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Food Insecurity and Health of International Students

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FOOD INSECURITY AND HEALTH OF INTERNATIONAL STUDENTS

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ABSTRACT

International college students may be at risk for suffering from food insecurity and poor health. The purposes of this study were to: 1) determine if the household adult food security status (HAFSS) differs between undergraduate and graduate international students (INSTUD) attending the University of Mississippi (UM); 2) establish if a statistically significant relationship exists between health (physical functioning (PF) , role limitations due to physical health (RLPH), role limitations due to emotional problems (RLEP), energy/fatigue (EF), emotional well-being (EWB), social functioning (SF), pain (P), and general health (GH) and HAFSS; 3) assess if health differs between INSTUD living in food secure and food insecure households at UM; and 4) determine if health predicts HAFSS in INSTUD attending UM. A cross-sectional survey design was used. Methods included sending a fifty-eight-question survey questionnaire assessing current food insecurity status and health to 750 randomly-selected INSTUD via university email. This survey included questions to assess basic demographic information, the USDA's HFSSM Six-Item Short Form and the RAND 36-Item Short Form. To determine the differences in HAFSS in undergraduate and graduate INSTUD, a Pearson Chi-square test was performed. A Pearson's correlation coefficient was used to identify if a statistically significant relationship exists between health and HAFSS. When assessing the difference in health status between food secure and food insecure INSTUD, a two-tail independent samples t-test was used. When identifying if health predicts HAFSS, an ordinal logistic regression with proportional odds

test was performed. Participants (n=94, 12.5% response rate) were from thirty-five different countries were primarily male (n=48, 51.1%), graduate students (n=50, 53.2%), that received funding (n=82, 87%). INSTUD were categorized by high food security (n=27, 28.7%), marginal food security (n=12, 12.8%), low food security (n=24, 25.5%), and very low food security (n=31, 33%). The majority of participants were characterized as being non-OECD member countries (n=75,80%), with noted differences in food security by students from non-OECD and OECD countries. No differences in HAFSS were observed between undergraduate and graduate students ($p=.344$). Significant relationships between RLPH ($p<.05$), EF ($p<.001$), EWB ($p<.05$), SF ($p<.001$), P ($p<.05$), and GH ($p<.001$) and food security status were noted. RLPH ($p=.043$), SF ($p<.001$), and GH ($p<.001$) differed between food secure and food insecure INSTUD. Health scores in these areas were higher in food secure INSTUD. Essentially, as health scores decreased, food security worsened. Analysis also found decreased odds of living in a food insecure household for individuals with good SF (OR=.95) and GH (OR=.96). To conclude, INSTUD at UM may suffer from poor health and experience food insecurity. Better SF and better GH promote food security among INSTUD.

DEDICATION

I would like to dedicate this work to Jesus Christ, for whose love for all people from every nation inspired this project.

ACKNOWLEDGEMENTS

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INTRODUCTION

Food insecurity is defined as inadequate or unreliable access to sufficient food (United States Department of Agriculture, 2017). While many people are at risk for suffering from food insecurity, college students are particularly at-risk for becoming food insecure (Bruening, Brennhofer, van Woerden, Todd, & Laska, 2016; Gaines, Robb, Knol, & Sickler, 2014; Gallegos, Ramsey, & Ong 2014; Morris, Smith, Davis, & Null, 2016; Patton-López, López-Cevallos, Cancel-Tirado, & Vazquez, 2014; Silva et al., 2015). Factors contributing to food insecurity among college students include having fair or poor health, being employed, low income, receiving support from student loans, living alone, having inadequate time for shopping or preparation, being a single parent, and being African American or Latino (Bruening, Argo, Payne-Sturges, & Laska, 2017).

Prevalence of food insecurity ranges from 14-59% on U.S. college campuses (Gaines, Robb, Knol, & Sickler, 2014; Patton-López, López-Cevallos, Cancel-Tirado, & Vazquez, 2014; Maroto, Snelling, & Linck, 2015) and varies based upon region and sampling pool. At an Alabama university, fourteen percent of students were food insecure; however, other studies report food insecurity prevalence rates to be much higher (Gaines, Robb, Knol, & Sickler, 2014). At an Oregon university, 59% of students were identified as food insecure, and at a Maryland community college, 56% of students identified as being food insecure (Gaines, Robb, Knol, & Sickler, 2014; Patton López, López-Cevallos, Cancel-Tirado, & Vazquez, 2014; Maroto, Snelling, & Linck, 2015).

Within the literature on food insecurity on college campuses, populations studied vary. Some studies only include undergraduate students (Lin et al., 2013; Bruening, Brennhofer, van Woerden, Todd, & Laska, 2016; Gaines, Robb, Knol, & Sickler, 2014; Knol, Robb, McKinley & Wood, 2017), while other studies include both undergraduate and graduate students (Silva et al., 2015; Watson, Malan, Glik, & Martinez, 2017). Some studies stratify samples by undergraduate and graduate status, while others do not. (Henry, 2017; Maroto, Snelling, & Linck, 2015; Soldavini, Berner, & Silva, 2019).

International students have a potential to suffer from food insecurity; however, only three papers have focused on this population (Watson, Malan, Glik, & Martinez, 2017; Henry, 2017; Soldavini, Berner, & Silva, 2019). International students seeking to study in the United States have to undergo a thorough process surrounding their financial ability to attain an F-1 or M-1 Student Visa, and the U.S. Citizenship and Immigration Services require that international students have adequate finances to support them for the duration of their program of study (U.S., Citizenship and Immigration Services, 2016). For instance, a student who is sponsored fully by their government, academic institution, or other foundation/sponsoring agency must provide a letter written by the sponsor disclosing the amount and duration of their sponsorship to confirm their ability to finance tuition and other estimated costs (The University of Mississippi, 2018). If a student is using their personal or family funds, they must provide an official bank statement from the past six months; this statement must contain an official bank seal and signature from a bank officer (The University of Mississippi, 2018).

Cost of tuition and other expenses associated with international student university attendance vary. For example, the University of Mississippi has an estimated cost of attendance for both undergraduate and graduate level international students of $42,633 per academic year

(The University of Mississippi, 2018). With this large financial burden, international students may be at risk for suffering from food insecurity.

The health status of these university students may also be associated with food insecurity, since the association of food insecurity and poor physical and mental health is supported by the literature (Afulani, Coleman-Jensen, & Herman, 2018; Alvarez, Lantz, Sharac, & Shin, 2015; Berkowitz et al., 2013; Bishop & Wang, 2018; Brucker, 2016; Bruening, Dinour, Rosales Chavez, 2017; Bruening, van Woerden, Todd, & Laska, 2018; Crews et al., 2014; Darling, Fahrenkamp, Wilson, D'Auria, & Sato, 2017; Dominick, Olnyk, Widmar, Ruple, Grennell Weir, & Acharya, 2018; Gregory & Coleman-Jensen, 2017; Gowda, Hadley, & Aiello, 2012; Gucciardi,Vahabi, Norris, Del Monte, and Farnum, 2014; Hernandez, Reesor, & Murillo, 2017; Holben and Berger, 2017; Holben & Pheley, 2006; Knol, Robb, McKinley & Wood, 2017; King, 2018; Laraia, 2013; Lee, Scharf, and DeBoer, 2018; Leung, Epel, Willett, Rimm, & Laraia 2015; Leung, Tester, & Laraia, 2017; Liu et al., 2014; Martinez, Frongillo, Leung, & Ritchie, 2018; Patton-López., López-Cevallos, Cancel-Tirado, & Vazquez, 2014; Pheley, Holben, Graham, & Simpson, 2002; Tarasuk, Mitchell, McLaren, and McIntyre, 2013; Saiz et al., 2016; Seligman et al., 2010). Yet, research is lacking in food insecurity and health among international students' in the United States. Notably, most research published on food insecurity and health has utilized food insecurity as a predictor of health outcomes (Holben & Berger-Marshall, 2017). However, Tarasuk, Mitchell, McLaren, and McIntyre (2013), using a Canadian sample, utilized physical and mental health conditions as a predictor of food insecurity. They reported that most chronic physical and mental health conditions, including diabetes, cardiovascular disease, fibromyalgia, and depression, increased the odds of food insecurity, independent of household demographics (Tarasuk, Mitchell, McLaren, and McIntyre, 2013). The possibility of food insecurity and both

mental and physical health outcomes being bidirectional is well supported in the literature (Bruening, Argo, Payne-Sturges, and Laska, 2017; Afulani et al., 2018; Crews et al., 2014; Bruening, Dinour, and Chavez, 2017; Maynard, Andrade, Packull-McCormick, Perlman, Leos-Toro, Kirkpatrick, 2018). Specifically, one study found that depression could lead to change in work status and income which may affect their food security status (Leung et al., 2015).

Therefore, this study investigated food insecurity and health among international students attending the University of Mississippi. The purposes of this study were to: 1) determine if the household adult food security status differs between undergraduate and graduate international students attending the University of Mississippi; 2) establish if a statistically significant relationship exists between health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) and Household Adult Food Security Status; 3) assess if health differs between international students living in food secure and food insecure households at the University of Mississippi; and 4) determine if health predicts Household Adult Food Security Status in international students attending the University of Mississippi. Table 1 summarizes the research questions and null hypotheses.

