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FOOD INSECURITY AND PRODUCE BEHAVIORS OF ADULTS WITH CHILDREN IN
RURAL, APPALACHIAN MISSISSIPPI

A Thesis

presented for the fulfillment of requirements

for the degree of Master of Science in Food and Nutrition Services

in the Department of Nutrition and Hospitality Management

The University of Mississippi

by

Tiffany L. Shirley

May 2019

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ABSTRACT

Adults living in food insecure households consume fewer fruits and vegetables than adults living in food secure households (Hanson & Connor, 2014). The purpose of this study was to examine differences in fruit and vegetable behaviors (intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) in rural, Appalachian Mississippi. A cross-sectional survey of parents (n=1144) recruited from three elementary schools in rural, Appalachian Mississippi utilized validated measures of produce behaviors: 1) fruit, vegetable, and total produce intakes; 2) perceived benefits of barriers to, and control of produce intake; 3) stage of readiness to change fruit and vegetable intakes; and 4) 7-item fruit and vegetable scale score (a measure of produce intake frequency and variety). Differences between food security groups for the measures were assessed using a series of two-tailed independent samples t-tests. Overall, 455 surveys were returned (40%), provided from individual response rates of 168 surveys (46%), 140 surveys (37%), and 147 surveys (37%). Results showed that participants among the three schools were 34 ± 8 years, primarily Caucasian (n=258/452, 57%), female (n=416/450, 92%), living in food secure households (n=367/455, 81%), and low-income areas (n=318/328, 97%). Perceived control (p=.006), perceived barriers (p=.017), the 7-item fruit and vegetable scale score (p=.022), and fruit intake (p=.003) were significantly greater among those in fully food secure households compared to those in food insecure households. Perceived

control ($p=.001$), perceived barriers ($p<.001$), stage of readiness for fruit intake ($p<.001$), stage of readiness for vegetable intake ($p=.032$), the 7-item fruit/vegetable scale score ($p<.001$), fruit ($p<.001$) and total produce ($p=.001$) intakes were significantly greater among those living in fully food secure households, compared to those in not fully food secure households. No other measures differed between groups ($p>.05$). Overall, food insecurity (food insecure; not fully food secure) was associated with decreased produce intakes (fruit, vegetable, total) and behaviors (perceptions; lower 7-item fruit and vegetables scale scores) compared to the more food secure counterparts (food secure; fully food secure). Nutrition interventions that address food insecurity and produce intake is warranted.

DEDICATION

This work is dedicated to my husband, my parents, and my extended family. Their constant encouragement and support throughout this journey have made all the difference in my success. I would not be the individual I am without their positive influence.

This work is also dedicated to my thesis advisor and academic mentor, Dr. David H. Holben. His tireless guidance has facilitated such academic growth and provided me with noteworthy opportunities during my graduate education.

Lastly, this work is dedicated to my Lord, for blessing my life in such a way to allow opportunities such as these and the strength to bring it to completion.

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TABLE OF CONTENTS

	PAGE
INTRODUCTION.....	1
REVIEW OF LITERATURE.....	6
METHODOLOGY.....	41
RESULTS.....	51
DISCUSSION.....	57
REFERENCES.....	71
LIST OF APPENDICIES.....	98
VITA.....	124

LIST OF TABLES

TABLE	PAGE
1. Research Questions and Hypotheses.....	4
2. Recommended intake of Fruits and Vegetables According to Calorie Level.....	12
3. Levels of Food Security Status.....	16
4. Health Belief Model Major Concepts.....	31
5. Transtheoretical Model Stages of Change.....	32
6. Domains, Constructs, and Origins.....	33
7. Domains and Constructs Related to Testing Variables.....	45
8. Questions for the 7-item food behavior checklist for a limited resource audience.....	47
9. Research Variables and Score Instruments of Measure.....	48
10. Research Questions and Statistical Measures.....	49
11. Participant Demographics.....	52
12. Food Security Status of Parent Respondents.....	54
13. Adult Produce Behaviors of Food Secure and Food Insecure Households.....	55
14. Adult Produce Behaviors of Fully Food Secure and Not Fully Food Secure Households.....	56

LIST OF FIGURES

FIGURE	PAGE
1. Food Insecurity by State Territories.....	22
2. Validation and relationship of 13-item tool and the 7-item food behavior checklist.....	34
3. The Appalachian Region.....	35
4. Rural-Urban Counties throughout the Appalachian Region.....	36
5. Distressed Counties in Appalachia.....	37
6. Food Deserts in the Appalachian Region.....	39
7. Map of Calhoun County, Mississippi.....	41

CHAPTER I: INTRODUCTION

Chronic diseases, such as heart disease, stroke, cancer, type 2 diabetes, arthritis, and obesity, are the most common health problems in the United States, impacting approximately three in four Americans (Centers for Disease Control and Prevention, 2017a; Gerteis, et al., 2014). In many cases, the existence of one or more of these diseases lessens an individual's quantity and quality of life (Megari, 2013; Buttorff, Ruder, Bauman, & Rand Corporation, 2017). In fact, chronic disease remains the leading cause of death and disability in the United States, accounting for 7 out of 10 deaths annually (Centers for Disease Control and Prevention, 2017c; Melonie, Anderson, & the National Center for Health Statistics, 2016; National Center for Health Statistics, 2016). Further, chronic disease-related expenses account for 86% of national healthcare costs and 93% of total Medicare expenditures (Gerteis, et al., 2014; U.S. Department of Health and Human Services, 2012). If this trend remains constant, the cost is projected to reach forty-two trillion dollars by 2030 (Partnership to Fight Chronic Disease, 2016).

Although chronic diseases are common and detrimental to society, they are highly preventable (Centers for Disease Control and Prevention, 2009). The risk factors related to development and progression of these diseases are now widely understood and can usually be minimized with effective lifestyle modifications. According to the World Health Organization (2017), one of the most prominent modifiable risk factors is diet quality, as supported by other studies that have shown an inverse association between fruit and vegetable intake and chronic disease risk (Aune et al., 2017; Bazanno et al., 2002, Boeing et al., 2012; Hung et al., 2014; Li,

Fan, Zang, Hou & Tang, 2014). Even so, the majority of Americans struggle to meet the daily fruit and vegetable intake recommendations set forth by the 2015-2020 Dietary Guidelines for Americans (Centers for Disease Control and Prevention, 2017d). The Centers for Disease Control and Prevention reported that only 12.2% of U.S. adults are meeting fruit recommendations, and only 9.3% are meeting vegetable intake recommendations (Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017).

Individuals experiencing poverty and poor food access are especially at risk for falling short of the recommended dietary patterns associated with the 2015-2020 Dietary Guidelines for Americans (Grimm, Foltz, Blanck, & Scanlon, 2012; Hanson & Connor, 2014; Leung, Epel, Ritchie, Crawford, & Laraia, 2014; Lin & Morrison, 2016; Mook, Laraia, Oddo, & Jones-Smith, 2016; Tanumihardjo et al., 2007; Taylor et al., 2017), leading to chronic disease-related outcomes (Berkowitz, S., Berkowitz, T., Meigs, J., & Wexler, D., 2017; Gregory & Coleman-Jensen, 2017; Laraia, 2013; Seligman, Laraia, & Kushel, 2010). Apart from poverty, the inability to attain adequate food for an active, healthy life, food insecurity, is also preventable, yet it affects millions of Americans annually (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018a; Holben & Marshall, 2017). In 2016, 12.3% of U.S. households experienced food insecurity sometime during the year, with 7.4% of households experiencing low food security, and 4.9% of households experiencing very low food security (Rabbit, Coleman-Jensen, & Gregory, 2017a).

Some households experience food insecurity at a greater rate than others. U.S. households with children experience food insecurity at a higher rate (16.5%), than those without children (10.5%) (Coleman-Jensen et al., 2017a). Households in rural and southern areas also experience higher rates of food insecurity, compared to those in other regions (Coleman-Jensen

et al., 2017a; 2018a). Finally, among states, Mississippi had the highest rate of food insecurity in the nation between 2014-2016 (Coleman-Jensen et al., 2017a). Similarly, households in some Appalachian communities experience higher rates of food insecurity than the national average (Coleman-Jensen et al., 2017a; 2018a; Pheley, Holben, Graham, & Simpson, 2002; Holben & Pheley, 2006; Poole, Jamieson, & Holben, 2017).

Adults living in food insecure homes have higher rates of chronic diseases (Seligman, Laraia, & Kushel, 2010; Gregory & Coleman-Jensen, 2017; Laraia, 2013). In fact, food security status is a stronger predictor of chronic disease than income (Gregory & Coleman-Jensen, 2017). Food insecurity is associated with all 10 of the most common chronic diseases, with the progression and severity significantly differing between adults in households with marginal, low, and very low food security (Gregory & Coleman-Jensen, 2017). Rural and Appalachian regions, especially in Mississippi, have higher prevalence rates of both chronic disease prevalence and food insecurity (Holben & Pheley, 2006; Jones, 2010; Marshall, et al., 2017; Short, 2014).

While research has been conducted related to produce behaviors in food insecure, rural, and Appalachian samples (Fiorita, Holben & Harshman, 2012; Lutfiyya, Chang, & Lipsky, 2012; Ray, Holben, & Holcomb, 2012; Schoendberg, Howell, Swanson, Grosh, & Bardach, 2013; Short, Oza-Frank, & Conrey, 2012; Wang et al., 2014), to our knowledge, no research has been conducted in rural, Appalachian Mississippi related to food insecurity and consumption of fruits and vegetables among adult parents of elementary-aged children. Therefore, the purpose of this study was to determine if there are differences in produce behaviors (related to intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) of parents/caretakers of elementary school children by food security status (food secure compared

to food insecure; fully food secure compared to not fully food secure) in a rural, Appalachian Mississippi community. The produce behaviors in this study are constructs derived from the Social Cognitive Theory and the Health Belief Model (Townsend, et al., 2003; 2005; 2007). In this thesis document, the term “produce” refers to both fruit and vegetables, and “behaviors” includes intakes as a behavior measure. References to “fruit intake”, “vegetable intake”, and “total produce intake” in this document is measured by self-reported daily servings, unless otherwise specified. Lastly, parents/caretakers will be referred to as “parents” in this thesis document. The specific research questions and hypotheses for this study are listed in Table 1.

Table 1

Research Questions and Hypotheses

Research Question	Hypotheses
Does parent perceived control of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Perceived control of produce intake will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).
Do parent perceived barriers of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Perceived barriers of produce intake will be less for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).
Do parent perceived benefits of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Perceived benefits of produce intake will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).
Does the parent 7-item scale score differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	The 7-item scale score will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).

(Table 1 continued on page 5)

(table continued)

Does parent fruit intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Fruit intake will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).
Does parent vegetable intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Vegetable intake will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).
Does parent total produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Total produce intake will be greater for parents living in households characterized by greater food security (food secure/fully food secure), compared to their less food secure counterparts (food insecure/not fully food secure).

CHAPTER II: REVIEW OF LITERATURE

The purpose of this study was to determine if there are differences in produce behaviors (related to intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) in a rural, Appalachian Mississippi community.

Chronic Disease in the United States

A chronic disease is “a physical or mental health condition that last more than one year and causes functional restrictions or requires ongoing monitoring or treatment” (Basu, Avilia, & Ricciardi, 2016). These diseases may include heart disease, stroke, cancer, type 2 diabetes, arthritis, and obesity (Centers for Disease Control and Prevention, 2017a). Chronic diseases have become among the most prevalent health issues in the United States, affecting three in four Americans (Centers for Disease Control and Prevention, 2017a). The Partnership to Fight Chronic Disease (2016) predicts that the number of people with three or more chronic diseases will increase to 83 million by 2030, if trends remain constant (Partnership to Fight Chronic Disease, 2016).

Chronic disease remains the leading cause of death and disability in the United States, according to the Center for Disease Control and Prevention (CDC) (2017a). In fact, the National Center for Health Statistics (2016) reported that chronic diseases were among seven of the top 10 causes of death in 2014, with heart disease and cancer accounting for approximately 46% of all deaths (National Center for Health Statistics, 2016). The most common chronic disease-related

cause of disability is arthritis, and 23 million of the 54 million diagnosed patients have trouble with activities of daily living due to their condition (Barbour, Helmick, Boring, & Brady, 2017; Brault, et al., 2009). Similarly, diabetes is the driving cause of kidney disease, lower limb-amputations, and new cases of blindness in the United States (CDC, 2011).

The cost of chronic disease is significant in the United States, accounting for 86% of national healthcare costs and 93% of total Medicare expenditures (Gerteis et al., 2014; U.S. Department of Health and Human Services, 2012). Future related costs are predicted to reach forty-two trillion dollars by 2030 (Partnership to Fight Chronic Disease, 2016). Buttorff, Ruder, and Bauman (2014) examined chronic disease related costs in their study using a Medical Expenditure Panel Survey (MEPS) sample of the U.S. civilian, noninstitutionalized population. Individuals with five or more chronic conditions spend 14 times more on health services than people with no chronic conditions (Buttorff et al., 2014). Gerties et al. (2014) found that people with multiple chronic conditions account for 64% of clinician visit revenue, 83% of prescription costs, 88% of home health visit expenses, and 70% of inpatient stay-related costs.

Complications due to both chronic diseases and related depression are often the primary cause of lost revenue and productivity in the workforce for employees, employers, and their family members (Junnett, Schwatka, Tenney, Brockbank, & Newman, 2017; Lerner, Allaire, & Reisine, 2005; Meraya & Sambamoorthi, 2016). In fact, Mitchell and Bates (2011) found that an average-sized employer lost 40 cents in productivity for every dollar of employee medical cost.

Indeed, chronic disease-related costs in the workplace are often associated with absenteeism or decreased effectiveness during working hours due to employee family member's conditions. The Partnership to Fight Chronic Disease (2009) explained that, in the United States, family caregivers provide 80% of all long-term care services for chronically ill patients, and

more than 50 million working Americans (60%) find themselves in a caregiver role each year. Finally, Nakaya et al. (2016) discovered a significant positive association between undergoing medical treatment for chronic disease and the risk of unemployment.

Although chronic diseases have become increasingly detrimental to society, they are preventable (CDC, 2009). The risk factors related to development and progression of chronic diseases are well understood and can usually be minimized with effective lifestyle modifications (Benziger, Roth, & Moran, 2016; GBD 2013 Risk Factors Collaborators et al., 2015). The World Health Organization (2017) indicates that one of the most prominent modifiable risk factors is diet quality, especially in terms of fruit and vegetable consumption.

Chronic Disease Risk and Fruit and Vegetable Intake

Research suggests that adequate daily fruit and vegetable intake reduces the risk of chronic diseases (Dietary Guidelines for Americans, 2015). The U.S. Department of Agriculture (USDA) translated the health benefits of nutrients found in fruits and vegetables in relation to health and chronic disease through “Choose MyPlate”; this concept was based on the Dietary Guidelines for Americans (USDA, 2016a). The summary stated that vegetables have no cholesterol content, a dietary intake concern for some individuals in development of cardiovascular disease. On the other hand, vegetables, and many fruits, have high levels of potassium, which helps to prevent hypertension. Further, dietary fiber from vegetables, as part of an overall healthy diet, helps reduce blood cholesterol levels and may lower risk of heart disease. The summary also highlighted how eating a diet rich in some vegetables and fruits may protect against certain types of cancers (USDA, 2016a). Similarly, Slavin, and Lloyd (2012) conducted an epidemiological and clinical study review on nutrients in fruits and vegetables and found that decreased nutrient intakes of vitamins, minerals, dietary fiber, phytochemicals, and

polyphenols are associated with certain chronic diseases.

Not only is the specific nutritional composition of different fruits and vegetables important in prevention, but also the total amount of daily servings. Boeing et al. (2012) observed strong evidence toward chronic disease prevention with increased total intake of fruits and vegetables for hypertension, coronary heart disease, and stroke. The systemic review indicated potential decreases in risk of Type 2 diabetes mellitus due to increased fruit and vegetable consumption, as well. However, the authors considered the possibility for reduced diabetes risk to be indirectly associated with fruit and vegetable consumption, as produce consumption may promote a healthy weight and reduce the risk of obesity (Boeing et al., 2012).

He, Newsom, Lucas, and MacGregor (2007) investigated coronary heart disease risk (CHD) and fruit and vegetable intake among 278,459 individuals, presenting 9,143 CHD events, over 11 years. Results showed that individuals who typically consumed 3 or less servings of fruits and vegetables per day could reduce their CHD risk by 17% if fruit and vegetable consumption was increased to 5 or more servings per day (He et al., 2007).

Micha et al. (2015) conducted a global systematic analysis to quantify key foods related to non-communicable diseases in adults and suggested optimal consumption levels of fruits and vegetables associated with lowest risk of certain diseases. For a standardized serving of 100 grams of fruit, the authors determined that 4.4 servings per day significantly decreases the risk of ischemic stroke, while 3.0 servings per day decreases the risk of total stroke. Coronary heart disease risk (CHD) was decreased by 2.4 servings per day. Decreased risk of lung cancer was observed with 2.8 servings of fruit per day, and decreased risk of esophageal cancer was seen with only 1.7 servings of fruit per day (Micha et al., 2015).

