes made to this measure. Numerical codings are in the order of the races/ethnicities presented, with American Indian or Alaska native" coded "1", through "Other", which is coded "6".

Food security. Food security would be formed using the following measures: FSQ.032 A: “I am going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for {you/your household} in the last 12 months, that is since {DISPLAY CURRENT MONTH AND LAST YEAR}: {I/We} worried whether {my/our} food would run out before {I/we} got money to buy more.”; FSQ.032 B: “The food that {I/we} bought just didn’t last, and {I/we} didn’t have enough money to get more food”; FSQ.032 C: “{I/We} couldn’t afford to eat balanced meals.”; FSQ.041: “In the last 12 months, since last { DISPLAY CURRENT MONTH AND LAST YEAR }, did {you/you or other adults in your household} ever cut the size of your meals or skip meals because there wasn’t enough money for food?”; FSQ.052: “How often did this happen?”; FSQ.061: “In the last 12 months, did you ever eat less than you felt you should because there wasn’t enough money for food?”; FSQ.071: “[In the last 12 months], were you ever hungry but didn’t eat because there wasn’t enough money for food?”; FSQ.081: “[In the last 12 months], did you lose weight because there wasn’t enough money for food?”; FSQ.092: “[In the last 12 months], did {you/you or other adults in your household} ever not eat for a whole day because there wasn’t enough money for food?”; FSQ.102: “How often did this happen?”; FSQ.162: “In the last 12 months, did {you/you or any member of your household} receive benefits from the WIC program?”; and FSQ.755: “Do {you/you or anyone in your household} currently get SNAP or Food Stamps? This includes any SNAP benefits or Food Stamps, even if the amount is small and even if the benefits are received on behalf of children in the household.”

With regard to the three FSQ.032 measures, “Often true” will be coded “1”, “Sometimes true” coded “2”, “Never true” coded “3”, “Refused” coded “7” and “Don’t know” coded “9”. The response categories of “Refused” and “Don’t know” will be recoded as missing for the purposes of analysis, with no other changes made to these three measures. With regard to FSQ.041, this measure incorporated the response categories of “Yes”, “No”, “Refused”, and “Don’t know”. The response categories of “Refused” and “Don’t know” will be recoded as missing for the purposes of analysis, with “Yes” coded “1”, and “No” coded “0”. With respect to FSQ.052, this measure incorporated the following response categories: “Almost every month”, “Some months but not every month”, “In only 1 or 2 months”, “Refused”, and “Don’t know”. The response categories of “Refused” and “Don’t know” will be recoded as missing as well for the purposes of analysis, with “Almost every month” coded “1”, “Some months but not every month” coded “2”, and “In only 1 and 2 months” coded “3”.

Next, FSQ.061, whether in the last 12 months the respondent ever ate less than they felt they should because there wasn’t enough money for food, will be coded in the same way as FSQ.041, as will FSQ.071, FSQ.081, FSQ.092, FSQ.162, and FSQ.755. FSQ.102, measuring frequency, will be addressed in the same manner as FSQ.052.

Smoking in the household. Smoking in the household this will be measured using the following variables: SMQ.470: “Not counting decks, porches, or detached garages, how many people who live here smoke cigarettes, cigars, little cigars, pipes, water pipes, hookah, or any other tobacco product inside this home?”; and SMQ.480: “(Not counting decks, porches, or detached garages) During the past 7 days, that is since

last [TODAY'S DAY OF WEEK], on how many days did {anyone who lives here/you}, smoke tobacco inside this home?". SMQ.470 is measured as a whole two-digit number, while SMQ.480 is measured as the number of days, as a whole number, from zero to seven. With regard to both measures, response categories of "Refused" and "Don't know" will be recoded as missing.

Data Analysis Plan

Initial data cleaning and diagnostics, IBM SPSS 23 was used for all analyses conducted in this study. First, the data were screened and cleaned as necessary prior to the conducting of any statistical analysis. With regard to categorical variables, a series of frequency tables were constructed initially in order to determine whether there are any values for these variables outside of the normal expected range based upon the NHANES codebooks. Additionally, minimum and maximum scores were calculated and reported for any continuous measures included within this study also to determine whether there were any values for these measures, which lie outside of the expected range.

If any stray data points were found on the basis of these initial analyses conducted for the purposes of screening, they were recorded as missing prior to any statistical analysis being conducted. Additionally, these data were cleaned as necessary prior to the conducting of any statistical analysis. This was an included recoding variable with responses such as "not applicable" or "refused" being coded as missing data, and other variables being recoded as discussed above. One reason for recoding of variables was to combine multiple categories of responses in situations where the sample sizes associated with these individual categories were extremely small. Variables may also be recoded in

order to create a new variable with larger sample size with respect to its response categories in general.

In addition to these initial screening and cleaning procedures, initial diagnostics was also done to ensure that all continuous variables to be analyzed using parametric statistics were normally distributed. Normality was determined using a histogram and the Shapiro-Wilk (Sen & Srivastava, 2012) test, and calculating measures of skewness and kurtosis. If normality was not found to be present, the Johnson (Khattree & Rao, 2009) family of transformations was applied to the measure in question using Stata 13, with this resultant data then being transferred back into SPSS format for the purposes of analysis in SPSS 23.

For any continuous variable that was not normally distributed but was successfully transformed into a new variable with a normal distribution through the use of the Johnson family of transformations, parametric tests were still conducted. If the transformation was not found to be successful, non-parametric tests, which did not incorporate the assumption of normality, was instead conducted.

Research questions and hypotheses. The research questions included in the current study, as well as the hypotheses that were tested, were, as follows:

Research Question 1: Is food security associated with good nutritional status?

Research Question 2: Is living in a smoking household associated with poor nutritional status?

Research Question 3: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status?

Research Question 4: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status?

The alternative and null hypotheses were, as follows:

Hypothesis 1_A: Food security is associated with good nutritional status.

Hypothesis 1_0: Food security is not associated with good nutritional status.

Hypothesis 2_A: Living in a smoking household is associated with poor nutritional status.

Hypothesis 2_0: Living in a smoking household is not associated with poor nutritional status.

Hypothesis 3_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status.

Hypothesis 3_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between food security and nutritional status.

Hypothesis 4_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status.

Hypothesis 4_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between living in a smoking household and nutritional status.

Descriptive statistics. A series of descriptive statistics was first presented. This consisted of frequency tables for all categorical variables, along with measures of central tendency and variability for all continuous variables. The frequency tables were reported the sample sizes and percentages for each response category of each categorical variable. The measures of central tendency tabulated and reported for the continuous measures were consist of the mean and median values, with the measures of variability consisting of the standard deviation, range, and minimum and maximum scores.

Inferential statistics. A series of inferential statistical tests were conducted in order to test the study hypotheses. A determination of which method of analysis was most appropriate for each analysis depends upon the level of measurement of the outcome or dependent variable being analyzed.

The dependent variable nutritional status by combining were dichotomous, consisting of "yes" as good nutritional status or "no" as poor nutritional status responses which were recoded as "1" and "0", respectively, for the purposes of analysis. In all of these cases, logistic regression was used, as this method was specifically suited to cases where the dependent variable was dichotomous and in which a set of independent variables need to be examined.