Table 1. *Research Questions and Null Hypotheses*

Research Question	Null Hypothesis
Does household adult food security status differ between undergraduate and graduate international students attending the University of Mississippi?	Household adult food security status does not differ between undergraduate and graduate international students attending the University of Mississippi.
Is there a statistically significant relationship between health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) and household adult food security status?	There is not a statistically significant relationship between health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) and household adult food security status.
Does health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) differ between the University of Mississippi international students living in food secure and food insecure households?	Health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) does not differ between the University of Mississippi international students living in food secure and food insecure households.
Does health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) predict household adult food security status in international students attending the University of Mississippi?	Health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) does not predict Household adult food security status in international students attending the University of Mississippi.

CHAPTER 2

REVIEW OF LITERATURE

Food Insecurity Prevalence Trends and History

According to the 2017 estimates, 11.8% of U.S. households were found to be food insecure with 4.5% identified as having very low food security (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). As shown in Figure 5, these percentages have decreased since 2011. However, prior trends in food insecurity prevalence show that in 2001 food insecurity prevalence rates were at a prevalence of 10.7% and increased until 2004 when the prevalence was found to be around 12% (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). In 2005, food prevalence rates declined slightly to 11% and remained at this rate until 2008 when the percentage of food insecurity rose to 14.6%. The food insecurity prevalence rate did not change until 2011 when it was recorded at 14.9%, the highest in the last two decades. From 2011 forward, rates trended downward to the current food insecurity prevalence percentages (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). On a state level, New Mexico had the highest average of food insecurity at 17.9%, while Hawaii had the lowest average at 7.4% from the years of 2015-2017. Mississippi had an average food insecurity rate of 17.2% (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). The 2017 data also found that 8% of households with adults only were determined to be food insecure (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). Balistreri (2016), suggests that households without children have an increasing severity

and depth of food security. Additionally, Gregory and Coleman-Jensen (2013) determined that Supplemental Nutrition Assistance Program (SNAP) participants suffering from food insecurity that have household incomes of 200% or less of the federal poverty line were affected by food prices.

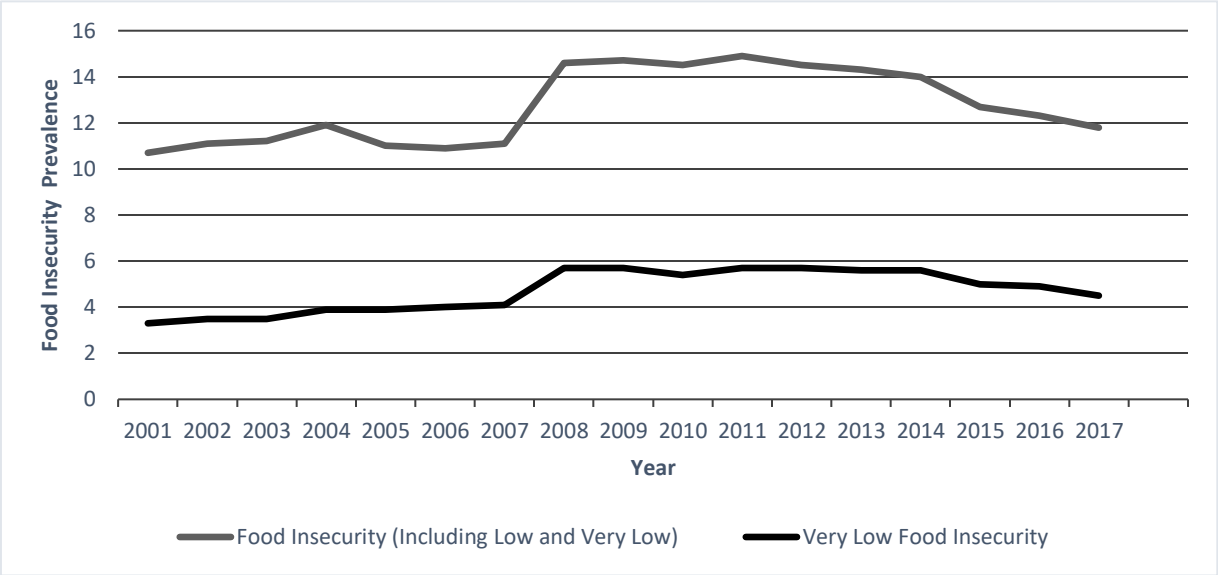

Figure 1. Trends in the Prevalence of Food insecurity and Very Low Food Security in U.S. Households, 2001-2017.Coleman-Jensen, A., Rabbitt, M.P., Gregory, C.A, and Singh, A. (2018). Household food security in the United States in 2017. Retrieved from https://www.ers.usda.gov/webdocs/publications/90023/err-256.pdf?v=0

Food Security Measures

Various scales are used as indicators for food security (Pereira & Hodge, 2015). Scales may have different concentration areas or one specifically, these include "food availability, access, utilization" and "the stability of food security over time" (Jones, Ngure, Pelto, & Young, 2013, p. 484). Food insecurity scales are classified into two groups. One group of scales are based on the concept of food consumption adequacy (Cafiero, Melgar- Qui˜nonez, Ballard, & Kepple, 2014). Food insecurity indicators or scales included in this group are the prevalence of undernourishment, Food Consumption Score (FCS), and the Household Dietary Diversity Score (HDDS). The prevalence of undernourishment, a fundamental Food and Agriculture

Organization (FAO) food security measure is presently used an indicator to keep up with advancement against the Millennium Development Goals (Cafiero, Melgar-Qui˜nonez, Ballard, & Kepple, 2014; Jones, Ngure, Pelto, G, & Young, 2013; Maxwell, Coates, & Vaitla, 2013). The Millennium Development Goals include: 1) to eradicate extreme poverty and hunger; 2) to achieve universal primary education; 3) to promote gender equality and empower women; 4) to reduce child morality; 5) to improve maternal health; 6) to combat HIV/AIDS, malaria, and other diseases; 7) to ensure environmental sustainability; and 8) to develop a global partnership for development (World Health Organization, 2018).

Food Consumption Score is a food frequency scale developed by the World Food Programme (hunger relief humanitarian organization) that is used to assess food security and vulnerability (Cafiero, Melgar- Qui˜nonez, Ballard, & Kepple, 2014 & Maxwell, Coates, & Vaitla, 2013). The Household Dietary Diversity Score is similar to the Food Consumption Score except for its addition of a 24-hour recall period that lacks in frequency information (Maxwell, Coates, & Vaitla, 2013). The second group is comprised of experienced-based food security scales. Scales in this group include the Household Food Security Survey Module (HFSSM), Household Food Insecurity Access Scale (HFIAS), the Household Hunger Score (HHS), the Latin America and Caribbean Food Security Scale (ELACSA), and the Food Insecurity Experience Scale (FIES). The HFSSM is a food security assessment developed by the United States Department of Agriculture (Appendix B). With this measure, food security status is categorized into four categories on a continuum. Categories include high food security, marginal food security, low food security, and very low food security. With high food security, a household has not had issues obtaining satisfactory qualities and quantities of food. For marginal food security, households have had some issues obtaining satisfactory qualities and quantities of

food, but have ultimately not been considerably affected. Households identifying with low food security have reduced the quality or quantity of their diets, but eating patterns were not considerably affected. Very low food security households are defined as having disrupted eating patterns of multiple members due to deficient resources. Households with high or marginal food security are classified as food secure, while households with low or very low food security are classified as food insecure (USDA, 2017).

Another experience-based food security scale, the HFIAS, is a food security assessment created to understand household behaviors that suggest inadequate food access and related anxiety; it may be used across cultural contexts (Maxwell, Coates, & Vaitla, 2013, (Coates, Swindale, & Bilinsky, 2007) (Appendix C). From this assessment, the HHS was created. The HHS includes three specific questions that are socially set (Maxwell, Coates, & Vaitla, 2013) (Appendix D). The ELCSA is used in international environments and combine both behavioral and psychological indicators (Maxwell, Coates, & Vaitla, 2013) (Appendix E). Finally, the FIES was developed by the Food and Agriculture Organization (Appendix F). The FIES is used as a part of the Gallup World Poll. This scale is an 8-item questionnaire available in two distinctive versions, one version for individuals, and the other for households. Responses for this assessment are yes/no. Data are measured based upon items answered and the probability of food insecurity for a household or individual above a particular severity level (Food and Agriculture Organization of the United Nations, 2017). Additionally, food security is being determined via self-assessment measures. Table 2 summarizes the food security scales.

Table 2. *Food Security Scales*

Food Security Scales based on the Concept of Food Consumption Adequacy	▪ Prevalence of Undernourishment ▪ Food Consumption Score (FCS) ▪ Household Dietary Diversity Score (HDDS) (Cafiero, Melgar- Qui˜nonez, Ballard, & Kepple, 2014; Jones, Ngure, Pelto, G, & Young, 2013; & Maxwell, Coates, & Vaitla, 2013)
Experienced-based Food Security Scales	▪ Household Food Security Survey Module (HFSSM) ▪ Household Food Insecurity Access Scale (HFIAS) ▪ Household Hunger Score (HHS) ▪ Latin America and Caribbean Food Security Scale (ELACSA) ▪ Food Insecurity Experience Scale (FIES) (Food and Agriculture Organization of the United Nations, 2017; Maxwell, Coates, & Vaitla, 2013; USDA, 2017)

The six-item U.S. Adult Food Security Survey Module was used for this study, since it distinctly classifies between food security severity and has exceptional predictive validity (Pérez-Escamilla & Segall-Corrêa, 2008).