For a standard 100 g serving of vegetables, 5.3 servings per day decreased the risk of a

heart attack, with a lesser 3.7 servings per day reducing the risk of coronary heart disease.

Reduced risk of esophageal cancer was observed at 1.5 servings of vegetables per day (Micha et al., 2015).

Wang et al. (2014) examined the dose-response relation between fruit and vegetable consumption and risk of chronic disease-related mortality through a systematic review of 16 cohort studies. A 4% reduction was seen in cardiovascular disease mortality risk for each additional daily serving of vegetables after 1 serving consumed and a relative 4% risk reduction for each additional daily serving of fruit after 1 serving (Wang et al., 2014). Likewise, cancer mortality hazard ratio was 0.99 for each additional daily serving of fruit and vegetables. A subsequent study by Aune et al. (2016) had similar findings, and reductions in all-cause mortality risk were observed up to 800 g/day of fruits or vegetables for all outcomes except cancer, which was only 600 g/day. Further, the researchers discovered inverse associations between the intake of apples and pears, green leafy vegetables, citrus fruits, and cruciferous vegetables for cardiovascular disease risk (Aune et al., 2016). Hung et al. (2004) found that green leafy vegetable intake showed the strongest inverse association with cardiovascular disease risk, and an inverse association of fruit and vegetable intake with the risk of cardiovascular disease and all-cause mortality was observed by Bazanno et al. (2002).

Reference Intakes and the Dietary Guidelines for Americans

Compounding scientific research on the dose-specific responses of nutrients in fruits and vegetables related to chronic disease risk has led to defined, standard recommendations for daily intake. In 2017, the Institute of Medicine published guiding principles for developing DRIs based on chronic disease risk (National Academies of Sciences, Engineering, & Medicine, 2017). Dietary reference intakes (DRI) are a set of reference values used to plan and assess nutrient

intakes according to age and gender in healthy people (Murphy & Poos, 2002; Institute of Medicine et al., 2003). Collectively, DRI implications of chronic disease risk provide a basis for the development of the Dietary Guidelines for Americans, while also serving other nutrition-related objectives in consumer health and awareness (HHS & USDA, 2015; Institute of Medicine et al., 2003; National Academies of Sciences, Engineering, & Medicine, 2017).

The Dietary Guidelines for Americans provide evidence-based nutrition guidance for people ages 2 and older, primarily focused of reducing the risk of chronic disease in the United States (HHS & USDA, 2015). Along with DRIs, the development of the Dietary Guidelines for Americans is dependent on other data analysis, food pattern modeling analysis, reports from federal agencies and scientific organizations, meta-analyses, and original systematic reviews (HHS & USDA, 2015). The Advisory Committee, appointed by the United States Department of Agriculture and Department of Health and Human Services, applies all new related evidence to the previous set of Dietary Guidelines for Americans and allows for public comments before the final release (HHS & USDA, 2015). A new edition is provided to the public every five years to ensure the most succinct, food-based guidance (HHS & USDA, 2015). Federal programs apply these recommendations in differing ways to meet the nutrition needs of Americans through food-related, nutrition-related, and other-related polices and educational programs (HHS & USDA, 2015). The 2015-2020 edition encompass recommendations for multiple food groups including: fruits, vegetables, protein, grains, and dairy (HHS & USDA, 2015).

For vegetables, the 2015-2020 Dietary Guidelines for Americans promotes a variety of vegetables from the five subgroups: dark greens, red and orange, legumes (beans and peas), starchy, and other; the recommendations include fresh, frozen, juiced, canned, and dried options of vegetables (HHS & USDA, 2015). The daily amount proposed for a 2,000-calorie diet is two

and one-half cup equivalents per day, but different calorie levels with vegetable equivalents are provided (HHS & USDA, 2015), as listed in Table 4. The recommendations also provide weekly amounts for each vegetable subgroup (HHS & USDA, 2015). Key nutrients provided by vegetables include dietary fiber, potassium, vitamin A, Vitamin C, Vitamin K, copper, magnesium, manganese, Vitamin E, Vitamin B6, folate, iron, thiamin, niacin, and choline (HHS & USDA, 2015).

The 2015-2020 Dietary Guidelines for Americans provides recommendations for whole fruit, as canned, frozen, or dried, in addition to fruit juice (HHS & USDA, 2015). With a 2,000-calorie diet, two cups of fruit are recommended per day, but other calorie levels equivalents are also provided (Table 2) (HHS & USDA, 2015). Half of the recommended fruit intake was specified to derive from whole fruit (HHS & USDA, 2015). Key nutrients provided by fruits are dietary fiber, potassium, and vitamin C (HHS & USDA, 2015).

Table 2

Recommended Intake of Fruits and Vegetables According to Calorie Level

Food Group	Calorie Levels and Cup-Equivalent Recommendations											
	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Vegetables	1	1.5	1.5	2	2.5	2.5	3	3	3.5	3.5	4	4
Fruits	1	1	1.5	1.5	1.5	2	2	2	2	2.5	2.5	2.5

Note. Adapted from “the 2015-2020 Dietary Guidelines for Americans” by the U.S. Department of Health and Human Services and the U.S. Department of Agriculture, 2015. Copyright 2015.

Adherence to the 2015-2020 Dietary Guidelines for Americans

Although adequate daily consumption of fruits and vegetables within the recommendations decreases risk of chronic diseases, Americans habitually consume less than the

recommended intake of fruits and vegetables set forth by the Dietary Guidelines for Americans (HHS & USDA, 2015). The 2015-2020 Dietary Guidelines for Americans included summarized data from 2007-2010, showing that only about 25% of the U.S. population ages 1 and older consume fruit at or above the recommended intake and only about 10% consume vegetables at or above the recommended intake (Dietary Guidelines Advisory Committee, 2015; HHS & USDA, 2015).

In the 2015-2020 Dietary Guidelines for Americans report, the cup-equivalent daily intake for vegetables was higher for males than females, with highest intake in comparison to recommendations for both sexes at ages 1-3 years, and 51-70 years old. Lowest adherence to recommendations was seen for the 14-18 year old age group for both males and females (HHS & USDA, 2015). For fruit, the recommended cup-equivalent daily intake was met for both males and females at ages 1-8, with the least adherence at ages 14-30; both males and females ages 9-13 consumed, on average, one cup less than recommended of fruit (HHS & USDA, 2015). Females age 71 and above were closest to approaching, yet not meeting, fruit cup-equivalent recommendations for age (Dietary Guidelines Advisory Committee, 2015).

A 2017 CDC report stated that 12.2% of U.S. adults are meeting fruit recommendations, and only 9.3% meet vegetable recommendations (Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017). Fruit intake was highest among women (15.1%) and adults between 31 and 50 years old (13.8%) (Lee-Kwan et al., 2017). Vegetable intake was highest among women (10.9%) and adults over 51 years old (10.9%) (Lee-Kwan et al., 2017). Vegetable intake was higher among the higher income groups (11.4%) (Lee-Kwan et al., 2017). Fruit and vegetable intake varied by state, with Mississippi reporting only 8.7% intake of fruit and a 6.2% intake of vegetables (Lee-Kwan et al., 2017). Overall, total intake of both fruits and vegetables for all age groups declined

in comparison to the 2015-2020 Dietary Guidelines (HHS & USDA, 2015).

Characteristics Surrounding Low Fruit and Vegetable Intake

Rural and Appalachian regions have even lower intakes of fruits and vegetables, compared the rest of the nation. Lutfiyya, Chang, and Lipsky (2012) utilized data from the 2009 Behavioral Risk Factor Surveillance Survey (BRFSS) to examine the differences in fruit and vegetable consumption between U.S. rural and non-rural adults. Rural adults were significantly less likely to consume five or more servings of fruits and vegetables. The rural adults who consumed at least five servings were predominantly married, living in a household without children, and had an annual income above \$35,000 (Lutfiyya et al., 2012). Among states, 37 states had a lower prevalence of U.S. rural adult consumption of five or more servings, and only 11 states had a higher prevalence of the same (Lutfiyya et al., 2012). The authors concluded that U.S. rural adults living in lower-income households with children were at increased risk for suboptimal fruit and vegetable intake as recommended by the 2015-2020 Dietary Guidelines for Americans (Lutfiyya et al., 2012). In addition, Short, Oza-Frank, and Conrey (2012) assessed the fruit and vegetable intake of Appalachian women and found that only 22.5% of Appalachian women consume adequate intake of fruits and vegetables, compared to 25.1% of non-Appalachian women.

Education level and household income are also correlated with total fruit and vegetable intake of adults. Lin and Morrison (2016) reported that adults living in households below 185% poverty level consumed smaller quantities of produce, especially vegetables. The researchers found that individuals with college degrees consumed almost twice as much per year than those who had less than a high school education (Lin & Morrison, 2016). Dong and Lin (2009) found similar results among individuals at 130% of the poverty level. Lee-Kwan et al. (2017) observed

that meeting intake recommendations were 11.4% higher among the higher income groups.

Grimm, Foltz, Blanck, & Scanlon (2012) examined the income-to-poverty ratio, a measure that utilizes both reported income and household size, in comparison to fruit and vegetable intake with the 2009 U.S. Behavioral Risk Factor Surveillance System. The consumption of at least two fruits and three vegetables daily was examined. The authors found that the percentage of adults consuming at least three vegetables per day was lower for those living at greatest poverty compared to those with least poverty (Grimm et al., 2012). The authors emphasized the need for increased access, availability, and affordability of fruits and vegetables to help disparate households (Grimm et al., 2012). Availability and affordability were likewise reported as influencing dietary habits with fruit and vegetable intake in the sample of rural Appalachian residents (Fanning-Hardin, 2013).

Household Food Security Status

Food security is defined as having adequate food access for an active, healthy life (Holben & Marshall, 2017; Coleman-Jensen et al., 2018a). Food insecurity, on the other hand, is the inability to have consistent, dependable access to the food (Coleman-Jensen et al. 2017; Coleman-Jensen et al. 2018a; ERS, 2018c). Food insecurity is often coupled with anxiety over food sufficiency or shortage and reduced variety or desirability of the overall diet (Coleman-Jensen et al. 2018a; ERS, 2018c). Some instances of food insecurity may even provoke disrupted eating patterns and reduced intake (ERS, 2018c). Parents within the household may be at increased risk for disruption of eating patterns to protect their children in the household from experiencing disrupted eating patterns and reduced intake (ERS, 2018a).

Hunger is defined as an individual-level physiological condition that results from “prolonged, involuntary lack of food, results in discomfort, illness, weakness, or pain that goes

beyond the usual uneasy sensation” (Coleman-Jensen et al., 2018a; ERS, 2018c). Hunger is distinct from food insecurity, but can accompany very low food security (ERS, 2018c).

Levels of food security can be classified into high food security, marginal food security, low food security, and very low food security, as summarized in Table 3 (ERS, 2018c).

Likewise, these levels indicate whether a household is fully food secure or not fully food secure as shown in Appendix E.

Table 3

Levels of Food Security Status

USDA Food Security Category (Label)	Characteristics
High Food Security	no reported indications of food-access problems or limitations. (fully food secure)
Marginal Food Security	one or two reported indications. These indications are typically anxiety related to food sufficiency or shortage of food in the household. Little or no indication of changes in diets or food intake are present. (not fully food secure)
Low Food Security	reports of reduced quality, variety, or desirability of diet with minimal or no indication of reduced food intake. (not fully food secure)
Very Low Food Security	reports of multiple indications of disrupted eating patterns and reduced food intake. (not fully food secure)

Note. Adapted from “Definitions of Food Security” by the Economic Research Service (2018c). USDA.

These degrees of food security experienced by a household can fluctuate over time and be dependent on the varying costs of other basic needs (Tuttle & Beatty, 2017). Episodes of food insecurity are likely to reoccur in cycles and exist in a household for 7 months out of the year (ERS, 2017c). However, a household can be classified as having food insecurity based on a

single, severe episode during the year (Coleman-Jensen et al., 2018a).

Lower income households often face greater challenges in maintaining food security when household costs rise. Tuttle and Beatty (2017) examined the effect of changing gasoline and electricity prices over a four-year time frame using the Current Population Survey. Low-income households are more vulnerable to unexpected jumps in energy prices (Tuttle & Beatty, 2017). Overall, the participant in low-income households have significantly higher food-distress indicators and a higher probability of needing more money for food compared to the most recent grocery expenditures (Tuttle & Beatty, 2017). Similarly, drops in total household income may be detrimental to the amount of money that can be allocated for food (Office of Disease Prevention & Health Promotion, 2018). Further, the need for new medications may cause households to make tradeoffs with food purchasing when income is limited (Holben & Marshall, 2017; Biros, Hoffman, & Research, 2005; Sullivan, Clark, Pallin, & Camargo, 2008).

Coleman-Jensen et al. (2018a) and Bartfeld and Men (2017) explained how geographical location affects the likelihood of an individual or a household experiencing food insecurity. Food insecurity prevalence is distinct from the household-level characteristics like income, employment, and household structure (Coleman-Jensen et al., 2018a). Food insecurity in a state may be affected by average wages, cost of housing, unemployment rates; other related factors are policies affecting insurance coverage, earned income tax credit, and access to or participation in nutrition assistance programs (Bartfeld & Men, 2017).

Food Security Measurement

The U.S. Department of Agriculture Economic Research Service (ERS) has established standardized tools to measure food insecurity in the United States (ERS, 2017e). These include the U.S. Household Food Security Survey Module, the U.S. Adult Food Security Module, the

Six-Item Short Form of the Food Security Module, and the Self-Administered Food Security Survey Module for Youth ages 12 and older (ERS 2006; 2012a; 2012b; 2012c; 2017d). Overall, the various survey tools allow researchers to adapt the module to their survey content, edit and code responses, and calculate household food security through scale scores, to determine food security status (ERS, 2017e). Further, the Guide to Measuring Household Food Security (Revised 2000 edition) provides detailed guidance for researchers on how to use each of the survey modules in order to directly compare new results to published national statistics (Bickel, Nord, Price, Hamilton, & Cook, 2000; ERS, 2017e).

Both the U.S. Household Food Security Module and the U.S. Adult Food Security Module exhibit a three-stage design with screeners, and most households in the general population survey participating in national surveys are asked only three questions to minimize the response burden (ERS, 2017e). The Household Food Security Survey Module has five general population survey questions if there are children in the household and contains 18 items overall, and the U.S. Adult Food Security Module has been modified to exclude children in the questions and only contains 10 items (ERS, 2017e). The Six-Item Short Form of the Food Security Survey Module is a subset of the standard 18 items for surveys that cannot implement the 10 or 18 item versions (ERS 2012b; 2017d). Lastly, the Self-Administered Food Security Survey Module for Youth Ages 12 and Older was adapted in 2004, specifically for children (Connell, Nord, Lofton, & Yadrick, 2004; ERS 2006; 2017d).

The U.S. Census Bureau conducts an annual food security survey, called the Food Security Supplement, to achieve a representative sample of millions of U.S. households as the basis for national estimates (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017b; ERS, 2017b; 2017d). This Current Population Survey (CPS) Food Security Supplement contains questions

about food security, food expenditures, food sufficiency, and coping strategies (Coleman-Jensen, et al., 2017b; ERS, 2017e; Office of Disease Prevention & Health Promotion, 2018a).

With the CPS Food Security Supplement, one adult from each household is asked about whether or not certain experiences and behaviors occurred in the last 12 months that indicate food insecurity (Coleman-Jensen et al., 2017b; ERS, 2017b; 2017d). Household food security status is assigned based on the number of food-insecure conditions reported (Coleman-Jensen et al., 2017b). Some indicators from the survey question responses include not being unable to afford balanced meals, having low household food spending, reducing meal sizes, or being hungry because of too little money for food; voluntary fasting or weight-loss dieting are excluded from the measure (Coleman-Jensen et al., 2017b). The CPS Food Security Supplement questions are listed in Appendix A.

The questions are not specific of one person in the household or indicative of their individual food security status (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017b; ERS, 2017e). In fact, research shows children in a food insecure household may be food secure (Coleman-Jensen et al., 2018a). Collectively, this annual evaluation of food insecurity in the United States contributes to the operation of the federal nutrition assistance programs and other food programs or initiatives aimed at reducing food insecurity (ERS, 2017e).

