

WELCOME TO THE LAND OF OPPORTUNITY:
ASSURED FOOD SECURITY AND GOOD HEALTH
NOT INCLUDED

by

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For my little flower, Viola.

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ABSTRACT

Experienced by millions of Americans annually, food insecurity is the limited/uncertain access to readily obtainable and nutritionally adequate safe foods that are secured in a socially acceptable way and contribute to an active and healthy lifestyle (Anderson 1990). Previous findings suggest that a complex relationship exists between food security status and health status, especially among Hispanic populations; however, the number of studies addressing this relationship is limited. Utilizing secondary data from the 2011-2012 National Health and Nutrition Examination Survey, this study aims to assess how food security status affects health status for American households, and how acculturation moderates this relationship for Hispanic households.

Guiding this research is the Hispanic Epidemiological Paradox revealed by Markides and Coreil (1986) in their study of the health statuses of Hispanics living in the Southwestern United States. The principal contributions of this research are fourfold. First, it offers insight into the high prevalence of food insecurity in the United States. Second, it adds to existing research by examining how acculturation affects the susceptibility of Hispanic households to food insecurity and poor health compared to non-Hispanic households. Third, it shows the need to gather more in-depth food security and health data at the state and local levels. Lastly, this research highlights the need for policy creation/reform targeting the nutritional and health statuses of not only vulnerable racial and ethnic groups that are among the most susceptible to food insecurity and poor health, but also the larger American population as a whole.

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INTRODUCTION

Experienced by millions of Americans annually, food insecurity is the limited/uncertain access to readily obtainable and nutritionally adequate, safe foods that are secured in a socially acceptable way and contribute to an active and healthy lifestyle (Anderson 1990). Coleman-Jensen et al. (2014), one of the primary sources of annual national food insecurity statistics, report that since the U.S. Department of Agriculture (USDA) started tracking the food security status of American households in the late 1990s, the prevalence of food insecurity has increased from 10.5% in 2000 to almost 12% in 2004, declined slightly to 11% during 2005-2007, then increased substantially to 14.6% in 2008, and has remained for the most part unchanged since. In 2013 alone, approximately 17.5 million American households, or 49.1 million adults and children, reported experiencing food insecurity at some point(s) throughout the year. Although individuals of all racial and ethnic backgrounds are susceptible to food insecurity, Blacks, American Indians, and Latinos are typically the most at risk (Feeding America 2014).

National studies like those conducted by the USDA and the non-profit group *Feeding America* (2014) provide valuable annual statistics describing the state of food insecurity across the nation, but fail to examine how food insecurity affects things like individual/household health, public health, healthcare costs, and workforce preparation and participation. In fact, most emphasize hunger as a result of food insecurity. However, due to its links to multiple negative outcomes, especially with regard to health, food insecurity has become an important public health concern. It is estimated that in 2010

poor health associated with food insecurity cost Americans \$130.5 billion in healthcare expenditures (Shepard et al. 2011).

Negative health outcomes associated with food insecurity include, but are not limited to: obesity, diabetes, depression, and child behavior problems (Alaimo et al. 2001; Dinour et al. 2007; Huddleston-Casas et al. 2008; Seligman et al. 2007). For those already struggling to obtain adequate food, the additional cost of treating negative health outcomes can be devastating, often creating added financial burdens and/or unemployment. Research suggests that food insecurity among children has an even greater impact on healthcare costs compared to adult food insecurity because food insecure children have a higher risk of hospitalization, frequent sickness, and developmental impairments associated with malnutrition (Cook and Jeng 2009). Existing research also suggests that negative health outcomes associated with food insecurity adversely affect workforce preparation/participation and reduce the lifetime earnings for children living in food insecure households by an average of \$260,000 (Cook and Jeng 2009; Shepard et al. 2011).

Hispanics/Latinos are the largest ethnic group in the U.S. and contribute to nearly half of the 27.3% increase in total population between 2000 and 2010 (Ennis et al. 2011). When it comes to household food insecurity, 23.7% percent of Hispanic/Latino households report experiencing food insecurity at some point(s) during the year (Coleman-Jensen et al. 2014). As a result, nearly one in six Latinos in America participate in the Feeding America network in order to receive food assistance and cope with the effects of food insecurity (Feeding America 2015). Research suggests that

among Hispanic households, acculturation (how culturally integrated an individual/household is within the society they/it resides), serves as a moderating factor between food security status and health status (Buscemi et al. 2011; Gorman et al. 2011). These findings suggest that a complex relationship exists between food security status and overall health status, especially for the Hispanic population; however, the number of studies addressing this relationship is limited.

The Hispanic Health Paradox revealed by Markides and Coreil (1986) in their study of health among Hispanics living in the southwestern United States remains relevant today due to the limited understanding of why and how it exists. The paradox suggests that despite being worse off socioeconomically, the overall health of Hispanics (primarily those of Mexican descent) is similar or even better than that of non-Hispanic whites (Dhokarh et al. 2011). Suggestions as to why the Hispanic Health Paradox exists include the early and high fertility rate of Hispanic women, genetic heritage, cultural practices, and extended family support (Markides and Coreil 1986). Franzini et al. (2001) note that variations in age, gender, Hispanic subgroup, country of birth, cause of death, and acculturation also contribute to the paradox; however, how household food security status contributes to the paradox remains unanswered.

This research assesses the relationship between food security and health status among U.S. households, and how Hispanic ethnicity and level of acculturation among these households moderates this relationship. The principal contributions of this study are fourfold. First, it will offer insight into the high prevalence of food insecurity in America. Second, it will add to existing research by examining how acculturation affects the

susceptibility of Hispanic households to food insecurity and poor health compared to non-Hispanic households. Third, it will show the need to gather more in-depth food security and related health data at the state and local levels. Lastly, this research highlights the need for policy creation/reform targeting the nutritional and health statuses of not only vulnerable racial and ethnic groups that are among the most susceptible to food insecurity and poor health, but also the larger American population as a whole.

In the pages that follow, I will first provide a review of existing research regarding food security status, health status, and acculturation. Then, I will explain the methodological approach of this analysis. Finally, I will discuss findings, implications for future research, and suggestions for reducing/eliminating food insecurity in America.

FOOD SECURITY STATUS

Food security status typically denotes whether a household is categorized as food secure or food insecure. It is important to note, that while food security status is usually presented in a dichotomous fashion, it actually falls on a continuum which includes multiple levels of food security/insecurity. Food security status, the most commonly used measure of food security, is often applied in research addressing how sociodemographic and economic factors affect household food security. In the USDA's 2014 report on food security, sociodemographic/economic factors found to influence household food security status include Hispanic ethnicity, race, sex, age, household composition/status, employment status, and household income. Additional studies report similar findings regarding the influence of sociodemographic/economic factors on household food

security status, but unlike the USDA include education in their analyses (Bartfeld and Dunifon 2006; McCurdy and Metallinos-Katsaras 2011).

Sociodemographic/Economic Factors

Race: Compared to white and other households, black households are the most likely to be food insecure (Coleman-Jensen et al. 2014). While an abundance of food security research include race for descriptive/control purposes, many limit the classification of race to only include white and black. Bartfeld and Dunifon (2006) in their research of state-level predictors of food security among households with children include the categories of Asian and American Indian in their analysis. The authors' findings reveal that identifying as American Indian is a significant predictor of food insecurity among households with children, whereas identifying as Asian is not. American Indian households are also more likely than black households to be food insecure compared to white households (Bartfeld and Dunifon 2006).

Hispanic Ethnicity: Interest in how Hispanic ethnicity affects food security status is gaining momentum as the U.S. Hispanic population continues to increase. In their assessment of national household security Coleman-Jensen et al. (2014) report that the percent of Hispanic households categorized as food insecure (17.0%) and very food insecure (6.7%) are both considerably higher than national averages of 8.7% and 5.6%, respectively. Gorman et al. (2011) suggest that compared to non-Hispanic whites and English-speaking Hispanics, Spanish-speaking Hispanics face more social and economic disadvantage, report significantly more concern and the least satisfaction with their children's physical health, and have the highest rates of food insecurity. Similarly,

Buscemi et al. (2011) in their study of low-income Latino children visiting a faith-based primary care clinic, indicate that acculturation acts as a significant moderating variable between food insecurity and Body Mass Index (BMI) percentile.

Sex: Research addressing how food insecurity affects men is limited because so many studies focus on samples consisting of only women, or women and their children (Heflin et al. 2007; Gooding et al. 2012). Only a slight difference exists between food insecurity rates for single female households (15.2%) and single male households (14.6%) and the national average (14.3%). However, they increase dramatically when children are involved, with the risk for single females increasing to 34.4% and for single males to 23.1% (Coleman-Jensen et al. 2014). Matheson and McIntyre (2014) in their study of factors contributing to food insecurity among women also report females to be more food insecure compared to males, regardless of marital status.

Age: Another factor influencing household food security status is age, with children and seniors most affected. Nationally children experience the highest rates of food insecurity (21.4%), while the rate of adults experiencing food insecurity (14.0%) hovers near the national average (Coleman-Jensen et al. 2014). Recently the American Academy of Pediatrics (2015) announced their call for pediatricians to screen all children for the risk of food insecurity with the aim to reduce childhood malnutrition and its associated negative health outcomes by connecting families in need with federal/community resource assistance. Concerning seniors, Donley et al. (2014) in their assessment of household food security status among adult Floridians suggest that food insecurity has more of a negative impact on the physical/mental health of older adults age

50 and above compared to younger adults. Medication, lack of transportation, physical limitations, and dietary restrictions are just some of the stressors that many seniors face in addition to food insecurity (Feeding America 2015).

Education: Current research focuses on how maternal educational attainment affects child food security since female single parent households are among the most susceptible to food insecurity and because mothers are typically deemed responsible for household duties surrounding food purchasing/preparation (Bartfeld and Dunifon 2006; Martin and Lippert 2012). Results of a study including low-income families participating in a variety of food assistance programs indicate that educational attainment past high school may act as a protective factor for non-White households against food insecurity (Olson et al. 2004). Similarly, McCurdy and Metallinos-Katsaras's (2011) findings indicate that race impacts the relationship between postsecondary maternal education and household food security status by acting as a protective factor for black mothers and a risk factor for white mothers. The authors propose that education acts as a risk factor for white mothers by enabling them to decipher what survey questions relate to food insecurity, making them less likely to agree to them out of fear of being stigmatized as "food insecure".

Adult Employment Status: Child food insecurity rates are the lowest among households with children that have a full-time working adult (7.1%), with rates increasing dramatically when households have only one adult working part-time (21.4%) or have an adult unable to work due to disability (29.4%) (Coleman-Jensen and Nord 2013). In their study of household food security status, household income, and adult employment status,

Loopstra and Tarasuk (2013) suggest that as the number of employed adults (full and part-time) increases, severity of household food insecurity status decreases. Literature addressing food insecurity and employment status also suggests that the impact of living in a food insecure household as a child not only affects an individual's physical, mental, emotional, and social preparedness for employment, but also contributes to the creation of a less competitive workforce with limited education and technical skills (Cook and Jeng 2009).

Household Income: It is well established that poverty is associated with food insecurity, which is most prevalent among households with incomes below 185% of the poverty line (Bartfeld and Dunifon 2006). Households with higher incomes, however, are not completely protected from food insecurity, with 6.7% of households with incomes above 185% of the poverty line classified as food insecure (Coleman-Jensen et al. 2014). Findings by Nord and Brent (2002) propose that food insecurity does not decrease to negligible levels until household income reaches five times the poverty line. Similarly, Biggerstaff et al. (2002) suggest the measurement of annual income may not capture any changes in family circumstances that may put a family at economic risk of food insecurity and in need of food assistance because it does not account for economic situations like being homeless or victims of abuse, which may only be temporary.