Food Insecurity on United States College Campuses

According to Bruening, Argo, Payne-Sturges, & Laska 2017, food insecurity is an issue particularly at postsecondary institutions. Specific to college students in the United States, an average food insecurity rate of 32.9% was determined among 9 peer-reviewed studies that included data from City University of New York in 2011, San Jose University in 2014, University of Alaska Anchorage in 2013, 10 US community colleges in 2015, Humbodlt State University in California in 2015 and 2016, Pacific University in 2014, Maryland Community Colleges in 2013, University of Arkansas in 2016, University of Central Florida 2013, Bowling Green State University in 2014, Kent State in 2014, California State University in 2013, University of California San Francisco in 2015, Michigan Technical University in 2015,

University of New Hampshire in 2015, California State Polytechnic University in 2012, Fresno State in California on an unspecified date, Gavilan College in 2013, and Wisconsin Public Colleges in 2014 (Bruening, Argo, Payne-Sturges, & Laska, 2017). Outcomes for these nine studies varied greatly. One study found that individuals living alone or being single parents had higher rates of food insecurity prevalence. This is one of the single largest predictors of food insecurity, it is not specific to college students. Results also showed that food insecure students were more likely to report lower grade point average, have an affected ability to attend class and complete work, or withdraw from university (Bruening, Argo, Payne-Sturges, & Laska, 2017).

Another study by Gaines, Robb, Knol, & Sickler, 2014 revealed that food insecurity was associated with students receiving financial aid, receiving food assistance, being financially autonomous, operating without a budget, external distress, and credit card possession. Individuals were also more likely to report being food insecure if they received a Pell grant (Bruening, van Woerden, Todd, & Laska, 2018). A study conducted in California reported that students enrolled in more than thirteen hours were likely to be food insecure; researchers did not elaborate on the conditions surrounding this finding (Bruening,Argo, Payne-Sturges, & Laska, 2017). Substance use and partner conflict were also found to be associated with food insecurity (Bruening, Argo, Payne-Sturges, & Laska, 2017). There is also a larger probability to become food insecure for adults with disabilities (Brucker, 2016). Additionally, a study found that college freshman had greater occurrences of food insecurity at the end of each semester (Bruening, Woerden, Todd, & Laska, 2018).

One study assessed rates of food insecurity and its associated characteristics in both undergraduate and graduate students and found significant differences between these two student groups (Soldavini, Berner, & Silva, 2019). Soldavini, Berner, & Silva (2019) determined that a

greater number of undergraduate students were food insecure rather than food secure and graduate students were less likely to experience marginal food security or food insecurity. This is a reasonable finding considering that graduate students have increased chances to benefit from assistantships and tuition waivers, unlike undergraduate students (Sherry, Thomas, & Chui, 2009). There are a variety of differences noted between to these two student populations. Specifically, Soldavina, Berner, & Da Silva (2019) identified that food insecurity in undergraduates was associated with year in school, residency, body mass index (BMI), having a meal plan, and cooking occurrence. Marital status and perceived cooking skills were associated with food insecurity in graduate students (Sherry, Thomas, & Chui, 2009). International students are also at risk for becoming food insecure on college campus' in the United States (Bruening, Argo, Payne-Sturges, & Laska, 2017; Soldavini, Berner, & Silva, 2019). Undergraduate international students had greater odds of experiencing food insecurity (Soldavini, Berner, & Silva, 2019). While there is limited literature on international students studying in America and their associations with food insecurity, there are many studies that have investigated the challenges and acculturation of international students.

The International Student Struggle and Acculturation

International students come from both economically developed and non-developed countries. These countries are further detailed by the Organization for Economic Co-operation and Development (OECD), an organization dedicated to global economic development and aims to create a greater and more ethical world. Countries with current membership to the OECD include Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic,

Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States (Organization for Economic Co-operation and Development, 2019). When coming to America to study, both international students from economically developed and non-developed countries have to overcome a variety of issues.

Barriers for international student acculturation typically fall under academic, social and cultural themes (Wu, Garza, Guzman, 2014). Specifically, international students have reported issues with being overwhelmed by academic work, language, skills for class reading, paying bills, doing laundry, and independent living (Tsevi, 2018). Similarly, Sherry, Thomas, & Chui (2009) found that language issues, adapting to cultural norms, cultural misunderstanding, financial problems, and absence of friendships and social isolation were difficulties for international students. Researchers implied that financial weakness is very apparent in the international student population (Sherry, Thomas, & Chui, 2009). Acculturative stress, low resilience, anxiety and depression, and binge drinking have also been noted as issues for international students (Kim, Maleku, Lemleu, Du, & Chen, 2019, Bai, 2016). Challenges with family relationships for doctoral students were documented too (Campbell, 2015). With these issues prominent in this student population, many studies sought to determine how international students acclimated to their new cultural setting with respect to nutrition.

Regarding issues with acculturation, Lee, Gao, & Kim (2015) claim that inconsistency in meal time and size as well as lack of eating some meals contribute to unhealthy eating patterns in an American setting (Lee, Gao, &Kim, 2015). Hartwell, Edward, & Brown (2011) revealed seven themes regarding social and food acculturation which included purchase influence, traditional food, social facilitation, eating out, ideal meals, emotions, and personality. Researchers suggest that internationals could become better acclimated to American food if they

participated in culinary groups and food sampling at the beginning of the school term (Hartwell, Edwards, & Brown, 2011). Amos & Lordly (2014) found that acculturation could be bettered if new student orientations provided a food and nutrition element that educates international students on food choices as well as familiar foods and ingredients (Amos & Lordly, 2014). Being that food education is not always standard education for international students at most universities, it is important to examine how acculturation occurs. Additionally, Martinez-Ruiz, Tirelli, Izquierdo-Yusta, & Gómez-Ladrón-De-Guevara (2015) when examining how food purchasing decisions affected acculturation, found that sustainable production, appearance, and accessibility were the main factors that affected their purchasing decisions. Indicating that if food items do not match the standard that the international student is used to having, they may not purchase sufficient amounts of food. Leong (2013) proposes that a significant cultural adjustment is made by international students concerning food, especially junk food (Leong, 2013). Wu, Garza, & Guzman (2015) discuss other issues regarding food acculturation and state that some negative associations with acculturation include: interactions with professors, isolation from classmates, communication barriers, and pressure of parent's expectations. One study urged that American universities provide an experience for international students that is comparable to that of American students as to effectively attract students (Zhou & Cole, 2017). Hearty (2014) emphasizes that American Universities have special motivation in caring for internationals. Specifically, Hearty's (2014) study implies that international student enrollment at American universities greatly benefit the U.S. economy. This expression accentuates the importance of international students in America and the role that both the universities and international students play on the college campus. Being so, it is vital to assist international students in maintaining healthy lifestyles and preventing food insecurity.

Food Insecurity and Health

The literature reflects the potential impact of food insecurity on individual's health, including both physical and mental health (Knol, Robb, McKinley & Wood, 2017; Pheley, Holben, Graham, & Simpson, 2002). In fact, in one study, individuals were more likely to report chronic health issues as the severity of their food insecurity increased (Tarasuk, Mitchell, McLaren, and McIntyre, 2013). Regarding food insecurity and physical health, a variety of acute and chronic illness have been discovered to have clear associations (Dominick, Olnyk, Widmar, Ruple, Grennell Weir, & Acharya, 2018). Specifically, these health issues include cardiovascular disease, hypertension, coronary heart disease, hepatitis, stroke, cancer, asthma, insulin resistance, diabetes, chronic kidney disease, arthritis, chronic obstructive pulmonary disease, eating disorders, depression, and anxiety (Dominick, Olynk Widmar, Ruple, Grennell Weir, & Acharya, 2018; Saiz et al., 2016; Crews et al., 2014; Leung, Tester, & Laraia, 2017; Liu et al., 2014; Gregory & Coleman-Jensen, 2017). In pregnant females, food insecure individuals had higher prevalence of iron deficiency than those that were food secure (Park & Eicher-Miller, 2014). Food insecurity was also found to be associated with increased inflammation via high levels of c-reactive protein. Authors of this study suggested that food insecurity may use inflammation as a device in which chronic disease occurs (Gowda, Hadley, & Aiello, 2012). Regarding cardiovascular disease, Saiz et al. (2016) found that the likelihood of having positive cardiovascular health was less likely for food insecure individuals. Comparably, another study determined that there were associations between preferred blood pressure, fasting glucose levels, and total cholesterol levels and household food insecurity (Leung, Tester, & Laraia, 2017). Seligman et al. (2010), also found that food insecurity was related to self-reported hypertension and hyperlipidemia and clinically evidenced hypertension

and diabetes. The literature also noted that poor metabolic control and cholesterol control for adults with diabetes is linked to food insecurity (Berkowitz et al., 2013). Per Liu et al. (2014), the odds of being insulin resistant in adults without diabetes were greater when persons identified as having marginal, low, and very low food insecurity. Laraia (2013) too found associations between food insecurity and diabetes as well as poor diabetes management. Gucciardi, Vahabi, Norris, Del Monte, and Farnum (2014) also found that food insecurity was related to poor diabetes management. Another study found that there were increased odds of having prediabetes or diabetes for food insecure young adults ages twenty to thirty-nine (Lee, Scharf, and DeBoer, 2018). Similarly, Montgomery, Lu, Ratliff, and Mezuk (2017) and Holben & Pheley (2006) determined that food insecurity was associated with individuals suffering from prediabetes or diabetes; these individuals have increased odds for depression.