Food Insecurity in the United States

Like chronic disease, food insecurity is a preventable, yet widespread issue, affecting millions of Americans annually (Holben & Marshall, 2017; Rabbitt, Coleman-Jensen, & Gregory, 2017a). The 2017 prevalence estimates showed that 11.8% of U.S. households experienced food insecurity sometime during the year, with 7.3% of U.S. households experiencing low food security, and 4.5% experiencing very low food security (Coleman-Jensen

et al., 2018a). Even so, food insecurity rates have trended downward since 2016, when 12.3% of U.S. households experienced food security throughout the year, with 7.4% of households experiencing low food security, and 4.9% of households experiencing very low food security (Rabbitt, Coleman-Jensen, & Gregory, 2017a). An additional decline in food insecurity in the United States can be seen from 2011-2014 (Rabbitt, Coleman-Jensen, & Gregory, 2017a).

Households that experienced food insecurity any time during both 2016 and 2017 were food insecure for an average of 7 months during the year, and the households that had very low food security experienced the conditions in 1-7 days of the month (Coleman-Jensen et al., 2017a; 2018a). In 2017, the average food-insecure household spending for food was 23% less than the spending on food for food-secure households of similar size and composition (Coleman-Jensen et al., 2018a). This was less than 2016, when food-insecure households spent 29% less on food compared to food secure-households of similar size and composition (Coleman-Jensen et al., 2017a). Households with children spent less for food (12%), relative to the household food cost, compared to households without children (32%) for both 2016 and 2017 (Coleman-Jensen et al., 2018a). Household food expenditures were also lower in relation to household food cost when the household was headed by a single woman, compared to those headed by married couples (Coleman-Jensen et al., 2017a; 2018).

Households with children experienced food insecurity at a higher rate (15.7%) than those without children (10.1%) in 2017, but still to a lesser degree than in 2016 (16.5%) (Coleman-Jensen et al., 2017a; 2018a). The households with children under the age of 6 experienced food insecurity at a slightly higher rate of 16.4% in 2017 and 16.6% in 2016 (Coleman-Jensen et al., 2017a; 2018a). In almost half of the food insecure households with children, only the adults were food insecure, as parents or caregivers were able to maintain normal or near-normal diets

for their children while experiencing food insecurity themselves (Coleman-Jensen et al., 2017a; 2018a). Children and adults were both food insecure in 7.7% of households, with 0.7% of these households experiencing food insecurity to a degree that parents reported the children to either be hungry, skip a meal, or avoid eating for the day due to the household food insecurity (Coleman-Jensen et al., 2018a). This has slightly declined from 2016, when 8.0% of households experienced food insecurity among both children and adults, with 0.8% experiencing it to a degree that parents reported that the children were hungry, skipped meals, or avoided eating for the day because of the household food insecurity (Coleman-Jensen, et al., 2017a). In many instances, the older children in the household experienced food insecurity more severely to protect the younger children, like with the parents (Coleman-Jensen et al., 2018a; ERS, 2018a).

Only 9.5% of households with married-couple families experienced food insecurity, while 30.3% of households headed by a female with no spouse experienced food insecurity, in 2017 (Coleman-Jensen et al., 2018a). In 2016, 9.9% of households with married-couple families experienced food insecurity, while 31.6% of households headed by a female with no spouse experienced food insecurity (Coleman-Jensen et al., 2017a). Among ethnicities, the primarily black, non-Hispanic households experienced food insecurity at a greater rate (21.8%), compared to Hispanic households (18.0%), other non-Hispanic households (9.9%), and white, non-Hispanic households (8.8%) in 2017 (Coleman-Jensen et al., 2018a). However, in 2016, the primarily black, non-Hispanic households experienced food insecurity at 22.5%, compared to Hispanic households at 18.5%, other non-Hispanic households at 10.7%, and white, non-Hispanic households at 9.3% (Coleman-Jensen et al., 2017a). Households with higher income-to-poverty ratios were more likely to be food insecure than the national average in both 2016 and 2017 (Coleman-Jensen et al., 2017a; 2018a).

Certain geographic areas, such as rural or southern regions, have higher rates of food insecurity compared to the rest of the nation (Coleman-Jensen et al., 2017a; 2018a). In 2017, rural households only accounted for 13.3% of food-insecure households (Coleman-Jensen et al., 2018a; 2018b). In 2016, rural households accounted for 15% of food-insecure households, higher than their 14% share of all U.S. households (Rabbit, Coleman-Jensen, Gregory, 2017b). Among states, Mississippi had the third highest rate of food insecurity in the United States during 2015-2017 (17.2%), closely following Arkansas (17.4%) and Louisiana (17.3%) (Coleman-Jensen et al., 2018a). State-specific levels of food insecurity are pictured in Figure 1. Previous studies support that households in Appalachian communities experience higher rates of food security, as well (Coleman-Jensen et al., 2017a; Pheley, Holben, Graham, & Simpson, 2002; Holben & Pheley, 2006; Jamieson & Holben, 2017; Johnson et al., 2018).

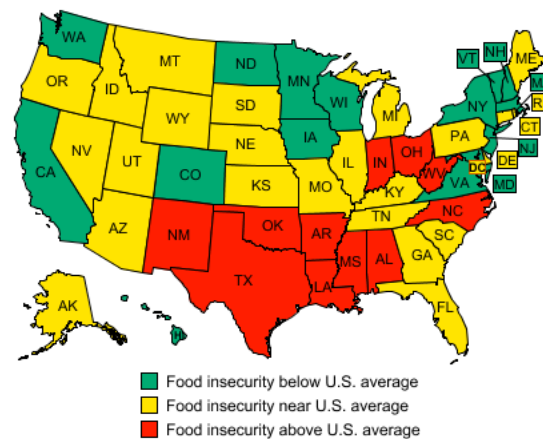


Figure 1. Food insecurity by state territories, above, below, or near the U.S. average from the years 2015-2017. Reprinted from *Prevalence of Food Insecurity, average 2015-17*, by Coleman-Jensen, A., (2017). USDA. Economic Research Service.

Food Insecurity and Fruit and Vegetable Consumption

Adults living in food insecure household consistently consume less than the recommended intake of daily fruits and vegetables set forth by the 2015-2020 Dietary Guidelines for Americans (Grimm, Foltz, Blanck, & Scanlon, 2012; Hanson & Connor, 2014; Lin &

Morrison, 2016). The 2015-2020 Dietary Guidelines for Americans recognized food access, household food insecurity, and acculturation as key contextual factors affecting fruit and vegetable intake (Coleman-Jensen et al., 2018a).

Hanson and Connor (2014) conducted a systematic review and found that food-insecure adults consumed fewer vegetables, fruit, and dairy products than food secure adults and had lower related intake of vitamin A and vitamin B₆, calcium, magnesium, and zinc. Leung et al. (2014) observed a significant reduction in vegetable intake among food insecure participants, compared to food secure participants, when analyzing data from the 1999-2008 National Health and Nutrition Examination Surveys.

Similarly, Johnson et al. (2018) conducted a systematic review and found that food-insecure women had lower food frequencies and related micro-nutrient intakes for fruits and vegetables compared to food-secure women. Food insecurity was negatively associated with adequate intake of calcium, iron, magnesium, vitamins A and C, and folate (Johnson et al., 2018).

Taylor et al. (2017) reported a steady decline in fruit and vegetable intake among a representative sample of U.S. adults as food security status worsened from marginal to very low food security. The very low food secure adults only received 2% of their total energy from fruit and 5% from vegetables, with an increased reliance on snacks and sweets (Taylor, et al., 2017).

Mook et al. (2016) examined the taste, cost, produce selection, quality, and purchase ease as it relates to fruit and vegetable consumption in two economically-deprived communities in California, where 39% of the population was food insecure. Interactions were specifically tested by food security status, which was a strong moderator between fruit and vegetable consumption and all tested variables (Mook et al., 2016).

Food Insecurity and Chronic Disease

Chronic disease risk is directly correlated to household food security status (Berkowitz, S., Berkowitz, T., Meigs, J., & Wexler, D., 2017; Gregory & Coleman-Jensen, 2017; Laraia, 2013). Gregory and Coleman-Jensen (2017) examined the relationship between food security and chronic disease using data from the 2011-2015 National Health Interview Survey (NHIS). The authors found that food insecurity was a stronger predictor for chronic disease than income for the likelihood of development of a chronic disease, as well as the number of chronic conditions reported (Gregory & Coleman-Jensen, 2017). The adults living in households with a lower food security status had significantly higher prevalence of chronic disease, when comparing marginal, low, and very low food security (Gregory & Coleman-Jensen, 2017). Specifically, adults in households with very low food security were 40% more likely to have a chronic disease than adults in households with high food security (Gregory & Coleman-Jensen, 2017). The number of chronic diseases for adults in low food security households was 18% higher than those in high food-security homes (Gregory & Coleman-Jensen, 2017).

Similarly, Seligman, Laraia, and Kushel (2010) examined the association between food insecurity and chronic disease among low-income National Health and Nutrition Examination Survey (NHANES) participants and found an association between cardiovascular disease and food insecurity. Although not a representative sample of the U.S., food insecurity was associated with self-reported and laboratory evidence of hypertension as well as hyperlipidemia at a 95% confidence interval in 5,094 participants (Seligman, Laraia, & Kushel, 2010).

Lastly, Berkowitz et al. (2017) examined the trends with food insecurity and cardiometabolic disease for U.S. adults from 2005-2012. Food insecurity was positively correlated with diabetes mellitus, hypertension, coronary heart disease, congestive heart failure,

and obesity. The sample of 21,196 NHANES participants was not large enough to be a representative sample of the U.S. However, 56.2% of participants had at least one cardiometabolic condition, 24.4% had 2 or more, and 8.5% had 3 or more cardiometabolic conditions (Berkowitz, S., Berkowitz, T., Meigs, & Wexler, 2017). Overall, the annual percentage change in food insecurity for those with a cardiometabolic condition was 13.0%, compared with 5.8% for adults without a cardiometabolic condition. Rates of food insecurity were 8.0% greater in participants with diabetes, 3% greater with hypertension, 9.4% greater with coronary heart disease, 6.3% greater with congestive heart failure, and 3.2% greater with obesity (Berkowitz, S., Berkowitz, T., Meigs, & Wexler; 2017). Similarly, Vercammen, et al. (2019) found that adults with very low food security had higher odds of greater than 20% 10-year cardiovascular disease risk, compared to higher levels of food security.

Both poor physical and mental health are positively associated with food insecurity (Pheley, 2002). Food insecurity has been positively associated with stress, depression, and psychological disorders (Leung, 2014; Lei, 2015; Jung, Kim, Bishop, & Hermann, 2018; McLaughlin et al., 2012).

Programs to Combat Food Insecurity

There are federal food and nutrition assistance programs and community-based programs available to assist food insecure households in meeting food needs (Office of Disease Prevention & Health Promotion, 2018a; Oliveira, 2018). Almost two-thirds of the USDAs annual budget goes towards food and nutrition assistance programs in order to alleviate food insecurity (Oliveira, V, 2018). Eligibility requirements for participation in federal programs are primarily based on household income compared to the federal poverty threshold and household size (Office of Disease Prevention & Health Promotion, 2018a; USDA, 2018b). Thus, these

programs typically cover all Medicaid beneficiaries (Office of Disease Prevention & Health Promotion 2018a). However, specific eligibility requirements are dependent on the state of residence (Office of Disease Prevention & Health Promotion 2018a).

There are 15 domestic food and nutrition assistance programs available through the USDA Food and Nutrition Service, and the three largest federal food and nutrition assistance programs are SNAP (Supplemental Nutrition Assistance Program), the National School Lunch Program, and WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) (Office of Disease Prevention & Health Promotion, 2018a; Oliveira, 2018). A full list of the 15 domestic food and nutrition assistance programs administered by the USDA is in Appendix B.

SNAP (Supplemental Nutrition Assistance Program), formerly known as Food Stamps, provides monthly benefits to income-eligible households to purchase certain food items through SNAP-authorized retailers (Office of Disease Prevention & Health Promotion, 2018a; Oliveira, 2018; USDA, 2018a). The WIC-eligible food items contain a variety of fresh foods from the various food groups like breads and cereals, fruits and vegetables, meats, fish, poultry, and dairy products, and particular focus is put on fruit and vegetable consumption (USDA, 2017b). SNAP benefits exclude beer or alcoholic beverages, vitamins and medicines, non-food grocery items, hot foods, or any other pre-prepared convenience foods (USDA, 2017b). The participating locations depend on the area of residence, but they typically include supermarkets, grocery stores, and farmers markets (Office of Disease Prevention & Health Promotion, 2018a).

The National School Lunch Program (NSLP) serves free and reduced-price lunches to income-eligible students in public and nonprofit private schools or daycare facilities across the United States (Office of Disease Prevention & Health Promotion, 2018a). The NSLP guidelines require the inclusion of fruits, vegetables, whole grains, low-fat dairy, and meat/meat alternatives

with specific requirements for both daily and weekly servings of fruit and vegetables by grade level. (USDA, 2012). The weekly vegetable requirement for kindergarten through grade 8 is three servings of dark green, red/orange, beans/peas, starchy and other vegetables, and grades 9-12 have requirements of five servings weekly (USDA, 2012). Similarly, the weekly fruit requirement for kindergarten through grade 8 is 2.5 servings (cups) of fruit, and grades 9-12 have requirements of five servings of fruit weekly (USDA, 2012). Aside from providing nutritious lunches to children with more fruits and vegetables, this program reduces household food insecurity in the United States by enabling higher household food expenditures for low-income families (Ralston & Coleman-Jensen, A, 2017).

If at least 50% of students qualify for free or reduced priced meals through the National School Lunch program at a public elementary school, the USDA Fresh Fruit and Vegetable Program (FFVP) is another program that can be implemented to encourage fruit and vegetable consumption (USDA, 2017a; Bica et al., 2016). This program provides funding for schools to serve free fruit and vegetable snacks to students at times other than lunch (USDA, 2017a).

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutrition education and supplemental food packages to income-eligible mothers, infants, and children throughout the United States (Office of Disease Prevention & Health Promotion, 2018a; USDA, 2014). WIC is a USDA federally-funded nutrition program providing grants to each state for distribution of supplemental foods with the use of a voucher system after the required nutrition education has been completed (USDA, 2016c). The program targets those eligible mothers who are at nutrition risk while pregnant, breastfeeding, or up to 6 months postpartum (USDA, 2016c). The infants and children who are considered at nutrition risk can receive WIC benefits until the age of 5 (USDA, 2016c). Packages vary depending on the stage

of life for the child or stage of pregnancy for the mother, but inclusion of fresh fruits and vegetables is emphasized in all whole-food voucher plans (USDA, 2016c).

Food pantries and emergency/soup kitchens are community-based resources for food insecure households, but availability varies widely among states (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017b). Generally, food pantries aid those in need by distributing unprepared food for off-site use, while emergency kitchens provide prepared food for users to eat on-site (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017b). While most of the food distributed by food pantries and emergency kitchens are locally-sourced donations and rely on volunteers for service, the USDA supplements these resources through the Emergency Food Assistance Program (TEFAP) (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017b).

Participation in Federal Food Assistance Programs

The annual CPS Food Security Supplement measure includes questions about the use of federal food and nutrition assistance programs if respondents met the minimum income eligibility requirements in initial screeners (Coleman-Jensen et al., 2017b; 2018a; ERS, 2017e). Additionally, food security responses are correlated to a respondents' use of a food assistance program, to examine the relationship between food security status and program use (Coleman-Jensen et al., 2017b; ERS, 2017e). Outlining this relationship can provide insight to researchers on the ways that low-income households cope with difficulties in obtaining adequate food and reveal opportunities for program improvements to best meet participant needs (ERS, 2017e).

In 2017, 42.2 million people participated in SNAP every month, 7.3 million people participated in WIC every month, and 30.0 million children participated in the National School Lunch Program each day (Oliveira, 2018). In 2016, participation was slightly more, with 44.2 million people participated in SNAP monthly, about 7.7 million people participated in WIC, and

30.3 million children participated in the National School Lunch Program (Coleman-Jensen, 2017b). For both years, on the days following SNAP benefit use, the average daily food expenditures were substantially higher than any other days of the month. Food-at-Home spending showed the same pattern, but spending food away-from-home showed no significant differences with SNAP usage time. (Coleman-Jensen, et al., 2017b; 2018a; Oliveira, 2018).

Considering food security status, about 50.1% of households receiving SNAP benefits were food insecure, 38.2% of households receiving WIC were food insecure, and 41.8% of households receiving free or reduced lunches were food insecure in 2017 (Coleman-Jensen et al., 2018). In fact, about 58% of food-insecure households reported using at least one of the largest three food and nutrition assistance programs in 2017 (Coleman-Jensen et al., 2018a; 2018b). In 2016, about 51.2% of households receiving SNAP benefits were food insecure, 40.6% of households receiving WIC were food insecure, and 43.0% of households receiving free or reduced lunches were food insecure (Coleman-Jensen et al., 2017a). About 59% of food-insecure households reported the use of at least one of these three food and nutrition assistance programs during 2016 (Coleman-Jensen, et al., 2017a).