Household Composition and Housing Status

Household composition, whether a household has children, and total number of individuals living in a household all influence the likelihood of a household being categorized as food insecure (Kalil and Chen 2008). The prevalence of food insecurity

among households with children (19.5%) is almost double that of households without children (11.9%) and as the number of children living in a household increases, so does the prevalence of food insecurity (Bartfeld and Dunifon 2006; Coleman-Jensen et al. 2014). Another aspect of household composition is marital status. Findings by Dean et al. (2011) show how lacking a partner/spouse increases the susceptibility of seniors, especially male seniors, to food insecurity. Similarly, Bartfeld and Dunifon (2006) state that the odds of a household with children experiencing food insecurity are significantly higher for those run by single mothers or if it consists of a complex living arrangement, such as when children from other relatives or unrelated boarders reside within the household.

Finally, housing status, or whether a household is owned or rented is an important factor in a household's risk of experiencing food insecurity. Gorton et al. (2010) in their evaluation of food security literature discuss how main household expenditures like housing cost often takes priority over the purchase of food. Although Olson et al. (2004) propose that owning (versus renting) a home is a significant protective factor against food insecurity, Gregory and Coleman-Jensen (2013) report that housing status does not significantly affect household food security status for those participating in government programs like SNAP. Concerning college students, Nelson Laska et al. (2010) find that those living with parents or in a rented apartment/house have less healthy home food availability compared to those living on campus.

PHYSICAL AND MENTAL HEALTH

The association between food insecurity and obesity remains at the forefront of current research due to its seemingly contradictory relationship and inconsistent findings among research addressing how food insecurity affects obesity (Franklin et al. 2012). Existing research suggests that there is a strong positive association among food insecurity and obesity for women, while findings for men remain inconsistent (Hanson et al. 2007; Martin and Ferris 2007). Findings among children are also mixed depending on age, race/ethnicity, household income, and sex (Dinour et al. 2007). Mediating factors like marital status, maternal stressors, and food stamp participation also appear to positively influence the association between food insecurity and obesity (Dinour et al. 2007; Lohman et al. 2009).

Seligman et al. (2007) suggest that adults experiencing severe food insecurity are more likely to have diabetes compared to those who are food secure. A common proposed explanation of this association is that food insecurity may act as a risk factor for diabetes due to the frequent consumption of inexpensive food high in calories and low in nutrition (Drewnowski and Darmon 2005). Food insecurity also affects glycemic control (management of blood sugar levels), with food insecure diabetic adults experiencing poorer glycemic control compared to adult diabetics who are food secure (Bawadi et al. 2012). Fitzgerald et al. (2011) in their study of Latinas age 35-60 suggest that an inverse relationship exists between food insecurity and diabetes among older Latinas with type 2 diabetes and less acculturation. Older Latinas are more likely to

report food insecurity compared to younger Latinas without type 2 diabetes and more acculturation.

Huddleston-Casas et al. (2008) suggest that depression among adults has a bidirectional relationship with food insecurity. Kim and Frongillo (2007) propose that food insecurity may contribute to the increased risk of depression through its interaction with stressors like economic hardship and food deprivation. Likewise, the association between depression and disability may also increase the risk of food insecurity (Lee and Frongillo 2001). Depression not only affects the food security status of those that are depressed, but also the health statuses of their children as well. Casey et al. (2004) report that mothers experiencing depression are more likely to report fair/poor child health and frequent hospitalization of their children compared to mothers without depressive symptoms.

ACCULTURATION

Acculturation is the process of the simultaneous social, psychological, and behavioral changes that individuals undergo as they learn to adopt aspects of a new culture while modifying features of their culture of origin (Kaiser 2009; Satia-Abouta 2002). Research focused on how acculturation moderates the relationship between food security status and health is severely limited. The few studies that do encompass these three concepts vary in methodological approaches and findings. For example, in their study of the association between food insecurity, acculturation, demographic factors, and fruit and vegetable intake among Hispanic children, Dave et al. (2009) report that higher rates of acculturation and food insecurity are significantly associated with lower fruit and

vegetable intake at home. In contrast, Buscemi et al. (2011) report that Hispanic families which are more acculturated are more likely to be food secure compared to less acculturated families. Buscemi et al. (2011) also report that acculturation is a significant moderator in the relationship between food insecurity and BMI among Hispanic children, suggesting that as acculturation increases, food insecurity and BMI increase.

A substantial number of epidemiological studies report that increased acculturation results in a significant health decline for Hispanic immigrants in the U.S., both across time and generations (Cook et al. 2009; Cho et al. 2004; Vega et al. 2003). Factors like excess psychological stress, declining social ties, and adopting unhealthy diets are commonly used to explain the decline in health for first-generation Hispanics, while questions remain surrounding the decline in health for subsequent generations (Fox et al. 2015). Delavari et al. (2013) suggest that the “healthy migrant effect” diminishes with greater acculturation as influences from the new culture may promote unhealthy weight gain. Isasi et al. (2015) report that acculturation is associated with obesity, with the strongest predictor of obesity being length of residency.

The relationship between acculturation and food security status is just as unclear as the one between acculturation and health. Findings remain inconsistent with some studies reporting a positive association between high levels of acculturation and food insecurity, while others report how greater acculturation plays a protective role (Kaiser et al. 2002; Mazur et al. 2003). Adding to the complex relationship between acculturation and food insecurity are factors like social networks and food stamp management skills.

Dhokarh et al. (2011) suggest low levels of acculturation, lack of social networks, and poor food stamp management skills may contribute to household food insecurity.

RESEARCH QUESTIONS

Current literature highlights the independent influence of multiple sociodemographic/economic and household composition/status factors on household food security status and overall health status. It is for this reason that such factors have been included in this study as control variables and for descriptive purposes. The literature also suggests that for Hispanics acculturation affects both food security status and health, however, limited research exists assessing how acculturation moderates the relationship between them. Guiding this study are 2 main research questions pertaining to non-Hispanic and Hispanic households, separately, based upon review of the literature. See below for research questions and Figure 1 depicting the hypothesized relationships between the independent, dependent, and moderating variables.

RQ1: How does household food security status affect health status for U.S. residents when controlling for sociodemographic and household characteristics?

RQ2: How does acculturation moderate the relationship between household food security status and health status for U.S. Hispanic residents when controlling for sociodemographic and household characteristics?

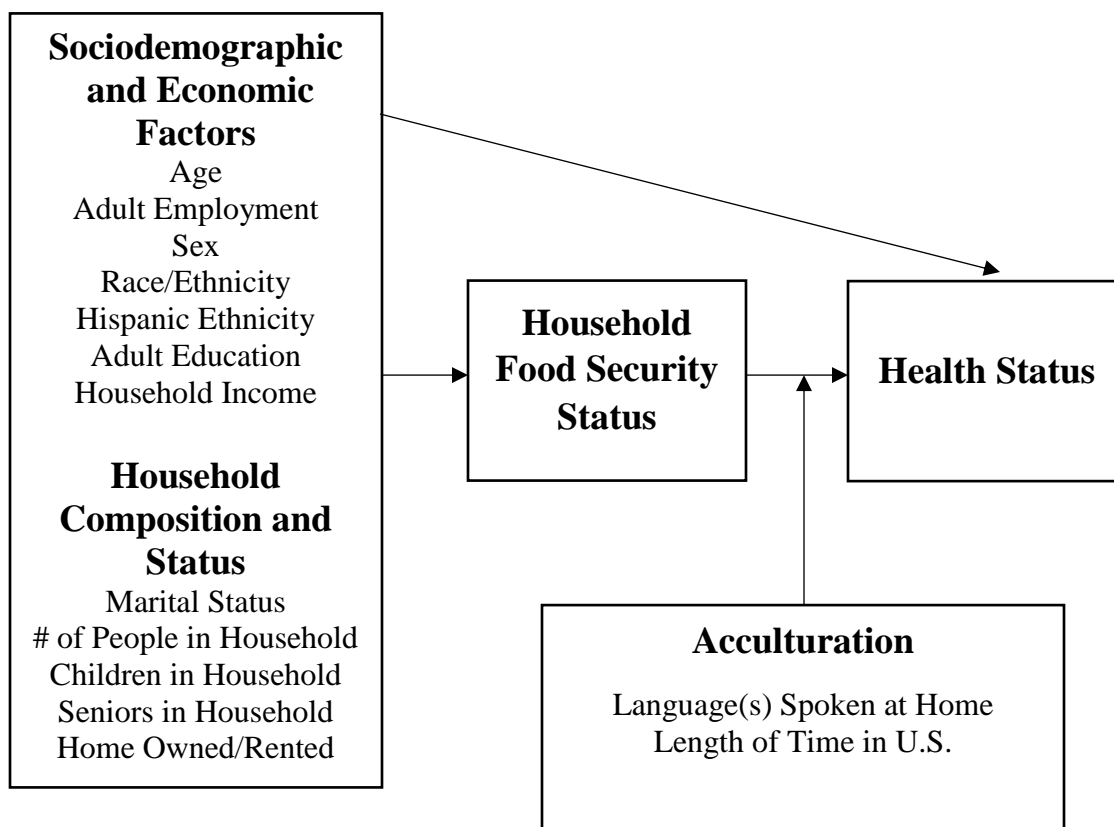


Figure 1. Hypothesized Relationships between Independent, Dependent, and Moderating Variables

DATA AND METHODS

I use a secondary, quantitative dataset which is cross-sectional in design to examine the relationship between household food security status, health status, and level of acculturation for Hispanic residents, when controlling for sociodemographic and household characteristics. Data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) are most appropriate because this survey includes comprehensive coverage known of health outcomes associated with food insecurity and acculturation. The 2011-2012 NHANES data are also the most current set of public

access data containing previously collected data related to household food security, acculturation, and self-reported health status collected at a national level of analysis.

Procedures

The National Health and Nutrition Examination Survey (NHANES) is a sequence of studies conducted by the National Center for Health Statistics (NCHS) and Centers for Disease Control and Prevention (CDC) to assess the health and nutritional status of adults and children in the United States through the combination of interviews and physical examinations. The NHANES program began in the early 1960s and is conducted as a series of surveys focusing on different population groups or health topics. In 1999 the survey became a continuous program with a varying focus on an assortment of health and nutrition topics. Each year the survey examines a nationally representative stratified multistage probability sample of about 5,000 civilian non-institutionalized persons from 15 counties throughout the country. Analytical guidelines issued by the CDC (2013) for the 2011-2012 NHANES state that only a small number of primary sampling units (PSUs) are sampled each year and the releasing of only 1 year of data increases the possibility of disclosure of a sample person's identity and as a result, data is publicly released in 2-year cycles.

Occasionally, the NHANES sampling design is modified in order to obtain larger proportions of particular sub groups related to certain public health interests through oversampling. For various NHANES cycles, different sub groups are oversampled to increase the reliability and precision estimates of health status indicators for the sub groups of interest (CDC 3013). An important change for the 2011-2012 NHANES is that

Asians are also now oversampled in addition to the current oversampling of Hispanics, non-Hispanic blacks, older adults, low income non- Hispanic whites, and those who identify as belonging to other unspecified races/ethnicities.

Food security, demographics, and household characteristics data for the 2011-2012 NHANES are collected as a part of the family questionnaire portion of the 2011-2012 NHANES household interview. The family questionnaire requires an adult household member (preferably the head of the household) to respond on behalf of the entire household. While the family questionnaire is used to collect information at the household level, the sample person questionnaire issued during the household interview is used to collect personal acculturation and health status data. The sample participant questionnaire is answered by participants themselves unless they are under the age of 16 years old, resulting in use of an adult proxy instead. Trained household interviewers administered the survey in each sample participant's home with the assistance of a computer-assisted personal interview system and Blaise software (Statistics Netherlands 2016). Interpreters were used for non-English/non-Spanish participants.

Measures

Food security is assessed using the 18 -item U.S. Food Security Survey Module (FSSM), which the U.S. Census Bureau also includes in each Current Population Survey (CPS) (CDC 2015). Households with children are asked to answer all 18 items, while households without children only are asked to answer ten items. Item examples include "We worried whether our food would run out before we got money to buy more." and "We relied on only a few kinds of low-cost food to feed our children because we were

running out of money to buy food.” Questions included in the 18-item FSSM apply to all individuals living in a household, not just those participating in the NHANES.

