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Determinants of Fruit and Vegetable Consumption for Adults in the Panhandle of Nebraska

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Abstract

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Erin Norman

MA, Eastern Michigan University, 2015

BS, Chadron State College, 2009

Dissertation Submitted in Partial Fulfillment

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Abstract

Low fruit and vegetable (F/V) consumption has been documented and is associated with increased risk of chronic disease. Previous studies have revealed that consuming the recommended servings of F/V per day can be influenced by many determinants including healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived quality, and perceived cost of fruits and vegetables. The purpose of this study was to examine these determinants of F/V consumption at the individual level of the socioecological model for adults ages 18 years and older residing in the panhandle of Nebraska. The socioecological model (SEM) provided the theoretical framework for this research. Data were collected using an electronic version of the Strong Women Follow-up Survey. The survey was distributed by the Panhandle Public Health District Listserv and online Facebook platform to adults from each of the 12 counties in the panhandle of Nebraska. The Statistical Package for Social Sciences version 27 was used to conduct a bivariate linear regression and multiple linear regression analysis for research questions. A total of 139 sample participant responses were used for data analysis. Results showed that healthy eating self-efficacy was a significant determinant of F/V consumption which accounted for 10.4% of the variation of fruit consumption and 17.7% of the variation of vegetable consumption. All other independent variables revealed no statistical significance. The results suggested the need for further research of other determinants at higher SEM levels. Positive social change implications include tailoring of future interventions by researchers and Panhandle Public Health Department employees to improve the health of adults living in the panhandle of Nebraska.

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Dedication

First, thank you to God for giving me the persistence and personal motivation to push through these difficult and stressful challenges over the past five years. There were many times I thought of quitting, but you always calmed my fears and doubts and surrounded me with encouragement and guidance. Also, I would like to dedicate this study to my husband, kids, and my parents. They have put up with an awful lot of family disruptions to accommodate my study needs, and I appreciated it. Their encouragement and willingness to help means more to me than they could ever imagine. To my colleagues in the Family and Consumer Science Department at Chadron State College, thank you for your continuous support and for helping me to always look for the light at the end of the tunnel.

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Chapter 1: Introduction to the Study

In this study, I examined the determinants of fruit and vegetable (F/V) consumption among adults in the northwest Panhandle of Nebraska. The determinants chosen for assessment were derived from the individual level of the socioecological model, which assess how perception can influence health behavior (Sallis & Owen, 2015). An electronic survey was used to collect data on (a) healthy eating self-efficacy, (b) cooking confidence, (c) perceived family support to consume F/V, (d) perceived access to F/V, (e) perceived cost of F/V, and (f) perceived quality of F/V. This study's findings highlight the need for further exploration of the different levels of the Socio-ecological model SEM using objective measures, and development of interventions aiming to increase F/V consumption.

This chapter provides (a) background on the recommended amount of F/V for consumption each day, (b) trends surrounding F/V consumption in the United States by income, race/ethnicity, and education, and (c) provides an understanding of F/V consumption. I discuss in Chapter 2, prior research on the problem conducted by other researchers to provide more in-depth knowledge of the topic. I also include information acquired from other research intervention studies to increase F/V consumption. Further research on the significance of the study is expressed to further public health efforts to create social change for a healthier Nebraska population, and improve future efforts to increase F/V consumption.

Background of the Study

Across the United States, there has been a steady increase in the number of adults who are overweight or obese (Kleinert & Horton, 2015). According to Hales (2020), 42.2% of adults in the United States are obese. Obesity is a significant public health concern because of the close associations between obesity and other chronic diseases including cardiovascular disease, stroke, (Singh et al., 2013), cancer (Lauby-Secretan et al., 2016; Xia et al., 2014), and Type 2 diabetes (Centers for Disease Control and Prevention [CDC], 2019; Hruby et al., 2016; Mihai & Remus, 2018; The GBD 2015; 2017). To further compound this health crisis, the medical costs associated with obesity and chronic disease has had severe economic consequences due to medical expenditures, and loss of productivity (CDC, 2019; Kleinert & Horton, 2015; Kleinman et al., 2014; Pearson-Stuttard et al., 2017).

Consumption of F/V is associated with healthy weight maintenance and reduced risk of chronic disease due to the low calorie and high micronutrient content (Bertoia et al., 2015; CDC, 2019; United States Department of Agriculture [USDA], 2015). Currently, the *Dietary Guidelines for Americans 2015-2020* recommends for adults to consume 1.5-2.0 cups of fruit per day and 2-3 cups of vegetables per day (USDA, 2015). However, estimates show that only 12.2% of Americans meet this recommendation (Lee-Kwan et al., 2017). In Nebraska, F/V consumption is lower than the national average, with 11.4% of adults consuming the recommended daily fruit intake and 7.9% of adults consuming the recommended daily vegetable intake (CDC, 2018).