In 2017, 4.7% of all U.S. households reported food pantry use, and 0.6% of households reported emergency kitchen use sometime during the year, which is practically unchanged from 2016 when 4.8% reported food pantry use and 0.6% reported emergency kitchen use (Coleman-Jensen, et al., 2017b; 2018b). In 2017, only 1.8% of food-secure households utilized food pantries, but 26.0% of food-insecure households utilized food pantries; similarly, 0.2% of food-secure households utilized food kitchens, and 3.3% of food-insecure households utilized emergency kitchens (Coleman-Jensen et al., 2018b). In 2016, the same percentage of food-secure households utilized food pantries and emergency kitchens, but 26.5% of food-insecure

households utilized food pantries and 3.5% of food-insecure households utilized emergency kitchens (Coleman-Jensen et al., 2017b).

The Health Belief Model and the Transtheoretical Model (Stages of Change)

While research supports that external factors such as geographical location (southern, rural, Appalachian residence), household income, education level, and household food security status may have an impact on fruit and vegetable intakes, research also indicates that internal factors can impact fruit and vegetable intake (Grimm, et al., 2012; Horacek, et al., 2002; Lin & Morrison, 2016; Lutfiyya, et al., 2012; Yen, et al., 2014). The Health Belief Model and Transtheoretical Model outline specific psychosocial indicators, related to perceptions and intentions, that can predict fruit and vegetable intake (Townsend, et al., 2003; 2005; 2007). Further, these indicators can provide insight for developing interventions related to increasing produce intake (Henry, et al., 2006; Yen, et al., 2014).

First, the Health Belief Model focuses on an individual beliefs and mental processes related to changing health behaviors (Nikos, et al., 2014). It is based on the idea that a person will take a health related action if the individual feels the negative health condition can be avoided, has a positive expectation to taking the recommended action to avoid the negative health consequence, and believes that he/she can successfully take the recommended health action (Resource Center for Adolescent Pregnancy Prevention, 2019; Rural Health Information Hub HRSA, 2019a). For this thesis study, the positive health action is applied as adequate intake of fruits and vegetables compared to recommendations, and the avoidable negative health consequence is development and progression of chronic disease.

The Health Belief model is based on six main concepts that are defined in Table 4.

Table 4

Health Belief Model Major Concepts

Model Concept	Definition
Perceived susceptibility	An individual's belief of the likelihood/perceived threat of developing a condition
Perceived severity	An individual's belief regarding the seriousness and consequences of a condition
Perceived benefits	An individual's belief about the effectiveness or efficacy of the advised action's likelihood to reduce the seriousness or impact of the condition, potential positive benefits of action
Perceived barriers	An individual's belief in the tangible and intangible/psychological cost or problems in performing the desired behavior
Cues to action	Strategies to activate readiness to perform a specific action
Self-efficacy	An individual's confidence in their ability to take action or perform the desired task

Note. Adapted from Nikos, et al., 214 and Resource Center for Adolescent Pregnancy Prevention, 2019.

Second, the Transtheoretical Model, also called the Stages of Change model, focuses on the stages of awareness and readiness of an individual to perform a desirable health behavior (Prochaska & Velicer, 1997; Rural Health Information Hub HRSA, 2019b). The Transtheoretical Model was originally developed and implemented through studies that examined the experiences of individuals who chose to quit smoking (the desired health behavior) compared to those requiring further treatment (Prochaska, & DiClemente, 1983). The researchers concluded that the individuals quit smoking only if they were ready to do so, termed “intentional change” (Prochaska, & DiClemente, 1983). This approach has been adapted and utilized in more recent studies with other desired health behaviors, such as consuming adequate amounts of fruit and vegetables for chronic disease risk reduction, as in this thesis study (Rural

Health Information Hub HRSA, 2019a).

The Transtheoretical Model is based on the Social Cognitive Theory, which emphasizes social reinforcement, in the past and present, as a way of acquiring and maintaining a behavior change (Wang, et al., 2018). Unlike the Health Belief model, this model is based on the attitudes as the antecedent in the ability to change (Wang, et al., 2018). The Transtheoretical model poses that individuals move through six stages of change, which are defined in Table 5.

Table 5.

Transtheoretical Model Stages of Change

Model Stage	Definition
Precontemplation	no intention of taking action in the next 6 months, often accompanied by an unawareness their behavior is problematic or results in negative consequences, with a feeling that the barriers of the action are greater than the benefits
Contemplation	Intention to start a healthy behavior in the next 6 months, with a realization that their current behavior is problematic and benefits versus barriers has been debated internally, yet a feeling of ambivalence towards changing the behavior still exists
Preparation	Intention to take action in the next 30 days with initiation of small efforts towards behavior change supported by the belief that this change will result in a healthier life
Action	Change has been initiated and continues or is planned to be continued, with potential modification of problematic behaviors, replaced with new healthier behaviors
Maintenance	Sustained behavior change for more than 6 months and intention to maintain desired behaviors in the future, with efforts towards preventing recurrence of any earlier stages of change
Termination	Lack of desire to return to unhealthy behaviors and assure relapse will not occur (less often acquired and often not considered with interventions)

Note. Adapted from Wang, et al., 2018.

The constructs derived from both the Social Cognitive Theory and the Health Belief Model have been used to create the validated 13-Item Tool to Assess Psychosocial Indicators of Fruit and Vegetable Intake in Low Income Communities (Townsend, et al., 2005). This tool allows researchers to assess indicators of behavior change related to consuming adequate daily servings of fruits and vegetables, as with this thesis study. The domains and constructs related to the 13-Item Tool to Assess Psychosocial Indicators of Fruit and Vegetable Intake in Low Income Communities are outlined in Table 6.

Table 6

Domains, Constructs, and Origin

Domain of change	Psychosocial construct of the domain	Model of Origin
Predispositioning	Perceived benefit	Transtheoretical Model
	Perceived control	The Transtheoretical Model and the Health Belief Model
Enabling	Self-efficacy (also called perceived barriers in tool)	The Transtheoretical Model and the Health Belief Model
Intention	Readiness to eat more fruit	Transtheoretical Model
	Readiness to eat more vegetables	Transtheoretical Model
	Perceived diet quality	Neither theory but incorporated into the tool

Note. Information adapted from Townsend and Kaiser 2005; 2007. The Transtheoretical Model is related to the Social Cognitive Theory. Not all domains and constructs were used in this thesis study.

The desired result of these behaviors, adequate fruit and vegetable intake, can be further examined with the 7-item food behavior checklist for a limited resource audience (Townsend et al., 2005). This tool, which provides the 7-item scale score, is a separate tool that was validated

along with the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities and is often used in conjunction with this measure (Appendix H). The 7-item food behavior checklist for a limited resource audience includes questions related to variety of fruits and vegetables in the diet and total daily servings. Although the 7-item food behavior checklist for a limited resource audience is not as detailed as a 24-hour dietary recall, 24-hour recalls were utilized in the validation of this measure (Townsend et al., 2005). The 7-item scale score compares favorably to this longer method of a 24-hour recall that increases respondent burden, often resulting in decreased participation (Townsend et al., 2005; 2007). The relationship between the constructs of the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities, the 7-item food behavior checklist for a limited resource audience, and the 24-hour dietary recall is displayed in Figure 2.

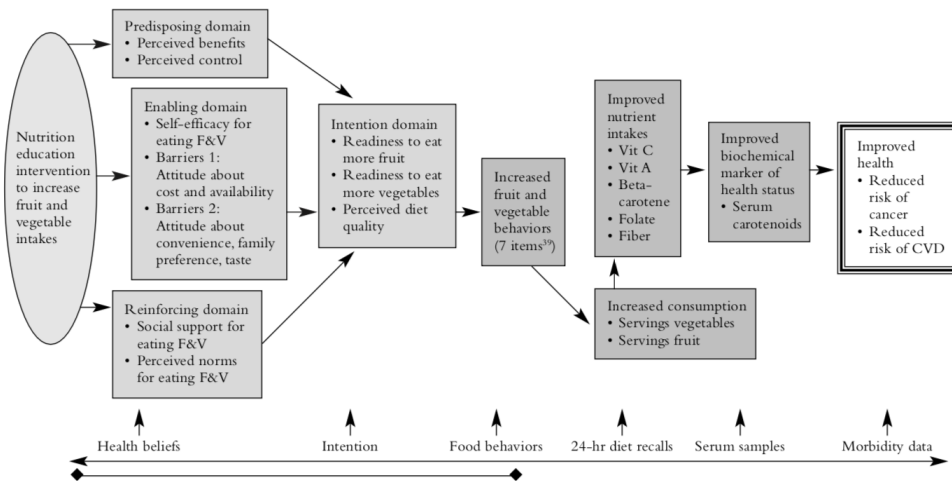


Figure 2. Validation and relationship of 13-item tool and the 7-item food behavior checklist. Reprinted from *Development of a tool to assess psychosocial indicators of fruit and vegetable intake for 2 federal programs* (Townsend, et al., 2005).

The Appalachian Region (The Setting for the Study)

The Appalachian Regional Commission (ARC) defines Appalachia as the 205,000-square-mile region of the Appalachian Mountains that stretches from New York to Mississippi

(Figure 3) (ARC, 2018a). The region includes all of West Virginia and parts of twelve other states, including Georgia, Alabama, Mississippi, Maryland, New York, Ohio, Pennsylvania, Kentucky, North Carolina, South Carolina, and Tennessee (ARC; 2018a).

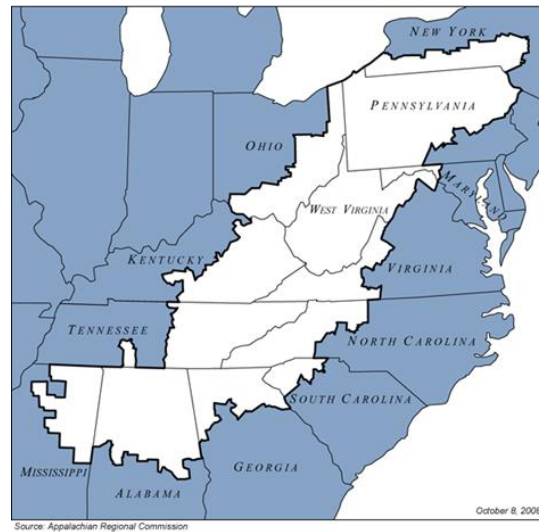


Figure 3. The Appalachian Region. Reprinted from Appalachian Regional Commission: Map of Appalachia (2008).

The Appalachian region encompasses 420 counties total, and 107 of the counties are classified as rural (ERS, 2018b; Marshall, et al., 2017). Overall, 42% of the Appalachian region is rural, compared to 20% of the nation’s population. Figure 4 highlights the rural counties (Marshall, et al., 2017).

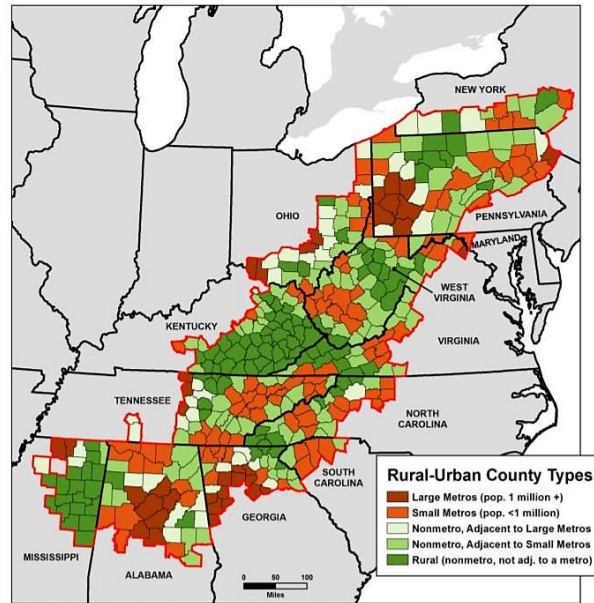


Figure 4. Rural and Urban Counties throughout the Appalachian Region. Reprinted from *Health Disparities in Rural Appalachia*, Marshall, et al. (2017). *Appalachian Regional Commission*.

The USDA Economic Research Service (ERS) classifies rurality of an Appalachian area by population size with Rural-Urban Continuum Codes (ERS, 2016). These codes distinguish metropolitan counties by population compared to their metro areas, and nonmetropolitan counties by degree of urbanization (ERS, 2016).

Rural communities are increasingly being classified as having persistent poverty, meaning that they consistently present poverty rates of 20% or more in 1990, 2000, and 2010-2015 (Housing Assistance Council, 2012; Miller, & Weber 2003). The median household income for a persistent poverty county is \$31,212, compared to \$54,737 for the nation, with increased unemployment rates (Fahe, 2018). Most of the counties with the persistent poverty classification are located in the Southeast and Appalachia (Fahe, 2018).

Both poverty rate and unemployment rate are factored in with per capita income to classify the economic status of an Appalachian county (ARC, 2013). The composite index of these three economic indicators is ranked in comparison to the national averages. Designations

are distressed, at-risk, transitional, competitive, or attainment (ARC, 2013; ARC, 2018c). The distressed counties are the most severe and fall within the highest 10% of the nation's economically-depressed areas (ARC, 2013). The distressed Appalachian counties are indicated in Figure 5. Kentucky has the most distressed areas, and Mississippi has the second highest number of distressed areas among the Appalachian states in both 2016 and 2017 (ARC, 2018c).

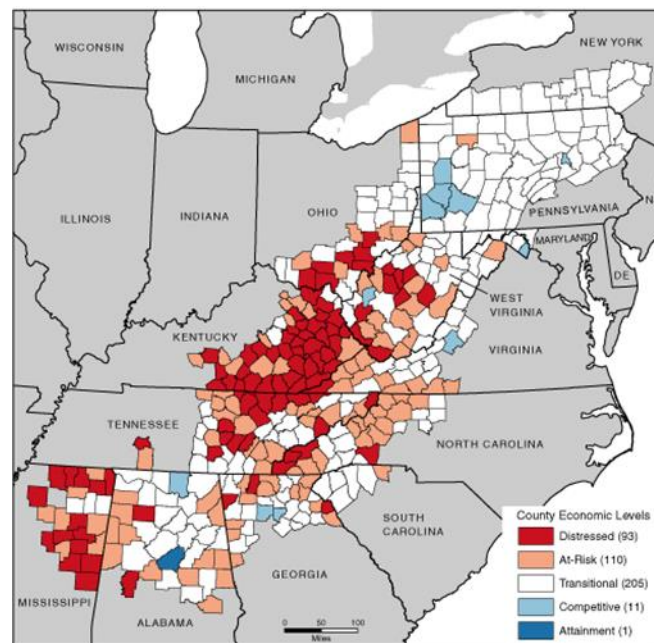


Figure 5. Distressed Counties in Appalachia. Retrieved from https://www.arc.gov/research/MapsofAppalachia.asp?MAP_ID=105 (2016). Appalachian Regional Commission (2016).

Pollard, Jacobsen, and the Population Reference Bureau (2017) reported that the economy in Appalachia has diversified slightly over the last decade, but it is still primarily dependent on mining, forestry, agriculture, and industry. The types of industry, in the region, include chemical, manufacturing and professional service industries. The labor force rate in Appalachia during 2012-2016 was lower than the rates in 2007-2011. Further, the decline in the labor force rate was the greatest in Southern Appalachia and nonmetropolitan counties (Pollard,

Jacobsen, & the Population Reference Bureau, 2017). The authors also noted that the percent of Appalachian adults over 25 years old who have a high school diploma rose to 86 percent in 2012-2016 (Pollard, Jacobsen, & the Population Reference Bureau, 2017). In addition, the percentage of persons ages 25 and over with a baccalaureate degree or higher remained below the national average for the Appalachian regions within Kentucky, Maryland, Ohio, Virginia, Mississippi, and West Virginia (Pollard, Jacobsen, & the Population Reference Bureau, 2017).

Much of the Appalachian population lack access to fruits and vegetables or other nutritious foods for optimal health (Gallagher, 2010; Lilly & Todd, 2015; Stump, 2016; USDA, 2009). Food deserts create greater vulnerability to food insecurity and poor fruit and vegetable intake (Food Research & Action Center, 2018; Stump, 2016; USDA, 2009). Gallagher (2010) and Lilly and Todd (2015) noted that the Appalachian region has many food deserts, a low-income area in which the majority of residents have minimal access to a supermarket or large grocery store (CDC, 2017b; ERS, 2017a). Areas are considered food deserts when residents live more than one mile from a supermarket in urban or suburban areas and more than 10 miles from a supermarket in rural areas (Morton & Blanchard, 2007; USDA, 2009). The U.S. Department of Agriculture (USDA) Economic Research Service measures distance to determine food deserts by dividing the country into multiple 0.5 km square grid and using the distance from the center of each grid to the nearest grocery store to determine the area's food accessibility (USDA, 2009). The food deserts in the Appalachian region are shown in Figure 6.