Homoscedasticity was also assumed in linear regression analyses. In order to determine whether this assumption was violated, a scatterplot of the regression-

standardized residuals along with the regression standardized predicted values were plotted in a scatterplot. A diffuse "cloud" of plotted data would serve to indicate the lack of violation of this assumption. Additionally, a series of partial regression plots were also be constructed for each linear regression analysis conducted. A review of these partial regression plots was served to determine whether the assumptions of linearity, as well as the lack of influential outliers, were violated in any of these linear regression analyses. Linear regression also assumes the lack of multicollinearity.

Measures of tolerance and variance inflation factors were calculated and reported in order to ensure that this assumption is not violated in any of these analyses. High multicollinearity would be indicated by measures of tolerance below 0.20 or variance inflation factors above 5. While linear regression analysis also assumes a lack of autocorrelation, this was not tested for since these data are not time-series.

Finally, the measure of how healthy the respondent feels that his/her overall diet is (DBQ.700) was treated as an ordinal variable for the purposes of the study. In this case, ordinal logistic regression was proposed, as this method of regression analysis was particularly suited to situations in which the dependent variable was measured on the ordinal level of measurement. This method of regression analysis made the assumption of parallel lines, which could be tested using the Brant test (Liu, 2016).

The regression assumption related to the fact that there were equal "differences" between each category of the dependent variable with respect to the relationship between the independent variables included in the model and this dependent variable. If this assumption was violated, then an alternate method of regression analysis was

recommended, such as generalized ordinal logistic regression or multinomial logistic regression.

Stata 13 was used as necessary for those analyses not supported by SPSS 23. Also, this study used one of the alternative methods of analysis in any cases where the Brant test indicated the violation of this assumption. Some researchers used a method of adjusting the alpha level when conducting multiple tests, such as the Bonferroni method or the Sidak method (Walker, 2010). This was more commonly done when a substantial set of bivariate analyses were conducted, and are used less frequently with multivariate analyses, like regression.

With respect to the current study, no adjustment was made to the alpha level since multivariate analyses were the focus. In addition, due to the number of analyses conducted, adjustment of the alpha level for comparison in groups served to substantially reduce the alpha level for the determination of statistical significance, making it very difficult for statistical significance to be achieved in any of the analyses conducted. Linear regression produced unstandardized as well as standardized regression coefficients, while logistic regression produced odds ratios.

Ordinal logistic regression also produces odds ratios, while multinomial logistic regression produced relative risk ratios. With respect to the linear regression analyses conducted, the unstandardized regression coefficients were focused upon the interpretation of the results of these analyses, with these coefficients interpreted as a one-unit change in the independent variable being associated with a B unit change in the dependent variable. Odds ratios resulting from any logistic or ordinal regression analyses

conducted were interpreted in the following way: a one-unit change in the independent variable was associated with an odds of a positive response with respect to the dependent variable. If a multinomial logistic regression analysis was conducted, the associated relative risk ratios were interpreted in the same way as odds ratio.

With respect to the interpretation of confidence intervals and probability values, that was not planned for the confidence intervals were interpreted such that the inclusion of zero within the confidence interval was indicated the lack of statistical significance, specifically that the associated parameter estimate was not significantly different from zero, while the lack of the inclusion of zero within the confidence interval was indicated statistical significance. Additionally, with regard to probability values, an alpha of .05 was used as the standard for statistical significance in this study. Therefore, any calculated probability values below .05 were judged as statistically significant, with any calculated probability values of .05 or above deemed to be non-significant.

Threats to Validity

External Validity

Threats to validity included threats to external validity, internal validity, as well as threats to construct validity and statistical conclusion validity. First, with respect to threats to external validity, this could include factors such as testing reactivity, interaction effects of selection and experimental variables, the specificity of variables, reactive effects of experimental arrangements, and multiple-treatment interference.

Because the secondary data analysis was proposed, as opposed to primary data collection, for the current study, the researcher had no impact on any of these potential

factors relating to external validity. Furthermore, this study used the secondary data instead of primary data, which was good for external validity because the researcher had no impact on any bias, or potential factors that normally causes a risk to external validity. While bias may be present within the data proposed for study, such as response bias and survey sampling bias, it was not felt that these biases, if they existed, were any more pronounced than in any other survey data.

Internal Validity

Next, threats to internal validity included history, maturation, testing, instrumentation, statistical regression, experimental mortality, and selection-maturation interaction. Similar to the threats to external validity discussed in the previous paragraph, due to the use of secondary data analysis in the current study, the researcher had no impact upon these potential threats to internal validity. There was no instrument change during the course of this administration of the NHANES survey, precluding the possibility of instrumentation as a threat to internal validity.

However, as with all survey research, the potential for selection bias existed. The remaining potential threats to internal validity discussed were not felt to be relevant with respect to the current study. This study intended to find the correlation between dependent & independent variables, which was best, suited for the findings. While confounding presented itself as a potential concern, this study sought to use a correlational approach, as this approach helped the future scholars for further research and did not seek to determine causal inferences between the independent and dependent variables included within the analyses conducted.

Construct Validity

Finally, with respect to threats to construct validity or statistical conclusion validity, potential threats to construct validity were accounted for by proposing the use of a number of measures in relation to the variables for analysis in this study instead of the use of a single measure, with this approach removing the possibility of mono-operation and mono-method bias. Exact definitions of constructs were also provided by the researcher, intended to remove the possibility of inexact definitions of constructs as a threat to construct validity. While some variables were proposed to be collapsed for the purposes of analysis as discussed previously, this was done on a very limited basis, serving to reduce the possibility of reduction with respect to the level of measurements of constructs as a potential threat to construct validity. Due to this distinct nature between the measures included in this study, construct confounding does not appear to be a threat to construct validity.

Statistical conclusion validity: With respect to statistical conclusion validity, several potentials for error existed when conducting inferential statistical tests in general. First, the type I error was made when a null hypothesis that shouldn't be rejected was rejected. This was termed a "false positive" as the researcher determined that significance existed when this was in fact incorrect. Additionally, a type II error was made when a false null hypothesis was not rejected. This was termed a "false-negative" as the researcher determined that there was no significant relationship when one, in fact, did exist. With respect to the current study, the probability of making a type I error was equal to the alpha level, which was chosen as .05 corresponding to a 5% chance that a type I

error was made in any analysis conducted. The probability of making a type II error within the current study depended on the level of statistical power associated with the analyses conducted. Additionally, a type III error related to the situation in which a significant result was found in relation to a directional hypothesis, but in the opposite direction as to what was hypothesized. This was possible in the present study due to the presence of several directional hypotheses.

Ethical Procedures

With respect to ethical procedures, concern over ethics was not as pronounced as in many other studies due to the fact that the analysis of secondary data was done, with no data being collected by the researcher. Therefore, this researcher did not have any direct contact with human participants. With respect to gaining access to the data, this consisted of a very simplified procedure due to the fact that the NHANES datasets are publicly available. Therefore, any individual wishing to analyze these datasets was able to download them directly from the Internet and analyze them on his/her computer.

With this being the case, the current study did not incorporate anything relating to the treatment of human participants, as this was not relevant here. This study only incorporated secondary data analysis, and with ethical concerns relating to recruitment materials and processes not being relevant, and with ethical concerns relating to data collection or intervention activities again not being significant within the context of the current study. Also, these datasets were already anonymous, with no personally identifying information included. With respect to confidentiality, personal information was not available within the public datasets associated with the NHANES survey.

Therefore, no special or particular protections were made for the purposes of data storage.