Meeting these dietary recommendations is variant based on income, education, age, race, and ethnicity (Briz et al., 2017; CDC, 2019; Colapinto et al., 2018; Deliens et al., 2018; Lee-Kwan et al., 2017). The prevalence of obesity is highest among adults aged 40 years and older, low-income, lower levels of educational attainment, women, and African Americans (CDC, 2019; Hales et al., 2020; USDA, 2015). Comparatively, similar individual characteristics are associated with low F/V consumption. The lowest consumption of daily servings is noticed among the lowest household income groups, those with less than a college education, African Americans, Hispanics, and men (Briz et al., 2017, Chai et al., 2018; Colapinto et al., 2018; Colon-Ramos et al., 2015). The age determinant in correlation with F/V consumption varies from study to study with some finding that older age is associated with increased consumption (Briz et al., 2017) while others found a decreased consumption (Colapinto et al., 2018; de Menezes et al., 2018).

Determinants from other levels of the socioecological model have been shown to have mixed results on F/V consumption outcomes (Allcott et al., 2018; Askelson et al., 2018; Baruth et al., 2011; Bernales-Korins et al., 2017; Dean & Sharkey, 2011; Fertig et al., 2019; Lo et al., 2019). These determinants include self-efficacy, cooking confidence, social support, and the environmental context in which the individual lives, which can influence a person's access to F/V, the F/V's cost, and the overall quality of F/V. Self-efficacy is defined as confidence in oneself to perform a behavior and is one of the most influential individual determinants related to F/V consumption (de Menenzes et al., 2018; Lo et al., 2019; Smith et al., 2019). That confidence in one's ability to consume more F/V can produce the motivation and preplanning, which can translate into improved healthy

eating behaviors (Lo et al., 2019; Smith et al., 2019; Zhou et al., 2017). Therefore, self-efficacy needs to continue to be studied among different populations to provide a better understanding of its role in future intervention efforts.

Cooking confidence is essential to encourage self-efficacy of F/V consumption. Intervention studies aiming to improve cooking skills and home-cooking confidence have resulted in increased inclusion of F/V's being served at mealtimes (Fertig et al., 2019; Utter et al., 2018). However, to prepare healthy home-cooked meals, there needs to be a certain amount of family support in the home (Haynes-Maslow et al., 2013; Smith et al., 2019). Support can come from a partner, spouse, extended family, and even children (Haynes-Maslow et al., 2013; Stluka et al., 2015). A lack of family support can possibly deter the purchasing and preparation of F/V's, leading to reduced consumption.

Self-efficacy, cooking confidence, and social support are all essential determinants at the inner levels of the SEM, but the food environment also influences these behaviors (Allcott et al., 2018; Kern et al., 2017; Martinez-Carrasco et al., 2012; Story et al., 2008). A supportive food environment is needed to strengthen determinants in the lower levels of the SEM (Story et al., 2008). Access to quality affordable food can be challenging in an area that has few or no supermarkets and higher food prices (Co & Bakken, 2018). Access can be further reduced if transportation is not reliable (Allcott et al., 2018; Hawkes et al., 2015; Haynes-Maslow et al., 2015). The cost of F/V is cited in the literature as one of the most prevalent food environment barriers to meeting the daily recommendation (Bernales-Korins et al., 2017; Evans et al., 2015; Haynes-Masslow et al., 2015). The cost barrier is especially prevalent among low-income individuals and

families, who report altering their dietary patterns when financial funds are tight (Hawkes et al., 2015). However, when this barrier is reduced, purchasing and consumption of F/V are significantly increased (Askelson et al., 2018; Bernales-Korins et al., 2017; Marcinkevage et al., 2019).

Further, the perceived quality of F/V is associated with increased costs (Dean & Sharkey, 2011). Often supermarkets are perceived to carry the highest quality produce, but access to supermarkets is not equal to all citizens in the United States (Dean & Sharkey, 2011). Rural and remote areas in the United States have fewer supermarkets, which requires its residents to drive further for the quality that they deem necessary for consumption (Allcott et al., 2018; Dean & Sharkey, 2011). Objective measures of the previously described determinants are important to understand the complex interlinking they have on each other. However, subjective measure of these determinants is also important. Objective measures and subjective perceptions may not always align exactly (Pinho et al., 2017). It is likely that many individuals will measure their food and social environments differently based on their own set of standards, which will result in different perceptions of the same food and social environments (Pinho et al., 2017). Therefore, subjective measure of these determinants at the individual level may be used to guide future research at higher levels of the SEM.

Problem Statement

Recently the Nebraska Food Council was developed to improve food and economic security among state residents while also attempting to improve health outcomes (Radding, 2015). As previously described, several different determinants can

influence F/V consumption, and the magnitude of influence for each determinant can vary for different populations (Powell-Wiley et al., 2014; Xue et al., 2020). Few previous studies have taken place in the panhandle of Nebraska, and no studies identifying the determinants of F/V consumption have taken place in Nebraska (Chai et al., 2018; Dean & Sharkey, 2011, Middaugh et al., 2012; Stluka et al., 2015). Therefore, the specific problem is that more research is needed in the northwest panhandle of Nebraska to identify which determinants significantly impact F/V consumption. Results from this study allow for increased tailoring of future intervention efforts and positive social change to improve F/V consumption.