In order to describe the overall food security status for each household surveyed, a categorical household-level variable is used to depict the food security status of the entire household. Original categories for the variable measuring household food security status include “full food security”, “marginal food security”, “low food security”, and “very low food security”. Respondents who answer “No” to the first three items of the FSSM are designated as living in a food secure household. This study combines the 3 food insecurity categories into 1 group, resulting in a new dichotomous (Food Secure = 0, Food Insecure = 1) household food security status variable.

Demographic questions included in the NHANES are similar to those used on the Current Population Survey (CPS) issued by the U.S. Census Bureau (2010). Race and Hispanic ethnicity are measured using two separate questions which ask the respondent what race/ethnicity they consider themselves to be. Responses from the two questions are combined and categorized as “Mexican American”, “Other Hispanic”, “Non-Hispanic White”, “Non-Hispanic Black”, “Non-Hispanic Asian”, and “Other Race-Including Multi-Racial” in the secondary dataset used in this study. Since this study has a focus on Hispanic households, race and Hispanic ethnicity are measured separately through the creation of two new race/ethnicity variables.

Sex is measured using the traditional dichotomous categorization of “Male” and “Female”. Adult respondents age 20 and older are asked about the highest level of education they have completed with responses being categorized as either “Less than 9th

grade”, “9-11th grade and 12th grade with no diploma”, “High school graduate/GED or equivalent”, “Some college or AA degree”, and “College graduate or above”. Adult employment status is assessed for respondents age 16 and older by asking them about the type of work they did the week prior to being interviewed with response categories including “Working at a job last or business”, “With a job or business, but not at work”, “Looking for work”, and “Not working at a job or business”. Annual household income is measured by classifying reported household incomes into 14 categories that include incomes ranging from \$0-\$100,000. If the respondent was not willing or able to provide an exact dollar amount, the interviewer asked an additional question to determine whether the income was <\$20,000 or \$20,000 and above. Finally, “age in years of the participant at the time of screening” ranges from 0 to 80 years of age and over.

Household composition is measured by participants’ response to questions regarding children/seniors residing in the household, how many individuals live in the household, and marital status. Whether children live in a household is determined based on the number of children and their ages reported living in the household by the household member completing the family questionnaire. How many adults age 60 and older live in the household is determined in the same way as number of children. Total number of people in the household is calculated based on the response provided by the household member speaking on behalf of the household, with responses ranging from 1 to 7 or more people in the household. Unlike the previous scale variables, marital status is measured using the categories “Widowed”, “Divorced”, “Separated”, “Married”, “Living

with partner”, and “Never married”. Finally, whether the household is “Owned”, “Being bought”, “Rented”, or “Other arrangement” determines household status.

Acculturation is measured using the question “What language(s) is/are usually spoken at home?” Response categories include “Only Spanish”, “More Spanish than English”, “Both equally”, “More English than Spanish”, and “Only English”. The question, “In what month and year did you come to the United States to stay?” is also used to measure acculturation among Hispanic participants, with responses grouped into 9 categories beginning with “Less than 1 year” and ending with “50 years or more”. These questions are similar to those constructed for Marin's Short Acculturation Scale for Hispanics and are among the most commonly used measures of acculturation among Hispanics (Marin et. al., 1987).

Since the NHANES includes both a physical examination and a survey, multiple aspects of health are assessed in each wave. Questions pertaining to current health status are similar to those used in the CDC’s National Health Interview Survey (NHIS) and address both physical and mental health. For this study only one question, “Would you say your general health is...?”, is used to determine current health status. Response categories for the current health status include “Excellent”, “Very Good”, “Good”, “Fair”, and “Poor”. Current research supports the decision to only use this single self-assessment question, as it is the most widely used and relied on measure of health status (Haddock et al. 2006; Zajacova and Dowd 2011).

STATISTICAL ANALYSIS

These data are appropriate for quantitative analysis and was analyzed using the Statistical Package for the Social Sciences 23 (SPSS 23). Frequencies and crosstabs were used to describe the sample, and Chi-squared tests of independence and multivariate regression analyses for assessing the relationships between variables. Due to their categorical design, all but three variables (age, number of people in household, health status) were transformed in order to be used in multivariate regression analyses. The scale variables age and number of people in the household were, however, transformed into categorical variables for descriptive purposes and to be used in Chi-square analyses. The main dependent five category health status variable remained in its original ordinal form for all statistical analyses. Finally, since only adults age 20 and older were asked questions regarding education, employment, and marital status, respondents age 19 and younger were excluded from the analysis.

Frequencies and Crosstabs

After these data were cleaned, frequency tables were run for all sociodemographic and household composition variables, in addition to, the household food security status, health status, and acculturation variables. The frequency tables were reviewed in order to determine whether or not the categorical variables needed to be transformed into new variables with less categories for better analysis. Of the sixteen variables of interest in this study, all but the dependent variable (overall health status) were transformed into new variables. Upon the completion of all variable

transformations, frequency distributions for all original and recoded variables were performed to check for inconsistencies and for describing the final sample.

Besides frequencies, crosstabs were also performed for descriptive purposes. Crosstabs were used to separate the sample according to their responses to the questions asked in the 2011-2012 NHANES that are related to the variables of interest in this study. The responses of each sociodemographic/economic, household characteristic/status, and acculturation variable were first compared across household food security status responses, and then those for overall health status. The same procedure was then done for household food security status and overall health status.

Since crosstabs require categorical variables, the original age and number of people living in the household variables were transformed from their continuous form, to an ordinal one. The original age variable was transformed to consist of seven categories ranging from 20-29 years to 80-years and above. Likewise, the original number of people living in the household variable was also transformed to include seven categories. Categories for the new number of people living in the household range from one individual to more than seven individuals.

Chi-squared Tests of Independence

In order to determine if there were statistically significant associations between the variables of interest in this study, a series of Chi-squared tests of independence were performed among the entire final sample. First, the relationship between each sociodemographic/economic and household characteristic/status variable with household food security status were assessed. Then, another series of Chi-squared tests were

conducted to assess the relationship between each sociodemographic/economic and household characteristic/status variable with overall health status. Finally, two separate sets of Chi-squared tests were performed among only Hispanics in the sample to assess the relationship between the two acculturation variables with household food security status and overall health status.

The application of Chi-squared tests of independence to determine significant associations between the variables of interest was appropriate due to their categorical structure. As mentioned previously, original scale variables (age and total number people in the household) were transformed to be used in the Chi-squared analyses. The random selection of participants and the large size of the final sample also satisfied conditions required to perform Chi-squared tests. In order to determine statistical independence between variables, the Chi-squared test statistic (χ^2), degrees of freedom, and p -values were evaluated for each test performed. Larger χ^2 test statistics and degrees of freedom in addition to p -values that were less than .05 indicated statistically significant associations between variables, but not their direction or strength.

Dummy Variable Recodes

The original four category household food security status variable was transformed into a dichotomous categorical variable, resulting in the classification of the sample as either Food secure = 0 or Food insecure = 1. Similarly, the original six category race/ethnicity variable was split into two new variables representing race (Non-Hispanic White = 0, All other Races = 1) and Hispanic ethnicity (Non-Hispanic = 0, Hispanic = 1), separately. An additional two dummy variables were created to isolate

each Hispanic subgroup (Mexican American, Other Hispanic) in order to determine if there were significant differences between the groups as predictors in the Hispanic only regression models. Sex was recoded into a new binary variable with Males = 0 and Females = 1. The original five category adult education variable was also transformed into a binary variable (HS Diploma/GED and above = 0, No HS Diploma/GED = 1) to be used in logistic regression analysis.

The original four category adult employment variable was transformed into a new binary employment status variable consisting of the categories Working = 0 and Not Working = 1. The original household income variable with fourteen categories was also transformed into a new binary variable with the categories Greater than \$20,000 = 0 and Less than \$20,000 = 1. Two new variables representing children in the household (No = 0, Yes = 1) and seniors in the household (No = 0, Yes = 1) were created from the original variables assessing the number of children and seniors in each household. The original six category marital status variable was also transformed and collapsed into two categories, resulting in adults being classified as either Married/Living with Partner = 0 or Widowed/Divorced/Separated/Never Married = 1. Likewise, the original four categories of the housing status variable were reduced to Owned/Being Bought = 0 and Renting = 1. Responses for the original category “Other arrangement” were excluded from analysis due to the lack of specification of the housing status and the small amount of respondents who chose this answer (n = 259).

The two variables assessing acculturation among respondents who identified as Hispanic were both transformed for use in logistic regression analysis. The original five

categories for language(s) spoken at home variable was transformed to represent whether a respondent speaks More English than Spanish/English only = 0 or Spanish Only/More Spanish than English/Both Equally = 1. The original nine category length of time in U.S. variable was missing a substantial amount of cases. As a result, a new scale variable was created using mean substitution. This was possible due to the original length of time variable consisting of ordinal data arranged in an ascending order in categories ranging from less than 1 year to more than 50 years. The mean substitution of the length of time variable helped to regain some missing cases due to non-response, resulting in the creation of 400 additional responses to the question assessing length of time living in the U.S. for Hispanic respondents.

The original five category health status variable remained in its original form for all statistical analyses performed in this study. Leaving the health status variable in its original form was most appropriate due to the variable's lack of statistical association to all of the other variables of interest when in binary form (Poor = 0, Good = 1). Since its multiple category form is not appropriate for logistic regression, four ordinal regression analyses were performed instead. As a result, all of the dichotomous variables created for logistic regression with reference categories coded as 0 were recoded for use in ordinal regression. The SPSS 23 software used in this study's statistical analysis automatically uses the last category as the reference category in ordinal regression analysis, therefore all logistic recodes were transformed where the reference category is coded as the last category. For example, the logistic recode for household food security status is food

secure = 0 and food insecure = 1, where the ordinal recode is the opposite with food insecure = 0 and food secure = 1.

Multivariate Regression Analyses

In this study, two sets of multivariate logistic regressions were performed in order to analyze how sociodemographic/economic factors and household composition/status variables affect household food security status for non-Hispanic and Hispanic households, separately. The second logistic regression with only Hispanic households included the acculturation variable measuring length of time residing in the U.S., in addition to those measuring sociodemographic/economic factors, household composition/status variables, and household food security status. The use of logistic regression was most appropriate due to the dichotomous categorical form of the dependent variable (household food security status). Exponentiated betas (β) calculated from reported logistic regression parameter β by the SPSS 23 software used in the analysis were assessed along with all reported p -values. Independent variables entered into each logistic model were found to be statistically significant predictors of the dependent variable if $p < .05$.

Besides the two sets of logistic regression analyses, four sets of multivariate ordinal regressions were performed. The initial two sets of ordinal regression analyses were performed to determine the relationship between sociodemographic/economic factors, household composition/status variables, and health status for non-Hispanic households and Hispanic households, separately. As in the case of the second multivariate logistic regression, the length of time variable was included in the ordinal

regression model including only Hispanic households. A final set of multivariate ordinal regressions were then performed for non-Hispanic households to determine the relationship between sociodemographic factors, household composition/status variables, household food security status, and health status. A similar final model was also performed for Hispanic households, however, like the other Hispanic only models, it included the addition of the length of time variable.

In addition to the multivariate ordinal regression analysis, model fitting, goodness-of-fit, pseudo R^2 , and a test of parallel lines were assessed first in order to determine: the existence of a relationship between the independent and dependent variables, the accuracy of the fit of the model, and if the odds for each explanatory variable were consistent across the thresholds of the outcome variable. Also, the SPSS software used in the analysis does not compute the estimated odds (e^β), or how many times more or less the likelihood of one event occurring with respect to another event, for ordinal regression analyses. Therefore, estimated odds were calculated for each independent variable with the equation $e^{a+\beta} / e^a = e^\beta$ (Bozpolat 2015).