Summary

In summary, a quantitative, correlational design was used in the current study. The correlational design was the best approach for this study because it focused on the relationship between the predictors and outcomes proposed for analysis. While confounding did present itself as a potential concern, since the current study used a correlational approach and not sought to determine causal inferences between the independent and dependent variables, confounding was less of a concern.

A quantitative methodology was used here due to the fact that the study incorporated hypotheses, with a quantitative methodology being required in order to statistically test null hypotheses, which was vital to trying to answer the study's research questions. The analyses proposed for the present study consisted of descriptive statistics along with a series of regression analyses. Descriptive statistics consisted of frequency tables for categorical measures of interest and measures of central tendency and variability for continuous measures. Regression analyses were proposed to include linear, ordinal logistic, and multinomial logistic regression, as appropriate, which was served to determine the extent to which the independent variables of respondent food security, living in a smoking household, and demographics impacted nutritional status among adults in the U.S. The following chapter served to present and discuss the results of the analyses conducted for the current study.

Chapter 4: Results

Introduction

In this chapter, I present and discuss the results of the analyses conducted for this study. The purpose of this study was to improve understanding of the predictors of nutritional status. The research questions and hypotheses were, as follows:

Research Question 1: Is food security associated with good nutritional status?

Research Question 2: Is living in a smoking household associated with poor nutritional status?

Research Question 3: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status?

Research Question 4: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status?

The alternative and null hypotheses were, as follows:

Hypothesis 1_A: Food security is associated with good nutritional status.

Hypothesis 1_0: Food security is not associated with good nutritional status.

Hypothesis 2_A: Living in a smoking household is associated with poor nutritional status.

Hypothesis 2_0: Living in a smoking household is not associated with poor nutritional status.

Hypothesis 3_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status.

Hypothesis 3_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between food security and nutritional status.

Hypothesis 4_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status.

Hypothesis 4_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between living in a smoking household and nutritional status.

Initially, I calculated a series of descriptive statistics in order to present an initial illustration of the data collected and the respondents included within this study; these statistics consisted of frequencies and percentage of responses associated with each response category for all categorical measures included in the study. In addition, measures of central tendency and variability were calculated and reported for all continuous measures of interest. Following the diagnostic analyses, three regression models were conducted.

Results

Table 2 presents the sample sizes and percentages of response associated with the categorical measures for demographics included in this study. First, with regard to demographic measures, slightly over 49% of respondents were male, with close to 51% female. Regarding race/ethnicity, slightly over 36% of respondents were non-Hispanic White, with slightly over 22% non-Hispanic Black. A total of 17% of respondents were Mexican American, with slightly over 15% other race/multiracial, and slightly over 9% other Hispanic. Finally, with respect to level of education, close to 8% had a less than 9th grade level of education, with close to 14% having between a 9th and 11th grade level of education or 12th grade with no diploma. Close to 23% were a high school graduate or had a GED or equivalent, with close to 31% having some college or an Associate of Arts (AA) degree. Finally, 25% of respondents had a college degree or above.

Table 2

Frequencies of Categorical Measures: Demographics

Measure	*N*	Valid %
Gender		
Male	5003	49.2%
Female	5172	50.8%
Valid Total	10175	100.0%
Race/Hispanic origin		
Mexican American	1730	17.0%
Other Hispanic	960	9.4%
Non-Hispanic White	3674	36.1%
Non-Hispanic Black	2267	22.3%
Other Race/Multiracial	1544	15.2%
Valid Total	10175	100.0%
Education level - Adults 20+		
Less than 9th Grade	455	7.9%
9-11th Grade, 12th Grade with no Diploma	791	13.7%
High School Graduate/GED or Equivalent	1303	22.6%
Some College or AA Degree	1770	30.7%
College Graduate or Above	1443	25.0%
Valid Total	5762	100.0%

Table 3 summarizes the results pertaining to the categorical food and dietary measures included in this study. Over 42% of respondents mentioned having a good diet, and about 70% never worried about running out of food. Slightly over 75% stated that they never experienced food not lasting, 75.3% said that it was never true that they could not afford balanced meals, 64.3% said that they did not cut the size of or skip meals, 63% said that they did not eat less than they should, 78.6% stated that they did not refrain from eating when hungry, 89.1% stated that they did not lose weight due to not having money for food, and 82.1% stated that they did not refrain from eating for a whole day. More

than three quarters stated that they did not receive WIC, and nearly 90% stated that they did not receive food stamps. Finally, 46.7% said that no one smoked inside the home, but 52.1% said that there was smoking inside the home every day of the previous week.

Table 3

Frequencies of Categorical Measures: Food and Dietary Measures

Measure	*N*	Valid %
How Healthy is the Diet		
Excellent	546	8.4%
Very good	1350	20.9%
Good	2743	42.4%
Fair	1482	22.9%
Poor	342	5.3%
Valid Total	6463	100.0%
HH Worried run out of food		
Often true	1007	10.0%
Sometimes true	1967	19.6%
Never true	7070	70.4%
Valid Total	10044	100.0%
HH Food didn't last		
Often true	663	6.6%
Sometimes true	1816	18.1%
Never true	7574	75.3%
Valid Total	10053	100.0%
HH Couldn't afford balanced meals		
Often true	565	5.6%
Sometimes true	1542	15.3%
Never true	7939	79.0%
Valid Total	10046	100.0%
HH Adults cut size or skip meals		
No	2137	64.3%
Yes	1189	35.7%
Valid Total	3326	100.0%

(table continues)

HH Eat less than should		
No	2095	63.0%
Yes	1232	37.0%
Valid Total	3327	100.0%
HH Hungry, but didn't eat		
No	2616	78.6%
Yes	712	21.4%
Valid Total	3328	100.0%
HH Lost weight, no money for food		
No	2960	89.1%
Yes	361	10.9%
Valid Total	3321	100.0%
HH Adults not eat whole day		
No	1298	82.1%
Yes	283	17.9
Valid Total	1581	100.0%
HH WIC benefit: receive in last 12 month		
No	6463	78.3%
Yes	1791	21.7%
Valid Total	8254	100.0%
HH FS benefit: currently receive		
No	2577	89.9%
Yes	290	10.1%
Valid Total	2867	100.0%
Number of people who smoke inside this home		
0	1145	46.7%
1	724	29.5%
2	511	20.8%
3	72	2.9%
Valid Total	2452	100.0%
In past week # days person smoked inside		
0	98	7.5%
1	179	13.7%
2	230	17.6%
3	49	3.8%
4	35	2.7%

5	27	2.1%

(table continues)

6	7	.5%
7	679	52.1%
Valid Total	1304	100.0%
(Based on NHANES dataset 2015)		

Measure	*N*	Valid %

With respect to the continuous measures included within this study, the mean number of meals not prepared at home was 2.847 (*SD* = 3.517) with a minimum of zero and a maximum of 22 meals. The mean number of meals from a fast food or pizza place was 2.005 (*SD* = 2.592), with a minimum of zero and a maximum of 22. Age in years at screening had a mean of 31.484 (*SD* = 24.422), with a minimum of zero and a maximum of 80, and finally, annual household income had a mean of 8.490 (*SD* = 4.475), which was between the categories of X and Y and had a minimum of one and a maximum of 15.