Purpose of the Study

The purpose of this study was to examine the determinants of F/V consumption at the individual level of the SEM for adults ages 18 years and older residing in the panhandle of Nebraska. A quantitative cross-sectional design using the Strong Women Follow-Up survey was used to collect data from the study participants (Appendix A). At the individual-level, variables included self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality. Surveying this underresearched population and location added to the literature a more specific understanding of the determinants of F/V consumption, and guide future research at higher levels of the SEM.

Research Question(s) and Hypotheses

The following seven research questions and associated hypotheses guide this study:

RQ1: To what degree is healthy eating self-efficacy correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 1_1$: Healthy eating self-efficacy is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 1_1$-Healthy eating self-efficacy is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 1_2$: Healthy eating self-efficacy is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 1_2$: Healthy eating self-efficacy is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ2: To what degree is cooking confidence correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 2_1$: Cooking confidence is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 2_1$: Cooking confidence is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 2_2$: Cooking confidence is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 2_2$: Cooking confidence is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ3: To what degree is perceived family support correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 3_1$: Perceived family support is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 3_1$: Perceived family support is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 3_2$: Perceived family support is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 3_2$: Perceived family support is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ4: To what degree is perceived access to fruits and vegetables correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 4_1$: Perceived access to fruits and vegetables is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 4_1$: Perceived access to fruits and vegetables is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 4_2$: Perceived access to fruits and vegetables is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 4_2$: Perceived access to fruits and vegetables is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ5: To what degree is perceived cost correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 5_1$: The perceived cost of fruits and vegetables is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_a5_1: The perceived cost of fruits and vegetables is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_05_2: The perceived cost of fruits and vegetables is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a5_{2:}$ The perceived cost of fruits and vegetables is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ6: To what degree is perceived quality of fruits and vegetables correlated with and vegetable consumption among adults in the panhandle of Nebraska?

H_06_1: Perceived quality is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_a6_1: Perceived quality is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_06_2: Perceived quality is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

H_a6_2: Perceived quality is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ7: To what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 7_1$: Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are not predictors of fruit consumption among adults in the panhandle of Nebraska.

$H_a 7_1$: Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are predictors of fruit consumption among adults in the panhandle of Nebraska.

$H_0 7_2$: Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are not predictors of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 7_2$: Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are predictors of vegetable consumption among adults in the panhandle of Nebraska.

Theoretical Foundation

The socioecological model (SEM) was used as the theoretical framework for the study. Bronfenbrenner (1994) theorized that multiple environments interdependently influence one another and the behavior of populations. Additionally, a person can influence the environments in which they interact (Bronfenbrenner, 1994). The SEM is becoming more popular among intervention efforts, as increasing evidence supports improved behavior outcomes because of using multifactorial health intervention strategies (Robinson, 2008; Sallis & Owens, 2015). This framework emphasized the development of dietary behaviors from personal knowledge, skills, social support from family and the community, as well as the environmental impact such as the distribution

of stores offering affordable, quality produce (Story et al., 2008). Each of the layers is interlinked and cannot be separated from each other (See Chapter 2). Therefore, more comprehensive studies are needed that include multiple layers of the SEM.

Individual perceptions of personal self-efficacy, cooking confidence, support, access, cost, and quality are important (Haynes-Maslow et al., 2013, 2015; Kushida et al., 2017). These perceptions are real to the population and therefore need investigating (Haynes-Maslow et al., 2015). To guide future intervention efforts for increasing F/V consumption among different populations, multiple levels of influence, in a variety of settings, and using a variety of intervention strategies are needed, especially among understudied populations (Robinson, 2008). In this study, I focused on factors from the individual level to explain how they influence F/V consumption among adults in the panhandle of Nebraska.

Nature of the Study

The nature of this study was quantitative with a cross-sectional design that I used to understand how individual food perceptions influence F/V consumption. The independent variables or determinants examined in this study included (a) healthy eating self-efficacy, (b) perceived cooking confidence, (c) perceived family support, (d) perceived access to F/V, (e) perceived quality of F/V, and (f) perceived cost of F/V among adults living in the panhandle of Nebraska. Analysis of these determinants were assessed to examine their impact on the dependent variable, which is F/V consumption. Primary data was collected using a version of the Strong Women Follow-up survey (Lo et al., 2019). Listserves from the Panhandle Public Health District (PPHD) were used to

distribute electronic copies of the survey to panhandle residents. The data was analyzed to determine to what degree each determinant influences F/V consumption among Nebraska panhandle residents.

Definitions

Cooking Confidence: Confidence in one's ability to perform various cooking skills and techniques, which includes the preparation of fruit and vegetables (Lo et al., 2019).

Healthy Eating Self-efficacy: Confidence in oneself to consume a healthy diet, which can be achieved from four types of information: performance accomplishments, experience, verbal persuasion, and physiological states (Bandura, 1977).

Low Access: Low access is defined as living greater than one mile from a supermarket in urban areas, and greater than ten miles from a supermarket in rural areas (USDA, 2018). A census tract with 70% of the population in an urban area and 90% in a rural area is considered to be a low-access community (USDA, 2019).

Low-income community: The criteria to be a considered a low-income community is defined as having census tract where the poverty rate is greater than 20% or the tract's median family income is less than or equal to 80% of the state's median family income, or the tract in a metropolitan area has a median family income that is less than or equal to 80% of the metropolitan areas mean family income (USDA, 2019).