RESULTS

Sample Description

The final sample consisted of 5,560 U.S civilian non-institutionalized adults age 20 years-old and older. Although the sample contained slightly more females (n = 2,820) than males (n = 2,740), the sex distribution was near equal. The majority of the sample identified as either non-Hispanic white (37%) or non-Hispanic black (26%), with the

remainder of the sample identifying as non-Hispanic Asian (14%), other Hispanic (10%), Mexican American (10%), and other race/multi-racial (3%). Approximately 20% of the sample identified as being of Hispanic origin.

Roughly half of the sample reported actively working at a job or business compared to the other half of the sample who reported that they were currently not working due to vacation/sick days or being unemployed/looking for employment. Less than 25% of the sample reported not having a high school diploma or a general education diploma (GED)/equivalent, while 21% reported having a high school diploma/GED or equivalent. The majority (55%) of the sample reported completing some college, an Associate's degree, or a Bachelor's/higher degree. Reported yearly household income amounts reflect the level of educational attainment reported among respondents, with 75% of the sample stating that they had a household income that is \$20,000 or greater.

Almost half of the sample (48%) lived in a household that consisted of either two or three individuals. Respondents who lived in larger households comprising of six or more people only made up 10% of the sample. These statistics are consistent with the results for both variables pertaining to whether children/seniors resided in the household, with approximately 60% of the sample reporting that they did not live with any children/seniors. The majority of the sample (56%) reported being married or living with a partner which is reflected in the large number of respondents ($n = 1,683$) who stated that they lived with only one other person. Finally, the majority of the sample (58%) reported living in a household that was owned or in the process of being bought. See

Table 1 for sociodemographic and household composition/status frequencies. Lower totals are due to missing or excluded data.

There were 718 respondents age 20 years and older who identified as being of Hispanic origin and that answered the question assessing length of time residing in the United States. The majority (49%) were found to have been living in the U.S. between 10 to 29 years. There were 813 Hispanic respondents age 20 years and older who answered the question addressing language(s) spoken at home. The majority (52%) reported speaking only Spanish or more Spanish than English in the home. The difference in number of responses for each question measuring acculturation is due to missing data and the fact that the questions were asked on two different parts of the 2011-2012 NHANES. Not all of the respondents may have completed both the family and acculturation questionnaires. See Table 2 for acculturation variable frequencies.

18-Item U.S. Food Security Survey Module Distribution

There were 5,530 adult respondents age 20 and older who completed the first three items of the 18-Item U.S. Food Security Survey Module (FSSM). Of the final sample, 27 respondents did not complete any portion of the FSSM because they were not issued the family questionnaire which contains the household food security survey module due to “no eligible adult respondent in the family available” or “refusal” (CDC 2015). Responses for these three items are coded so that higher score totals indicate food secure households. Respondents determined to be living in food secure households (those who answered “never” to all of the first three items) did not answer any remaining items on the FSSM.

Those that answered “sometimes” or “often” to at least one of the first three items of the FSSM (n = 1,760) were asked to complete the next seven items regarding adult food security status. The majority of these items have responses which are coded in binary form, with those with higher scores indicating a high number of “No” responses. Those who answered “No” to the items “In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food?” and “In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?” did not complete the subsequent items asking how often the situations depicted occurred. Respondents who did not live in households with children were not required to complete the remainder of the FSSM.

Respondents with children under the age of 18 years-old living in their household (n = 2,166) were asked to complete the remaining eight items of the FSSM pertaining to child food security status. Responses for these items are coded so that higher score totals indicate food secure households. Those who answered “No” to the item addressing children in the household skipping meals did not complete the following item asking how often the situation depicted occurred. See Table 3 for the 18-Item U.S. Food Security Survey Module distribution of responses.

Crosstabs and Chi-square Analyses

First, in order to determine if any significant relationships existed between each sociodemographic/economic and housing composition/status variable on household food security status, a series of crosstabulation and Chi-square analyses were performed.

While crosstabs analyses results described how responses were distributed across the categories of the independent and dependent variables, Chi-square results determined whether the relationship between variables were statistically significant. All but one of the independent variables (i.e. sex) were found to have a statistically significant relationship with household food security status. Of the 5,533 respondents age 20 years and above who completed the FSSM, the majority (68%) were identified as living in a food secure household during the previous year. The remaining 32% of respondents were identified as living in a food insecure household.

With regard to age, older respondents were overrepresented in the food secure category of the dependent variable, especially among those age 80 years and above (84%). In contrast, adults age 20-29 years-old (39%) were overrepresented in the food insecure category. A larger proportion of responses from those who identified as non-Hispanic Asian (83%) or non-Hispanic white (75%) comprised the food secure category, while those who identified as Mexican American (49%), other race/multi-racial (45%), non-Hispanic black (40%), or other Hispanic (38%) were overrepresented among the food insecure. The trend seen between the race/ethnicity and household food security status variables was also seen among Hispanic ethnicity and household food security status, with Hispanic respondents (43%) greatly overrepresented within the food insecure category compared to non-Hispanic respondents (29%).

Those reporting that they were not currently working (64%) were underrepresented in the food secure category of the dependent variable, yet overrepresented in the food insecure category (36%) compared to those who reported

actively working. Similarly, those who reported having a yearly household income less than \$20,000 (54%) were also overrepresented in the food insecure category compared to those who reported yearly household incomes over \$20,000 (25%). Nearly equal proportions of respondents who reported having less than a 9th grade education (46%), not finishing high school (45%), or completed a high school diploma/equivalent (40%) were overrepresented among the food insecure compared to those who completed some college (33%) or a Bachelor's degree or higher (13%).

Respondents who reported living with a child(ren) (40%) were identified as living in a food insecure household more often than those who did not live in a household with children (27%), while those who reported living with a senior (74%) were identified as living in a food secure household more often than those who did not live with a senior (63%). Those who reported that they were married (75%) or widowed (72%) were also identified as living in a food secure household in the past year more often than those, who reported that they were never married (64%), divorced (60%), living with a partner (54%), or separated (49%). Respondents who were separated from a spouse (51%) or living with a partner (46%) were overrepresented the most among the food insecure group. Those who reported renting (47%) were also overrepresented among the food insecure. Finally, 75% of those who reported living with one other person were identified as living in a food secure household during the past year the most, while those who lived in a household with more than seven individuals (56%) were identified as food insecure the most. See Table 4 for crosstabs and chi-square results for

sociodemographic/economics, household characteristic/status, and household food security status.

A second series of crosstab and Chi-square analyses were performed to determine whether if any significant relationships existed between each sociodemographic variable, housing composition/status variable, and household food security status with overall health status. All predictors were found to have a statistically significant relationship with health status, although the relationship between sex and health status was weaker than the relationships between the other predictors and the dependent variable. Of the 4,704 respondents age 20 years-old and above who completed the Computer Assisted Personal Interview (CAPI) questionnaire portion of the 2011-2012 NHANES, 4% described their health as poor, 16% as fair, 34% as good, 23% as very good, and 9% as excellent.

Respondents who reported their health status as poor the most were between the ages of 60-79 years-old. Those age 80 years and above (26%) reported fair overall health the most compared to all other age groups. Responses indicating good over health were nearly equally distributed among all age groups. While the proportion of responses indicating very good health were approximately equally across all age groups as well, respondents age 20-29 years-old (34%) reported their health status as very good the most. Respondents age 20-29 years-olds (14%) were also overrepresented in the excellent health category as well. Women in the sample described their health as poor, fair, or good more often than men, while men reported very good or excellent health more often than

women. Although there were differences in the distribution of responses for men and women across overall health, they were small.

Respondents who identified as Mexican American (6%) were the only race/ethnicity overrepresented in the poor health category. Mexican Americans (31%) were also overrepresented in the fair health status category, along with other Hispanics (29%) and non-Hispanic blacks (22%). Responses indicating good health were nearly equally distributed across all races/ethnicities. Non-Hispanic whites (33%), non-Hispanic Asians (32%), and those identifying as other race/multiracial (31%) reported their overall health status as very good more often than Mexican Americans (19%), other Hispanics (17%), and non-Hispanic blacks (23%). As in the case of the distribution of responses across race/ethnicity and good health, responses in the excellent category were also nearly equal in proportion, though Mexican Americans (8%) were slightly underrepresented. Similar distributions were found with regard Hispanic ethnicity and health status with Hispanic respondents reporting poor (5%) or fair (30%) health more often than non-Hispanics; a near equal distribution of good health responses across both groups; and the overrepresentation of non-Hispanics in the very good (29%) and excellent (10%) health categories.

The distribution of responses related to overall health were similar among employment status and household income categories. Respondents who were not working or had a yearly household income under \$20,000 were overrepresented in both the poor and fair categories, while a large proportion of those who reported working or having a yearly household income above \$20,000 described their health as either very good or

excellent. Employment status and household income responses were near equal in distribution across the good health category. The distribution of health status across educational attainment was polarizing, with those who reported completing less than 9th grade greatly overrepresented in the fair (46%) category and underrepresented in the very good (9%). The exact opposite was true for the distribution of responses among those who reported the obtainment of a Bachelor's degree or higher within the same health categories at 9% and 41%, respectively.

Those who reported living in a household with children described their health as good (42%) or excellent (11%) more often than those living in a household without children. The opposite was true for the very good health, which contained a larger proportion of responses from those who reported living in a household without children (28%). Poor and fair health responses were evenly distributed among households with and without children. Respondents who reported living in a household with seniors reported more often that their health was poor (5%) or fair (23%) compared to those who reported living in a household without seniors. A larger proportion of those who reported living in a household without seniors described their health as very good (30%) or excellent (12%) compared to those who reported living in a household with at least one senior resident.

Those who identified as widowed or separated described their health status as poor or fair more often than those who were married, divorced, never married, or living with a partner. Responses were nearly equally distributed across marital status with regard to good health; however, those who identified as divorced (43%) were slightly

overrepresented in this category compared to other marital status groups. Those who identified as either married or never married described their health as very good the most, and were equally represented among the very good health status category. Finally, those who identified as never been married described their health as excellent (12%) more often than those who identified as married (10%), widowed (6%), divorced (10%), separated (8%), or living with a partner (9%).

Compared to those who reported renting their home, those who owned their home or were in the process of buying their home were overrepresented among only the very good (30%) and excellent (11%) health status categories. With regard to number of people in the household, those with only one occupant described their health as poor (5%) the most, though only slightly more often than those living in households with two or more occupants. Those living in households with six or more people reported fair or good health more often than those living in households with less people. Respondents who reported living in a house with two, three, or four people described their health as very good or excellent more often than those living by themselves or in a household with five or more occupants.

Lastly, those identified as living in a food insecure household reported poor (6%), fair (27%), or good health (41%) more often than those living in a food secure household. Although, the amount of those living in a food insecure household who reported good health was near equal to the amount of those living in a food secure household who also described their health as good (40%). Those identified as living in a food secure household reported their health as very good (31%) or excellent (11%) more often than

those living in a food insecure household. See Table 5 for crosstabs and chi-square results for sociodemographic/economics, household composition/status, household food security status, and health status.

Bivariate analyses were performed for both acculturation variables among only Hispanic respondents. In order to assess the relationship between length of time in the U.S. and household food security status, an independent t-test was performed. A statistically difference in mean length of time in the U.S. was found between those identified living in a food secure household and those living in food insecure households ($t = 3.805(1110)$; $p < .001$). Mean scores for the household food insecurity status groups did not represent average years, but rather one of the original nine ordinal length of time in U.S. variable categories. Based on the results of the independent t-test this means that the majority of those identified living in food secure households reported living in the U.S. between 15-19 years, whereas the majority of those identified living in food insecure households reported living in the U.S. between 10-14 years. Though the independent t-test was statistically significant, there was very little difference between category means, or length of residency in the U.S., for each household food security status group.

Crosstabs and Chi-square analyses were performed to determine if there was a significant relationship between language(s) spoken in the home and household food security status. Those who reported speaking more English than Spanish (73%) in the household were identified as food secure more often than any other language category. Hispanic respondents who reported speaking both English and Spanish equally (33%) or only English (33%) in the household were identified as food insecure more often than

those who reported speaking only Spanish (32%), more Spanish than English (21%), or more English than Spanish (27%). Chi-square results indicated no statistically significant relationship between language spoken at home and household food security status. See Table 6 for bivariate results for acculturation and household food security status.