Mental health has been shown to be affected by food insecure status. However, researchers have suggested that the association between food insecurity and mental health is bidirectional (Bruening, Dinour, Rosales Chavez, 2017). Specifically, Afulani, Coleman-Jensen, & Herman (2018) determined that greater odds of suffering from a severe mental illness were correlated with food insecurity. Particularly, depression was associated with food insecurity in low-income adults and the likelihood of being depressed was the greatest in SNAP participants with very-low food insecurity and SNAP-eligible nonparticipants (Leung, Epel, Willett, Rimm, & Laraia 2015). Some mental health issues related to food insecurity included disordered eating, depression, stress, and anxiety (Darling, Fahrenkamp, Wilson, D'Auria, & Sato, 2017). Leung, Epel, Willett, Rimm, & Laraia (2015) proposed that depressive feelings, thoughts, and behaviors are impacted by food insecurity. One study stated that participants with a past food insecure status had larger quantities of disordered eating, depressive symptoms and stress compared to

participants who did not have a past food insecure status (Darling, Fahrenkamp, Wilson, D'Auria, & Sato, 2017). Similarly, Bruening, van Woerden, Todd, & Laska, 2018, found that food insecurity was associated with a greater likelihood of stress and depressed mood. Another study found that food insecure students had a considerably high amount of poor mental health indicators in comparison to those who identified as food secure (Martinez, Frongillo, Leung, & Ritchie, 2018). Bruening, Woerden, Todd, and Laska (2018) discovered that the odds of suffering from high levels of stress and depressive mood were almost two times more likely in food insecure individuals than food secure persons. It was also found that the odds of not having enough money to pay for mental health services were associated with food insecurity (Afulani, Coleman-Jensen, &Herman, 2018). Individuals had greater odds of reporting fair or poorer mental health when they identified as being food insecure in the past year when compared to those who identified as food secure in the past year (Brucker 2016).

One study found that individuals were more likely to demonstrate poor health if they identified as food insecure (Brucker, 2016). Alvarez, Lantz, Sharac, & Shin (2015) reported that participants identifying as food insecure were seventy percent more likely to categorize their health status as fair or poor than patients presenting as food secure. Women identified as food insecure were more likely to report fair or poor health (Alvarez, Lantz, Sharac, & Shin, 2015). Likewise, another study found that college students who were food insecure were more likely to report their health status as fair or poor than students with food security (Knol, Robb, McKinley & Wood, 2017 & Patton-López., López-Cevallos, Cancel-Tirado, & Vazquez, 2014). Similarly, students were more likely to report fair/poor health when they identified as severely food insecure (Farahbakhsh, Hanbazaza, Ball, Farmer, Maximova, & Willows, 2017). Additionally, a self-reported health status of fair or poor was observed in students living off-campus; this was

assessed by using a single, valid question (Knol, Robb, McKinley & Wood, 2017). In a study that evaluated food insecurity and its associations health effects over time, results showed that no longitudinal associations exist between food insecurity and health behavior or effects (Bruening, van Woerden, Todd, and Laska, 2018).

Brucker (2016) found individuals that were food insecure or that had been food insecure for the last year had greater frequencies of emergency room and hospital visits. Food insecurity has been shown to have associations with increased healthcare costs; particularly in individuals with illnesses like diabetes, heart disease, and hypertension (Berkowitz, Basu, Meigs, & Seligman, 2018). Specifically, Berkowitz, Basu, Meigs, & Seligman (2018) found that approximately $1,800 in greater healthcare costs per year were associated with food insecurity. Since this cost impacts income, individuals may have to rely upon low-cost, calorically dense foods and thus perpetuate their food insecurity and poor health state (Decker and Flynn, 2018). For example, in one quantitative study, participants reported frequently having to choose whether they would purchase food or their prescriptions (Higashi, Lee, Pezzia, Quirk, Leonard, & Pruitt, 2017). Tarasuk et al. (2015) also found that as the severity of food security status increased, that health care cost rose. Specifically, researchers found that individuals had significant increased odds of using health care when they identified as being severely food insecure.

Food insecurity not only affects the health of adults, but according to Holben and Berger (2017), food insecurity impacts health across the lifespan. For instance, food insecurity has clear associations with obesity and externalizing and internalizing behavior in children (King, 2018; Lee, Scharf, & DeBoer, 2017). Health in older adults too has been impacted by food security. The literature supports that in older adults, food insecurity is associated with mobility limitations

and obesity in older women (Bishop & Wang, 2018; Hernandez, Reesor, & Murillo, 2017). Research in the older adult population is limited (Holben and Berger, 2017).

Health as a Predictor of Food Insecurity

In particular to food insecurity, health has been shown to be a predictor (Garg, Toy, Tripodis, Cook, & Cordella , 2015; Hagedorn & Olfert, 2018; Hanson & Olson, 2012; Hunt, Benjamins, Khan, & Hirschtick, 2018; Maynard, Andrade, Packull-McCormick, Perlman, Leos-Toro, Kirkpatrick, 2018; Pellowski, Barnett, Kuo, Koen, Zar, & Stein, 2017). In a study that examined females from high-income countries, investigators suggest that an individual may be at increased vulnerability to food security when lack of steady employment results from a mental health condition; supporting the claim that health is a predictor for food insecurity (Maynard, Andrade, Packull-McCormick, Perlman, Leos-Toro, Kirkpatrick, 2018). Another study found that the lonelier a participant was, the more likely they were to be food insecure (Hunt, Benjamins, Khan, & Hirschtick, 2018). Hunt, Benjamins, Khan, & Hirschtick (2018) results suggest that loneliness is a predictor of food insecurity. Specific to pregnant women, depression and childhood trauma were identified as predictors of perceived household food insecurity (Pellowski, Barnett, Kuo, Koen, Zar, & Stein, 2017). One study that investigated food insecurity and behavioral characteristics identified health as a significant predictor for food security in both undergraduate and graduate students at a rural university in Appalachia (Hagedorn & Olfert, 2018). Particular to low-income rural families, lasting risk for depression and lasting chronic health conditions were found to be predictors of persistent food insecurity (Hanson & Olson, 2012). Comparably, Garg et al. (2015) determined that among low-income families with young children, household adult food insecurity is predicted by maternal depression.

CHAPTER 3

METHODOLOGY

Study Design

International students at the University of Mississippi were surveyed using a cross-sectional survey research design. Data were gathered via survey questionnaire administered using Qualtrics online survey software. This study was conducted in the spring, 2018, and was approved by the University of Mississippi's Institutional Review Board (IRB) prior to data collection. No incentive was provided for completing this survey.

Setting

The setting for this study was at the University of Mississippi. The University of Mississippi is a rural, public university located in the Southeastern region of the United States. Campuses for this university include the Oxford, Desoto, Grenada, Boonville, and Tupelo campuses. The University of Mississippi has an overall student population of 23,780 with students represented from eighty-six countries (The University of Mississippi, 2017).

Participants

The population for this study was the 950 international students attending the University of Mississippi. International students for this study were defined as students that are non-native to America and have come to America to complete work towards a college degree of any type, participate in the Intensive English Program, or are involved with the exchange, visiting, and pre-college programs, including both undergraduate and graduate. Requirements for

participation was an age of eighteen years and older and classification as an international student by the University of Mississippi. International students on all campuses were included (Oxford, Desoto, Grenada, Boonville, and Tupelo). Surveys were sent to 750 randomly-selected international students via university email. Participants were selected by the Office of Institutional Research, Effectiveness, and Planning (OIREP). OIREP limits samples to 750 at the University of Mississippi, which was the rationale for sampling only 750 of the 950 students.

Instrument and Measures

A fifty-eight question survey to assess basic current food insecurity status and health was administered to international students at the University of Mississippi (Appendix A). The survey included seven questions to establish basic demographic information, the USDA's Household Food Security Survey Module (HFSSM): Six-Item Short Form (Appendix B), and the RAND 36-Item Health Survey 1.0 Questionnaire Items (Appendix G). Surveys were scored using standardized scales as shown in Table 3 (United States Department of Agriculture, 2017; Hays, 1994; Duckworth & Quinn, 2009). Appendix B and Appendix G provided scoring for these measures. Based upon the number of responses, a scale score (Rasch measurement model) was assigned and food security status was scored. In addition, a food security category was assigned. The Rand 36-Item Health Survey 1.0 Questionnaire Items was selected for our study since it captures self-reports of eight health concepts in a generic and coherent manner (Hays, 1994). For the eight health concepts (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health), a health score was assigned based upon the responses to the instrument's question. The median was determined for each health concept (physical functioning – 95, role limitations due to physical health – 75, role limitations due to emotional problems –

33, energy/fatigue – 45, emotional wellbeing- 60, social functioning – 62.5, pain – 80, and general health – 60). Poor health was considered to be at or below the median, while good health was above the median. Table 3 and Appendix G summarize the instrument's scores and associated procedures. The USDA's HFSSM: Six item short form was designed with the intention to assess food security in the United States; however, developers expect this measure to be appropriate for assessment in other setting with appropriate cultural translations (Bickel, Nord, Price, Hamilton, & Cook, 2000). The Rand-36 Item Health Survey is available for translation (Hays, 1994). Studies have also validated RAND-36-Item Health Survey 1.0 for cross-cultural use when appropriately translated (Zhang, Qu, Lun, & Guo, Liu, 2012; Orwelius et al., 2018).

Table 3. *Variables, Measures/Instruments, and Score/Scale Score Ranges*

Variable	Measure/Instruments	Score/Scale Score Ranges
Demographic	Questions to assess age, country of origin, ethnicity, gender, relationship status, number of children, length of attendance, and funding	Score ranges differ due to varying answers
Food Security Status	USDA's Household Adult Food Security Survey Module: Six Item Short Form	Rasch measurement model: 0 (lowest) -8.48 (highest)[a]
Health	RAND 36-Item Health Survey 1.0 Questionnaire Items	0 (lowest; less desirable health state) - 100 (highest; more desirable health state)

[a] Food security status was also determined by raw score.