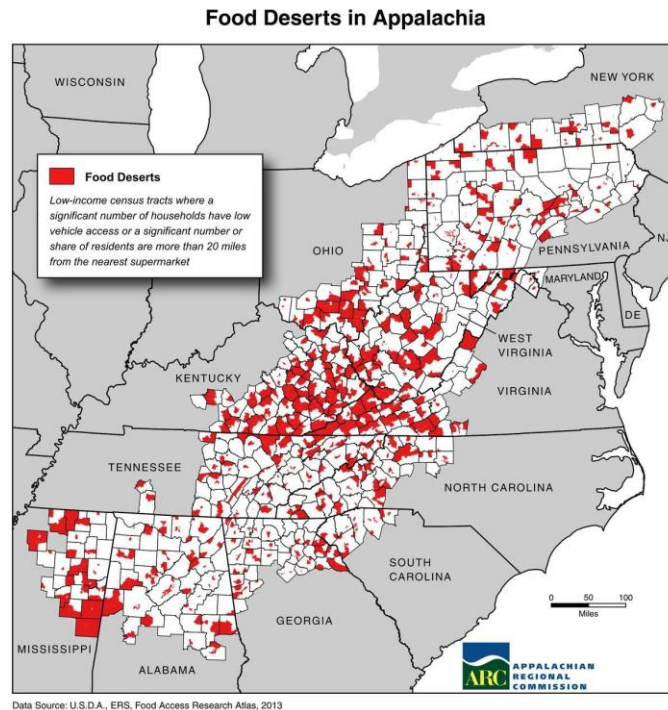


Figure 6. Food Deserts in the Appalachian Region. Reprinted from *Inside Appalachia*, by the Appalachian Regional Commission (2016).

Summary

Chronic diseases affect three in four Americans (Centers for Disease Control and Prevention, 2017a). Although consumption of fruits and vegetables reduces the risk of chronic disease, only about 25% of the U.S. consumes fruit at or above the recommended intake and about 10% consumes vegetables at or above the recommended intake (Dietary Guidelines Advisory Committee, 2015; HHS & USDA, 2015). Certain characteristics are associated with even lower fruit and vegetable intake levels, such as living in rural or Appalachian regions, having a low education level, and having a low household income or income-to-poverty ratio (Grimm, Foltz, Blanck, & Scalon, 2012; Lin & Morrison, 2016; Lee-Kwan et al., 2017; Lutfiyya, Chang, & Lipsky, 2012). Further, individuals who experience food insecurity often have lower intakes of fruits and vegetables and higher chronic disease risk (Gregory & Coleman-Jensen, 2017; Hanson & Connor, 2014; Laraia, 2013; Taylor et al., 2017). Lastly, psychosocial

indicators of perceptions and intentions may give insight regarding an individual's readiness to eat more fruits and vegetables to decrease chronic disease risk (Rural Health Information Hub HRSA, 2019a; 2019b).

The Appalachian region is a 205,000-square-mile region of the Appalachian Mountains that stretches from New York to Mississippi (ARC, 2018a). Appalachia consists primarily of rural counties (ERS, 2018b, Marshall, et al., 2017). Some of the counties exhibit persistent poverty or are classified as distressed and contain food deserts; which are characteristics further associated with food insecurity (ERS, 2017a; Fahe, 2018; Marshall, et al., 2017).

CHAPTER III: METHODOLOGY

The purpose of this study was to determine if there are differences in produce behaviors (related to intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) in a rural, Appalachian Mississippi community.

Study Approval, Design, and Setting

This study was approved by the University of Mississippi Institutional Review Board. The participating school district also approved the study. Data were collected in September of 2016.

A cross-sectional survey of the parents was conducted in a school district in Calhoun County, Mississippi (see Appendix C), providing data of this population and area for that specific point in time. Calhoun County, Mississippi, is highlighted in Figure 7.



Figure 7. Map of Calhoun County, Mississippi. Reprint of *Calhoun County, MS*, by the World Atlas (2016).

Calhoun County, Mississippi, is a rural, Appalachian community. It has a Rural-Urban Continuum Code 9 (rural, not adjacent to a metro area) (USDA, 2016b). In 2016, according to Feeding America, the food insecurity rate in Calhoun County, MS, was 18.4% (Feeding America, 2018a; 2018b). Parts of Calhoun County were food deserts in 2016 according to the USDA Food Access Research Atlas (Lawrence, 2015; National Initiative for Children's Healthcare Quality, 2017; Todd & Lilly, 2015; USDA, 2017d).

Economically, Calhoun County, Mississippi, is classified as distressed, by the Appalachian Regional Commission, and is within the top 10% of the nation's unemployment and poverty rates (ARC, 2017). In 2016, the employment rate was 6.5%, compared to the national average of 4.6% (Bureau of Labor Statistics, 2018). Similarly, 26.3% of the population lived in poverty, and approximately 19% of the population was above 185% of poverty (ARC, 2017; Feeding America, 2018a). About 68% of the population was eligible for SNAP, WIC, free school meals through the National School Lunch program, and TEFAP (Feeding America, 2018a). However, Calhoun County is not classified as having persistent poverty (ERS, 2018a).

In 2016, the most common jobs in Calhoun County, Mississippi, were in production (21.4%), administration (12.3%), transportation (5.9%), and management (7.9%), with emphasis on farming, fishery, and forestry (Data USA, 2016). Calhoun County is a highly agricultural area, leading in the nation's sweet potato production (Tillman, 2016). Other major crops produced in Calhoun County are cotton, corn, and soybeans (Tillman, 2016).

Demographically, the Calhoun County population is primarily English speaking and is 69.8% White, 28.5% African-American, and 5.6% Hispanic. (U.S. Census Bureau, 2016). Within this population, 74.6% of residents have a high school degree or higher, and 10.9% have a bachelor's degree or higher (United States Census Bureau, 2016). In 2016, the most common

degrees were in nursing and elementary education (Data USA, 2016). The illiteracy rate for Calhoun County, Mississippi is approximately 20% (National Center for Education Statistics, 2003).

Participants

This study used existing data from the 2016 *Farm-to-Youth!* project. Participants were male and female individuals at least 18 years or older, who were the parent or legal guardian of a child attending one of three participating elementary schools in Calhoun County, Mississippi. Only one household member was permitted to participate in the study, and it was requested that they be the one primarily responsible for preparing food in the home.

Procedures

Participants were recruited through take-home survey packets provided by their child's homeroom teacher during September 2016. All enrolled students (n=1144) received packets. An information sheet within the packet outlined the research purpose, along with the voluntary and confidential nature of the study (See Appendix C). A produce cookbook [*From Asparagus to Zucchini: A Guide to Cooking Farm-Fresh Seasonal Produce* (Madison Area Community Supported Agriculture Coalition, 2004)] was included as an incentive to complete and return the survey. All survey data were analyzed using IBM Statistical Package for the Social Sciences (version 23, 2015).

As shown in Appendix D, the survey contained demographic questions, including age, gender, education, marital status, race, and occupation. Within the occupation types, full time work was specified on the survey as 35 or more hours per week, and part time work was specified on the survey as less than 35 hours per week. Self-reported address of residence was used to determine whether the respondent lived in a food desert/low access area, or a low-income

area. Comparisons were made regarding how far they lived from the grocery store and the poverty rate (Fahe, 2018; USDA, 2009; 2018b). Frequency tests were run to determine the demographic characteristics of the respondents.

Food security status was determined using the USDA's validated ten-question household survey measure (Appendix I) (ERS, 2012c). Responses were numerically coded according to the number of positive responses, using USDA procedures (ERS, 2012c), and other missing or nonapplicable responses were scored as "missing data" (Appendix F). Responses of "often true" or "sometimes true" were considered to be positive responses, and responses of "never true", or "don't know" were considered to be non-positive choices, which did not contribute to the total score value. Score classifications were assigned with the USDA Food Security Measurement Guide (Appendix E) (ERS, 2012c). Demographic statistics were used to determine the frequency of food security as high, marginal, low, or very low food security. Additional frequency tests were run to determine the number of respondents living in food secure (high food security or marginal food security) households or food insecure (low food security and very low food security) households and fully food secure (high food security) households or not fully food secure (marginal food security, low food security, and very low food security) households.

The produce behaviors, including perceived benefits of produce intakes, perceived barriers to produce intake, and perceived control of produce intake and stage of readiness for fruit and vegetable intakes were evaluated with the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low income communities (see Appendix G) and the validated 7-item Food Behavior Checklist for a Limited Resource Audience (see Appendix H) (Townsend et al., 2003; 2005; 2007).

The 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-

income communities is a validated survey tool, including 13 questions/items addressing 3 domains of change and 6 psychosocial constructs) (Townsend et al., 2005; 2007). The different constructs have varying amounts of related questions, but each construct score ranges from 0-1, based on the scoring methods outlined in Appendix H. Construct definitions specific to the theory implications in this thesis study, and the structure of the tools are provided in Table 7. For the purposes of this study, only 3 psychosocial constructs (perceived benefits, perceived control, and perceived barriers/self-efficacy) were measured.

Table 7

Domains and Constructs Related to Testing Variables

Domain (related to change)	Psychosocial construct of the domain	Definition of the construct	Items in Domain	Item Score
Predispositioning	Perceived benefit	Outcome expectations of what a person believes will happen as a result of performing a behavior that can provide motivation for eating fruits and vegetables.	2	0-1
	Perceived control	Related to who is in control of the food shopping and preparation and refers to having a perception of autonomy over these food-related behaviors	2	0-1
Enabling	Self-efficacy (also called perceived barriers)	The confidence a person feels in performing specific fruit and vegetable behaviors in different of circumstances and the feeling that barriers can be overcome	6	0-1
Intention	Readiness to eat more fruit	Willingness to increase the current intake of fruit in comparison to the amount eaten in the past. Readiness to change is measured by the stage of change algorithm.	1	0-1

(Table continued on page 46)

(table continued)

Readiness to eat more vegetables	Willingness to increase the current intake of vegetables in comparison to the amount eaten in the past. Readiness to change is measured by the stage of change algorithm.	1	0-1
Perceived diet quality	One's personal thoughts on the nutritional acceptability of the current diet pattern a person is consuming in comparison to the recommended diet for what is considered "healthy" or "wholesome" and "with variety"	1	0-1

Note. This tool contains 13 items, and 3 domains with the fruit and vegetable behavior scale having 7 items. These 7 items represent a change in diet-quality indicator. For the tool, each construct has a maximum value of 1 point for a range of 0 to 6 points for the tool using a summarized score of equal weights of the 6 constructs. Answer options were in a three-point scale of agree, either agree or disagree, or disagree. Other answer options were yes or no. Information adapted from Townsend and Kaiser 2005; 2007. Not all constructs were used in this thesis study.

The 7-item food behavior checklist for a limited resource audience provides the 7-item scale score in this research study, which derives from a sum of the individual scores to the 7 questions (Townsend and Kaiser 2003; 2005; 2007). Question options include "yes" or "no" options for some questions, and "never", "sometimes", "often", or "always" options for other questions, which is outlined in Appendix H. Overall, questions assess variety of fruits and vegetables in the diet and total daily servings, as shown in Table 8. A higher 7-item scale score indicates more positive produce behaviors (Townsend and Kaiser 2003; 2005; 2007).

Table 8

Questions for the 7-item food behavior checklist for a limited resource audience

Questions
1. Do you eat more than one kind of fruit daily?
2. During the past week, did you have a citrus fruit or citrus juice?
3. Do you eat 2 or more servings of vegetables at your main meal?
4. Do you eat more than one kind of vegetable each day?
5. Do you eat fruits or vegetables as snacks?
6. How many servings of vegetables do you eat each day?
7. How many servings of fruit do you eat each day?

Note. Derived from Townsend, et al., 2003; 2005; 2007. Appendix H.

Assessment of daily serving of fruit and vegetable intake were included within the validated 7-item Food Behavior Checklist for a Limited Resource Audience (see Appendix H), and thus the 7-item scale score, and these self-reported measures were extracted from the tool as an additional variable within the research questions (Townsend et al., 2003; 2005; 2007). The fruit and vegetable servings from this report were summed to determine total produce intake in this study. Table 9 summarizes all variables, variable values, and related instruments of produce behaviors included in the research questions of this thesis study.

Table 9

Research Variables and Score/Instruments of Measure

Research Variables	Variable value	Testing instruments
Perceived control of produce intake	0-1	2 questions from the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities
Perceived benefit of produce intake	0-1	2 questioned from the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities
Perceived barriers of produce intake	0-1	6 questions from the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities
7-item scale score	0-∞	Sum of all individual answers from the 7-item Food Behavior Checklist for a Limited Resource Audience
Fruit intake	0-∞	Extracted from the question of self-reported daily intake of fruit from the 7-item Food Behavior Checklist for a Limited Resource Audience
Vegetable intake	0-∞	Extracted from the question of self-reported daily intake of fruit from the 7-item Food Behavior Checklist for a Limited Resource Audience
Total produce intake	0-∞	Summed from the self-reported fruit and vegetable intake, from two questions in the 7-item Food Behavior Checklist for a Limited Resource Audience

Note. Reference Appendix G and H for more details. Vegetable intake, fruit intake, total produce intake, and the 7-item fruit and vegetable scale score are continuous variables by self-report, so values can range from 0 to infinity. As displayed in Appendix G, the total score for questions related to perceived benefits and barriers is the sum of items scores/number of items. The highest value for an individual score is one. The lowest value is 0. Therefore, these scores can range from 0-1 in value. The highest value for the two perceived control responses is 0.50, but this calculation is the sum of the two answer scores. Therefore, the highest score possible for this is 1 and the lowest is 0.

Mean, standard deviation, and frequency were used to summarize produce intake and behaviors and perceived benefit and control. Two-tailed independent samples t tests were conducted to determine the significant statistical differences of the mean \pm standard deviation of

the produce measures evaluated. Data was stratified in two ways to compare these measures. The comparison groups were the parents living in food secure homes and the parents living in food insecure homes. In addition, the parents living in fully food secure homes and those living in not fully food secure homes were compared. The independent, discrete variable was household food security status, and the continuous, dependent variables were the produce behaviors. A P-value less than 0.05 was utilized to determine statistical significance. Table 10 summarizes the research questions and the associated statistical measures.

Table 10

Research Questions and Statistical Measures

Research Question	Statistical Procedure
Does parent perceived control of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
Do parent perceived barriers of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
Do parent perceived benefits of produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
Does the parent 7-item scale score differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
Does parent fruit intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
Does parent vegetable intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test

(Table continued on page 50)

(table continued)

Does parent total produce intake differ by household food security status (food secure compared to food insecure; fully food secure compared to not fully food secure)?	Two independent samples t-test
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CHAPTER IV: RESULTS

The purpose of this study was to determine if there are differences in produce behaviors (related to intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) in a rural, Appalachian Mississippi community. A total of 455 surveys with complete food security responses were returned from the 1,144 distributed surveys, yielding a 40% response rate. Of the 455 surveys, the number of returned surveys for each of the three schools were 168 surveys (37%), 140 surveys (31%), and 147 surveys (32%), respectively. This provides individual response rates of 46%, 37%, and 37%. In this results section, data are reported for those answering the questions related to the constructs measured. Therefore, less than 455 participants may be associated with a particular question.

Participant Demographics

Parent participants were 34 ± 8 years. Overall, participants were primarily Caucasian (57%), female (92%), and married (54%), and had some college or higher education (55%). Most participants lived in a low-income area (97%) but was in an area not classified as having low access/food deserts (98%). Participant demographics are summarized in Table 11.

Table 11

Participant Demographics

Gender	n (450)	%
Female	416	92
Male	34	8
Race	n (452)	%
Caucasian white	258	57
African American black	137	30
Hispanic	51	11
American Indian or Native Alaskan	1	0.2
Asian Native	3	0.7
Unspecified or “other” race	2	0.4
Marital Status	n (443)	%
Married	237	53
Widowed	11	2
Divorced	51	12
Separated	17	4
Single or never married	127	29
Education	n (451)	%
Less than high school education	69	15
High school graduate with high school diploma, or the equivalent (GED)	132	29
Some college or higher education	250	56

(Table continued on page 53)

(Table continued)

Occupation	n (444)	%
Worked full time	270	61
Worked part time	43	10
Students (full-time or part-time)	9	2
Social security disability	17	4
Applying for social security	5	1
Retired	3	1
Unemployed	89	20
Other	8	2
Community Characteristics	n (395)	%
Living in a food desert/low access	8	2
Not in an area of food deserts/low access	387	98
Living in a low-income area	318	97
Other	10	3

Note. The “n” value in the columns represents the number of respondents that identified with the corresponding category in the row. The header value provided under “n” represents the number of respondents that identified a specific answer regarding this category. The header value listed may not equal 455, which was the total surveys returned with complete food security responses, as some of the respondents left certain sections or questions blank on the survey (See limitations in discussion section).

Participant Food Security Status

The majority of respondents (81%) lived in food secure households. Participant food security status is summarized in Table 12.