With regard to normality, none of the dependent variables included within this study were continuous, and as the types of regression analysis used did not assume normality of the dependent variable, tests of normality did not need to be conducted on any of this study's measures. Regarding how healthy the respondent felt that his/her overall diet was, the Brant test (William, 2014) was not statistically significant, with all *p*-values being above 0.05, which indicated that the assumption of parallel lines was not violated in this analysis. For this reason, ordinal regression was used as opposed to an alternate method of regression analysis.

Additionally, correlations were conducted between the independent variables included in this study in order to determine whether multicollinearity was present. Of

these correlations, the strongest was found to be the correlation between being worried that they'll run out of food and that food won't last, r (10042) = .814, $p < .001$. While strong, this did not suggest the presence of unacceptably high multicollinearity with respect to this set of predictors.

Regarding the number of meals not prepared at home and the number of meals from a fast food or pizza place, the means and standard deviations were compared in order to determine whether overdispersion, which consists of the variation being higher than the mean, was present with respect to these measures, which was then used to determine whether the Poisson or the negative binomial model should be used. In both cases, the standard deviations were found to be higher than the means, indicating that overdispersion was present and that the negative binomial model should be used. Two of the variables needed to be dropped from these models due to redundancy, cutting meal size and spending a day without food.

The results of the regression models included in Tables 4 through 6 serve to answer Research Questions 1 and 2:

Research Question 1:Is food security associated with good nutritional status?

Research Question 2: Is living in a smoking household associated with poor nutritional status?

They also test null hypotheses 1 and 2:

Hypothesis 1_0: Food security is not associated with good nutritional status.

Hypothesis 2_0: Living in a smoking household is not associated with poor nutritional status.

All three-regression models incorporate the predictors of food security and living in a smoking household, while all three regressions also incorporate three different measures of nutritional status as outcomes. All three regression analyses led to the rejection of the first null hypothesis, while no evidence was found for the association between living in a smoking household and nutritional status, indicating that the second null hypothesis was not rejected.

The first regression analysis had diet healthiness as its dependent variable and used ordinal regression. These results are presented in Table 4. As shown, statistical significance was found for food running out and food not lasting, not being able to afford balanced meals, age, education, and ethnicity. These results also indicated that all ethnicities as compared with the comparison category of other race or multi-racial were associated with an increased likelihood of a poorer diet. Additionally, being more likely to worry about their food running out, a lower likelihood of their food not lasting, being less likely to afford balanced meals, along with younger respondents and more highly educated respondents had a significantly greater likelihood of a poorer diet. This regression model was found to achieve statistical significance, with the test of parallel lines not achieving statistical significance, indicating that the assumption of parallel lines was not violated in this analysis.

Table 4

Logistic Regression Analysis with Healthiness of Diet

Measures	Estimate	*SE*	Wald χ^2 (*df*)	95% CI	
				Lower	Upper
Food run out	-0.169	0.075	12.105* (1)	-0.006	0.610
Food not last	0.243	0.073	17.286** (1)	0.392	0.382
Not afford	-0.500	0.063	94.166*** (1)	-0.372	0.360

Cut meal size	-0.140	0.081	5.005 (1)	0.024	0.383
Ate less	0.263	0.123	18.360 (1)	0.550	0.777
Didn't eat	0.173	0.158	4.584 (1)	0.527	0.698
Lost weight	-0.071	0.199	1.679 (1)	0.378	0.719
Day w/o food	-0.167	0.176	4.008 (1)	0.228	0.701
WIC benefits	0.105	0.137	8.084 (1)	0.448	0.891
SNAP/stamps	-0.131	0.215	15.362 (1)	0.435	0.949
N. smoke	-0.016	0.066	5.680 (1)	0.154	0.915
Days smoke	0.052	0.025	58.872 (1)	0.117	0.939
Age	-0.009	0.001	137.480*** (1)	-0.006	0.712
Education	-0.180	0.034	106.420** (1)	-0.100	0.787
Income	0.002	0.009	1.744 (1)	0.023	0.754
Males	-0.042	0.051	1.914 (1)	0.065	0.525
Mexican American	0.777	0.090	125.997*** (1)	0.962	0.445
Other Hispanic	0.316	0.096	16.937** (1)	0.512	0.384
Non-H. White	0.201	0.080	12.839* (1)	0.369	0.528
Non-H. Black	0.443	0.099	50.336** (1)	0.659	0.647

Note. *p<.05, **p<.01, ***p<.001; -2 LL (Intercept only) = 28083.386, -2 LL (Final) = 26943.387, $\chi^2(20) = 1139.998$, $p < .001$; Goodness-of-Fit (Pearson): $\chi^2(40667.200) = 41757.478$, $p < .001$; Goodness-of-Fit (Deviance): $\chi^2(40667.200) = 26941.169$, $p = 1.000$; Cox and Snell $R^2 = .106$, Nagelkerke $R^2 = .113$, McFadden $R^2 = .041$; Test of Parallel Lines: -2 LL = 244.955, $\chi^2(60) = 73.665$, $p = .111$.

The second regression model, using negative binomial regression, focused upon the outcome of the number of meals that the respondent ate in the past seven days that were prepared away from home. The results are presented in Table 5. In this analysis, statistical significance was found with respect to the effects of age, ethnicity, worrying about their food not lasting, cutting the size of their meals, eating less, not eating, having lost weight, receiving WIC benefits, receiving SNAP/stamps, education, and income. Males as compared with females were associated with a greater number of meals prepared away from home, with non-Hispanic whites and non-Hispanic blacks being associated with a greater number of meals away from home as compared with the comparison category of other race or multi-racial. Being less likely to worry that their

food wouldn't last, not cutting their meal size, not having eaten for a whole day, being more highly educated, and having a higher income were associated with a higher number of meals prepared away from home, with not eating less than they should, not having lost weight, not receiving Women, Infants, & Children (WIC) benefits, and not receiving Supplemental Nutrition Assistance Program SNAP/ food stamps that offers nutrition assistance to low income individuals or families and provides economic benefits to communities being associated with a lower number of meals. Additionally, this regression model was found to achieve statistical significance.

Table 5

Negative Binomial Regression Analysis with Number of Meals Away from Home

Measures (*df*)	B	*SE*	95% CI		Wald χ^2
			Lower	Upper	
(Intercept)	0.282	0.150	-0.029	0.594	6.847 (1)
Males	0.233	0.024	0.186	0.280	94.541*** (1)
Mexican American	0.066	0.049	-0.031	0.163	2.186 (1)
Other Hispanic	0.061	0.054	-0.045	0.166	1.458 (1)
Non-H. White	0.101	0.043	0.017	0.186	7.537* (1)
Non-H. Black	0.209	0.043	0.124	0.293	26.050*** (1)
Food run out	-0.059	0.034	-0.126	0.008	3.545 (1)
Food not last	0.113	0.040	0.035	0.190	8.739** (1)
Not afford	-0.021	0.039	-0.099	0.056	0.658 (1)
Cut meal size	0.196	0.063	0.060	0.331	22.798** (1)
Ate less	-0.115	0.050	-0.216	-0.014	7.644* (1)
Didn't eat	0.244	0.074	0.094	0.393	16.770** (1)
Lost weight	-0.253	0.078	-0.406	-0.099	11.021** (1)
Day w/o food	-0.158	0.141	-0.490	0.175	6.431 (1)
WIC benefits	-0.105	0.039	-0.182	-0.027	9.150** (1)
SNAP/stamps	-0.260	0.100	-0.512	-0.008	59.429* (1)
N. smoke	-0.038	0.031	-0.114	0.037	9.603 (1)
Days smoke	0.017	0.009	-0.006	0.039	14.699 (1)
Age	0.001	0.001	-0.001	0.002	1.221 (1)
Education	0.089	0.016	0.055	0.122	57.985*** (1)
Income	0.033	0.004	0.025	0.040	102.763*** (1)

Note. *p<.05, **p<.01, ***p<.001; LR χ^2 = 629.323, df = 20, p < .001; Goodness of Fit: Deviance = 9884.998, df = 9666, Value/df = 1.023; Scaled Deviance = 9884.998, df = 9666; Pearson χ^2 = 10396.641, df = 9666, χ^2/df = 1.076; Scaled Pearson χ^2 = 10396.641, df = 9666; LL = -21038.317; AIC = 42118.634; AICC = 42118.730; BIC = 42269.384; CAIC = 42290.384.