Perceived Access: The belief that a grocery store, supermarket, or other types of food vendor is conveniently available to acquire the food needed for a healthy diet, including fruits and vegetables (CDC, 2011).

Perceived Cost: The amount of money needed to purchase fruits and vegetables, is acceptable to the consumer, relative to other food items, and allows them to buy adequate amounts of the food to support a healthy diet regularly (Chapman et al., 2017).

Perceived Family Support: Encouragement and discouragement from immediate or extended family members to consume more healthy foods and meals, including fruits and vegetables (Lo et al., 2019).

Perceived Quality: Perceived quality is the judgment made by the consumer about the excellence or superiority of a product. This is different from objective quality, which includes physical characteristics but is geared towards more food technology and engineering of the product (Martinez-Carrasco, 2012).

Serving of Fruit: Any fruit or 100% fruit juice that is fresh, frozen, canned, or dried. The fruit can be cooked or raw, whole, cut-up, or mashed. A serving is considered one cup of fruit or 100% fruit juice or ½ cup of dried fruit (USDA, n.d.). Questions regarding fruit and fruit juice consumption on the Strong Women Follow-up Survey include D-1.1, through D-1.4.

Serving of Vegetable: Any vegetable or 100% vegetable juice that is fresh, frozen, canned, or dehydrated. Vegetables can be cooked or raw, whole, cut-up, or mashed. The five subcategories of vegetables include dark-green vegetables, starchy vegetables, red and orange vegetables, beans and peas, and other vegetables. One cup of vegetables would consist of one standard cup of raw or cooked vegetable or vegetable juice. One cup of vegetables is also equal to two cups of raw leafy greens (USDA, n.d.). Questions

regarding vegetable on the Strong Women Follow-up Survey include D-1.5, through D-1.19.

Supermarket: A supermarket is considered a large grocery store or supercenter that contains all major food groups, including fresh meat and poultry, dairy, dry packaged foods, and frozen foods. A supermarket also is required to have a minimum of $2 million in annual sales (USDA, 2019).

Assumptions

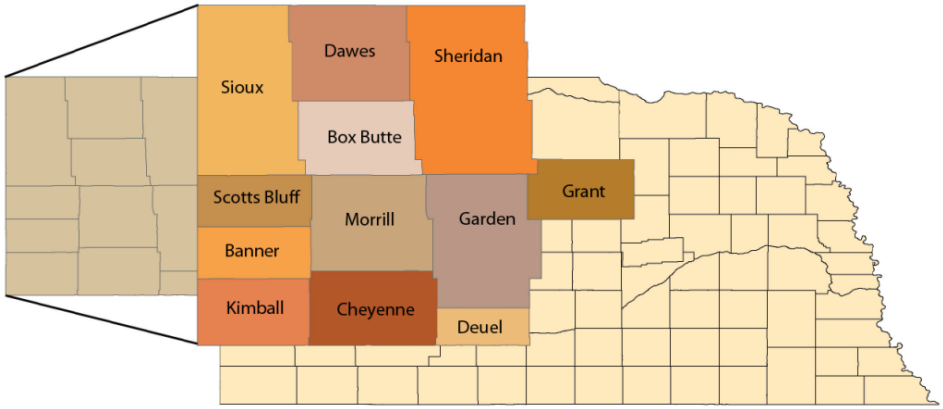
Assumptions were made in this study. First, I assumed that survey participants provided honest answers regarding their age, geographic location, F/V consumption, and their perceived individual, perceived social, and perceived food environments. The second assumption was that the study sample parameters were appropriate and that all participants have experience purchasing, preparing, and consuming F/V's. These assumptions are necessary due to the distinct differences in Nebraska regions and how these regional differences impact F/V consumption.

Scope and Delimitations

Nebraska's panhandle is the region in the northwest corner of Nebraska. This region includes the following counties: Banner, Box Butte, Cheyenne, Dawes, Deuel, Garden, Grant, Kimball, Morrill, Scotts Bluff, Sheridan, and Sioux (Figure 1). The PPHD serves these 12 counties, and the counties all share similar socioeconomic characteristics among its residents and similar geographical characteristics (PPHD, 2017).

Figure 1

Panhandle Public Health District Counties and Geographic Location Within the State