Table 12

Food Security Status of Parent Respondents

USDA Food Security Category	n (455)	%
High Food Security	308	68
Marginal Food Security	59	13
Low Food Security	56	12
Very Low Food Security	32	7
Food Secure vs. Food Insecure	n (455)	%
Food secure	367	81
Food insecure	88	19
Fully Food Secure versus Not Fully Food Secure	n (455)	%
Fully Food Secure	308	68
Not Fully Food Secure	147	32

Note. The “n” value in the columns represents the number of respondents that identified with the corresponding category in the row. The header value provided under “n” represents the number of respondents that identified a specific answer regarding this category.

Adult Produce Intakes and Behaviors by Food Security Status

Of the produce behaviors measured, perceived control ($p=.006$), perceived barriers ($p=.017$), the 7-item fruit and vegetable scale score ($p=.022$), and fruit intake ($p=.003$), significantly differed between the food secure and food insecure groups. Table 13 summarizes the produce behaviors of participants by food security status when comparing the food secure and food insecure groups.

Table 13

Adult Produce Behaviors of Food Secure and Food Insecure Households

Characteristics	Food Secure (mean ± SD)	Food Insecure (mean ± SD)	P Value ^a
13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities			
Perceived control score	0.84 ± 0.24	0.76 ± 0.25	.006
Perceived barriers score	0.90 ± 0.15	0.84 ± 0.19	.017
Perceived benefits score	0.82 ± 0.23	0.81 ± 0.23	.613
Stage of Readiness for vegetables intake score	0.70 ± 0.32	0.64 ± 0.28	.087
Stage of Readiness for fruit intake score	0.65 ± 0.27	0.58 ± 0.31	.062
7-item Food Behavior Checklist for a Limited Resource Audience			
7-item fruit and vegetable score	15.07 ± 3.39	14.12 ± 3.28	.022
Fruit intake (servings)	1.76 ± 0.99	1.41 ± 0.95	.003
Vegetable intake (servings)	2.11 ± 1.03	2.09 ± 1.16	.822
Total produce intake (servings)	3.86 ± 1.71	3.49 ± 1.74	.083

Note. For the full list of questions regarding each measure, reference Appendix G (13-item) and Appendix H (7-item). ^a alpha= .05

As noted in Table 14, perceived control (p=.001), perceived barriers (p<.001), stage of readiness for fruit (p<.001), stage of readiness for vegetables (p=.032), the 7-item fruit and vegetable scale score (p<.001), fruit intake (p<.001), and total produce intake (p=.001)

significantly differed between participants living in fully food secure households and those living in not fully food secure households.

Table 14

Adult Produce Behaviors of Fully Food Secure and Not Fully Food Secure Households

Characteristics	Fully Food Secure (mean ± SD)	Not Fully Food Secure (mean ± SD)	P Value ^a
<i>13-item tool to assess psychosocial indicators of fruit and vegetable intake in low-income communities</i>			
Perceived control	0.85 ± 0.24	0.77 ± 0.25	.001
Perceived barriers score	0.91 ± 0.14	0.84 ± 0.18	.000
Perceived benefits score	0.82 ± 0.23	0.81 ± 0.24	.726
Stage of Readiness for vegetable intake score	0.71 ± 0.33	0.65 ± 0.28	.032
Stage of Readiness for fruit intake score	0.67 ± 0.25	0.56 ± 0.31	.000
<i>7-item Food Behavior Checklist for a Limited Resource Audience</i>			
7-item fruit and vegetable scale score	15.29 ± 3.43	14.03 ± 3.11	.000
Fruit intake (servings)	1.84 ± 0.99	1.37 ± 0.94	.000
Vegetable intake (servings)	2.15 ± 1.04	2.02 ± 1.06	.204
Total produce intake (servings)	3.98 ± 1.74	3.36 ± 1.60	.001

Note. For the full list of questions regarding each measure, reference Appendix G (13-item) and Appendix H (7-item). ^a alpha= .05

CHAPTER V: DISCUSSION

The purpose of this study was to determine if there are differences in produce behaviors (related to intakes; perceptions) of parents of elementary school children by food security status (food secure compared to food insecure; fully food secure compared to not fully food secure) in a rural, Appalachian Mississippi community.

The results of this study showed that selected produce behaviors of parents of elementary school children differ by food security status. First, fruit intake was significantly greater for the more food secure groups (both the food secure and fully food secure groups) compared to their less food secure counterparts (food insecure and no fully food secure). Second, produce intake was only greater for fully food secure, compared to not fully food secure groups but not between the food secure and food insecure groups. Lastly, vegetable intake did not differ by food security status of either stratified group.

Further, perceived control and the 7-item scale score was significantly greater for the more food secure groups (both the food secure and fully food secure groups) compared to their less food secure counterparts (food insecure and no fully food secure), and perceived benefits was significantly less for the equivalent food security comparisons (food secure compared to food insecure; fully food secure compared to not fully food secure). Stage of readiness for fruit and vegetable intake was only significantly greater for the fully food secure compared to the not fully food secure groups, as the food secure and food insecure groups displayed no significant

differences for this measure. Lastly, perceived benefits did not differ by food security status of either stratified group.

Produce Intake Behavior of Food Secure Compared to Food Insecure Groups

In this study, fruit intakes were higher than vegetables intakes, consistent with the findings of Hanson and Connor (2014) and Frongillo (1996) and further supported by the likeability and potential increased consumption of fruit juice and other fruit-related snacks (Byrd-Bredbenner, et al., 2017; HHS & USDA, 2015). Even so, all intakes reported, regardless of food security status, were less than the recommended servings per day (Dietary Guidelines for Americans, 2015). In this study, the mean fruit intake for food secure adults compared to food insecure adults was 1.76 servings (± 0.99 SD) and 1.41 servings (± 0.95 SD), respectively. In comparison, the recommended intake for fruit set forth by the 2015-2020 Dietary Guidelines for Americans is a minimum of 2 servings per day (HHS & USDA, 2015). Likewise, the mean vegetable intake in this thesis study was 2.11 servings (± 1.03 SD) for food secure adults and 2.09 servings (± 1.16 SD) for food insecure adults. The recommended vegetable intake set forth by the 2015-2020 Dietary Guidelines for Americans is a minimum of 2.5 servings per day (HHS & USDA, 2015). Lastly, the mean total produce intake, even for the highest intake group that had 3.98 servings (± 1.74 SD), the fully food secure adults, was approximately 1 serving less than daily recommendations. This is comparable with the findings of Lutfiyya, et al. (2012), who concluded that U.S. rural adults living in low-income houses with children were at increased risk for suboptimal fruit and vegetable intake compared to recommendations.

The findings of this study support the hypothesis that fruit intake will be significantly greater for the food secure compared to food insecure groups. However, the findings of this study did not support the hypothesis that vegetable intake would be significantly greater among

those living in food secure households, compared to their food insecure, counterparts. Lastly, the findings of this study do not support the hypothesis that total produce intake will be greater for those in food secure households, compared to those in food secure households.

Other studies have examined fruit and vegetable intake by food security status and found contrasting results. Frongillo, et al. (1997) found that fruit and vegetable consumption (total produce intake) was lower for food insecure compared to food secure participants. In a systematic review by Hanson and Connor (2014), the researchers also found that food-insecure adults consumed fewer fruits and vegetables than food secure adults. Lastly, Kendall, Olson, and Frongillo (1996) studied women in food insecure households and found that they had lower vegetable intake than those in food secure households. More specifically, Taylor et al. (2017) found that the percentage of participants that consumed fruit and vegetables decreased significantly as food insecurity worsened from marginal to low and very low food security.

Similarly, Tarasuk (2001) found that women in households with no hunger had a higher mean intake of fruits and vegetables compared to those experiencing moderate or severe hunger. Although hunger is distinct from food insecurity, it can accompany the most severe food insecurity (ERS, 2018c), making this a comparable measure, as well.

Some studies have observed intakes by food security status in Appalachia and found significantly different intakes by food security status. For example, a study by Holben and Smith (2014) observed fruit intakes, vegetable intakes, and total produce intakes by food security status among Appalachian parents with children. These researchers found that reported fruit, vegetable, and total produce intakes decrease as food insecurity worsened.

Many studies have examined produce intakes by level of poverty and found similar results. For example, Leung et al. (2014) found a significant reduction in vegetable intake

among lower poverty participants compared to higher poverty participants. Income-to-poverty ratio, as it relates to fruit and vegetable intake, cannot provide a direct comparison to the results of this study, but it is worth considering. The relationship between poverty, regardless of the measure, and food security status is strong. Lin and Morrison (2016) noted the relationship between income, poverty, and food security status in their study by finding the participants below 185% poverty level consumed smaller quantities of produce, especially vegetables. Don and Lin (2009) found similar results among individuals at the 130% poverty level. Lastly, Lee-Kwan et al. (2017) observed that meeting intake recommendations were 11.4% higher among the higher income groups. Hence, the results in each of these studies contrast the results in this thesis study, when considering income as a comparable measure.

Gromis, et al. (2007) found no significant differences in fruit and vegetable intake by food security status among food stamp users. Another study by Mello, et al. (2011) found fruit intake to be the only significantly different intake by food security status, similar to this thesis study. However, food insecure adults actually reported higher fruit intake when compared to the food secure adults in their study. The authors attributed this finding to increased fruit juice consumption among the food insecure participants (Mello, et al., 2011).

Overall, most studies related to food security status and fruit and vegetable intake show similar trends of consumption for fruit, vegetable, and total produce intakes. The reasons that fruit intake and total produce intake, but not vegetable intake, would be significantly different for food secure compared to food insecure participants in this thesis study remains unclear. Even so, certain community aspects that were similar among all participants, regardless food security status, could have influenced these insignificant finding.

Similar cultural influences of the area and access to supermarkets or grocery stores in rural areas can impact all food security status groups and produce intakes, similarly (Dean & Sharkey, 2011; Fanning-Hardin, 2013). Results showed that 98% of respondents did not live in a food desert, so similar access in this area, regardless of food security status, may support the insignificant differences (Table 11). Additionally, income and education have been shown to influence significance of fruit and vegetable intake differences between groups (Dong & Lin, 2009; Lin & Morrison, 2016; Lee-Kwan, et al., 2017). The results in this thesis study displayed that 97% of respondents lived in a low-income area. Such prevalence of low-income, regardless of food security status, may have contributed to insignificant differences of vegetable and total produce intake. Regarding education, 56% of respondents had a college degree or higher, and 29 % had a high school education, so this factor is more varied than other aspects among the sample but could still have contributed to insignificant differences in intakes between the food secure and food insecure groups.

Other Produce Behaviors of Food Secure Compared to Food Insecure Groups

Townsend et al. (2007) stated that an individual's consumption patterns, like fruit and vegetable intakes, are directly influenced by their stage of readiness and their health beliefs, like perceived barriers, perceived benefits, and perceived control. In fact, Mook et al (2016) found this to be true with perceived barriers in relation to fruit and vegetable intake among economically deprived adults in their study. Hence, analyzing these health variables would ideally give insight to the differences in intakes.

The findings of this thesis study do not support the hypothesis that perceived benefits or stage of readiness for fruit and vegetable intake of the participants would be greater for those living in food secure, compared to those living in food insecure, households. The fact that

perceived benefits and stage of readiness in this study were not significantly different might indicate why vegetable intakes and total produce intakes themselves were not significantly different between groups, as supported by Townsend, et al. (2007). However, the findings of this study do support the hypothesis that perceived control would be significantly greater for the participants living in food secure, compared to those living in food insecure homes. Further, the findings of this study support the hypothesis that perceived barriers would be less for participants living in food secure, compared to those living in food insecure homes, as with Mook, et al. (2016).

Insight about the research models and theories utilized for these produce behaviors may provide further rationale for the differences in findings by food security status. The research model/theory origins of the produce measures of this study, as included in the 13-item tool to assess psychosocial indicators of fruit and vegetable intake in low income communities, are included in Table 6 of the literature review. As displayed in the table, all produce measures used in this thesis study included the transtheoretical model concepts. However, perceived control and perceived barriers (termed “self efficacy” in the table) were the only psychosocial construct related to this thesis study that utilizes the health belief model concepts, also (Table 6). The differences between the Health Belief Model and the Transtheoretical model, as it applies to this study, likely contributed significant differences in perceived control and perceived barriers. Further, it likely contributed to the insignificant differences in perceived benefits and stage of readiness for fruit and vegetable intake by food security status.

First, the health belief model focuses on whether a person believes they can do the behavior, regardless of their related desire or intention (Nikos, et al. ,2014). Alternatively, the transtheoretical model focuses on the attitude of awareness and readiness of an individual to

perform that desired health behavior (Prochaska & Velicer, 1997). Individuals with higher food security status in this study likely had a significantly stronger belief that they had the ability to eat more fruits and vegetables or control over their intake, compared to the less food secure groups. However, these individuals likely did not have an attitude of readiness or a desire to eat more fruits and vegetables, regardless of their perceived ability and control. In this study, perceived control would be directly related to perceived barriers of performing the task, which was the only other significant finding between food secure and food insecure groups. The fact that perceived barriers were significantly less for the food secure compared to the food insecure groups could be attributed to increased availability and variety options of foods, as supported by USDA food security definitions (ERS, 2018c).

The hypothesis was supported for the 7-item scale score, which was significantly greater for the participants in food secure, compared to food insecure households. Since the 7-item scale score includes questions about fruit intake and vegetable intakes, and the results of this study displayed that vegetable intake and total produce intake were not significantly different for food secure compared to food insecure groups, one might assume that the 7-item scale score comparison would produce insignificant findings, likewise (Townsend, et al., 2007). Even so, other factors are included in the total score of the measure that could influence significance of differences between groups, such as frequency and variety of consumption (Table 8; Appendix H). Research supports that the variety of fruit and vegetables that a person consumes reduces as food insecurity worsens (ERS, 2018a; Nunnery, Labban, & Dharod, 2017; Olivera, 2018). Thus, the different levels of variety of fruits and vegetables consumed between the food secure and food insecure participants likely resulted in significant differences between groups for the 7-item scale score.

Produce Intakes and Other Behaviors of Fully Food Secure Compared to Not Food

Insecure Groups

Results supported the hypothesis that fruit intakes would be significantly different for the fully food secure compared to not fully food secure groups. However, this study did not support the hypothesis that vegetable intakes would be significantly different between fully food secure compared to not fully food secure groups. Similar community aspects, as discussed with the food secure and food insecure groups, may have contributed to this insignificant difference among the fully food secure and not fully food secure, as well. Lastly, the results support the hypothesis that total produce intakes would be significantly greater in those living in fully food secure, compared to those not living in fully food secure households. These findings underscore that any indication of food insecurity may precipitate dietary patterns characterized by poorer produce intakes.

The hypothesis was not supported that perceived benefit of fruit and vegetable intake would be not significantly less for the fully food secure and not fully food secure groups. However, the hypothesis was supported for perceived control, stage of readiness for fruit and stage of readiness for vegetable intake, and 7-item scale score, as these measures were all significantly greater between the fully food secure and not fully food secure groups. Lastly, the hypothesis was supported that perceived barriers would be significantly less for the fully food secure compared to the not fully food secure groups.

As shown in Appendix E, the classification of household food security allows for 0-2 positive responses on the USDA Food Security Module (ERS, 2012c). Alternatively, the classification of fully food secure does not allow for any positive responses on the USDA Food Security Module (ERS, 2012c). Therefore, any positive responses on the module classifies the

household as not fully food secure. Despite the use of mean and standard deviation to report findings, the differences in food security scoring could have contributed to the increase in statistically significant differences when comparing participants between these food security categories opposed to the comparisons of food secure and food insecure groups.

The rationale between the differences of related theories, as discussed with the food secure and food insecure groups, supports these findings, likewise. However, these results display that more sensitive indications of food insecurity (due to the differences in scoring by these food security classifications) may have a stronger impact on produce behaviors related to intention and readiness, compared to the food secure and food insecure groups. To our knowledge, this is the first study to utilize this evaluation method and provide these significant findings. This finding is important for public health practitioners.

As noted by Holben and Marshall (2017), food insecurity is a preventable public health threat. As such, the findings of this thesis study indicate that, among adults with elementary school children, any indication of food insecurity, when observing differences in fully food secure and not fully food secure adults, is associated with poorer produce behaviors for fruit intakes, total produce intake, perceived control, perceived barriers, stage of readiness for fruit, and the 7-item scale score.

Limitations

This study had limitations. A primary limitation of this study is that the results were based on self-report. This approach assumes that the participants were honest about the responses in all measures contained in the survey. For food security status, fear of admitting severity of food insecurity in a household may have caused participants to not answer truthfully.

Yet, the instrument is valid and reliable (ERS, 2012c). Other health indicators and behaviors fall within this same risk.