The final model conducted focused upon the outcome of the number of meals that the respondent mentioned in the previous outcome that they got from a fast food or pizza place, with this model also consisting of a negative binomial regression model. This analysis found statistical significance with respect to the effects of gender, ethnicity, food running out, food not lasting, not eating, age, and education. With regard to the categorical measures, males were associated with a higher number of meals as compared with females. Next, with regard to ethnicity, Mexican Americans, non-Hispanic whites, and non-Hispanic blacks were associated with a higher number of meals as compared with the comparison category of other race or multi-racial. With respect to the remaining measures, being less likely for their food to not last and not eating were associated with a higher number of these meals, while a reduced likelihood of their food running out, older individuals, and individuals with higher education was associated with a reduced number of these meals. This regression model also achieved statistical significance.

Table 6

Negative Binomial Regression Analysis with Number of Meals from a Fast Food/Pizza Place

Measures	B	*SE*	95% CI		Wald χ^2 (*df*)
			Lower	Upper	
(Intercept)	.881	.149	.586	1.176	42.324*** (1)
Gender=1	.246	.030	.187	.305	71.448*** (1)
Mexican American	.209	.060	.091	.328	13.954** (1)
Other Hispanic	.054	.066	-.075	.183	0.731 (1)

Non-H. White	.142	.048	.047	.237	9.001** (1)
Non-H. Black	.466	.051	.366	.566	85.034*** (1)
Food run out	-.094	.041	-.174	-.013	6.021* (1)
Food not last	.132	.046	.042	.223	8.492** (1)
Not afford	-.072	.043	-.157	.014	3.404 (1)
Cut meal size	.240	.105	-.011	.491	25.986 (1)
Ate less	-.099	.113	-.374	.175	6.216 (1)
Didn't eat	.230	.084	.063	.397	10.559** (1)
Lost weight	-.105	.106	-.315	.105	1.428 (1)
Day w/o food	-.157	.140	-.468	.154	4.260 (1)
WIC benefits	.035	.045	-.053	.124	0.780 (1)
SNAP/stamps	-.290	.128	-.619	.039	55.457 (1)
N. smoke	.016	.026	-.040	.073	1.641 (1)
Days smoke	.014	.016	-.026	.054	10.102 (1)
Age	-.005	.001	-.006	-.003	41.742*** (1)
Education	-.060	.018	-.097	-.024	17.461** (1)
Income	.007	.005	-.003	.016	2.919 (1)

Measures (*df*)	B	*SE*	95% CI	Wald χ^2

Note. *p<.05, **p<.01, ***p<.001; LR χ^2 = 461.610, *df* = 20, p < .001; Goodness of Fit: Deviance = 6333.780, *df* = 7298, Value/*df* = .868; Scaled Deviance = 6333.780, *df* = 7298; Pearson χ^2 = 7339.482, *df* = 7298, χ^2/*df* = 1.006; Scaled Pearson χ^2 = 7339.482, *df* = 7298; LL = -13761.337; AIC = 27564.674; AICC = 27564.800; BIC = 27709.537; CAIC = 27730.537.

With regard to the interaction effects, additional models were run (included in Appendix A) which included the appropriate interaction effects, which were calculated and included in the models if both main effects were found to achieve statistical significance in the models just discussed. These models served to answer the third and fourth research question included in this study:

Research Question 3: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status?

Research Question 4: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status?

With these models also serving to test the third and fourth null hypotheses included in this study:

Hypothesis 3_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between food security and nutritional status.

Hypothesis 4_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between living in a smoking household and nutritional status.

In the initial set of regression models conducted, as no significant main effects were found with regard to smoking, this obviated the need to examine smoking as a potential moderator. This also indicates that the fourth null hypothesis was not rejected. However, in the models incorporating interaction effects, significant moderation was found in relation to gender, race/ethnicity age, and food security, indicating that the third null hypothesis is rejected.

First, with regard to the outcome of the healthiness of the diet, interaction effects were calculated between the significant main effects of food running out, not lasting, and not being able to afford well-balanced meals, and age, education, income and race/ethnicity. The results of this analysis found no significant interaction effects, and hence

no significant moderations. With regard to the second model, focusing upon the number of meals eaten away from home, interaction effects were calculated between the significant main effects of worrying about their food not lasting, cutting the size of their meals, eating less, not eating, having lost weight, receiving WIC benefits, receiving SNAP Supplemental Nutrition Assistance Program / food stamps, and age, race/ethnicity, education, and income. These results only found a significant interaction between WIC benefits and ethnicity. With regard to the final model, focusing upon the number of meals eaten from a fast food/pizza place, significant interactions were found between worrying about their food running out, whether their food wouldn't last, and gender as well as ethnicity, along with the interaction between whether their food wouldn't last and age. This indicates significant moderation in these cases as well.

Summary

The analyses conducted for this study examined the research questions and tested the hypotheses included in this study. Following the initial descriptive analyses conducted, the diagnostic tests indicated the lack of multicollinearity as well as the fact that the Brant test did not find the assumption of parallel lines to be violated in this analysis. The means and standard deviations associated with the second and third outcomes indicated that these data were overdispersed, which led to the decision of negative binomial regression models being used in these two cases. The model results led to a rejection of null hypotheses one and three. The following chapter will discuss these results in relation to previous literature and theory, as well as the limitations of the current study and possibilities for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

In this chapter, I discuss the results found in this current study and their relation to previous literature and theory, along with the limitations of this study and possibilities for future research. To review, this study's purpose was to improve understanding of the predictors of nutritional status. With regard to this study's results, similarities as well as differences were found when comparing the results of this study with previous literature and theory. The key findings included the significance of demographics and food security, as well as moderation between these two sets of measures. The limitations identified consisted of the use of cross-sectional data, the focus on one specific country, and the smaller set of outcomes and predictors included for analysis. Suggested future research draws upon these limitations in order to expand knowledge in this area of study by accounting for and surpassing these limitations.

Interpretation of the Findings

With regard to the first outcome of diet healthiness, I found that all ethnicities as compared with the comparison category of other race or multiracial had an increased likelihood of a poorer diet. Being more likely to worry about their food running out, having a lower likelihood of their food not lasting, being less likely to afford balanced meals, and being younger and more highly educated were associated with a greater likelihood of a poorer diet.

With regard to the second outcome, being male was associated with a greater number of meals prepared outside the home. In addition, being non-Hispanic White and

non-Hispanic Black was associated with a higher number of meals prepared outside the home as compared with the comparison category of other race or multiracial. Being less likely to worry that their food would not last, not cutting their meal size, not having eaten for a whole day, being more highly educated, and having a higher income were associated with a higher number of meals prepared away from home, while not eating less than they should, not having lost weight, not receiving WIC benefits, and not receiving SNAP/food stamps were associated with a lower number of meals prepared away from home.