A second set of crosstabs and Chi-square analyses were performed only among Hispanics in the sample in order to assess the relationships between the acculturation variables and health status. A one-way ANOVA was performed among the length of time in U.S. variable and overall health status. Results revealed no statistically significant difference in mean length of time in the U.S. across overall health status categories. As in the independent t-test results for length of time in U.S. and household food security status, there was very little difference between category means, or length of residency in the U.S., across each health status group.

Crosstabs and Chi-square analyses were performed to determine if there was a significant relationship between language(s) spoken in the home and overall health status. Those that reported speaking both Spanish and English equally (6%) reported their health status as poor the most frequent. Hispanic respondents who reported that they only spoke English in the household described their overall health status as fair the most often (24%), while those who reported that they spoke more English than Spanish in the household described their health as good more often than the other language groups (45%). Those that reported that they spoke only English (24%) or both Spanish and English equally (24%) in the household were equally distributed across the very good health status category and overrepresented compared to the other language(s) spoken

categories. Similarly, those that reported that they spoke only Spanish (10%) or more Spanish than English (10%) described their health as excellent the most often. See Table 7 for bivariate results for acculturation and health status.

Regression Analyses

A multivariate logistic regression analysis was performed to determine if household food security status could be predicted for non-Hispanic households by each sociodemographic/economic characteristic and household composition/status variable when controlling for the other independent factors. Sex was excluded from the analysis due the statistically nonsignificant relationship found between the variable and household food security status. Of the ten predictor variables that were included in the analysis, all but one (seniors in the household) were statistically significant predictors of household food security status. Independent variables explained about 21% of the variance in household food security status.

The results of the multiple logistic regression indicated that for every 1-year increase in a non-Hispanic respondent's age, the odds of them having experienced household food insecurity in the past year decreased by 1.2%. The analysis also indicated that non-Hispanic respondents who reported that they were currently not working were 1.3 times more likely than those who reported actively working to have experienced household food insecurity in the past year. Similarly, the analysis indicated that non-Hispanic respondents who had not obtained a high school diploma/GED were 1.6 times more likely than those who had obtained a high school diploma/GED or higher to have experienced household food insecurity in the past year. The analysis also indicated that

non-Hispanics who reported a household income of less than \$20,000 per year were 2.9 times more likely than those who reported annual household incomes totaling \$20,000 or more to have experienced household food insecurity in the past year.

Of the non-Hispanic respondents, all other races/ethnicities were 1.2 times more likely than whites to have experienced household food insecurity in the past year. The analysis also indicated that as the reported number of people living in the household increased by one individual, the odds of the non-Hispanic respondent having experienced household food insecurity in the last year increased by 22%. Similarly, non-Hispanics who reported not being currently married or having never been married were 1.6 times more likely to report household food insecurity in the past year compared to those who were married or living with a partner. With regard to children in the household, results from the analysis indicated that non-Hispanic respondents who reported living in a household with children were 1.3 times as likely as those who did not live with children to have experienced household food insecurity in the last year. Finally, the analysis indicated that non-Hispanics who reported renting their homes were 2.4 times more likely to have experienced household food insecurity in the past year compared to those who owned or were buying their home. See Table 8 for multivariate logistic regression results predicting household food security status for non-Hispanic households.

A second multivariate logistic regression analysis was performed to determine if household food security status could be predicted for Hispanic households by each sociodemographic/economic characteristic, household composition/status variable, and acculturation variables when controlling for the other independent factors. As with the

non-Hispanic model, sex was not included in the analysis. Language spoken in the home was also excluded from the analysis due to nonsignificant findings in the bivariate analyses. Of the eleven predictor variables that were included in the analysis, only four (household income, total number of people in the household, housing status, and Hispanic ethnicity) were found to significantly predict household food security status. Also, similar to non-Hispanics, approximately 21% of the variance in household food security status was explained by the independent variables.

The results of this multivariate logistic regression analysis again indicated that household income was a strong predictor of household food security status among Hispanic households. Hispanic respondents who reported an annual household income that was less than \$20,000 were 4.1 times more likely to have experienced household food insecurity in the past year than those who had annual income equaling \$20,000 or more. With regard to household composition, the results of the analysis indicated that as reported number of people living in the household increased by 1 individual among Hispanic households, the odds of the Hispanic respondent having experienced household food insecurity in the last year increased by 31%. Results from the analysis also indicated that Hispanic respondents who reported renting their home were 1.7 times more likely than those who reported owning their home or in the process of buying their home to have experienced household food insecurity in the past year. Lastly, Hispanic respondents who identified as Mexican American were 1.4 times more likely to have experienced household food insecurity in the past year compared to those who identified as belonging to a different Hispanic origin.

As with the non-Hispanic model, whether a household contained seniors did not significantly affect household food security status. The Hispanic model differed from the non-Hispanic model in that age, employment status, level of education, children in household, and marital status also did not significantly affect household food security status. Annual household income appeared to have a larger effect on household food security status for Hispanics than non-Hispanics. The same was true for total number of people in the household as well. Household status was the only statistically significant predictor in the Hispanic model that appeared to have less of an effect on household food security status compared to the non-Hispanic model. Finally, the non-Hispanic model as a whole appeared to be a better predictor of household food security status, as it explained a slightly larger amount of the variance in the dependent variable. See Table 9 for multivariate logistic regression predicting household food security status for Hispanic households with acculturation variables.

A multivariate ordinal regression analysis was performed in order to determine if overall health status could be predicted for non-Hispanic households by each sociodemographic/economic characteristic and household composition/status variable when controlling for the other independent factors. Though no statistically significant relationship was found between sex and household food security status in the bivariate analyses, one was found between sex and overall health status. Therefore, sex was included in the multivariate ordinal regression analysis. Of the eleven predictor variables included in the analysis, all but two (children in the household, seniors in the household) were statistically significantly predictors of overall health status.

Upon review of the results from the multivariate ordinal regression, I determined significant differences between the model established with the independent variables and the initial model established without the independent variables ($\chi^2 = 448.945(11)$, $p < .001$), thus determining that a relationship existed between the independent and dependent variables. The lack of statistical significance found in the results of the goodness-of-fit test indicated that the model was consistent with the data ($\chi^2 = 11346.075(11425)$, $p = .698$). Accuracy of the fit of the model was also determined by examination of pseudoR², which indicated that approximately 13% of the variance in the dependent variable (overall health status) was explained by the independent variables. Finally, the results of the test of parallel lines indicated that the odds for each explanatory variable were not consistent across the thresholds of the outcome variable, overall health status ($\chi^2 = 83.510(33)$, $p < .001$).

The results of the multivariate ordinal regression analysis indicated that for every 1-year increase in a non-Hispanic respondent's age, the odds of them being in the poor, fair, good, or very good category was lowered by about 3% compared to the excellent category. The analysis also indicated that working (versus not working) was associated with a 0.67 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. Regarding educational attainment, the results of the analysis indicated that receiving a high school diploma/GED or college degree (versus not completing high school) was associated with a 0.48 decrease in odds

of being in the poor, fair, good, and very good categories compared to the excellent health category. Likewise, the model indicated that having an annual household income that was \$20,000 or greater (versus an annual household income less than \$20,000) was associated with a 0.56 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category.

The results of the multivariate ordinal regression analysis indicated that identifying as non-Hispanic white (versus another race/ethnicity) was associated with a 0.74 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. The results of the analysis indicated that as reported number of people living in the household increased by 1 individual, the odds of being in the poor, fair, good, or very good category was lowered by about 14% compared to the excellent category. Similarly, being married or living with a partner (versus being widowed, divorced, separated, or never married) was associated with a 0.82 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. The results of the analysis also indicated that owning/buying a home (versus renting) was associated with a 0.76 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. Finally, identifying as a male (versus female) was associated with a 0.88 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. See Table 10 for ordinal regression predicting overall health status for non-Hispanic households.

A second multivariate ordinal regression analysis was performed in order to determine if overall health status could be predicted for Hispanic households by each sociodemographic/economic characteristic, household composition/status variable, and acculturation variables when controlling for the other independent factors. Language spoken in the home was excluded from the analysis due to nonsignificant findings in the bivariate analyses. As with the non-Hispanic ordinal regression model, sex was included in the analysis due to the statistically significant relationship found between sex and health status in the bivariate analyses. Of the twelve predictor variables included in the analysis, only six (age, employment, level of education, annual household income, housing status, and Hispanic ethnicity) were statistically significant predictors of overall health status.

A significant difference between the model established with the independent variables and the initial model established without the independent variables was evident ($\chi^2 = 161.277(12)$, $p < .001$), thus determining that a relationship existed between the independent and dependent variables. The lack of statistical significance found in the results of the goodness-of-fit test indicated that the model was consistent with the data ($\chi^2 = 3377.586(3248)$, $p = .055$). Accuracy of the fit of this model was also determined by examination of pseudoR², which indicated that approximately 19% of the variance in the dependent variable (overall health status) was explained by the independent variables. Finally, the results of the test of parallel lines indicated that the odds for each explanatory

variable were consistent across the thresholds of the outcome variable, overall health status ($\chi^2 = 34.646(36)$, $p = .533$).

The results of the second multivariate ordinal regression analysis indicated that for every 1-year increase in a Hispanic respondent's age, the odds of them being in the poor, fair, good, or very good category was lowered by about 3% compared to the excellent category, which was identical to non-Hispanics. Likewise, the analysis showed that working (versus not working) was associated with a 0.67 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. While annual household income that equaled or was greater than \$20,000 (versus an annual household income less than \$20,000) was associated with a 0.60 decrease in odds, completing high school/GED, some college or a college degree (versus not completing high school/GED) was associated with a 0.67 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. Owning or buying a home (versus renting) was associated with a 0.55 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. Lastly, those who identified as Mexican American (versus another Hispanic ethnicity) were 30% less likely to be in the poor, fair, good, and very good categories compared to the excellent health category.

Like with the non-Hispanic model, children and seniors living in the household were not determined to be significant predictors of overall health status. Although significant in the non-Hispanic model, total number of people in the household, marital status, and sex were not significant predictors of health status in the Hispanic model.

Only age, employment status, annual household income, and housing status were significant predictors in both models. Finally, the Hispanic model was slightly better at predicting the outcome of the dependent variable than the non-Hispanic model. See Table 11 for ordinal regression predicting overall health status for Hispanic households with acculturation variables.

A third multivariate ordinal regression analysis was performed in order to determine if overall health status could be predicted for non-Hispanic households by each sociodemographic/economic characteristic, household composition/status variable, and household food security status when controlling for the other independent factors. Of the twelve predictor variables included in the analysis, all but three (children in the household, seniors in the household, sex) were statistically significant predictors of overall health status. Once again, there was a significant difference between the model established with the independent variables and the initial model established without the independent variables ($\chi^2 = 516.969(12)$, $p < .001$), thus determining that a relationship existed between the independent and dependent variables. The lack of statistical significance found in the results of the goodness-of-fit test indicated that the model was consistent with the data ($\chi^2 = 11748.689(11904)$, $p = .843$), and accuracy of the fit of the model (pseudoR²), indicated that approximately 15% of the variance in the dependent variable (overall health status) was explained by the independent variables. Finally, the results of the test of parallel lines indicated that the odds for each explanatory variable

were not consistent across the thresholds of the outcome variable, overall health status ($\chi^2 = 90.855(36), p < .001$).

The results of the third multivariate ordinal regression analysis indicated little change in the strength and significance of the predictor variables for non-Hispanics upon the inclusion of household food security status in the final non-Hispanic model. The results did indicate, however, that sex was no longer a significant predictor of overall health status for non-Hispanics with the addition of household food security status. The results also indicated that living in a food secure household (versus living in a food insecure household) was associated with a 0.54 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. See Table 12 for ordinal regression predicting overall health status for non-Hispanic households with household food security status.