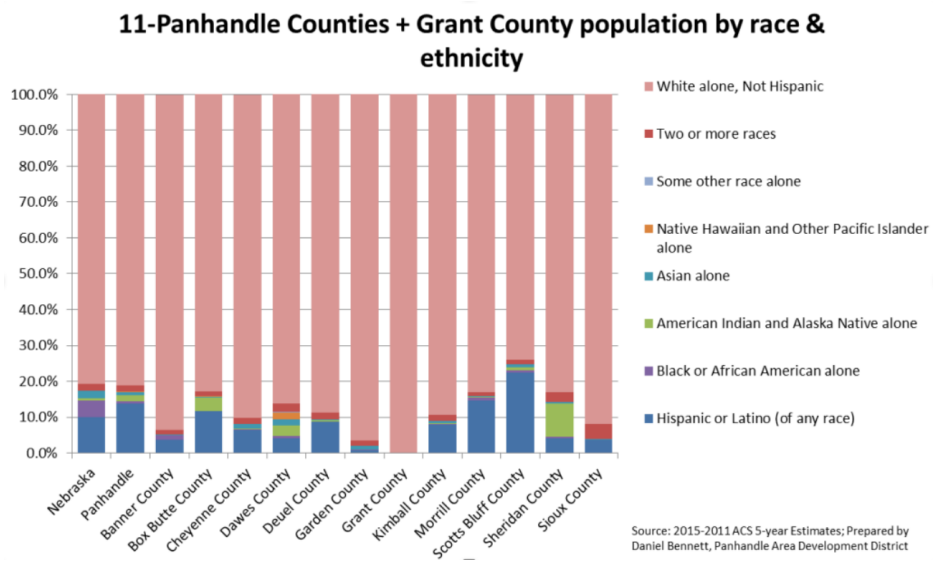


Note: Reprinted from *Community Health Needs Assessment, July 13*, 2020. Retrieved from http://www.pphd.org/Site/Documents/CHIP/2017%20CHNA_v07.14.2017.pdf Reprinted with permission from PPHD.

In this study, participants included all adults ages 18 years and older, who reported physical residence in one of the listed counties. All racial, ethnic, income and education groups were included. The predominant race in this region is non-Hispanic White (PPHD, 2017). However, some communities have higher concentrations of Hispanic and American Indian populations (Figure 2; PPHD, 2017). Data collection was conducted in English due to the high English-speaking proficiency and low foreign-born rates in these counties (PPHD, 2017).

Figure 2

Counties in the Panhandle of Nebraska by Race



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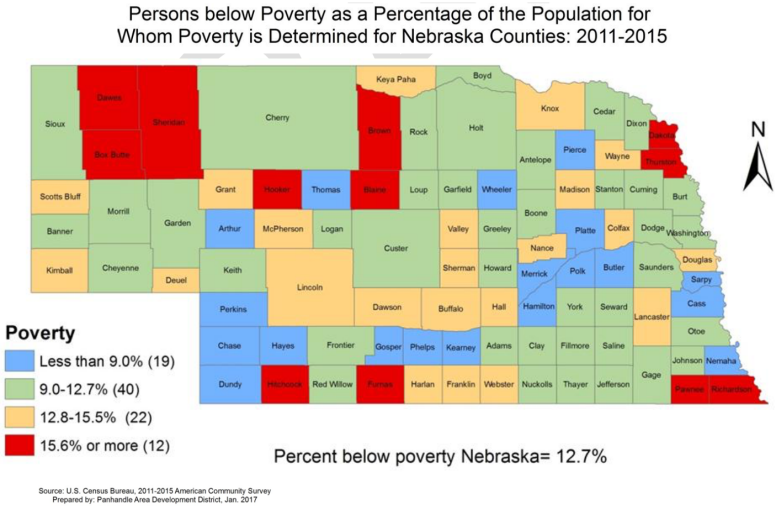
Low education attainment and low family income levels are frequently described as determinants of reduced F/V consumption (Bernales-Korins et al., 2017; Story et al., 2008). Educational attainment among adults living in the panhandle of Nebraska is less than the state and national averages of educational attainment (PPHD, 2017). Additionally, the percent of persons who are below the poverty level is higher than the state average in seven of the panhandle's 12 counties (Figure 3) (PPHD, 2017). Additionally, seven of the 12 counties in the panhandle reported having greater

Figure 3

Percentage of Persons Below Poverty, Nebraska Counties



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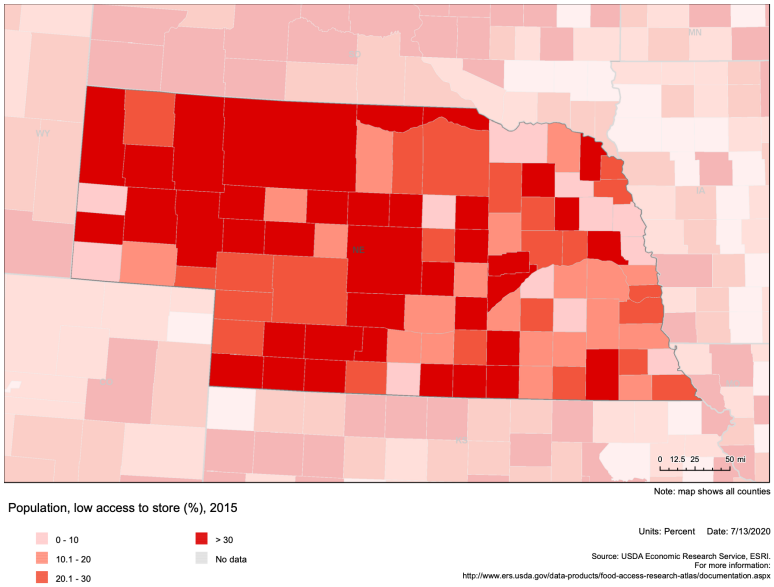
than 30% of the population have low access to a grocery store (USDA, 2019). Additionally, 20.1-30% Duel County and Dawes County residents have low access to a grocery store (Figure 4; USDA, 2019). Low access is defined as living greater than one mile from a supermarket in urban areas, and greater than ten miles from a supermarket in rural areas (USDA, 2019). Even though it has been well documented that there is a lack of grocery stores and supermarkets in the panhandle, Allcott et al. (2018) have determined that many are willing to drive for grocery shopping. Therefore, it may be more beneficial to assess perceived access as a determinant. These features of Nebraska's panhandle merit the need for further study into the determinants of F/V consumption.