With respect to the final outcome, being male was associated with a higher number of meals prepared away from home that were prepared in in fast food or pizza places, while being Mexican American, non-Hispanic White, and non-Hispanic Black were associated with a higher number of these meals as compared with the comparison category of other race or multiracial. Additionally, being less likely to have their food not last and not eating were associated with a higher number of these meals, while having a reduced likelihood of their food running out, being older, and having higher education were associated with a reduced number of meals prepared away from home.

This study's research questions and hypotheses were, as follows:

Research Question 1: Is food security associated with good nutritional status?

Research Question 2: Is living in a smoking household associated with poor nutritional status?

Research Question 3: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status?

Research Question 4: Do the demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status?

The alternative and null hypotheses were, as follows:

Hypothesis 1_A: Food security is associated with good nutritional status.

Hypothesis 1_0: Food security is not associated with good nutritional status.

Hypothesis 2_A: Living in a smoking household is associated with poor nutritional status.

Hypothesis 2_0: Living in a smoking household is not associated with poor nutritional status.

Hypothesis 3_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between food security and nutritional status.

Hypothesis 3_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between food security and nutritional status.

Hypothesis 4_A: The demographic factors of gender, race/ethnicity, age, and socioeconomic status moderate the relationship between living in a smoking household and nutritional status.

Hypothesis 4_0: The demographic factors of gender, race/ethnicity, age, and socioeconomic status do not moderate the relationship between living in a smoking household and nutritional status.

The results of these analyses showed that food security did predict nutritional status, while living in a smoking household did not. This result led to the rejection of the first null hypothesis, but not the second. Next, the results pertaining to the interaction effects showed that demographic factors race/ethnicity that moderate the relationship between food security and nutritional status, with no significant association found with smoking. Thus, Null Hypothesis 3 was rejected, but not Null Hypothesis 4.

The results of this study serve to support the social ecological model (Bronfenbrenner, 1970) and Evans et al.'s (2001) based on the social ecologic theory model that includes Intrapersonal factors incorporate knowledge, attitudes, behavior, self-concept, skills, and developmental history, while interpersonal processes and primary groups incorporate formal and informal social networks and social support systems, which include family and friends as well as co-workers. Furthermore, social ecologic model's institutional factors incorporate social institutions with organizational characteristics, along with formal and informal rules and regulations. A healthy population depends on environmental factors such as employment, income security, educational opportunities, public health policy and engaged and active communities (Lantz & Pritchard, 2010). According to Evans et al.'s (2001) model of the social production of disease, this study's results showed the significant impact of demographic and measures of socioeconomic status, on nutritional status outcomes.

The positive association found between food security and nutritional status in this study confirms previous research (Armar-Klemesu, 2001; Guillen & Rivas, 2006; Gundersen & Ribar, 2011; Lawrence et al., 2013; Markos et al., 2014). This study also confirms previous research with respect to the importance of demographics (Alkerwi et al., 2015; Bowman & Vinyard, 2004; Drewnowski et al., 2014; Markos et al., 2014; Satia et al., 2004; Yon et al., 2008). Study findings do not do so with regard to smoking; smoking by race/ethnicity might be partly explained by sociocultural influence, and disparities by education might be partly attributable to variations in the understanding of the range of health hazards caused by smoking (Markos et al., 2014; Mlčochová, 2013; Noble et al., 2015; Pereira et al., 2005; Yun et al., 2017).

Limitations of the Study

This study had a number of limitations. First, this study used cross-sectional data. While the analysis of cross-sectional data can determine correlations between variables of interest, it cannot be used to determine causality. Therefore, this study cannot make any conclusions as to causality with respect to the relationships between the independent and dependent variables included in this study. Second, this study used nationally representative data collected in the United States. While this does allow for the generalization of the results obtained to the population from which the sample was drawn, the extent to which these results can be applied to other populations is unknown. Third, this study focused upon a fairly small, discrete number of predictors and outcomes. While the relationships between the measures included in this study were determined on

the basis of the analyses conducted, the relationships between these outcomes and other predictors, or these predictors and other outcomes, is unknown.

Recommendations

With regard to possibilities for future research, the limitations discussed in the previous section can be drawn upon in order to determine possibilities for future research within this area of study. Future studies could incorporate panel data, which is the data collected over time and over the same individuals and which is commonly used in cross sectional studies and perform appropriate panel data analyses or other time-series analyses in order to determine causality. Such panel data analyses could consist of panel regression, (Buck, 2014) for example, or cross-lagged models using a structural equation methodology. Regression model's Lagged versions, a time series data in regression of predictors could be used, for example, in order to determine whether causal relationships exist over time between the predictors and the outcomes being studied (Levine, Albers, & Hripcsak, 2016)

Regarding the limitation of not being able to generalize the results to other populations outside the U.S., future research could examine the same relationships using data from country-wide surveys conducted in other countries in order to help establish whether the relationships found in this current study are similar to those in other countries and cultures.

Finally, regarding the limitation of the small numbers of predictors and outcomes focused upon within this study future research could expand upon this study by examining a broader set of outcomes as well as a larger range of predictors in order to

further explore the topic of this study. All of these possibilities would help to expand upon this study and broaden knowledge in this area.

Implications

The results of this study highlighted the importance of food safety and respondent demographics and the association between them and nutritional status. Public health professionals should focus on these findings when creating new programs and policies. Doing so may help to improve the nutritional status of the U.S. population.

Conclusion

This study served to advance this area of literature by exploring nutritional status (dependent variable), food security and living in a smoking household (independent variables), and the moderating effects of demographic factors that include gender, age, and socioeconomic status measures which have not been examined in their relation to nutritional status in the previous studies. According to the World Health Organization (2017) inadequate nutrition is a global public health issue. A healthy diet is the most important element to ensure healthy individuals in the community and in the nation (CDC, 2017). Furthermore, the CDC (2017) reported that adults in lower income communities are more likely to live in a smoking house; this increases the risk of many diseases, including cardiovascular and lung diseases by 25% to 30% annually and increases the yearly productivity loss to $6.6 billion. In 2017, an estimated 1 in 8 (40 million) Americans were food insecure, including more than 12 million children; taken together, issues such as, low education unemployment or underemployment and food

insecurity are important social determinants of health most reported in African American, Latinos, seniors, and residents of rural communities.

Two of this study's four hypotheses were supported with food security being associated with improved nutritional status, and the relationship being significantly moderated by race/ethnicity. The results showed that food security did predict nutritional status (table 4, first three rows of results, highlighted blue, table 5, "food not last", etc. table 6, again, "food run out", "food not last") while living in a smoking household did not. Furthermore, the results pertaining to the moderating effects showed that demographic factors race/ethnicity the relationship between food security and nutritional status, with no significant association found with smoking. A healthy population depends on environmental factors such as employment, food security, educational opportunities, public health policy and engaged and active communities (Lantz & Pritchard, 2010). According to Evans et al.'s (2001) model of the social production of disease, this study's results showed the significant impact of demographic factors moderation on nutritional status outcome. While this study contained several limitations, future research can be built on this study by reducing limitations and by making public health policies promoting nutritional awareness for individuals and generations to come.