A final multivariate ordinal regression analysis was performed in order to determine if overall health status could be predicted for Hispanic households by each sociodemographic/economic characteristic, household composition/status variable, acculturation variables, and household food security status when controlling for the other independent factors. Of the twelve predictor variables included in the analysis, only seven (age, adult employment, education, household income, housing status, Hispanic ethnicity, and household food security status) were statistically significant. I determined after reviewing the ordinal regression results that there was a significant difference from the initial/constant only model ($\chi^2 = 166.381(13), p < .001$) and that the model was a good

fit based on standard tests including goodness-of-fit ($\chi^2 = 3365.482(3251)$, $p = .079$), pseudoR² (19%), and parallel lines ($\chi^2 = 35.462(39)$, $p = .632$).

The results of the final multivariate ordinal regression analysis indicated little change in the strength and significance of the predictor variables for Hispanics upon the inclusion of household food security status in the final Hispanic model. Consistent with the results of the initial Hispanic ordinal regression model, total number of people living in the household, marital status, and sex were not significant predictors as in the non-Hispanic models. Finally, living in a food secure household was associated with a 0.72 decrease in odds of being in the poor, fair, good, and very good categories compared to the excellent health category. See Table 13 for ordinal regression predicting overall health status for Hispanic households with acculturation variables and household food security status.

DISCUSSION

The purpose of this study was to assess the relationship between food security and health status among U.S. households for both non-Hispanics and Hispanics, and how level of acculturation among Hispanic households moderates this relationship. The final sample consisted of 5,560 U.S. civilian non-institutionalized adults age 20 years-old and older. Non-Hispanic whites comprised the majority of the sample and the sex distribution was near equal. Approximately 20% of the sample identified as Hispanic. Just over half (52%) of Hispanics reported speaking only Spanish or more Spanish than English in the home and 49% reported living in the U.S. between 10-29 years.

Approximately 32% of the sample lived in a food insecure household during the previous year. This rate is much higher than what other nationally representative studies reported during those same years, 15% and 14%, respectively (Coleman-Jensen et al. 2104). It is most likely that the oversampling of those who are commonly identified as being at risk of experiencing household food insecurity (Hispanics, low income non-Hispanic whites, non-Hispanic blacks) contributed to the higher rate of household food insecurity among the final sample. Those who lived in food insecure households were predominantly age 20-29 years-old, female, Mexican American, not currently working, had less than a 9th grade education, had an annual household income less than \$20,000, lived in a household with children, rented their home, or reported being separated from their spouse.

Roughly 20% of the sample described their current overall health status as poor or fair, while the majority (57%) of respondents described their health as good or very good. Those with poor or fair health were mostly over the age of 60, female, Mexican American, had less than a 9th grade education, lived in a household with seniors, were separated from their spouse, or rented their home. In addition, those who lived in single inhabitant households described their health as poor the most, while those who lived in a household with six or more people described their health as fair the most. Those with poor or fair health were also more likely to be food insecure, which is consistent with literature linking food insecurity with negative health outcomes such as obesity, diabetes, and depression (Dinour et al. 2007; Huddleston-Casas et al. 2008; Seligman et al. 2007).

There were noticeable differences between the non-Hispanic and Hispanic regression models. While total number of people in the household and marital status were significant predictors of health status in the non-Hispanic model, they were not for Hispanics. This suggests that household composition affects health status differently between the two groups. Interestingly, these same differences were not seen in the models predicting household food security status for both groups. More research is needed to assess the relationship between household composition, household food security status, and overall health status between non-Hispanic and Hispanic households.

Similarly, more research is needed to examine the relationship between sex, household food security status, and overall health. The results of the multivariate regression analyses indicated that sex was a significant predictor of health status for non-Hispanics, but not for Hispanics. However, sex was no longer a significant of health for either group upon the inclusion of household food security in the final models. It is possible that an individual's gender and associated gender roles, not biological sex, may explain why no association was found between sex and household food security status, and the change in the relationship between sex and health status when household food security status was included in the final model.

Among Hispanics, Mexican Americans were more likely to experience both household food insecurity and poor health more often than those of other Hispanic origins (e.g. Dominican Republic, Guatemala). These findings contradict those associated with the Hispanic Health Paradox which suggests that those of Mexican origin have health statuses similar to that of non-Hispanic whites despite differences in

socioeconomic status (Markides and Coreil 1986). The uneven proportion of Mexican Americans to other Hispanics in the sample may have contributed to these findings. More research among Hispanic sub groups is needed to determine the complex relationship between Hispanic ethnicity, household food security status, and health.

Acculturation did not appear to affect the relationship between household food security status and health for Hispanic households. The fact that the majority of Hispanics in the sample reported living in the U.S. for at least 20 years and identified as American could have contributed to the nonsignificant findings, as they were likely already integrated into American society. Further examination of the relationship between age and length of time residing in the U.S. may provide more insight into the complex relationship between food insecurity and health among Hispanics. In addition, the use of only one question to assess language(s) spoken in the home may have also contributed to the nonsignificant findings. While the assessment of language(s) spoken in the home with one question is one of the most commonly used ways to measure acculturation, it does not account for other psychological/physiological changes undergone by those transitioning into a new environment/culture. See Figure 2 for final diagram of independent, dependent, and moderating variables.

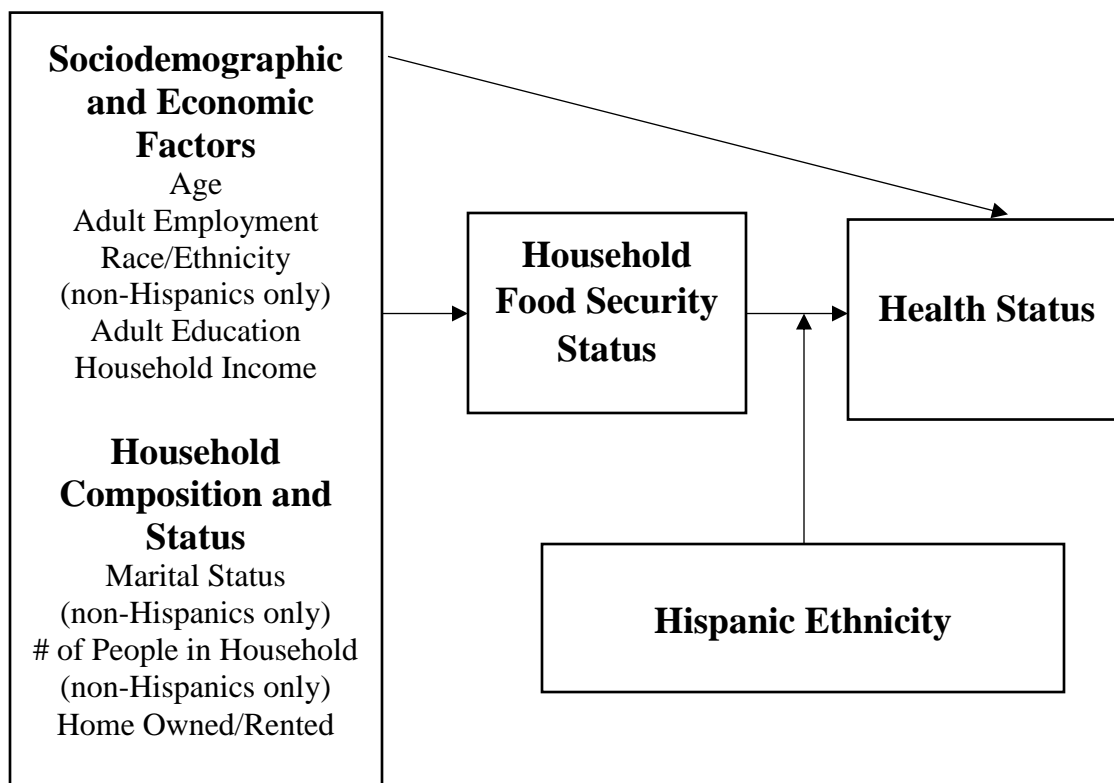


Figure 2. Final Diagram of Independent, Dependent, and Moderating Variables

Limitations

As with all research, this study had its limitations. Among them was the decision to use secondary public access cross-sectional data spanning two independent NHANES data cycles. While cross-sectional data can provide valuable information about how the relationship between variables exists during a specific time, it is limited in that it lacks the ability to establish causality and is highly susceptible to confounding factors which may be affecting the relationship between the variables of interest. An additional limitation of cross-sectional studies like this one are their reliance on questionnaires that require respondents to report on past events that they may have trouble recalling. The use

of multiple questionnaires in the 2011-2012 NHANES from which the data set used in this study was formed have the potential to exacerbate the problem of response error.

Another limitation of the study was that only one person in the household spoke on behalf of the entire household for the Food Security Status Module portion of the 2011-2012 NHANES. While time and cost effective, interviewing only one person in the house provides limited information about other household members' perceptions of their food situation. Large quantitative studies like the NHANES are also great for collecting a large volume of data, but are limited in that they fail to capture the subjective experiences of those living with household food insecurity/poor health. In addition, since the data was open to the public, respondent sequence numbers were masked for confidentiality purposes, limiting the ability to group respondents by household.

Another limitation of this study was the limited focus on the relationship between household food security, health, and acculturation among children. According to Cook and Jeng (2009), food insecure children face an increased risk of developing behavioral problems due to the negative effects of food insecurity. Malnutrition, which is a common consequence of food insecurity, contributes to child behavioral problems such as apathy, anxiety, and difficulty getting along with other children (Alaimo et al. 2001). Jyoti et al. (2005) report similar findings in their longitudinal study of children from kindergarten to third grade, with food insecurity negatively affecting academic performance for both boys and girls and social skills for boys, while positively affecting weight gain for girls. Current research also suggests that factors like parental stress

mediates the relationship between food insecurity and child behavioral problems (Huang et al. 2010).

In their study addressing parental citizenship status and food security status among low income Hispanic households, Kalil and Chen (2008) suggest that low-income children of non-citizen mothers are more susceptible to food insecurity compared to low-income children of native mothers. In addition, the more socially integrated (or acculturated) immigrant parents are, the lower the risk of food insecurity for Hispanic households. Gorman et al. (2011) report similar findings regarding food security status and acculturation in their study of low-income Hispanic households, but also that the level of acculturation for Hispanic mothers positively affects the health status of both mothers and their children.

Recommendations

In order for the problems of food insecurity and poor health to be resolved, interventions must be applied at multiple levels. Borrowing upon the social ecological model, solutions for ending the prevalence of food insecurity and poor health are discussed. The social ecological model suggests that interventions to produce change must occur at multiple levels of society (McLeroy et al. 1988). Change addressing food insecurity and poor health must first occur at the societal level with policy creation and/or reform. Specifically, policies effecting access to food like the U.S. Farm Bill need to be reexamined.

The Farm Bill is the keystone of agricultural and food policy in the U.S., and has been ever since its inception during the Great Depression (Nestle 2007). Among its

purposes are the distribution of resources for trade, rural development, farm credit, conservation, agricultural research, and food/nutrition programs. Also mandated by the Farm Bill are agricultural subsidy programs, which primarily aid those who grow corn, wheat, and soy. While the bill does good to provide assistance to farmers and supports our governmental food assistance programs like SNAP and WIC, it also affects how/what we eat through subsidizing crops with less nutritional value compared to others such as fruits and vegetables.

Until change occurs at the broadest level, food insecurity and associated negative health outcomes will continue to plague the nation. Policy change has the potential to open a gateway to streamline resources to lower levels of society and to change how we view food, nutrition, and health. For example, resources allocated to more state and local level research can help to target those most susceptible to food insecurity and poor health, while creating tailored solutions specific to at risk communities. More aid for food banks/pantries combating food insecurity on the front line can help those in need get access to safe and nutritious foods, instead of just processed, prepacked foods high in salt, fat, and sugar. Structural/societal level change also has the potential to reacquaint individuals with the food they eat by creating opportunities for individuals to see/learn about where their food comes from and how it is produced. The time for change is now. If current food and nutrition policy remains the standard, we all will continue to be vulnerable to unnecessary and burdensome health outcomes.