Figure 4

Number of Panhandle Counties with Low Access



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Limitations

The potential limitations of this study need to be noted. First is the use of self-reported data. Studies have often demonstrated an overestimation of F/V consumption when using self-reported data (Dean & Sharkey, 2011; Lo et al., 2019; Williams et al., 2010). Secondly, the study's generalizability is limited due to the reduced racial/ethnic diversity among panhandle residents. However, there are other areas of Nebraska or Midwest region of the United States where demographic, geographical, and socioeconomic characteristics are similar and might be applicable.

There is also the potential that some of the study's population have reduced access to the internet therefore limiting survey response. This can result in sampling bias to those residing in villages, towns, and cities that have access to more reliable internet providers at an affordable cost. Overall, Nebraska ranks 48th out of 50 for best-connected states, with only a few large metropolitan cities having access to affordable highspeed broadband for under $60 per month (Broadband Now, 2020). Residents living in more rural and remote locations throughout the panhandle frequently utilize more expensive satellite or cellphone-based internet providers or do not have internet at all (Broadband Now, 2020). This fact has the potential to reduce survey participation among some rural residents.

Significance of the Study

The study is one of the first of its kind to (a) study exclusively the Panhandle of Nebraska, (b) use the SEM, and (c) research determinants of F/V consumption among the panhandle of Nebraska's adult population. Although perceptions do not always accurately reflect objective measures of the higher SEM levels, these perceptions can provide some guidance on future interventions (Powell-Wiley et al., 2014; Vogel et al., 2019; Xue et al., 2020). Intervention efforts are most effective if they target multiple levels of the SEM (Applton et al., 2016; Vogel et al., 2019), and these perceptions of higher-level determinants may provide insight to what residents of the panhandle of Nebraska are experiencing in regards to their personal, social and physical food environments. Results from the study also support the need for more research studies and interventions using the SEM. Public health has been attempting to increase F/V

consumption in the United States for decades to reduce obesity and chronic disease. The study results generated region and population-specific data, that is useful to the Nebraska Food Council and PPHD to produce tailored interventions for increasing F/V consumption. Nebraska's panhandle is a widely rural region that has different geographic characteristics from the rest of the state. These 12 counties face shrinking populations in many of its small towns, except for a few larger cities, which make up the majority of population growth in the panhandle (PPHD, 2017). However, despite the shrinking population in the rural regions, the Panhandle of Nebraska still needs public health support (PPHD, 2017).

Summary and Transition

This study was an investigation of which determinants impact F/V consumption among adults in the panhandle of Nebraska. This is an important public health need due to the low F/V consumption rates among this population, and the high prevalence of obesity and chronic disease (PPHD, 2017). Previous researchers have suggested the need to examine the influence of self-efficacy further, cooking confidence, support, F/V access, F/V cost, and F/V quality on F/V consumption. (Alcott et al., 2018; Baruth et al., 2011; Bateman et al., 2017; Chai et al., 2018; Kern et al., 2017; Kushida et al., 2017). However, the degree of influence varies from region to region, and for different populations. Therefore, there is a need for using the socioecological model to uncover further the determinants of F/V consumption in the panhandle of Nebraska. This supplied data that is useful for the development of tailored interventions and support social change towards increased F/V consumption.

The remaining chapters describe the study in further detail. Chapter 2 reviews current literature on the research topic as well as a description of and applicability of the theoretical framework. In Chapter 3, the details of the research methods will be described. Chapter 4 will include a description and discussion of the research findings to provide an understanding of the influence of the presented determinants on F/V consumption. Finally, Chapter 5 will discuss the findings as related to the literature review, as well as describe the limitations and recommendations for future research. Further, aspects of positive social change because of the study will be addressed.

Chapter 2: Literature Review

The purpose of this study was to understand the determinants of F/V consumption among adults in the Panhandle of Nebraska. I examined the determinants of F/V consumption at the individual level of the SEM. Variables examined at the individual level included healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived quality, and perceived cost of F/V in the panhandle of Nebraska. The literature provided an understanding of the nutritional benefits related to consuming the recommended amount of F/V and its association with reducing obesity (see Bertoia et al., 2015; Le-Kwan et al., 2017). However, few adults in Nebraska consume the recommended one and a half to two cups of fruit and two to three cups of vegetables per day (Lee-Kwan et al., 2017). The literature also supported the need to further examine the barriers to F/V intake to improve future intervention strategies to increase F/V intakes (see Hawkes et al., 2015). In this chapter, I describe the literature search strategy, the theoretical foundation, and the review of the current literature on objective and subjective findings of the impact of self-efficacy, cooking confidence, family support, access, quality, and cost on F/V consumption.