Another limitation is the volunteer nature of the study, considering that the parents who chose to participate may have tended to have a similar quality. This would make the sample biased and potentially provide different outcomes than if everyone participated. Relatedly, the use of a produce cookbook as an incentive for survey completion [*From Asparagus to Zucchini: A Guide to Cooking Farm-Fresh Seasonal Produce* (Madison Area Community Supported Agriculture Coalition, 2004)] may have only been a desirable incentive to certain types of parents. Even so, the fact that each parent who received a packet was able to keep the cookbook, regardless of their completion and return of the survey, would have reduced this bias. Likewise, parents may have been discouraged from participating due to fear of reporting the food security status of the household. The result of this tendency would underestimate household food insecurity. The information sheet (Appendix C) assured participant confidentiality, which minimizes this limitation. Lastly, the volunteer nature of the study provided a convenience sample, which may have caused the results to not be representative (Wu Suen, et al., 2014).

When considering the limitation related to representative sampling, other outcomes must also be considered. In this study, some surveys contained blank demographic sections but had complete sections for the validated tool questions related to research variables, as reflected by inconsistent “n” values for different demographic characteristics in Table 11. Consistency of demographic reports did not affect the purpose or impact of the research questions, since the hypothesis and research questions only focused on food security status and produce intakes and behaviors. This was the determining factor for inclusion despite differences. Even so, inconsistency of demographics may have diminished the validity of sample characteristics, as a

way of relating to food insecurity prevalence and produce intakes and behaviors in other research studies. All the while, the fact that most demographics reported were close to a total of 455, the number of complete food security responses that the research variables were based from, diminishes the negative implications of this limitation (Table 11). In this study, the potential consequence of reduced sample size from eliminating surveys based on a single missing demographic variable was more detrimental than including demographics despite limited missing answers.

Since the purpose of the study and the outcome of the research questions was based on the validity of food security status, surveys with too many missing food security question responses were eliminated from the sample (Table 1). Even so, the USDA's validated procedures for "missing data" or nonapplicable responses for food security questions were utilized to minimize this limitation (Appendix F) (Bickel, et al., 2000).

The potential for illiteracy in certain homes existed, as Calhoun County has an illiteracy rate of 20%, which might discourage participation among some parents and ultimately decreased the sample size (National Center for Education Statistics, 2003). Even so, 56% of respondents had a college education and 29% had a high school diploma or GED, making this unlikely to create a great impact on respondent outcomes (Table 11). Even if caretakers were able to read or obtain help in reading the materials, the health literacy or previous health education related to understanding the materials may have caused caretakers not to participate, biasing the sample also. Including a measure of health literacy level might provide more insight regarding reasons for certain produce behaviors of the participant, as supported by Lim, et al., (2014). Interest and previous education related to the importance of fruit and vegetable intake and how it relates to health was not assessed in the sample, which could be included in future studies.

The fruit and vegetable measures did not include a definition or guideline for self-reported servings of fruits and vegetables in one day, leaving it open for interpretation by the respondent. Only two questions were used for the assessment of amount of fruit and vegetable intake, which provides limited information compared to a food frequency questionnaire or 24-hour dietary recall (Table 8). However, the method of this thesis study to assess produce intakes has been deemed reliable and valid by Townsend, et al. and originally considered 24-hour recall in tool development (2003; 2005; 2007) (Figure 2).

Finally, although occupation demographics displayed that 60% of respondents were working full time and 97% of respondents lived in a low-income area, frequency of other household economic indicators or poverty-related measures were not assessed in this thesis study, especially among different schools or food security statuses (Table 11). Analyzing this data would potentially correlate to household food security status of the participants and support intention and perception measures (perceived control, perceived barriers, perceived benefits, and stage of readiness for fruit and vegetable intake).

Future Directions

School-based interventions have been previously been effective in facilitating parental behavior change. For example, Rausch, et al., (2014) examined the effectiveness of a multi-model nutrition and physical activity education intervention on parents of kindergarten children and observed favorable outcomes related to knowledge, attitudes, and behaviors. Similarly, Pearson, et al. (2010) examined the effectiveness of a pilot family-based newsletter aimed at increasing fruit and vegetable consumption and found that parents in the intervention group had significantly higher fruit and vegetable consumption compared to the control group.

Other community-interventions, aiming to increase accessibility of fruits and vegetables rather than nutrition knowledge, have also been shown to significantly increase fruit and vegetable intake among food insecure adults. For example, a study by Savoie-Roscovs, et al. (2016) provided dollar-per-dollar match up vouchers for up to \$10 per week in farmers' market incentives for participants in the Utah Supplemental Nutrition Assistance Program. The researchers found that fewer individuals reported experiencing food insecurity–related behaviors after receiving the incentives and vegetable intake significantly increased (Savoie-Roscovs, et al., 2016). Similarly, Hanson, et al. (2017) examined fruit and vegetable intake of adults in low-income households that participated in a cost-offset (50% subsidized) community-supported agriculture program and observed higher fruit and vegetable intakes with participation. Miewald, Holben, and Hall (2012) found a food box program to be beneficial in increasing fruit and vegetable consumption and alleviating food insecurity. Lastly, Hopkins and Holben (2010) found community gardeners to increase produce intake among food insecure adults in rural Appalachian Ohio. Utilizing similar strategies in this rural, Appalachian Mississippi community in future studies might deem beneficial in increasing produce intakes and promoting desirable produce behaviors in food insecure adults.

Conclusions

To our knowledge, this is the first study to examine intakes along with stage of readiness, perceived barriers, perceived control, perceived benefits, and the 7-item scale score by food security status in rural, Appalachian, Mississippi. This is also the first study, to our knowledge, to identify food security statuses and food insecurity rates of this sample of parents in a rural, Appalachian, community. In this study, differences in adult fruit and total produce intake of parents of elementary school children by food security status were found. Likewise, differences

were seen in other produce behaviors, especially those related to perception of ability to do the task, when compared to individual readiness or intention. This study confirms the need for interventions related to food insecurity and produce behaviors in this segment of population. It also provides insight for future related studies. Identification of the specific differences in produce behaviors by food security status will further promote efforts to improve produce behaviors, potentially decreasing chronic disease rates among adults.

Based on these findings, more research is warranted on how to increase fruit and vegetable intake in parents with elementary school children, especially among those not fully food secure households. This study only evaluated perceived barriers and benefits to fruit and vegetable intake combined, as it relates to food security status, which is the methodology of most similar studies. Even so, developing a method to explore perceived barriers and perceived benefits to fruit and vegetable intakes, separately, is warranted and might better clarify the findings of this study. Utilizing the Health Belief Model (Nikos, et al., 2014), and Stages of Change model, as with the approach of Townsend, et al. (2005, 2007) and Chuan & Horwath (2001) would likely be the most appropriate validation approach. Previous studies utilizing perceived barriers and benefits of other desired health behaviors besides fruit and vegetable intake, have been successful in related validation processes (Kirby, Donovan-Hall, & Yardly, 2014; Marrero, et al., 2006; Simpson, Johnson, Farris, & Tsuyuki, 2002).

Additionally, produce related interventions are warranted for adults in rural, Appalachian Mississippi. Specifically, interventions should address intention and readiness to perform the task to promote this behavior change. Ultimately, continued research on this topic is vital to decrease the epidemic of chronic disease in Mississippi and in the United States to better understand household food security status among specific populations.

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APPENDIX

LIST OF APPENDICES

APPENDIX	PAGE
A. Current Population Survey Food Security Supplement Questions	100
B. The Domestic Food and Nutrition Assistance Programs provided by the USDA	102
C. Information Sheet.....	103
D. Cross-Sectional Parent Survey.....	105
E. Food Security Categories and Scale Score.....	116
F. Code of Missing Questions.....	117
G. 13-item Tool to Assess Psychological Indicators of Fruit and Vegetable Intake	118
H. Scoring of 7-item Food Behavior Checklist for a Limited Resource Audience	120
I. USDA’s Validated Ten-Question Household Survey Measure Scoring.....	121

APPENDIX A: CURRENT POPULATION SURVEY (CPS)
FOOD SECURITY SUPPLEMENT QUESTIONS

1. “We worried whether our food would run out before we got money to buy more.” Was that often, sometimes, or never true for you in the last 12 months?
2. “The food that we bought just didn’t last and we didn’t have money to get more.” Was that often, sometimes, or never true for you in the last 12 months?
3. “We couldn’t afford to eat balanced meals.” Was that often, sometimes, or never true for you in the last 12 months?
4. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn’t enough money for food? (Yes/No)
5. (If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
6. 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)
7. In the last 12 months, were you ever hungry, but didn’t eat, because there wasn’t enough money for food? (Yes/No)
8. In the last 12 months, did you lose weight because there wasn’t enough money for food? (Yes/No)
9. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn’t enough money for food? (Yes/No)

10. (If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

(Questions 11-18 were asked only if the household included children age 0-17)

11. “We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food.” Was that often, sometimes, or never true for you in the last 12 months?

12. “We couldn’t feed our children a balanced meal because we couldn’t afford that.” Was that often, sometimes, or never true for you in the last 12 months?

13. “The children were not eating enough because we just couldn’t afford enough food.” Was that often, sometimes, or never true for you in the last 12 months?

14. In the last 12 months, did you ever cut the size of any of the children’s meals because there wasn’t enough money for food? (Yes/No)

15. In the last 12 months, were the children ever hungry but you just couldn’t afford more food? (Yes/No)

16. In the last 12 months, did any of the children ever skip a meal because there wasn’t enough money for food? (Yes/No)

17. (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

18. In the last 12 months did any of the children ever not eat for a whole day because there wasn’t enough money for food? (Yes/No)

APPENDIX B: THE DOMESTIC FOOD AND NUTRITION ASSISTANCE PROGRAMS
PROVIDED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

- Commodity Supplemental Food Program (CSFP)
- Food Distribution Program on Indian Reservations (FDPIR)
- The Emergency Food Assistance Program (TEFAP)
- USDA Food in Schools
- Child and Adult Care Food Program (CACFP)
- Fresh Fruit and Vegetable Program (FFVP)
- National School Lunch Program (NSLP)
- School Breakfast Program (SBP)
- Special Milk Program (SMP)
- Summer Food Service Program (SFSP)
- Supplemental Nutrition Assistance Program (SNAP)
- Women, Infants, and Children (WIC)
- Farmers' Market Nutrition Program (FMNP)
- Seniors' Farmers Market Nutrition Program (SFMNP)

APPENDIX C: INFORMATION SHEET

INFORMATION SHEET

Title: Farm-to-YOUth! Evaluation of a Produce Education Program for Youth and Families

Investigators

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(662) 915-1359

THIS SHEET WILL BE REMOVED FROM YOUR SURVEY AFTER YOU RETURN IT. IT WILL BE USED TO ASSIGN YOU AN IDENTIFICATION NUMBER (SUBJECT NUMBER).

MY NAME IS: _____

By checking this box I certify that I am 18 years of age or older.

CHILD BRINGING HOME THIS SURVEY IS: _____

GRADE OF THE CHILD BRINGING HOME THIS SURVEY: _____

Description

The purpose of this research project is to determine the effect of school-based food and nutrition education in Calhoun County, Mississippi, on both parents and elementary school children. Parents will complete a survey before and after the program, when enrolled into the study.

Children will not complete a survey but will be asked to taste and rate foods in the cafeteria, if they want to. It will not be required. Food waste will also be observed before and after the program in the cafeteria. Your name or any other identifying information will not be on the survey, but you will have a subject number so that we can link your pre- and post-study information. If you have more than one child enrolled in the elementary school, please return all surveys together.

Cost and Payments

The pre- and post-surveys take about 10-minutes (each) to complete. Completing the survey means that you have enrolled into the study. You will not receive payment for participation, you will receive a cookbook with the pre-survey and a kitchen gadget with the post-survey. You will also receive education materials and kitchen gadgets during the program. Your child(ren) will bring them home. Some children may also bring home produce for you to taste.

Risks and Benefits

Parents: You may feel uncomfortable with some of the questions asked about the food situation in your household. For example, some questions ask if you worry about having enough money to buy food. We do not think that there are any other risks. A lot of people enjoy taking questionnaires. Information from the study may help to develop programs that benefit people in Mississippi and other areas of the country.

Children: We do not think that there are any risks for children. The school program includes opportunity for children to taste and rate foods. We do not anticipate any problems with food allergies in the cafeteria; however, the school nurse will be contacted if your child has an allergic reaction to a food.

Confidentiality

No identifiable information will be recorded for you or your children, therefore we do not think you can be identified from this study. We do ask for your address so that we can map how far you live from a supermarket.

Right to Withdraw

You or your children do not have to take part in this study, and you may stop participation at any time. If you start the study and decide that you do not want to finish, all you have to do is to tell Dr. Holben or Ms. Antolini, Reece, or Weber in person, by letter, or by telephone (contact information listed above). You may skip any questions you prefer not to answer.

IRB Approval

This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482 or irb@olemiss.edu.

Statement of Consent

I have read and understand the above information. By completing the survey, I consent to participate in the study.

APPENDIX D: CROSS SECTIONAL PARENT SURVEY

Farm-to-YOuth! Pre-Survey

This survey is intended to be completed by the parent/caretaker of the child bringing home the survey who is responsible for food preparation in the home. Completion of this survey is completely voluntary and may cease at any time. No one will be able to identify you in any report resulting from this survey.

Tell Us About You and Your Household.

How old are you? _____	What is your gender? (Circle one answer)	Male	Female
-------------------------------	---	------	--------

What is your race? (Circle all that apply)					
American Indian or Native Alaskan	Asian Native	Black or African American	Hispanic	Hawaiian or Other Pacific Islander	White
Other (Please specify.)					

What is <u>your</u> highest level of education completed?		(Check one box only)
Less than High School		
High School Graduate – high school DIPLOMA or the equivalent (GED)		
Some College or Higher		

What is your current marital status? (Circle one answer)				
Married	Widowed	Divorced	Separated	Single/Never Married
If not married, do you have a live-in partner? Yes No				
<u>Including you</u>, how many people live in your household?		_____ Children less than 18 years of age	_____ Adults	

What is <u>your</u> occupation type?		(Check one box only)
Working full-time (35 or more hours per week)		
Working part-time (fewer than 35 hours per week)		
Unemployed		
Student (either full or part-time)		
Social Security Disability		
Applying for Social Security		
Retired		
Other (Please explain)		

We are interested in how far you live from a grocery store? What is your address?

Do you currently have health insurance?			(Circle one answer)
No coverage/ self-pay	Medicaid or Medicare only	Private insurance only (job/ school/ purchased)	

Do you belong to a church / religious group? (Circle one answer)	Yes	No
---	-----	----

--	--	--

Do you smoke cigarettes/ tobacco?	Yes	No
Does someone in your household smoke?	Yes	No

In general my health is excellent, very good, good, fair, or poor. (Circle one answer)				
Excellent	Very Good	Good	Fair	Poor
If you are a woman, were you ever diagnosed with gestational diabetes or given birth to a baby weighing nine pounds or more? (Circle one answer)			I am not a woman.	Yes No
Do you have a mother, father, sister, or brother with diabetes?				Yes No
Have you ever been diagnosed with high blood pressure? (Circle one answer)				Yes No
Have you ever been diagnosed with type 1 diabetes? (Circle one answer)				Yes No
Have you ever been diagnosed with type 2 diabetes? (Circle one answer)				Yes No
Are you physically active? (Circle one answer)				Yes No
How much do <u>you</u> weigh? _____		Find your height in the left column and then circle one box in the row. <u>If you weigh less than the range of the left column, just circle your height.</u>		

Height	Weight (lbs.)		
4' 10"	119-142	143-190	191+
4' 11"	124-147	148-197	198+
5' 0"	128-152	153-203	204+
5' 1"	132-157	158-210	211+
5' 2"	136-163	164-217	218+
5' 3"	141-168	169-224	225+
5' 4"	145-173	174-231	232+
5' 5"	150-179	180-239	240+
5' 6"	155-185	186-246	247+
5' 7"	159-190	191-254	255+
5' 8"	164-196	197-261	262+
5' 9"	169-202	203-269	270+
5' 10"	174-208	209-277	278+
5' 11"	179-214	215-285	286+
6' 0"	184-220	221-293	294+
6' 1"	189-226	227-301	302+
6' 2"	194-232	233-310	311+
6' 3"	200-239	240-318	319+
6' 4"	205-245	246-327	328+

Tell Us About Your Food and Nutrition Habits and Behaviors.