Statistical Analysis

IBM SPSS was used to tabulate data and conduct analyses. Descriptive statistics were used to summarize demographic qualities of participants. A Pearson Chi-square test was performed to evaluate the differences in household adult food security status between undergraduate and graduate international students. To identify significant relationships between health and household adult food security status, a Pearson correlation coefficient was used. A two-tail independent samples t-test was used to assess the difference in health status of international students living in food secure and food insecure households. To determine if health predicts household adult food security status in international students, ordinal logistic regression with proportional odds test was conducted. A p-value less than 0.05 was used to identify statistical significance.

Table 4 summarizes the statistical procedures that were used to analyze each research question. Initially, the food security status of undergraduate and graduate international students was assessed. All data were merged since there was no difference by status. When determining participant health status good health was determined to be above the median while poor health was at or below the median with scores ranging from zero to one-hundred. All assumptions were met for statistical procedures performed.

Table 4. *Primary Research Questions and Statistical Procedures*

Research Question	Statistical Procedure
Does household adult food security status differ between undergraduate and graduate international students attending the University of Mississippi?	Pearson Chi Square
Is there a statistically significant relationship between health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) and household adult food security status?	Pearson's Correlation Coefficient
Does health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) differ between the University of Mississippi international students living in food secure and food insecure households?	Two-Tail Independent Samples T-Test
Does health (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) predict household adult food security status in international students attending the University of Mississippi?	Ordinal Logistic Regression with Proportional Odds Test

CHAPTER 4

RESULTS

Participant Characteristics

Of the 750 randomly-selected participants, responses were received from ninety-four international students (response rate, 12.5%). Table 5 summarizes participant demographic characteristics.

Table 5. *Participant Demographic Characteristics (n=94)*

Gender	n	%
Male	48	51.1
Female	46	48.9
Student Classification		
Undergraduate Student	44	46.8
Graduate Student	50	53.2
Funding		
Funded	82	87
Not Funded	12	12
Hourly Classification		
Full-Time	86	92
Part Time	8	9
Length of Attendance		
Less than one semester	9	10
One Semester	5	5
Two Semesters	28	30
More than two semesters	52	55

Overall, the majority of participants, as represented by our sample, were male (n=48, 51.1%) and enrolled in graduate education (n=50, 53.2%). The majority received funding (n=82, 87%). Those who received funding included both undergraduate (n=38, 46%) and graduate (n=44, 54%) international students. Additionally, the majority of participants were full-time students (n=86, 90%) and reported to have attended the University of Mississippi for more than two semesters (n=52, 55%). Participants reported the following ethnicities: Asian (n=57), black (n=5), Hispanic (n=7), white (n=24), or two or more races (n=1). Thirty-five countries were represented in the sample. Specifically, participants represented the following countries: Australia (n=1); Bangladesh (n=3); Barbados (n=1); Brazil (n=2); Canada (n=2); China (n=6); Dominica (n=1); Egypt (n=1); England (n=1); Georgia (n=1); Germany (n=3); Greece (n=1); India (n=14); Iran (n=3); Japan (n=2); Jordan (n=2); Malaysia (n=1); Mexico (n=2); Nepal (n=11); New Zealand (n=1); Nigeria (n=2); Norway (n=1); Oman (n=4); Pakistan (n=2); Russia (n=3); Saudi Arabia (n=1); Singapore (n=1); South Africa (n=1); South Korea (n=4); Sri Lanka (n=3); Taiwan (n=2); Thailand (n=1); United Kingdom (n=2); Venezuela (n=2); and Vietnam (n=2). More specifically, most participants were characterized as being from non-OECD member countries (n=75, 80%). Participants' household food security status and health status are described in Tables 6 and 7 respectively.

Table 6. *Household Adult Food Security Status of International Students at the University of Mississippi*

Food Security Status Category	n	%
High Food Security	27	28.7
Marginal Food Security	12	12.8
Low Food Security	24	25.5
Very Low Food Security	31	33.0

Table 7. *Participant Health Status*

Eight Health Concepts	Health Score (X ± SD)	Poor Health n (%)	Good Health n (%)
Physical Functioning	83 ± 22	58 (62%)	25 (27%)
Role Limitations Due to Physical Health	65 ± 39	43 (46%)	37 (39%)
Role Limitations Due to Emotional Problems	50± 44	40 (43%)	38 (40%)
Energy/Fatigue	47 ± 18	39 (42%)	35 (37%)
Emotional Wellbeing	58 ± 21	38 (40%)	36 (38%)
Social Functioning	65 ± 26	42 (45%)	34 (36%)
Pain	77 ± 23	41 (44%)	35 (37%)
General Health	60 ± 21	43 (46%)	42 (45%)

Household Adult Food Security Status by Country of Origin and Student Status

Table 8 summarizes the differences in Household Adult Food Security Status between undergraduate and graduate students.

Table 8. *Differences in Household Adult Food Security Status between Undergraduate and Graduate Participants* [a]

Food Security Status	Undergraduate Student n (%)	Graduate Student n (%)	P-Value [a]
Food Secure	16 (17%)	23 (24%)	.344
Food Insecure	28 (30%)	27 (29%)	

[a] Chi Square

Household Adult Food Security Status did not differ by student status, so data were merged for subsequent analyses. However, the small number of food secure, undergraduate students is a limitation of this analysis. A statistically significant difference in food security status was noted between students from OECD and non-OECD nations. Table 9 summarizes the differences in household adult food security status from OECD and non-OECD members.

Table 9. *Differences in Household Adult Food Security Status between OECD Members and Non-OECD Members* [a]

Food Security Status	OECD Member n (%)	Non-OECD Member n (%)	P-Value [a]
Food Secure	12 (13%)	26 (29%)	.001
Food Insecure	3 (3%)	49 (54%)	

[a] Chi Square

Correlations with Health and Food Security Status

The relationship of each of the eight health concepts (physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue,

emotional well-being, social functioning, pain, and general health) and food security status is shown in Table 10.

Table 10. *Relationship of Health Concept Scores to Household Adult Food Security Scale Score* [a]

Eight Health Concepts	r- value	P-value [a]
Physical Functioning	-.193	.081
Role Limitations Due to Physical Health	-.254	.023
Role Limitations Due to Emotional Problems	-.099	.390
Energy/Fatigue	-.314	.006
Emotional Wellbeing	-.270	.020
Social Functioning	-.463	<.001
Pain	-.236	.040
General Health	-.431	<.001

[a] Pearson's Correlation

Significant relationships were found between food security status and role limitations due to physical health ($p<.05$), energy/fatigue ($p<.001$), emotional well-being ($p<.05$), social functioning ($p<.001$), pain ($p<.05$), and general health ($p<.001$).

Health and Household Food Security

Table 11 summarizes the differences in the eight health score concepts (physical functioning, role limitations due to physical health, role limitations due to emotional problems,

energy/fatigue, emotional well-being, social functioning, pain, and general health) between food secure and food insecure international students.

Table 11. *Differences in the eight health concept scores between food secure and food insecure international students* [a]

Eight Health Concepts	Food Secure Score (X ± SD)	Food Insecure Score (X ± SD)	P-value [a]
Physical Functioning	87 ± 22	80 ± 22	.135
Role Limitations Due to Physical Health	75 ± 36	57 ± 39	.043
Role Limitations Due to Emotional Problems	51 ± 46	50 ± 42	.852
Energy/Fatigue	51 ± 17	43 ± 17	.066
Emotional Wellbeing	63 ± 21	54 ± 20	.087
Social Functioning	77 ± 25	57 ± 24	.001
Pain	81 ± 15	73 ± 27	.092
General Health	70 ± 17	54 ± 21	.001

[a] t test

The two-tail independent samples t-test indicated that there were differences in role limitations due to physical health (p=.043), social functioning (p<.001), and general health (p<.001) between international students living in food secure and food insecure households. Health scores in these areas were higher in with food secure international students. Basically, as health scores decreased, food security worsened. No other health scores differed significantly between groups.

Health Concepts and Food Security Status

The cumulative odds ordinal logistic regression with proportional odds test was utilized to determine if health (physical functioning, role limitations due to physical health, role

limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health) predicted household adult food security status among the sample participants. Prior to analysis, the assumption of multicollinearity and proportional odds were evaluated. There were proportional odds, as assessed by a full likelihood ratio test, comparing the fitted model to a model with varying location parameters, [$\chi^2(16) = 6.87$, $p = .976$]. The assumption of multicollinearity was met [VIF<10]. The deviance goodness-of-fit test indicated that the model was a good fit to the observed data [$\chi^2(211) = 161.12$, $p = .996$], but most cells were sparse with zero frequencies in 75.0% of the cells, due to continuous nature of predictor variable. However, the final model statistically significantly predicted the dependent variable over and above the intercept-only model [$\chi^2(8) = 31.10$, $p < .001$]. This model explains 37.1% of total variance as depicted by Nagelkerke pseudo R-square. Overall, this model is a good fit (i.e., the collected data is powerful enough to run cumulative odds ordinal logistic regression with proportional odds. Since all assumptions were not violated, analysis was conducted. Table 12. summarizes the odds of a participant living in a food secure household.