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APPENDICES

APPENDIX A: Tables

Table 1. Sociodemographic and Household Composition/Status Frequencies

	#	%
<i>How old [are you/is NAME]?</i>		
Age (n = 5560)		
20-29	994	18
30-39	963	17
40-49	899	16
50-59	913	16
60-69	908	16
70-79	520	9
80 and above	363	7
<i>Are you/ Is {NAME} male or female?</i>		
Sex (n = 5560)		
Male	2740	49
Female	2820	51
<i>What race do you consider [yourself/NAME] to be?</i>		
Race/Ethnicity (n = 5560)		
Mexican American	540	10
Other Hispanic	578	10
Non-Hispanic White	2041	37
Non-Hispanic Black	1455	26
Non-Hispanic Asian	794	14
Other Race/Multi-Racial	152	3
<i>Do you/Does {NAME} consider [yourself/themselves] to be Hispanic or Latino?</i>		
Hispanic Ethnicity (n = 5560)		
Hispanic	1118	20
Non-Hispanic	4442	80
<i>Which of the following were you doing last week...?</i>		
Adult Employment (n = 5558)*		
Working	2927	53
Not Working	2631	47
<i>What is the total household income before taxes and including all sources of income?</i>		
Household Income (n = 5268)*		
Under 20,000	1333	25
20,000 and over	3935	75

*Lower n totals are due to missing data.

<i>Table 1, continued.</i>	#	%
<i>What is the highest grade or level of school you have completed or the highest degree you have received?</i>		
Adult Education (n = 5555)		
Less than 9 th grade	550	10
9-11 th grade/12 th no diploma	782	14
High School graduate/GED or equivalent	1169	21
Some College or Associate's degree	1657	30
Bachelor's degree or higher	1397	25
<i>Do any children under the age of 18 live in your household?</i>		
Household has Children (n = 5560)		
No	3374	61
Yes	2186	39
<i>Do any adults age 60 or older live in your household?</i>		
Household has Seniors (n = 5560)		
No	3260	59
Yes	2300	41
<i>Are you now married, widowed, divorced, separated, never married, or living with a partner?</i>		
Marital Status (n = 5553)*		
Married	2683	48
Widowed	467	8
Divorced	571	10
Separated	204	4
Never Married	1188	21
Living with Partner	440	8
<i>Is this home owned, being bought, or rented by [you/you or someone else in your family]?</i>		
Housing Status (n = 5362)*		
Owned/Being Bought	3106	58
Rented	2256	42
<i>How many people live in this household?</i>		
# of People in Household (n = 5560)		
1	793	14
2	1683	30
3	1019	18
4	952	17
5	554	10
6	280	5
7 and above	279	5

*Lower n totals are due to missing data.

Table 2. Acculturation Variable Frequencies

	#	%
<i>In what month and year did you come to the United States to stay?</i>		
Length of Time in U.S. (n = 718)*		
Less than 1 year	6	1
1-4 years	53	7
5-9 years	91	13
10-14 years	123	17
15-19 years	91	13
20-29 years	137	19
30-39 years	107	15
40-49 years	72	10
50 years or more	38	5
<i>What language(s) is/are usually spoken at home?</i>		
Language spoken at home (n = 813)*		
Only Spanish	289	37
More Spanish than English	121	15
Both Equally	140	17
More English than Spanish	133	16
Only English	121	15

*Lower n totals are due to missing data.

Table 3. 18-item U.S. Food Security Survey Module Distribution of Responses

	<u>n</u>	<u>Mean</u>	<u>SD</u>	<u>Range</u>
1. We worried whether our food would run out before we got money to buy more. Was that often, sometimes, or never true for you in the last year?	5529	2.62	0.66	1-3
2. The food that we bought just didn't last and we didn't have money to get more. Was that often, sometimes, or never true for you in the last year?	5530	2.68	0.61	1-3
3. We couldn't afford to eat balanced meals. Was that often, sometimes, or never true for you in the last year?	5528	2.74	0.57	1-3
4. In the last year, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)	1760	1.62	0.49	1-2
5. (If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	673	1.85	0.70	1-3
6. In the last year, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)	1759	1.63	0.48	1-2
7. In the last year, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)	1760	1.78	0.41	1-2
8. In the last year, did you lose weight because there wasn't enough money for food? (Yes/No)	1757	1.87	0.34	1-2
9. In the last year, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	839	1.81	0.39	1-2
10. (If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	161	1.92	0.72	1-3
11. We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food. Was that often, sometimes, or never true for you in the last year?	2166	2.80	0.50	1-3
12. We couldn't feed our children a balanced meal, because we couldn't afford that. Was that often, sometimes, or never true for you in the last 12 months?	2166	2.87	0.40	1-3

<i>Table 3, continued.</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Range</i>
13.The children were not eating enough because we just couldn't afford enough food. Was that often, sometimes, or never true for you in the last year?	2166	2.93	0.29	1-3
14.In the last year, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)	370	1.79	0.41	1-2
15.In the last year, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)	370	1.95	0.22	1-2
16.(If yes to question 15) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	18	1.83	0.51	1-3
17.In the last year, were the children ever hungry but you just couldn't afford more food? (Yes/No)	370	1.89	0.31	1-2
18.In the last year did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)	370	1.99	0.12	1-2

Table 4. Crosstabs and Chi-square Results for Sociodemographic/economics, Household Characteristic/Status, and Household Food Security Status

	<u>Food Secure</u>	<u>Food Insecure</u>	<u>Total</u>
	<u>%</u>	<u>%</u>	<u>n</u>
Household Food Security Status*	68	32	5533
Age (n = 5533)*			
20-29	61	39	990
30-39	63	37	958
40-49	65	35	894
50-59	64	36	912
60-69	72	28	901
70-79	81	19	517
80 and above	84	16	361
		$\chi^2 = 132.402(6); p < .001$	
Sex (n = 5533)*			
Male	69	31	2727
Female	67	33	2806
		$\chi^2 = 2.562(1); p = .109$	
Race/Ethnicity (n = 5533)*			
Mexican American	51	49	538
Other Hispanic	62	38	574
Non-Hispanic White	75	25	2033
Non-Hispanic Black	60	40	1448
Non-Hispanic Asian	83	17	788
Other Race/Multi-Racial	55	45	152
		$\chi^2 = 265.449(5); p < .001$	
Hispanic Ethnicity (n = 5533)*			
Non-Hispanic	71	29	4421
Hispanic	57	43	1112
		$\chi^2 = 81.213(1); p < .001$	
Adult Employment (n = 5532)*			
Working	71	29	2918
Not Working	64	36	2614
		$\chi^2 = 25.665(1); p < .001$	

*Lower n totals are due to missing data.

<i>Table 4, continued.</i>	<i>Food Secure</i>	<i>Food Insecure</i>	<i>Total</i>
	<i>%</i>	<i>%</i>	<i>n</i>
Household Food Security Status*	68	32	5533
Adult Education (n = 5529)*			
Less than 9 th grade	54	46	546
9-11 th grade/12 th no diploma	55	45	777
High School graduate/GED	60	40	1162
Some College or Associate's	67	33	1651
Bachelor's degree or higher	87	13	1393
		$\chi^2 = 376.994(4); p < .001$	
Household Income (n = 5267)*			
Under 20,000	46	54	3935
20,000 and over	75	25	1332
		$\chi^2 = 371.086(1); p < .001$	
Household has Children (n = 5533)*			
No	73	27	3355
Yes	60	40	2178
		$\chi^2 = 102.351(1); p < .001$	
Household has Seniors (n = 5533)*			
No	63	37	3248
Yes	74	26	2285
		$\chi^2 = 71.542(1); p < .001$	
Marital Status (n = 5526)*			
Married	75	25	2672
Widowed	72	28	463
Divorced	60	40	570
Separated	49	51	203
Never Married	62	38	1180
Living with Partner	54	46	438
		$\chi^2 = 173.936(5); p < .001$	

*Lower n totals are due to missing data.

Table 4, continued.

	<u>Food Secure</u>	<u>Food Insecure</u>	<u>Total</u>
	<u>%</u>	<u>%</u>	<u>n</u>
Household Food Security Status*	68	32	5533
Housing Status (n = 5357)*			
Owned/Being Bought	79	21	3103
Rented	53	47	2254
		$\chi^2 = 417.273(1); p < .001$	
# of People in Household (n = 5533)*			
1	69	31	788
2	76	24	1676
3	68	32	1017
4	65	35	943
5	64	36	551
6	55	45	280
7 and above	44	56	278
		$\chi^2 = 152.916(6); p < .001$	

* Lower n totals are due to missing data.

Table 5. Crosstabs and Chi-square Results for Sociodemographic/economics, Household Composition/Status, Household Food Security Status, and Health Status

	<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Very Good</u>	<u>Excellent</u>	<u>Total</u>
	%	%	%	%	%	n
Health Status*	4	16	34	23	9	4704
Age (n = 4704)*						
20-29	1	11	40	34	14	848
30-39	2	15	40	31	12	767
40-49	3	17	43	28	10	735
50-59	5	24	38	25	8	762
60-69	6	23	39	24	8	830
70-79	6	25	39	21	9	465
80 and above	4	26	39	23	8	297
						$\chi^2 = 179.382(24); p < .001$
Sex (n = 4704)*						
Male	3	18	40	29	11	2371
Female	5	20	41	26	9	2333
						$\chi^2 = 16.409(4); p < .01$
Adult Employment (n = 4703)*						
Working	1	14	41	32	12	2468
Not Working	7	25	39	22	8	2235
						$\chi^2 = 242.470(4); p < .001$
Race/Ethnicity (n = 4704)*						
Mexican American	6	31	37	19	8	440
Other Hispanic	4	29	41	17	9	473
Non-Hispanic White	3	15	39	33	11	1795
Non-Hispanic Black	5	22	42	23	9	1248
Non-Hispanic Asian	2	12	42	32	12	607
Other Race & Multi-Racial	3	16	42	31	10	141
						$\chi^2 = 183.669(20); p < .001$

*Lower n totals are due to missing variables.

<i>Table 5, continued.</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Very Good</i>	<i>Excellent</i>	<i>Total</i>
	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>n</i>
Health Status*	4	16	34	23	9	4704
Hispanic Ethnicity (n = 4704)*						
Non-Hispanic	3	17	40	29	10	3791
Hispanic	5	30	39	18	8	913
				$\chi^2 = 106.715(4); p < .001$		
Adult Education (n = 4700)*						
Less than 9 th	10	46	31	9	5	417
9-11 th grade or 12 th no diploma	6	28	44	16	6	662
High School graduate/GED	3	21	46	23	7	995
Some College or Associate's	3	15	43	30	10	1432
Bachelor's or higher	1	9	33	41	16	1194
				$\chi^2 = 630.430(16); p < .001$		
Household Income (n = 4492)*						
Under 20,000	8	29	38	18	7	3381
20,000 and above	2	15	41	31	11	1111
				$\chi^2 = 204.469(4); p < .001$		
Household has Children (n = 4704)*						
No	4	19	39	28	10	2963
Yes	3	19	42	25	11	1741
				$\chi^2 = 9.296(4); p < .001$		
Household has Seniors (n = 4704)*						
No	2	16	40	30	12	2682
Yes	5	23	40	24	8	2022
				$\chi^2 = 86.943(4); p < .001$		

* Lower n totals are due to missing data.

<i>Table 5, continued.</i>	<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Very Good</u>	<u>Excellent</u>	<u>Total</u>
	%	%	%	%	%	<i>n</i>
Health Status*	4	16	34	23	9	4704
Marital Status (n = 4700)*						
Married	3	17	40	30	10	2236
Widowed	7	29	40	18	6	399
Divorced	3	23	43	21	10	499
Separated	8	33	37	14	8	172
Never Married	3	16	40	30	12	1032
Living with Partner	3	21	40	26	9	362
						$\chi^2 = 137.654(20); p < .001$
Housing Status (n = 4540)*						
Owned or Being Bought	3	17	39	30	11	2683
Rented	5	23	41	23	9	1857
						$\chi^2 = 57.909(4); p < .001$
People in Household (n = 4704)*						
1	5	22	38	26	9	706
2	4	17	39	30	11	1467
3	4	20	38	28	11	872
4	4	16	41	28	11	763
5	2	20	43	26	10	458
6	4	25	45	21	5	222
7 and above	3	24	49	15	9	216
						$\chi^2 = 62.578(24); p < .001$
Household Food Security Status (n = 4704)*						
Food Secure	3	15	40	31	11	2963
Food Insecure	6	27	41	19	7	1741
						$\chi^2 = 192.637(4); p < .001$

*Lower n totals are due to missing data.