I feel that I am helping my body by eating more fruits and vegetables. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I may develop health problems if I do not eat fruit and vegetables. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can eat fruit or vegetables as snacks. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can buy more vegetables the next time I shop. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can plan meals or snack with more fruit during the next week. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can eat two or more servings of vegetables at dinner. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can plan meals with more vegetables during the next week. (Circle one answer)	Agree (Yes)	Agree or Disagree (Maybe)	Disagree (No)
I feel that I can add extra vegetables to casseroles and stews.	Agree (Yes)	Agree or Disagree	Disagree (No)

(Circle one answer)		(Maybe)	
In your household who is in charge of what foods to buy? (Circle one answer)	I Am	Shared Decision	Other Person
In your household who is in charge of how to prepare the food? (Circle one answer)	I Am	Shared Decision	Other Person

How would you best describe your diet? (Circle one answer)				
Excellent	Very Good	Good	Fair	Poor

Which one statement best fits you? (Check one box only.)	
I am not thinking about eating more fruit.	
I am thinking about eating more fruit...planning to start within six months.	
I am definitely planning to eat more fruit in the next month.	
I am trying to eat more fruit now.	
I am already eating 3 or more servings of fruit a day	

Which one statement best fits you? (Check one box only.)	
I am not thinking about eating more vegetables.	
I am thinking about eating more vegetables...planning to start within six months.	
I am definitely planning to eat more vegetables in the next month.	
I am trying to eat more vegetables now.	
I am already eating 3 or more servings of vegetables a day.	

Do you eat more than one kind of fruit daily? (Circle only one.)			
Never	Sometimes	Often	Always

Do you eat more than 1 kind of vegetable in a day? (Circle only one.)			
Never	Sometimes	Often	Always

During the past week, did you have citrus fruit (such as orange or grapefruit) or citrus juice?	Yes	No
(Circle one.)		

How many servings of vegetables do you eat each day?	Number_____
---	-------------

Do you eat 2 or more servings of vegetables at your main meal? Sometimes, often, always, or never? (Circle one.)			
Sometimes	Often	Always	Never

Do you eat fruit or vegetables as snacks? (Circle one.)	Yes	No
How many servings of fruits do you eat each day?	Number_____	

Which one statement best fits you?	(Check one box only.)
I am not thinking about gardening to grow vegetables for my household.	
I am thinking about gardening to grow vegetables for my household. ...planning to start within six months	
I am definitely planning to garden to grow vegetables for my household in the next month.	
I am trying to garden to grow vegetables for my household.	
I am already gardening to grow vegetables for my household.	

Which one statement best fits you?	(Check one box only.)
I am not thinking about gardening to grow fruits for my household.	
I am thinking about gardening to grow fruits for my household. ...planning to start within six months	

I am definitely planning to garden to grow fruits for my household in the next month.	
I am trying to garden to grow fruits for my household.	
I am already gardening to grow fruits for my household.	

Which of these statements best describes the food eaten in your household in the last 12 months?			
(Check one box only.)			
Enough of the kinds of food I/we want to eat			
Enough but not always the kinds of food I/we want			
Sometimes not enough to eat			
Often not enough			
Don't Know or Refused			
Here are some reasons why people don't always have <u>enough to eat</u>. For each one, please tell me if that is a reason why YOU don't always have enough to eat.	Yes	No	Don't Know
Not enough money for food			
Not enough time for shopping or cooking			
Too hard to get to the store			
On a diet			
No working stove available			
Not able to cook or eat because of health problems			

Here are some reasons why people don't always have <u>the quality or variety of food they want</u>. For each one, please tell me if that is a reason why YOU don't always have the kinds of food you want to eat.	Yes	No	Don't Know
Not enough money for food			
Kinds of food (I/we) want not available			
Not enough time for shopping or cooking			

Too hard to get to the store			
On a special diet			

<p>In the past 12 months, (I/we) worried whether (my/our) food would run out before (I/we) got money to buy more.</p> <p style="text-align: right;">(Circle only one.)</p>			
Often true	Sometimes true	Never true	Don't Know or Prefer Not to Answer

<p>In the past 12 months, the food that (I/we) bought just didn't last, and (I/we) didn't have money to get more.</p> <p style="text-align: right;">(Circle only one.)</p>			
Often true	Sometimes true	Never true	Don't Know or Prefer Not to Answer

<p>In the past 12 months, (I/we) couldn't afford to eat balanced meals.</p> <p style="text-align: right;">(Circle only one.)</p>			
Often true	Sometimes true	Never true	Don't Know or Prefer Not to Answer

<p>In the past 12 months, did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?</p> <p style="text-align: right;">(Check one box only)</p>				
Yes. Almost every month	Yes. Some months but not every month	Yes. Only 1 or 2 months	No.	Don't Know or Prefer Not to Answer

<p>In the past 12 months, did you (personally) ever eat less than you felt you should because there wasn't enough money to buy food?</p> <p style="text-align: right;">(Check one box only)</p>		
Yes	No	Don't Know or Prefer Not to Answer

<p>In the past 12 months, were you (personally) ever hungry but didn't eat because you couldn't afford enough food?</p>
--

(Check one box only)		
Yes	No	Don't Know or Prefer Not to Answer

In the past 12 months, did you (personally) lose weight because you didn't have enough money for food?		
(Check one box only)		
Yes	No	Don't Know or Prefer Not to Answer

In the past 12 months, did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?				
(Check one box only)				
Yes. Almost every month	Yes. Some months but not every month	Yes. Only 1 or 2 months	No.	Don't Know or Prefer Not to Answer

Tell Us More About the Child who Brought This Home From School.

What is the child's age? _____	What grade is the child in? _____	
What is your child's gender? (Circle one answer)	Male	Female

What is your child's race? (Circle all that apply)					
American Indian or Native Alaskan	Asian Native	Black or African American	Hispanic	Hawaiian or Other Pacific Islander	White
Other (Please specify.)					

In the past year, have you been told by a medical professional that your child is overweight or obese? (Circle one answer)	Yes	No
In the past year, have you been told by a medical professional that your child has low iron? (Circle one answer)	Yes	No
In the past year, has your child ever been in trouble at school for behavior problems? (Circle one answer)	Yes	No
In the past year, has your child seen the school counselor or another counselor/medical professional for anxiety, depression, behavioral, or psychological problems? (Circle one answer)	Yes	No

In general my <u>child's</u> health is excellent, very good, good, fair, or poor. (Circle one answer)				
Excellent	Very Good	Good	Fair	Poor
How would you best describe your <u>child's</u> diet? (Circle one answer)				
Excellent	Very Good	Good	Fair	Poor

Does <u>your child</u> eat more than one kind of fruit daily? (Circle only one.)			
Never	Sometimes	Often	Always

Does <u>your child</u> more than 1 kind of vegetable in a day? (Circle only one.)			
Never	Sometimes	Often	Always

During the past week, did <u>your child</u> have citrus fruit (such as orange or grapefruit) or citrus juice? (Circle one.)	Yes	No
--	-----	----

How many servings of vegetables <u>does your child</u> eat each day?	Number _____
--	--------------

Does <u>your child</u> eat 2 or more servings of vegetables at your main meal? Sometimes, often, always, or never? (Circle one.)			
Sometimes	Often	Always	Never

Does <u>your child</u> eat fruit or vegetables as snacks? (Circle one.)	Yes	No
How many servings of fruits <u>does your child</u> eat each day?	Number _____	

Thank you for participating in our survey!

APPENDIX E: FOOD SECURITY CATEGORIES BY SCALE SCORES

Food Security Measurement Guide (Ten Item)

Number of Positive Questions or Responses	Scale Score	USDA Food Security Category	USDA Food Security Category (Dichotomous)	Fully Food Secure versus Not Fully Food Secure
0	0.0	High Food Security (0)	Food Secure (0)	Fully Food Secure (0)
1	1.2	Marginal Food Security (1)		Not Fully Food Secure (1)
2	2.2			
3	3.0	Low Food Security (2)	Food Insecure (1)	
4	3.7			
5	4.4			
6	5.0	Very Low Food Security (3)		
7	5.7			
8	6.4			
9	7.2			
10	7.7			

APPENDIX F: CODE OF MISSING QUESTIONS

Coding pattern	Interpretation Criteria
yy xx nnnnnnnnnnnnn	Impute the missing responses as “yes”. There is a more severe “yes” response and no less severe “no” response.
yyyy xx nnnnnnnnnnnnn	Impute the missing “no” response. There is no more severe “yes” response.
yyyyy n x y nnnnnnnnnnn	Impute the missing response as “no”. There is no more severe “yes” but there is also a less severe “no” response.
yyyyyyy x yy x n x y x nnn	Impute the first two missing responses as “yes” and the second two missing responses as “no”, based on the combined application of the above two rules.

Note. From Bickel et al., 2000. Code: y=yes, n=no, x= missing. Determine if cases with very few valid responses have enough information to be imputable, or if the entire case should be declared missing (i.e. unscalable, food security status unknown.) There are no hard and fast rules for this. It depends somewhat on how good you believe the partial data that you have are. If the household gave no valid responses to any scale item, then it should almost certainly be declared unscalable. Note that a household could refuse all of the first stage questions and then be skipped out of the rest of the questionnaire at the 1st-level screener. For such a household, it is probably not appropriate to score the skipped questions as “no” responses. Rather, those responses should also be assigned as missing and the household classified as unscalable/food security status unknown.

APPENDIX G: 13-ITEM TOOL TO ASSESS PSYCHOSOCIAL INDICATORS OF FRUIT
AND VEGETABLE INTAKE

Note. The value for each construct derives from one of the following domains: predispositioning, enabling, and intention, all related to change. The construct score should be calculated separately for equal weighed values, and then summed for the total score, ranging from 0-6.

Perceived Benefits (1 construct)				
Question	Answer Options			Scoring
“I feel that I am helping my body by eating more fruits and vegetables.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	Sum of items scores/number of items Agree=1; Agree or disagree (maybe)=0.5, disagree (no)= 0
“I may develop health problems if I do not eat fruits and vegetables.”	Agree (yes)-score as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	

Note. Section 1 in survey. Add scores and divide by 2.

Perceived Control (1 construct)				
Question	Answer Options			Scoring
“ In your household who is in charge of what foods to buy?”	I Am- score as 0.5	Shared decision-score as 0.25	Other person-score as 0	Sum of items scores I am=.05; shared decision=0.25; other person= 0
In your household, who is in charge of how to prepare the food?”	I Am- score as 0.5	Shared decision-score as 0.25	Other person-score as 0	

Note. Section 3 in survey. Predisposing Domain= perceived benefit construct score + perceived control construct score (Townsend et al., 2007)

Self-Efficacy (1 construct)				
Question	Answer Options			Scoring
“I feel that I can eat fruit or vegetables as snacks.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	Sum of items scores/number of items Agree=1; Agree or disagree (maybe)=0.5, disagree (no)= 0
“I feel that I can buy more vegetables the next time I shop.”	Agree (yes)-score as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	
“I feel that I can plan meals or snack with more fruit during the week.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	
“I feel that I can eat two or more servings of vegetables at dinner.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	
“I feel that I can plan meals with more vegetables during the next week.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	
“I feel that I can add extra vegetables to casseroles and stews.”	Agree (yes)-scored as 1	Agree or disagree (maybe)- score as 0.50	Disagree (no)-score as 0	

Note. Section 3 in survey. Add scores and divide by 6.

APPENDIX H: H. SCORING OF 7-ITEM FOOD BEHAVIOR CHECKLIST FOR A LIMITED
RESOURCE AUDIENCE

Question	Answer Options				Scoring
1. Do you eat more than 1 kind of fruit daily?	Never-scored as 1	Sometimes-scored as 2	Often-scored as 3	Always-scored as 4	Sum of item scores with the 7 questions listed (including ones below)
2. During the past week, did you have citrus fruit or citrus juice?	Never-scored as 1	Sometimes-scored as 2	Often-scored as 3	Always-scored as 4	
3. Do you eat 2 or more servings of vegetables at your main meal?	Never-scored as 1	Sometimes-scored as 2	Often-scored as 3	Always-scored as 4	
4. Do you eat more than 1 kind of vegetable each day?	Yes-scored as 2		No-scored as 1		Sum of item scores with the 7 questions listed
5. Do you eat fruits or vegetables as snacks?	Yes-scored as 2		No-scored as 1		
6. How many servings of vegetables do you eat each day?	<i>Participants wrote a number value in the blank</i>				Sum of item scores with the 7 questions listed
7. How many servings of fruit do you eat each day?	<i>Participants wrote a number value in the blank</i>				

Note. Participants were instructed to “Circle one” for all questions except the daily servings of fruits and vegetables (fill in the blank). The score was determined through total of all 7 scores.

APPENDIX I: USDA’S VALIDATED TEN-QUESTION HOUSEHOLD SURVEY MEASURE

SCORING

Question	Answer Options				Scoring
In the past 12 months, (I/We) worried whether (my/our) food would run out before (I/we) got money to buy more.	Often true	Sometimes true	Never true	Don’t know or prefer not to answer	Add up the total value of all scores for the 10 items and then refer to Appendix E.
	Scored as 1 for positive answers scoring	Scored as 1 for positive answer scoring	Scored as 0 for number of positive answers	See Appendix F	
In the past 12 months, the food that (I/we) bought just didn’t last, and (I/we) didn’t have money to get more.	Scored as 1 for positive answers scoring	Scored as 1 for positive answer scoring	Scored as 0 for number of positive answers	See Appendix F	
In the last 12 months, (I/we) couldn’t afford to eat balanced meals.	Scored as 1 for positive answers scoring	Scored as 1 for positive answer scoring	Scored as 0 for number of positive answers	See Appendix F	

(continued)	Yes. Almost every month.	Yes. Some months but not every month.	Yes. Only 1 or 2 months.	No.	Don’t know or prefer not to answer.
In the past 12 months, did (you/you or other adults in your household) ever not eat for a whole day because there wasn’t enough money for food?	Scored as 2 for positive answer scoring	Scored as 2 for positive answer scoring	Scored as 1 for positive answer scoring	Scored as 0 for positive answer scoring	See Appendix F

In the last 12 months, did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?	Scored as 2 for positive answer scoring	Scored as 2 for positive answer scoring	Scored as 1 for positive answer scoring	Scored as 0 for positive answer scoring	<i>See Appendix F</i>	
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	Yes	No	Don't know or prefer not to answer	<i>Add up the total value of all of the scores for the 10 items and then refer to Appendix E.</i>
In the last 12 months, did you (personally) lose weight because there wasn't enough money for food?	Scored as 1 for positive answer scoring	Scored as 0 for positive answer scoring	<i>See Appendix F</i>	
In the last 12 months, were you (personally) ever hungry but didn't eat because you couldn't afford food?	Scored as 1 for positive answer scoring	Scored as 0 for positive answer scoring	<i>See Appendix F</i>	
In the past 12 months, did you (personally) ever eat less than you felt like you should because there wasn't enough money to buy food?	Scored as 1 for positive answer scoring	Scored as 0 for positive answer scoring	<i>See Appendix F</i>	

(The next set of questions were optional by ERS, 2012c but used for the survey. It is not used to calculate any of the food security scales. It may be used in conjunction with income as a preliminary screener to reduce respondent burden for high income households).

Here are some reasons that people don't always have enough to eat. For each one, please tell if that is a reason why YOU don't always have enough to eat.	Yes	No	Don't Know
• Not enough money for food			
• Not enough time for shopping and cooking			
• Too hard to get to the store			
• On a diet			

• No working stove available			
• Not able to cook or eat because of health problems			

Here are some reasons people don't always have the quality or variety of food they want. For each one, please tell if that is a reason why YOU don't always have the same kinds of foods you want to eat.	Yes	No	Don't Know
• Not enough money for food			
• Kinds of foods (I/we) want not available			
• Not enough time for shopping and cooking			
• Too hard to get to the store			
• On a special diet			

VITA

Tiffany Shirley

Education

University of Mississippi - University, MS

- Bachelor of Science Dietetics and Nutrition, 2017

Northeast Mississippi Community College - Booneville, MS

- Associate Of Arts Liberal Arts, 2015

Academic Employment

Graduate Assistant: Seed, Read, Feed (Summer Library Program)

Bruce, MS (Summer 2018)

- created lesson plans for 30 students engaging in stem and nutrition-related topics
- survey analysis for food insecure families• conducted focus groups for research studies
- implemented class presentations/activities to promote nutrition knowledge

Graduate Research Assistant (Farm to *YOUth!* Dollars for Scholars Research Grant Project)

Oxford, MS (2017-2018)

- collaborated with investigators to screen/code survey data for statistical testing measures
- performed quantitative and qualitative analysis
- submitted findings that were published in peer-reviewed journals

Certifications and Affiliations

- Academy of Nutrition and Dietetics: student member (2015-present)
- Servsafe certification: Food Protection Manager
- School Nutrition Management certification

Research Presentations and Publications

Abstracts published in October 2018 Academy of Nutrition and Dietetics Journal (AND) and poster presentation at the 2018 AND Food and Nutrition Expo and Conference:

- Food insecurity and produce intakes and behaviors of adults with children: Tiffany Shirley, Michelle Weber, David Holben
- Grit, food security, and SNAP usage among parents in rural Mississippi: Marta Dees, Tiffany Shirley, Michelle Weber, David Holben
- Produce intake, food security, and SNAP usage among parents and elementary students in a rural, Appalachian, Mississippi county: David Holben, Marta Dees, Tiffany Shirley, Michelle Weber