Table 12. *Eight Health Concepts and Prediction of Food Security Status* [a]

Eight Health Concepts	Odds Ratio	P-value	Chi Square (χ^2)	95% Wald Confidence Interval	
				Lower	Upper
Physical Functioning	1.01	.647	.21	.979	1.035
Role Limitations Due to Physical Health	.99	.065	3.40	.973	1.001
Role Limitations Due to Emotional Problems	1.01	.134	2.25	.996	1.027
Energy/Fatigue	.98	.311	1.027	.945	1.018
Emotional Wellbeing	1.03	.135	2.24	.990	1.081
Social Functioning	.95	.002	9.85	.924	.982
Pain	1.01	.448	.58	.985	1.034
General Health	.96	.017	5.70	.936	.993

[a] Ordinal Logistic Regression with Proportional Odds Test

Social functioning had an odds ratio of .95 and general health had an odds ratio of .96. As such, there were decreased odds of living in a food insecure household for individuals with good social functioning and general health. Essentially, the better the participant's social functioning and general health, the less likely they are to live in food insecure households.

CHAPTER 5

DISCUSSION

Food Insecurity and International Student Status

Results showed that food security status did not differ between undergraduate and graduate students, supporting the null hypothesis. However, the previously noted inadequate cell sizes of the groups limits this finding. Other studies examined food insecurity in international college students, differences in student type were not examined (Watson, Malan, Glik, & Martinez, 2017; Henry, 2017). Only one study found a significant difference between undergraduate and graduate students, with undergraduates suffer greater food insecurity than the graduate students (Soldavini, Berner, & Silva, 2019). With limited research in these student populations, this is certainly an avenue for future research.

Food Insecurity and Health of International Students

Significant associations present between role limitations due to physical health, energy/fatigue, emotional well-being, social functioning, pain, and general health food security status were found in this study. Our findings contribute to the current literature by supporting this significant association as detailed below. Other studies show that statistically significant relationships were also found with food security and hypertension, coronary heart disease, hepatitis, stroke, cancer, asthma, arthritis, chronic obstructive pulmonary disease, depressive symptoms in individuals with diabetes or prediabetes, severe mental illness, and fair and poor self-rated health, greater odds of developing CKD, weight status, insulin resistance, diabetes, and

poor diabetes control and management (Leung, Tester, & Laraia, 2017; Montgomery, Lu, Ratliff Knol, Robb, McKinley, & Wood, 2017; Bruening, Dinour, Rosales, Chavez, 2017; Crew et al. 2014, Laraia, 2013; Gregory and Coleman-Jensen, 2017; Seligman et al. 2010; Berkowitz et al., 2013). Holben and Pheley (2006) also found significant connections between food insecure households and greater Body Mass Index (BMI), rates of obesity, and self-reported diabetes. Another study found associations between food insecurity and lower occurrence of preferred cardiovascular health (Saiz et al., 2016). One study found statistically significant associations between c-reactive protein and food insecurity (Gowda, Hadley, & Aiello, 2012). Indicating a relationship between food insecurity and inflammation since c-reactive protein is an inflammatory marker (Gowda, Hadley, & Aiello, 2012).

The assessment of whether health differed between international students living in food secure and food insecure households at the University of Mississippi revealed that there were only statistically significant differences in role limitations due to physical health, social functioning and general health. Similarly, one study sought to determine the differences in health condition quantities among participants (Dominick, Wilder, Ruple, Weir, & Acharya, 2018). Specifically, Dominick, Wilder, Ruple, Weir, & Acharya (2018) found that participants from the midwest United States that specified having diabetes or that live in a household with someone with a diabetes, Crohn's disease, an eating disorder or lived in a household with someone with an eating disorder, depression or anxiety, high blood pressure, or high cholesterol had greater differences in amounts of food insecurity. Investigators suggest that chronic illness may impact food insecurity and that the nature of the illness may be significant in deteriming chronic health's impact on food security (Dominick, Wilder, Ruple, Weir, & Acharya, 2018). Afulani, Coleman-Jensen, & Herman (2018) established that there were noted differences in severe

mental illness compared between participants identifying from each level of food security. In one study, depression differed significantly between food insecure and food secure individuals receiving SNAP benefits (Leung, Epel, Willett, Rimm & Laraia, 2015). One study reported significant differences in self-assessed health between participants with marginal and low, marginal and very low, and low and very low food security (Gregory & Coleman-Jensen, 2017). Contrary, Holben and Pheley (2006) found no differences in diastolic blood pressure, blood glucose, HbA1C, hemoglobin and total cholesterol between food secure and food insecure individuals. Only differences in BMI and obesity were noted between the food insecure and food secure groups in this study (Holben and Pheley, 2006). A lack of significant differences were also found between food secure and food insecure individuals receiving food assistance (Alvarez, Lantz, Sharac, and Shin, 2015). With the present study's findings in mind, it is pertinent that the universities create policies for both physical and mental health evaluation for those students identifying as food insecure.

When determining if health predicted household adult food security status in international students attending the University of Mississippi, results showed that individuals with positive social functioning and general health had decreased odds of living in a food insecure household. The data showed a participant's social functioning and general health significantly predicted food insecurity in participants. Per Bosc (2000), social functioning is termed as a person's connections with and role inside their external environment specific to social activities including work as well as relationships with family and friends. In a study that investigated low-income individuals with type 2 diabetes, it was found that increased social support protected against mental health issues in food insecure individuals (Kollannoor-Samuel et al., 2011). This finding considered, it is sensible to assume that activities to support

acculturation may be a vehicle for reducing food insecurity in international students.

Various studies discuss access to familiar or healthy foods for the international student population. Specifically, Brown, Edwards, & Hartwell (2009) state that food from a student's country of origin could be comforting to the student and may ease feelings of anxiety and isolation (Brown, Edwards, & Hartwell, 2009). Being so, access to home country food may be a vital factor in assisting international students in proper nourishment. Garden-Robinson, Eighmy, & Lyonga (2010) examined new and unfamiliar foods in the U.S and identified that fast-foods, ready-to-eat foods, processed food, and frozen foods as well as food safety practices were unfamiliar to international students. Researchers suggested that educational programs regarding food safety may increase food security. International student's acculturation to both American culture and food is vital to success as a student in America. Ruetzler, Taylor, & Hertzman (2012), suggest that interaction and socialization provided by the on-campus dining experience may be an important step of the adaption process for international students. It can be inferred from Ruetzler, Taylor, & Hertzman (2012), that food insecurity risk could be decreased if international students were presented with a more positive dining experience on the college campus. Additionally, researchers concluded that acculturation could be enhanced if universities would develop programs that enabled international students to feel engaged socially, culturally, and academically (Wu, Garza, & Guzman, 2015).

One study found that students who participated in the international student center's events and excursions had greater sense of belonging towards their university (Guvendir, 2018). International students can also master their new environment by increasing their social support through relationships with family, friends, a significant other, or ethnic/cultural groups (Aldawsari, Adams, Grimes, & Kohn, 2018). Tsevi (2018) supports this in finding that

international students were able to persist in their studies despite challenges when they worked hard academically, had socialization with family and friends, were involved in extracurricular activities, and student out-of-classroom activities. It is also suggested that the development of programs to aid social and academic development aid in this persistence. (Tservi, 2018). In fact, one study found that international students had increased social support and belonging when they completed a semester-long academic and cultural transition course which focused on intercultural competence; suggesting that enrollment in this course enhances intercultural skills (Brunsting, Smith, & Zachry, 2018). For those suffering with issues of mental health, culturally sensitive mental health services should be provided by universities (Kim, Maleku, Lemleu, Du, & Chen, 2019; Bai, 2016). In a study that examined the top twenty universities, it was found that events such as International Education Week (IEW), global festivals, world fairs, heritage and cultural celebrations, meet-and-greet receptions, sightseeing trips, coffee hours, global sibling and student mentor programs promote diverse, social engagement for international students (Martirosyan, Bustamante, & Saxon, 2019). The literature suggests that family relationships upon doctoral students may be improved if universities offered family programs and housing (Campbell, 2015). Bai (2016) suggest that international students can have lower stress levels and more positive acculturative experience when adequately supported by their school. Financial issues for undergraduate international students might be improved if universities provided more tuition assistance and scholarships. An orientation that covers U.S. culture, as well as American academic culture, could be beneficial to international students (Wu, Garza, & Guzman, 2014).

Our findings are further supported by many studies that found mental and physical health to be predictors of food insecurity Garg, Toy, Tripodis, Cook, & Cordella , 2015; Hagedorn & Olfert, 2018; Hanson & Olson, 2012; Hunt, Benjamins, Khan, & Hirschtick, 2018; Maynard,

Andrade, Packull- McCormick, Perlman, Leos-Toro, Kirkpatrick, 2018; Pellowski, Barnett, Kuo, Koen, Zar, & Stein, 2017; Tarasuk, Mitchell, McLaren, and McIntyre, 2013). Other studies found that maternal depression, loneliness, mental health conditions, behavioral characteristics, health, and chronic health conditions were found to predict food insecurity (Garg, Toy, Tripodis, Cook, & Cordella , 2015; Hagedorn & Olfert, 2018; Hanson & Olson, 2012; Hunt, Benjamins, Khan, & Hirschtick, 2018; Maynard, Andrade, Packull-McCormick, Perlman, Leos-Toro, Kirkpatrick, 2018; Pellowski, Barnett, Kuo, Koen, Zar, & Stein, 2017). Food insecurity has also been found to predict nutritional outcomes (Bhattacharya, Currie, & Haider, 2004). Another study found that health scores could be predicted by diseases like diabetes, eating disorders, and depression, and anxiety (Dominick, Wilder, Ruple, Weir, Acharya, 2018). Gregory & Coleman-Jensen (2017) determined that food security status is strongly predictive of chronic illness. Food insecurity status was also shown to predict health care utilization and costs (Tarasuk et al., 2015). Bruening, Woerden, Todd, & Laska (2018) discovered that food insecurity did not predict health behaviors or outcomes. Our findings will further support the claim that health predicts food insecurity presented by the aforementioned studies.