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Appendix: Models With Interaction Effects

```
SORT CASES BY Imputation_.
SPLIT FILE LAYERED BY Imputation_.
*Models with interactions
*Model 1: fsd032a, fsd032b, fsd032c
riagendr dmdeduc2 ridreth1

*Model 2: fsd032b, fsd041, fsd061, fsd071, fsd081, fsq162, fsd230
Gender, Ethnicity, Education, Income

*Model 3: fsd032a, fsd032b, fsd071
Gender, Ethnicity, Age, Education

*First, create dummies for nominal measures
*Gender, Ethnicity

COMPUTE female=0.
EXECUTE.

IF riagendr=2 female=1.
EXECUTE.

COMPUTE RACE1=0.
IF ridreth1=1 RACE1=1.
EXECUTE.

COMPUTE RACE2=0.
IF ridreth1=2 RACE2=1.
EXECUTE.

COMPUTE RACE3=0.
IF ridreth1=3 RACE3=1.
EXECUTE.

COMPUTE RACE4=0.
IF ridreth1=4 RACE4=1.
EXECUTE.

COMPUTE RACE5=0.
IF ridreth1=5 RACE5=1.
EXECUTE.

*Creating standardized measures.
```

```
*Gender Ethnicity Education Income Age

DESCRIPTIVES  VARIABLES = fsd032a fsd032b fsd032c fsd041 fsd061 fsd071
fsd081 fsq162 fsd230
 /SAVE.

*Creating interaction effects
*Model 1: fsd032a, fsd032b, fsd032c
riagendr dmdeduc2 ridreth1


COMPUTE fsd032a_female = zfsd032a * female.
EXECUTE.

COMPUTE fsd032a_dmdeduc2 = zfsd032a * zdmdeduc2.
EXECUTE.

COMPUTE fsd032a_RACE1 = zfsd032a * RACE1.
EXECUTE.

COMPUTE fsd032a_RACE2 = zfsd032a * RACE2.
EXECUTE.

COMPUTE fsd032a_RACE3 = zfsd032a * RACE3.
EXECUTE.

COMPUTE fsd032a_RACE4 = zfsd032a * RACE4.
EXECUTE.

COMPUTE fsd032b_female = zfsd032b * female.
EXECUTE.

COMPUTE fsd032b_dmdeduc2 = zfsd032b * zdmdeduc2.
EXECUTE.

COMPUTE fsd032b_RACE1 = zfsd032b * RACE1.
EXECUTE.

COMPUTE fsd032b_RACE2 = zfsd032b * RACE2.
EXECUTE.

COMPUTE fsd032b_RACE3 = zfsd032b * RACE3.
EXECUTE.
```

```
COMPUTE fsd032b_RACE4 = zfsd032b * RACE4.
EXECUTE.

COMPUTE fsd032c_female = zfsd032c * female.
EXECUTE.

COMPUTE fsd032c_dmdeduc2 = zfsd032c * zdmdeduc2.
EXECUTE.

COMPUTE fsd032c_RACE1 = zfsd032c * RACE1.
EXECUTE.

COMPUTE fsd032c_RACE2 = zfsd032c * RACE2.
EXECUTE.

COMPUTE fsd032c_RACE3 = zfsd032c * RACE3.
EXECUTE.

COMPUTE fsd032c_RACE4 = zfsd032c * RACE4.
EXECUTE.

*Model 1

PLUM dbq700 WITH female zfsd032a zfsd032b zfsd032c fsd041 fsd061
  fsd071 fsd081 fsd092 fsq162 fsd230
  smd470 smd480 RACE1 RACE2 RACE3 RACE4
  ridageyr zdmdeduc2 indhhin2
  fsd032a_female fsd032a_dmdeduc2 fsd032a_RACE1 fsd032a_RACE2
fsd032a_RACE3 fsd032a_RACE4 fsd032b_female
  fsd032b_dmdeduc2 fsd032b_RACE1 fsd032b_RACE2 fsd032b_RACE3
fsd032b_RACE4 fsd032c_female fsd032c_dmdeduc2
  fsd032c_RACE1 fsd032c_RACE2 fsd032c_RACE3 fsd032c_RACE4
  /CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5)
PCONVERGE(1.0E-6) SINGULAR(1.0E-8)
  /LINK=LOGIT
  /PRINT=CELLINFO FIT PARAMETER SUMMARY TPARALLEL
  /SAVE=ESTPROB PREDCAT PCPROB ACPROB.

*Model 2

*Model 2: fsd032b, fsd041, fsd061, fsd071, fsd081, fsq162, fsd230
Gender, Ethnicity, Education, Income
```

```
*fsd032b_female
fsd032b_RACE1
fsd032b_RACE2
fsd032b_RACE3
fsd032b_RACE4
fsd032b_dmdeduc2

COMPUTE fsd032b_indhhin2 = zfsd032b * zindhhin2.
EXECUTE.



COMPUTE fsd041_female = zfsd041 * female.
EXECUTE.

COMPUTE fsd041_RACE1 = zfsd041 * RACE1.
EXECUTE.

COMPUTE fsd041_RACE2 = zfsd041 * RACE2.
EXECUTE.

COMPUTE fsd041_RACE3 = zfsd041 * RACE3.
EXECUTE.

COMPUTE fsd041_RACE4 = zfsd041 * RACE4.
EXECUTE.

COMPUTE fsd041_dmdeduc2 = zfsd041 * zdmdeduc2.
EXECUTE.

COMPUTE fsd041_indhhin2 = zfsd041 * zindhhin2.
EXECUTE.



COMPUTE fsd061_female = zfsd061 * female.
EXECUTE.

COMPUTE fsd061_RACE1 = zfsd061 * RACE1.
EXECUTE.

COMPUTE fsd061_RACE2 = zfsd061 * RACE2.
EXECUTE.
```

```
COMPUTE fsd061_RACE3 = zfsd061 * RACE3.
EXECUTE.

COMPUTE fsd061_RACE4 = zfsd061 * RACE4.
EXECUTE.

COMPUTE fsd061_dmdeduc2 = zfsd061 * zdmdeduc2.
EXECUTE.

COMPUTE fsd061_indhhin2 = zfsd061 * zindhhin2.
EXECUTE.



COMPUTE fsd071_female = zfsd071 * female.
EXECUTE.

COMPUTE fsd071_RACE1 = zfsd071 * RACE1.
EXECUTE.

COMPUTE fsd071_RACE2 = zfsd071 * RACE2.
EXECUTE.

COMPUTE fsd071_RACE3 = zfsd071 * RACE3.
EXECUTE.

COMPUTE fsd071_RACE4 = zfsd071 * RACE4.
EXECUTE.

COMPUTE fsd071_dmdeduc2 = zfsd071 * zdmdeduc2.
EXECUTE.

COMPUTE fsd071_indhhin2 = zfsd071 * zindhhin2.
EXECUTE.



COMPUTE fsd081_female = zfsd081 * female.
EXECUTE.

COMPUTE fsd081_RACE1 = zfsd081 * RACE1.
EXECUTE.

COMPUTE fsd081_RACE2 = zfsd081 * RACE2.
```

```
EXECUTE.

COMPUTE fsd081_RACE3 = zfsd081 * RACE3.
EXECUTE.

COMPUTE fsd081_RACE4 = zfsd081 * RACE4.
EXECUTE.

COMPUTE fsd081_dmdeduc2 = zfsd081 * zdmdeduc2.
EXECUTE.

COMPUTE fsd081_indhhin2 = zfsd081 * zindhhin2.
EXECUTE.


COMPUTE fsq162_female = zfsq162 * female.
EXECUTE.

COMPUTE fsq162_RACE1 = zfsq162 * RACE1.
EXECUTE.

COMPUTE fsq162_RACE2 = zfsq162 * RACE2.