Table 6. Bivariate Results for Acculturation and Household Food Security Status

	<u>Food Secure</u> (n=629)	<u>Food Insecure</u> (n=483)
Length of Time in U.S. (n = 1118) * (Mean)	5.27	4.90
	$t = 3.805(1110); p < .001$	
	<u>Food Secure</u> (68% n=555)	<u>Food Insecure</u> (32% n=256)
Language spoken at home (n = 811) *		
Only Spanish	68%	32%
More Spanish than English	69%	31%
Both Equally	67%	33%
More English than Spanish	73%	27%
Only English	67%	33%
	$\chi^2 = 1.747(4); p = .782$	

* Lower n totals are due to missing data.

Table 7. Bivariate Results for Acculturation and Health Status

	<u>Poor</u> n=46	<u>Fair</u> n=269	<u>Good</u> n=356	<u>Very Good</u> n=166	<u>Excellent</u> n=76
Length of Time in U.S. (n=913)* (mean)	5.59	5.22	5.08	5.14	4.94
	$F=1.475; p=.208$				
	<u>Poor</u> 4% n=25	<u>Fair</u> 20% n=138	<u>Good</u> 40% n=277	<u>Very Good</u> 28% n=195	<u>Excellent</u> 9% n=62
Language spoken at home (n =697)*					
Only Spanish	4%	19%	40%	28%	10%
More Spanish than English	3%	18%	37%	32%	10%
Both Equally	6%	16%	38%	31%	9%
More English than Spanish	1%	23%	45%	24%	6%
Only English	5%	24%	39%	24%	9%
	$\chi^2 = 11.811(16); p = .757$				

*Lower n totals are due to missing data.

Table 8. Multivariate Logistic Regression Results Predicting Household Food Security Status for Non-Hispanic Households

	β (SE)	Exp. β
Constant		
Food Secure		
Food Insecure =1	-2.201(0.196)	
Age		
(Mean years)	-0.012(0.003)	0.988***
Adult Employment		
Working		
Not Working =1	0.294(0.084)	1.342***
Race/Ethnicity		
Non-Hispanic White		
All other Races =1	0.182(0.077)	1.200*
Adult Education		
H. S. Diploma/GED or Higher		
No H. S. Diploma/GED or Higher =1	0.463(0.099)	1.588***
Household Income		
>\$20,000		
<\$20,000 =1	1.064(0.093)	2.897***
Total # of People in the Household		
(Mean people)	0.200(0.032)	1.222***
Children in Household		
No		
Yes =1	0.240(0.107)	1.272*
Seniors in Household		
No		
Yes =1	-0.111(0.113)	0.895
Marital Status		
Married or Living with a partner		
Widowed/Divorced/Separated/Never Married =1	0.453(0.082)	1.573***
Household Status		
Owned/Being Bought		
Rented =1	0.885(0.081)	2.424***

*** $p < .001$, * $p < .05$, $R^2 = .23$

Table 9. Multivariate Logistic Regression Predicting Household Food Security Status for Hispanic Households with Acculturation Variables

	β (SE)	Exp. β
Constant		
Food Secure		
Food Insecure =1	-2.119(0.427)	
Age		
(Mean years)	0.003(0.007)	1.003
Adult Employment		
Working		
Not Working =1	0.212(0.157)	1.236
Adult Education		
H. S. Diploma/GED or Higher		
No H. S. Diploma/GED or Higher =1	0.216(0.152)	1.241
Household Income		
>\$20,000		
<\$20,000 =1	1.399(0.173)	4.050***
Total # of People in the Household		
(Mean people)	0.276(0.060)	1.318***
Children in Household		
No		
Yes =1	-0.091(0.201)	0.913
Seniors in Household		
No		
Yes =1	-0.213(0.214)	0.794
Marital Status		
Married or Living with a partner		
Widowed/Divorced/Separated or Never Married =1	-0.035(0.153)	0.966
Household Status		
Owned/Being Bought		
Rented =1	0.538(0.155)	1.713**
Length of Time in U.S.		
(Mean years)	-0.048(0.051)	0.953
Hispanic Ethnicity		
Other Hispanic		
Mexican American =1	0.384(0.150)	1.467*

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .21$

Table 10. Ordinal Regression Predicting Overall Health Status for Non-Hispanic Households

	<u>β(SE)</u>	<u>Exp.β</u>
Constant		
Poor =0	-5.728(0.202)	
Fair =1	-3.649(0.179)	
Good =2	-1.647(0.170)	
Very Good =3	0.196(0.171)	
Excellent = 4 (comparison group)		
Age		
(Mean years)	-0.017(0.003)	0.983***
Adult Employment		
Not Working	-0.425(0.071)	0.654***
Working =1		
Race/Ethnicity		
All other races/ethnicities	-0.305(0.064)	0.737**
Non-Hispanic White =1		
Adult Education		
No H. S. Diploma/GED or Higher	-0.732(0.088)	0.481***
H. S. Diploma/GED or Higher =1		
Household Income		
< \$20,000	-0.579(0.084)	0.560***
> \$20,000 =1		
Total # of People in the Household		
(Mean people)	-0.152(0.029)	0.859***
Children in Household		
Yes	0.083(0.093)	1.087
No =1		
Seniors in Household		
Yes	0.103(0.094)	1.108
No =1		
Marital Status		
Widowed/Divorced/Separated or Never Married	-0.200(0.068)	0.819**
Married or Living with a partner =1		
Household Status		
Rented	-0.278(0.072)	0.757***
Owned/Being Bought =1		
Sex		
Female	-0.128(0.063)	0.880*
Male =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .13$

Table 11. Ordinal Regression Predicting Overall Health Status for Hispanic Households with Acculturation Variables

	β (SE)	Exp. β
Constant		
Poor =0	-5.873(0.451)	
Fair =1	-3.342(0.411)	
Good =2	-1.389(0.396)	
Very Good =3	0.147(0.401)	
Excellent = 4 (comparison group)		
Age		
(Mean years)	-0.026(0.006)	0.974***
Adult Employment		
Not Working	-0.404(0.148)	0.670**
Working =1		
Adult Education		
No H. S. Diploma/GED or Higher	-0.750(0.144)	0.472***
H. S. Diploma/GED or Higher =1		
Household Income		
< \$20,000	-0.505(0.162)	0.604**
> \$20,000 =1		
Total # of People in the Household		
(Mean people)	-0.019(0.056)	0.981
Children in Household		
Yes	-0.293(0.185)	0.746
No =1		
Seniors in Household		
Yes	-0.106(0.195)	0.899
No =1		
Marital Status		
Widowed/Divorced/Separated or Never Married	0.061(0.140)	1.063
Married or Living with a partner =1		
Household Status		
Rented	-0.591(0.144)	0.554***
Owned/Being Bought =1		
Sex		
Female	-0.189(0.132)	0.828
Male =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .19$

Table 11, continued.

	β (SE)	Exp. β
Length of Time in U.S. (Mean years)	0.019(0.046)	1.10
Hispanic Ethnicity Mexican American All other races/ethnicities =1	-0.359(0.139)	0.70*

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .19$

Table 12. Ordinal Regression Predicting Overall Health Status for Non-Hispanic Households with Household Food Security Status

	β (SE)	Exp. β
Constant		
Poor =0	-5.849(0.204)	
Fair =1	-3.752(0.180)	
Good =2	-1.720(0.170)	
Very Good =3	0.140(0.171)	
Excellent = 4 (comparison group)		
Age		
(Mean years)	-0.019(0.003)	0.981***
Adult Employment		
Not Working	-0.393(0.071)	0.675***
Working =1		
Race/Ethnicity		
All other races/ethnicities	-0.283(0.064)	0.754***
Non-Hispanic White =1		
Adult Education		
No H. S. Diploma/GED or Higher	-0.698(0.088)	0.498***
H. S. Diploma/GED or Higher =1		
Household Income		
< \$20,000	-0.439(0.085)	0.645***
> \$20,000 =1		
Total # of People in the Household		
(Mean people)	-0.133(0.029)	0.875***
Children in Household		
Yes	0.112(0.093)	1.12
No =1		
Seniors in Household		
Yes	0.104(0.094)	1.11
No =1		
Marital Status		
Widowed/Divorced/Separated or Never Married	-0.151(0.069)	0.860*
Married or Living with a partner =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .15$

Table 12, continued.

	<u>β(SE)</u>	<u>Exp. β</u>
Household Status		
Rented	-0.173(0.073)	0.841*
Owned/Being Bought =1		
Sex		
Female	-0.120(0.063)	0.887
Male =1		
Household Food Security Status		
Food Insecure	-0.626(0.076)	0.535***
Food Secure =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .15$

Table 13. Ordinal Regression Predicting Overall Health Status for Hispanic Households with Acculturation Variables and Household Food Security Status

	β (SE)	Exp. β
Constant		
Poor =0	-5.920(0.451)	
Fair =1	-3.385(0.421)	
Good =2	-1.422(0.396)	
Very Good =3	0.119(0.402)	
Excellent = 4 (comparison group)		
Age		
(Mean years)	-0.026(0.006)	0.974***
Adult Employment		
Not Working	-0.391(0.148)	0.676**
Working =1		
Adult Education		
No H. S. Diploma/GED or Higher	-0.731(0.144)	0.481***
H. S. Diploma/GED or Higher =1		
Household Income		
< \$20,000	-0.397(0.168)	0.672*
> \$20,000 =1		
Total # of People in the Household		
(Mean people)	-0.003(0.057)	0.997
Children in Household		
Yes	-0.294(0.185)	0.799
No =1		
Seniors in Household		
Yes	-0.118(0.195)	0.889
No =1		
Marital Status		
Widowed/Divorced/Separated or Never Married	0.057(0.141)	1.09
Married or Living with a partner =1		
Household Status		
Rented	-0.550(0.145)	0.577***
Owned/Being Bought =1		
Sex		
Female	-0.196(0.132)	0.822
Male =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .19$

<i>Table 13, continued.</i>	<u>β(SE)</u>	<u>Exp.β</u>
Length of Time in U.S.		
(Mean years)	0.016(0.046)	1.016
Hispanic Ethnicity		
Mexican American	-0.332(0.139)	0.717*
All other races/ethnicities =1		
Household Food Security Status		
Food Insecure	-0.325(0.144)	0.723*
Food Secure =1		

*** $p < .001$, ** $p < .01$, * $p < .05$, $R^2 = .19$

APPENDIX B: IRB Exemption Letter

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129



EXEMPT APPROVAL NOTICE

10/6/2015

Investigator(s): Amber Pogacsnik
 Department: Sociology
 Investigator(s) Email: arp3r@mtmail.mtsu.edu
 Protocol Title: "Welcome to the Land of Opportunity: Assured Food Security and Good Health Not Included"
 Protocol ID: 16-1069

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above and this study has been designated to be EXEMPT.. The exemption is pursuant to 45 CFR 46.101(b) (4) **Collection or Study of Existing Data**

The following changes to this protocol must be reported prior to implementation:

- Addition of new subject population or exclusion of currently approved demographics
- Addition/removal of investigators
- Addition of new procedures
- Other changes that may make this study to be no longer be considered exempt

The following changes do not have to be reported:

- Editorial/administrative revisions to the consent of other study documents
- Changes to the number of subjects from the original proposal

All research materials must be retained by the PI or the faculty advisor (if the PI is a student) for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
 Middle Tennessee State University

NOTE: All necessary forms can be obtained from www.mtsu.edu/irb.