Limitations

This study had limitations. One limitation was that the survey questionnaire was only offered to participants in English. English comprehension may have ranged in participants. Even so, students must demonstrate proficiency in English with a required internet based TOEFL score of 79 which minimizes this limitation (The University of Mississippi, 2018). Additionally, using the six-item USDA food security measure may not have completely measured the most severe range of adult food insecurity. The 18-item USDA food security measure may more appropriately capture the most severe range in adult food insecurity. Even so, the six-item is

deemed appropriate by developers and reduces response burden (United States Department of Agriculture, 2017). Another consideration is that the HFIAS would have been a more appropriate tool to use for the assessment of food security since it is approved for use across cultural contexts (Coates, Swindale, & Bilinsky, 2007). The lack of incentives was also a limitation for this study. Considering that the survey was fifty-eight questions long, it is reasonable to assume that response burden may have played a role in our low response rate (12.5%) and if incentives were used, perhaps response rates might have been higher. Also, the small number of food secure students in the analysis of differences of in Household Adult Food Security Status between undergraduate and graduate students pose as a significant limitation. Being so, it is important to consider that the overall sample size (n=94) was low. It is possible that a significant difference might emerge from a larger sample.

Conclusion

International students at the University of Mississippi experience food insecurity. Being so, international students have the potential to suffer from poor health. Better social functioning and better general health promotes food security among international students. Future research should investigate measures taken to prevent and resolve food insecurity as well as to determine specific factors that contribute to the food insecure status of international students. Additionally, since no other studies have exclusively studied food insecurity in international students, more research should be conducted in this area. International college students' food security status might be improved if school policies regarding international students were created to ensure that students are evaluated periodically to determine their food security status. These policies might also safeguard international student food security by making sure that student food banks are well-advertised and available for international student access. At present, the university has no

such policies in existence for the international student population. It might also benefit universities to explore other interventions such as monthly or weekly events for international students that provide a free meal or classes on budgeting that promote more efficient grocery shopping practices. This is supported by Farahbakhsh et al.'s (2017) determination that government-based and university-based programs and policies are needed to improve food insecurity in college students. Since international students promote economic growth in the United States, it is essential that universities take an interest in their nutritional well-being and overall health. Hopefully, our findings will encourage future research to be conducted and further illuminate this issue and direct how to best amend food insecurity among international students studying in the United States on university campuses.

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List of Appendices

LIST OF APPEDICES

APPENDIX A: FOOD INSECURITY AND HEALTH AMONG INTERNATIONAL

STUDENTS SURVEY

For the following questions, select the answer that most accurately describes your situation.

1. Are you 18 years or older?

- Yes
- No

2. From which country are you a citizen?

---

3. What is your race/ethnicity?

---

4. Are you male or female?

- Male
- Female
- Other, Please Explain. _____

5. What is your relationship status?

- Single
- Married
- Divorced
- Other, Please Explain. _____

6. Do you have any children?

- Yes
- No

7. How long have you been a student at The University of Mississippi?

- Less than 1 Semester
- 1 Semester
- 2 Semesters
- More than 2 Semesters

8. Do you receive any type of funding (i.e., scholarship, grant, assistantship, etc.)?

- Yes, I receive funding.
- No, I do not receive funding.

9. "The food that I bought just didn't last, and I didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

- Often true
- Sometimes true
- Never true

10. "I couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

- Often true
- Sometimes true
- Never true

11. In the last 12 months, since last January did you ever cut the size of your meals or skip meals because there wasn't enough money for food?

- Yes
- No

12. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

- Almost every month
- Some months but not every month
- Only 1 or 2 months

13. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

- Yes
- No

14. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?

- Yes
- No

15. New ideas and projects sometimes distract me from previous ones.
- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

16. Setbacks don't discourage me.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

17. I have been obsessed with a certain idea or project for a short time but later lost interest.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

18. I am a hard worker.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

19. I often set a goal but later choose to pursue a different one.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

20. I have difficulty maintaining my focus on projects that take more than a few months to complete.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

21. I finish whatever I begin.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

22. I am diligent.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like me
- Not like me at all

23. In general, would you say your health is:

- 1 - Excellent
- 2 - Very good
- 3 - Good
- 4 - Fair
- 5 - Poor

24. Compared to one year ago, how would you rate your health in general now?

- 1 - Much better now than one year ago
- 2 - Somewhat better now than one year ago
- 3 - About the same
- 4 - Somewhat worse now than one year ago
- 5 - Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

25. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

26. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

27. Lifting or carrying groceries

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

28. Climbing several flights of stairs

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

29. Climbing one flight of stairs

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

30. Bending, kneeling, or stooping

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

31. Walking more than a mile

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

32. Walking several blocks

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

33. Walking one block
- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

34. Bathing or dressing yourself

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

During the past 4 weeks, you have had any of the following problems with your work or other regular daily activities as a result of your physical health?

35. Cut down the amount of time you spent on work or other activities

- Yes
- No

36. Accomplished less than you would like

- Yes
- No

37. Were limited in the kind of work or other activities

- Yes
- No

38. Had difficulty performing the work or other activities (for example, it took extra effort)

- Yes
- No

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

39. Cut down the amount of time you spent on work or other activities

- Yes
- No

40. Accomplished less than you would like

- Yes
- No

41.Didn't do work or other activities as carefully as usual

- Yes
- No

42. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

- 1 - Not at all
- 2 - Slightly
- 3 - Moderately
- 4 - Quite a bit
- 5 - Extremely

43. How much bodily pain have you had during the past 4 weeks?

- 1 - None
- 2 - Very mild
- 3 - Mild
- 4 - Moderate
- 5 - Severe
- 6 - Very severe

44. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- 1 - Not at all
- 2 - A little bit
- 3 - Moderately
- 4 - Quite a bit
- 5 – Extremely

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks...

45. Did you feel full of pep?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

46. Have you been a very nervous person?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

47. Have you felt so down in the dumps that nothing could cheer you up?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

48. Have you felt calm and peaceful?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

49. Did you have a lot of energy?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

50. Have you felt downhearted and blue?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

51. Did you feel worn out?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

52. Have you been a happy person?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

53. Did you feel tired?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

54. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- 1 - All of the time
- 2 - Most of the time
- 3 - Some of the time
- 4 - A little of the time
- 5 - None of the time

How TRUE and False is each of the following statements for you.

55. I seem to get sick a little easier than other people

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

56. I am as healthy as anybody I know

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

57. I expect my health to get worse

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

58. My health is excellent

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

APPENDIX B: USDA'S HOUSEHOLD FOOD SECURITY SURVEY MODULE: SIX-ITEM

SHORT FORM

1. "The food that I bought just didn't last, and I didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

2. "I couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

3. In the last 12 months, since last January did you ever cut the size of your meals or skip meals because there wasn't enough money for food?

- Yes
- No
- DK

4. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- DK

5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

- Yes
- No
- DK

6. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?

- Yes
- No
- DK

Coding and Categorization

For the Six-Item Short Form, an affirmative yes should be coded for responses of "often" or "sometimes: on questions HH3 and HH4, "yes" on AD1, AD2, and AD3, and "almost every month" and "some months but not every month" on AD1a. The sum of the six questions provides the household's raw score on the scale. The table below shows how food security status is assigned based on raw score. Households with a raw score 0-1 is described a food secure and raw score of 2-6 are described as food insecure.

Food Security Status Assignment

Raw Score 0-1	High or marginal food security (raw score of 1 may be considered marginal food security, but a large proportion of household or adult scale will have a raw score zero on the six-item scale).
Raw Score 2-4	Low Food Security
Raw Score 5-6	Very Low Food Security

If statistical procedures require an interval-level measure, scale scores based on the Rasch measurement model may be used. These scale scores are detailed in the table below. No interval-level score is defined for households that affirm no items.

Number of Affirmatives	Scale Score
0	N/A
1	2.86
2	4.19
3	5.27
4	6.30
5	7.54
6 (Evaluated at 5.5)	8.48

References

United States Department of Agriculture. (2017). U.S. adult food security survey module. Retrieved from: https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/survey-tools/#adult Accessed on January 9, 2018.

APPENDIX C: HOUSEHOLD FOOD INSECURITY ACCESS SCALE INDICATOR (HFIAS)

1. In the past four weeks, did you worry that your household would not have enough food?

    0 = • Yes
    1 = • No (skip to Q2)

1a. How often did this happen?

    1 = • Rarely (once or twice in the past four weeks)
    2 = • Sometimes (three to ten times in the past four weeks)
    3 = • Often (more than ten times in the past four weeks

2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?

    0 = • Yes
    1 = • No (skip to Q3)

2a. How often did this happen?

    1 = • Rarely (once or twice in the past four weeks)
    2 = • Sometimes (three to ten times in the past four weeks)
    3 = • Often (more than ten times in the past four weeks

3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?

    0 = • Yes
    1 = • No (skip to Q4)

3a. How often did this happen?

    1 = • Rarely (once or twice in the past four weeks)
    2 = • Sometimes (three to ten times in the past four weeks)
    3 = • Often (more than ten times in the past four weeks

4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

    0 = • Yes
    1 = • No (skip to Q5)

4a. How often did this happen?

1 = [ ] Rarely (once or twice in the past four weeks)
2 = [ ] Sometimes (three to ten times in the past four weeks)
3 = [ ] Often (more than ten times in the past four weeks

5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

0 = • Yes
1 = • No (skip to Q6)

5a. How often did this happen?