Literature Search Strategy

Four databases (Academic Search Complete, Agricola, CINAHL Plus with Full Text, and PubMed) were searched from January 2020 through May 2020 using the following search terms: *determinants, self-efficacy, fruit and vegetable intake, fruit and vegetable consumption, cooking skills, cooking confidence, food environment, socioecological model, social support, perceived quality,* and *food desert* with the

Boolean operator OR. The CDC, USDA, and the World Health Organization were also used to collect statistics, background information, and figures regarding F/V consumption patterns and trends.

Study Selection

Selection criteria for peer-reviewed journal articles included publication in English, peer-reviewed journal articles with full-text published from 2015 to the present, articles that (a) discussed or described determinants that influenced F/V consumption, (b) discussed F/V intakes related to weight control, and (c) included information about F/V intake interventions. Additional articles that discussed the SEM and its role in health determination were also included in the search. Some studies that were older than 5 years were included if they were relevant to the present study because of the determinant studied, or the SEM was the theoretical bases. Studies considered relevant to this study were identified by eliminating irrelevant and duplicated articles. Other studies were deemed to be irrelevant based on the following criteria:

- The article was specific to children or adolescents.
- The article was an editorial.
- The article was a dissertation.
- The literature was based on a newsletter.
- The literature was not focused on determinants of F/V consumption or intakes.
- The literature was not focused on interventions regarding the improvement of F/V consumption or intake.

Organization of the Studies

During the development of this literature review, organizational efforts were critical for the synthesis of such a large number of journal articles. All articles were listed in a literature review matrix by the following characteristics:

- Author name
- Date
- Theoretical framework
- Problem
- Purpose
- Summary of methodology, analysis, results, and conclusions

Theoretical Foundation

Bronfenbrenner (1994) proposed the bioecology model of human development as the developing person, the environment in which they live, and the interactions between the two. The underlying principle of the theory is that genetic material does not produce finalized traits and behaviors, but instead, it is the intricate involvement and influence of the surrounding environment that determine the developmental outcomes (Bronfenbrenner & Ceci, 1994). It also proposes that human development progresses through time with complex interactions between persons, objects, and symbols in the environment called *proximal processes* (Bronfenbrenner, 1994).

The SEM is an ecological paradigm adapted from Bronfenbrenner's bioecological model. The SEM consists of the geographical and social aspects of the microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Rosa & Trudge, 2013). Each

of the system-levels is encapsulated within the others, demonstrating the impact the various systems can have on each other (Figure 5). This is considered a major strength of the model because of the encouragement and ability to incorporate and conceptualize multiple levels of health behavior determinants in a single intervention effort.

Figure 5

Image of Socioecological Model

Note: Reprinted from *The socioecological model: A framework for prevention*, June 19, 2020. Retrieved from https://www.cdc.gov/violenceprevention/publichealthissue/social-ecologicalmodel.html. In the public domain.

Microsystem

This innermost level is a microsystem, which includes the immediate environment and the proximal process that sustain or produce development (Rosa & Trudge, 2013). The microsystem can consist of the home, family, school, peer groups, or the workplace where the developing person interacts face-to-face with others (Bronfenbrenner, 1994). The pattern of activities, social roles, experiences, and relationships can permit or inhibit various types of behavioral development (Bronfenbrenner, 1994). The interactions are also bidirectional. For example, a classroom environment can influence a child's behavior or development at home, and the home environment can affect a child's behavior and development in the classroom.

In the later development of the model, Bronfenbrenner expanded the microsystem to include the distinctive characteristics of an individual, such as their temperament, personality, and systems of belief (Rosa & Trudge, 2013). These relations have a profound impact on psychological function and are altered by the settings in which the developing person is situated (Rosa & Trudge, 2013). Concerning dietary behaviors, food choices can be altered based on cognition, biological factors, and demographic factors (Story et al., 2008). Examples of these factors' influence include self-motivation, self-efficacy, knowledge, and behavioral capability (Story et al., 2008). However, these microsystem influences likely vary for different persons and populations.

Mesosystem

The linkage and processes occurring across two or more settings of the same developing person are called a mesosystem (Bronfenbrenner, 1994). This system of systems is developed upon entering a new system and removing a system (Rosa & Trudge, 2013). Mesosystem and microsystem developmental characteristics are similar; however, the significant difference is that the activities and interpersonal roles are expressed across settings instead of in a single microsystem. This system is also bidirectional (Rosa & Trudge, 2013). Add summary and synthesis to fully develop the paragraph.

Exosystems

The exosystem, as defined by Bronfenbrenner (1994), comprises the processes and linkages between two or more settings. The developing individual is not directly situated in one or more of these settings and is not an active participant (Bronfenbrenner,

1994; Rosa & Trudge, 2013). However, the exosystem environment and experiences can influence the individual directly or indirectly. An indirect influence could be political legislation passed that affects the developing individual. For example, local zoning laws can regulate the distribution of fast-food restaurants and supermarkets in a community and their proximity to the residential sections of the community. This can either increase or decrease proximal access to these establishments. Other influences could result from a neighborhood-community context, family social networks, or the workplace, which can then be brought home and affect the developing individual (Bronfenbrenner, 1994).