EXECUTE.

COMPUTE fsq162_RACE3 = zfsq162 * RACE3.
EXECUTE.

COMPUTE fsq162_RACE4 = zfsq162 * RACE4.
EXECUTE.

COMPUTE fsq162_dmdeduc2 = zfsq162 * zdmdeduc2.
EXECUTE.

COMPUTE fsq162_indhhin2 = zfsq162 * zindhhin2.
EXECUTE.


COMPUTE fsd230_female = zfsd230 * female.
EXECUTE.

COMPUTE fsd230_RACE1 = zfsd230 * RACE1.
EXECUTE.
```

```
COMPUTE fsd230_RACE2 = zfsd230 * RACE2.
EXECUTE.

COMPUTE fsd230_RACE3 = zfsd230 * RACE3.
EXECUTE.

COMPUTE fsd230_RACE4 = zfsd230 * RACE4.
EXECUTE.

COMPUTE fsd230_dmdeduc2 = zfsd230 * zdmdeduc2.
EXECUTE.

COMPUTE fsd230_indhhin2 = zfsd230 * zindhhin2.
EXECUTE.

GENLIN dbd895 WITH fsd032a Zfsd032b fsd032c Zfsd041 Zfsd061
  Zfsd071 Zfsd081 fsd092 Zfsq162 Zfsd230
  smd470 smd480 female RACE1 RACE2 RACE3 RACE4 Zdmdeduc2 Zindhhin2
  ridageyr
  fsd032b_female
  fsd032b_RACE1 fsd032b_RACE2 fsd032b_RACE3 fsd032b_RACE4
fsd032b_dmdeduc2 fsd032b_indhhin2
  fsd041_female fsd041_RACE1 fsd041_RACE2 fsd041_RACE3 fsd041_RACE4
fsd041_dmdeduc2 fsd041_indhhin2
  fsd061_female fsd061_RACE1 fsd061_RACE2 fsd061_RACE3 fsd061_RACE4
fsd061_dmdeduc2 fsd061_indhhin2
  fsd071_female fsd071_RACE1 fsd071_RACE2 fsd071_RACE3 fsd071_RACE4
fsd071_dmdeduc2 fsd071_indhhin2
  fsd081_female fsd081_RACE1 fsd081_RACE2 fsd081_RACE3 fsd081_RACE4
fsd081_dmdeduc2 fsd081_indhhin2
  fsq162_female fsq162_RACE1 fsq162_RACE2 fsq162_RACE3 fsq162_RACE4
fsq162_dmdeduc2 fsq162_indhhin2
  fsd230_female fsd230_RACE1 fsd230_RACE2 fsd230_RACE3 fsd230_RACE4
fsd230_dmdeduc2 fsd230_indhhin2
  /MODEL fsd032a Zfsd032b fsd032c Zfsd041 Zfsd061
  Zfsd071 Zfsd081 fsd092 Zfsq162 Zfsd230
  smd470 smd480 female RACE1 RACE2 RACE3 RACE4 Zdmdeduc2 Zindhhin2
  ridageyr
  fsd032b_female
  fsd032b_RACE1 fsd032b_RACE2 fsd032b_RACE3 fsd032b_RACE4
fsd032b_dmdeduc2 fsd032b_indhhin2
  fsd041_female fsd041_RACE1 fsd041_RACE2 fsd041_RACE3 fsd041_RACE4
fsd041_dmdeduc2 fsd041_indhhin2
```

```
          fsd061_female fsd061_RACE1 fsd061_RACE2 fsd061_RACE3 fsd061_RACE4
fsd061_dmdeduc2 fsd061_indhhin2
          fsd071_female fsd071_RACE1 fsd071_RACE2 fsd071_RACE3 fsd071_RACE4
fsd071_dmdeduc2 fsd071_indhhin2
          fsd081_female fsd081_RACE1 fsd081_RACE2 fsd081_RACE3 fsd081_RACE4
fsd081_dmdeduc2 fsd081_indhhin2
          fsq162_female fsq162_RACE1 fsq162_RACE2 fsq162_RACE3 fsq162_RACE4
fsq162_dmdeduc2 fsq162_indhhin2
          fsd230_female fsd230_RACE1 fsd230_RACE2 fsd230_RACE3 fsd230_RACE4
fsd230_dmdeduc2 fsd230_indhhin2
          INTERCEPT=YES
         DISTRIBUTION=NEGBIN(1) LINK=LOG
          /CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL
MAXITERATIONS=10000 MAXSTEPHALVING=5
           PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD
           LIKELIHOOD=FULL
          /MISSING CLASSMISSING=EXCLUDE
          /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION.



        *Model 3

        *Model 3: fsd032a, fsd032b, fsd071
        Gender, Ethnicity, Age, Education
        *Don't have interactions with age

        COMPUTE fsd032a_ridageyr = zfsd032a * zridageyr.
        EXECUTE.

        COMPUTE fsd032b_ridageyr = zfsd032b * zridageyr.
        EXECUTE.

        COMPUTE fsd071_ridageyr = zfsd071 * zridageyr.
        EXECUTE.

        GENLIN dbd900 WITH Zfsd032a Zfsd032b fsd032c fsd041 fsd061
          Zfsd071 fsd081 fsd092 fsq162 fsd230
          smd470 smd480
          indhhin2 female RACE1 RACE2 RACE3 RACE4 Zridageyr Zdmdeduc2
          fsd032a_female fsd032a_RACE1 fsd032a_RACE2 fsd032a_RACE3 fsd032a_RACE4
fsd032a_ridageyr fsd032a_dmdeduc2
```

```
        fsd032b_female fsd032b_RACE1 fsd032b_RACE2 fsd032b_RACE3 fsd032b_RACE4
fsd032b_ridageyr fsd032b_dmdeduc2
        fsd071_female fsd071_RACE1 fsd071_RACE2 fsd071_RACE3 fsd071_RACE4
fsd071_ridageyr fsd071_dmdeduc2
        /MODEL Zfsd032a Zfsd032b fsd032c fsd041 fsd061
        Zfsd071 fsd081 fsd092 fsq162 fsd230
        smd470 smd480
        indhhin2 female RACE1 RACE2 RACE3 RACE4 Zridageyr Zdmdeduc2
        fsd032a_female fsd032a_RACE1 fsd032a_RACE2 fsd032a_RACE3 fsd032a_RACE4
fsd032a_ridageyr fsd032a_dmdeduc2
        fsd032b_female fsd032b_RACE1 fsd032b_RACE2 fsd032b_RACE3 fsd032b_RACE4
fsd032b_ridageyr fsd032b_dmdeduc2
        fsd071_female fsd071_RACE1 fsd071_RACE2 fsd071_RACE3 fsd071_RACE4
fsd071_ridageyr fsd071_dmdeduc2
        INTERCEPT=YES
       DISTRIBUTION=NEGBIN(1) LINK=LOG
        /CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL
MAXITERATIONS=10000 MAXSTEPHALVING=5
         PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD
         LIKELIHOOD=FULL
        /MISSING CLASSMISSING=EXCLUDE
        /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION.
```