1 = • Rarely (once or twice in the past four weeks)
2 = • Sometimes (three to ten times in the past four weeks)
3 = • Often (more than ten times in the past four weeks

6. In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?

0 = • Yes
1 = • No (skip to Q7)

6a. How often did this happen?

1 = • Rarely (once or twice in the past four weeks)
2 = • Sometimes (three to ten times in the past four weeks)
3 = • Often (more than ten times in the past four weeks

7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

1 = • Yes
2 = • No (skip to Q8)

7a. How often did this happen?

1 = • Rarely (once or twice in the past four weeks)
2 = • Sometimes (three to ten times in the past four weeks)
3 = • Often (more than ten times in the past four weeks

8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?

    0 = • Yes
    1 = • No (skip to Q9)

8a. How often did this happen?

    1 = • Rarely (once or twice in the past four weeks)
    2 = • Sometimes (three to ten times in the past four weeks)
    3 = • Often (more than ten times in the past four weeks

9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

    0 = • Yes
    1 = • No (questionnaire is finished)

9a. How often did this happen?

    1 = • Rarely (once or twice in the past four weeks)
    2 = • Sometimes (three to ten times in the past four weeks)
    3 = • Often (more than ten times in the past four weeks

APPENDIX D: HOUSEHOLD HUNGER SCALE (HHS)

1.In the past [4 weeks/30 days], was there ever no food to eat of any kind in your house because of lack of resources to get food?

0 = • Yes
1 = • No (skip to Q2)

1a. How often did this happen in the past [4 weeks/30 days]?

1 = • Rarely (1-2 times)
2 = • Sometimes (3-10 times)
3 = • Often (more than 10 times)

2. In the past [4 weeks/30 days], did you or any household member go to sleep at night hungry because there was not enough food?

0 = • Yes
1 = • No (skip to Q3)

2. How often did this happen in the past [4 weeks/30 days]?

1 = • Rarely (1-2 times)
2 = • Sometimes (3-10 times)
3 = • Often (more than 10 times)

3a. In the past [4 weeks/30 days], did you or any household member go a whole day and night without eating anything at all because there was not enough food?

0 = • Yes
1 = • No (Go to next section)

3a. How often did this happen in the past [4 weeks/30 days]?

1 = • Rarely (1-2 times)
2 = • Sometimes (3-10 times)
3 = • Often (more than 10 times)

APPENDIX E: LATIN AMERICA AND CARIBBEAN FOOD SECURITY SCALE (ELCSA)

1. Did you ever worry about your household running out of food?

   1 = • Yes
   0 = • No

2. Did your household ever run out of food?

   1 = • Yes
   0 = • No

3. Was your household deprived of eating a healthy diet?

   1 = • Yes
   0 = • No

4. Did you or any other adults in your household ever have an unbalanced diet?

   1 = • Yes
   0 = • No

5. Did you or any other adults in your household miss breakfast, lunch or dinner?

   1 = • Yes
   0 = • No

6. Did you or any other adults in your household eat less than you should?

   1 = • Yes
   0 = • No

7. Were you or any other adults in your household ever hungry and had nothing to eat?

   1 = • Yes
   0 = • No

8. Did you or any other adults in your household not eat for a whole day or eat only once a day?

   1 = • Yes
   0 = • No

9. Were any household members deprived of a healthy diet?

   1 = • Yes
   0 = • No

10. Did any household members under 18 have an unbalanced diet?

    1 = • Yes
    0 = • No

11. Did any household members under 18 ever miss breakfast, lunch or dinner?

    1 = • Yes
    0 = • No

12. Did any household members under 18 not have enough to eat?

    1 = • Yes
    0 = • No

13. Did you ever have to cut the size of the meals prepared for any household members under 18?

    1 = • Yes
    0 = • No

14. Were any household members under 18 ever hungry and had nothing to eat?

    1 = • Yes
    0 = • No

15. Did any household members under 18 ever not eat for a whole day or eat only once a day?

    1 = • Yes
    0 = • No

APPENDIX F: FOOD INSECURITY EXPERIENCE SCALE (FIES)

1. During the last 12 months, was there a time when You were worried you would not have enough food to eat because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

2. Still thinking about the last 12 months, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

3. Was there a time when you ate only a few kinds of foods because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

4. Was there a time when you had to skip a meal because there was not enough money or other resources to get food?

- Yes
- No
- DK
- Refuse to Answer

5. Still thinking about the last 12 months, was there a time when you ate less than you thought you should because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

6. Was there a time when your household ran out of food because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

7. Was there a time when you were hungry but did not eat because there was not enough money or other resources for food?

- Yes
- No
- DK
- Refuse to Answer

8. During the last 12 months, was there a time when you went without eating for a whole day because of a lack of money or other resources?

- Yes
- No
- DK
- Refuse to Answer

APPENDIX G: RAND 36-ITEM HEALTH SURVEY 1.0 QUESTIONNAIRE ITEMS

1. In general, would you say your health is:

- 1 - Excellent
- 2 - Very good
- 3 - Good
- 4 - Fair
- 5 - Poor

2. **Compared to one year ago**, how would you rate your health in general **now**?

- 1 - Much better now than one year ago
- 2 - Somewhat better now than one year ago
- 3 - About the same
- 4 - Somewhat worse now than one year ago
- 5 - Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your **health now limit you** in these activities? If so, how much?

3. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

4. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

5. Lifting or carrying groceries

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

6. Climbing **several** flights of stairs

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

7. Climbing **one** flight of stairs

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

8. Bending, kneeling, or stooping

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

9. Walking **more than a mile**

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

10. Walking **several blocks**

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

11. Walking **one block**
- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

12. Bathing or dressing yourself

- Yes, limited a lot
- Yes, limited a little
- No, not limited at all

During the past 4 weeks, you have had any of the following problems with your work or other regular daily activities as a result of your physical health?

13. Cut down the **amount of time** you spent on work or other activities

- Yes
- No

14. **Accomplished less** than you would like

- Yes
- No

15. Were limited in the **kind** of work or other activities

- Yes
- No

16. Had **difficulty** performing the work or other activities (for example, it took extra effort)

- Yes
- No

During the **past 4 weeks**, have you had any of the following problems with your work or other daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

17. Cut down the **amount of time** you spent on work or other activities

- Yes
- No

18. **Accomplished less** than you would like

- Yes
- No

19. Didn't do work or other activities as **carefully** as usual

- Yes
- No

20. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

- 1 - Not at all
- 2 - Slightly
- 3 - Moderately
- 4 - Quite a bit
- 5 - Extremely

21. How much **bodily** pain have you had during the **past 4 weeks**?

- 1 - None
- 2 - Very mild
- 3 - Mild
- 4 - Moderate
- 5 - Severe
- 6 - Very severe

22. During the **past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside the home and housework)?

- 1 - Not at all
- 2 - A little bit
- 3 - Moderately
- 4 - Quite a bit
- 5 – Extremely

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks...**

23. Did you feel full of pep?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

24. Have you been a very nervous person?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

25. Have you felt so down in the dumps that nothing could cheer you up?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

26. Have you felt calm and peaceful?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

27. Did you have a lot of energy?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

28. Have you felt downhearted and blue?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

29. Did you feel worn out?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

30. Have you been a happy person?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

31. Did you feel tired?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

32. During the **past 4 weeks**, how much of the time has **your physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

- 1 - All of the time
- 2 - Most of the time
- 3 - Some of the time
- 4 - A little of the time
- 5 - None of the time

How TRUE and False is **each** of the following statements for you.

33. I seem to get sick a little easier than other people

- Definitely true
- Mostly true
- Don’t know
- Mostly false
- Definitely false

34. I am as healthy as anybody I know

- Definitely true
- Mostly true
- Don’t know
- Mostly false
- Definitely false

35. I expect my health to get worse

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

36. My health is excellent

- Definitely true
- Mostly true
- Don't know
- Mostly false
- Definitely false

Coding and Categorization

Step 1: Precode each numeric values using the scoring key below. Each item is scored on a 0 (less desirable health state) to 100 (more desirable health state). Recoding values are detailed below.

Item Numbers	**Change original response category***	**To recoded value of**
1,2,20,22,34,36	1 2 3 4 5	100 75 50 25 0
3,4,5,6,7,8,9,10,11,12	1 2 3	0 50 100
13,14,15,16,17,18,19	1 2	0 100
21,23,26,27,30	1 2 3 4 5 6	100 80 60 40 20 0
24,25,28,29,31	1 2 3	0 20 40

	4 5 6	60 80 100
32,33,35	1 2 3 4 5	0 25 50 75 100

Step 2: Average together items in the same scale. This creates the 8 scale scores. Items in each scale are detailed in the table below. When calculating scale scores, missing data should not be taken into account.

Scale	**Number of Items**	**After recoding, average the following**
Physical Functioning	10	3,4,5,6,7,8,9,10.11.12
Role Limitations Due to Physical Health	4	13,14,15,16
Role Limitations due to Emotional Problems	3	17,18,19
Energy/Fatigue	4	23,27,29,31
Emotional Well-Being	5	24,25,26,28,30
Social Functioning	2	20,32
Pain	2	21,22
General Health	5	1,33,34,35,36

Reference

Hays, R.D. (1994). The *Medical Outcomes Study (MOS) Measures of Quality of Life.* Retrieved from the RAND Corporation website:https://www.rand.org/health/surveys_tools/mos/36-item-short-form/survey-instrument.html Accessed on February 25, 2018.

VITA

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EDUCATION

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