Macrosystem

The macrosystem is different from the first three system levels by including culture or subcultural influences, such as economic, legal, political, and educational systems (Rosa & Trudge, 2013). The macrosystem is heavily influenced by an overarching ideology, which then trickles down to provide a sense of uniformity among developing individuals. For example, each state has a set of educational guidelines for schools to create uniformity of education outcomes required of each school in that state. This can include religious, socioeconomic, ethnic, or societal norms that heavily influence the microsystem (Rosa & Trudge, 2013).

Chronosystems

The critical component of the chronosystem is the inclusion of time as essential to the human development process (Rosa & Trudge, 2013). The time component can be internal such as the internal development process that occurs biologically, such as puberty or menopause, or can be external such as starting school or the separation of a

family (Rosa & Trudge, 2013). If the change is considered normative, then it is expected to occur in a particular time range (Rosa & Trudge, 2013). However, some experiences can be nonnormative such as sudden death in the family (Rosa & Trudge, 2013). Add summary and synthesis to fully develop the paragraph and create a strong conclusion for the section.

Application of Theory to Study

The SEM includes the individual-level, social-level, and environmental-level determinants to produce positive behavior change (Sallis & Owen, 2015; Story et al., 2008). Therefore, the SEM is best for this study. Public health challenges are often complicated, making them difficult to address using only single-level analysis or intervention (Robinson, 2008). SEM application looks to produce a broad picture of behavior determinants setting the stage for future research. Determinants that effect F/V consumption span across the different SEM levels and uncovering these determinants for a specified population is beneficial in providing tailored intervention efforts in the future.

At the intrapersonal personal level, individuals may not know the importance of consuming adequate F/V's daily. Traditional intervention approaches often target individual-level determinants, including educational activities, to increase knowledge about the benefits and recommendations for F/V consumption (Story et al., 2008). However, behavior change to increase consumption will likely have little result if the intervention participants do not have the skills required to prepare F/V’s, family support to encourage consumption, or the physical and financial resources needed to purchase

more F/V's. Thus, more was needed to understand the determinants of F/V at the individual, social, and environmental SEM levels.

Analysis of Previous SEM Application on F/V Consumption

As previously mentioned, many research studies and interventions focus on individual-level factors when trying to improve fruit and vegetable consumption. Outcomes of these studies have shown some improvements in F/V consumption, but the significance is often small, and other intervention efforts may be best using more supportive environments and multifactorial approaches (Applton et al., 2016; Shaikh et al., 2008; Story et al., 2008). The physical and social environments are uniquely diverse for different populations across the United States, and so are the people that live in these environments. At the individual level, identified determinants include gender, race/ethnicity, education, income level, self-efficacy, knowledge, and cooking skills (Story et al., 2008). The social environment determinants include family, peers, friends, and other individuals living in the community that can influence F/V consumption via support, modeling, and establishing a social norm (Story et al., 2008). The physical environment can include the home, school, or work settings, as well as supermarkets and restaurants (Story et al., 2008). The individual, social, and environmental levels all influence interaction directly and indirectly to impact dietary behaviors. Therefore, a large combination of determinants could exist, deeming it essential for further exploration.

Application of the SEM in a systematic review of studies of non-Hispanic Blacks and low-income individuals found knowledge, taste preferences, culture, role

expectations, access, and availability were significant determinants of F/V consumption (Robinson, 2008). However, other studies have shown differences in F/V consumption based on social support, urban versus rural environments, access to quality F/V, race/ethnic background, support from a religious organization, self-efficacy, and cooking confidence (Baruth et al., 2017; Chai et al., 2018; Lo et al., 2019; McSpadden et al., 2016). These studies using the SEM had different results for different populations living in different environments, which adds to the uniqueness of each population and their surrounding social and physical environments.

Literature Review Related to Key Variables

Self-efficacy and Fruit and Vegetable Consumption

Self-efficacy is defined as the belief in oneself to perform or complete a particular task or behavior (Bernales-Korins et al., 2017; Fernandez et al., 2014; Hamilton et al., 2015). This complicated cognitive process can enhance or impede several health behaviors and is included as a critical component of many theoretical models due to its strong association with behavior change (Kelder et al., 2015). Due to the internal nature of self-efficacy, it is sometimes called *perceived self-efficacy* (Kelder et al., 2015). Research has determined that perceived self-efficacy is highly influential of personal, social, and situational factors that can further increase or decrease a person's confidence in themselves to consume a healthier diet by eating more F/V (Kelder et al., 2015; Shaikh et al., 2008; Smith et al., 2019). Higher levels of self-efficacy have also been found to increase a person’s persistence to maintain the consumption of more F/V (Kelder et al.,

2015) These critical findings about healthy eating self-efficacy and their correlation to improved behavior change merit the need for further investigation.

In recent decades, drastic changes in dietary behaviors have reduced the quality of health all around the world (World Health Organization [WHO], 2020). Additionally, lifestyles have changed, such as the increased intake of fast food, and reduced meal preparation in the home, making healthy dietary behaviors increasingly challenging (WHO, 2020). According to Bandura (1997), a primary influence of self-efficacy is previous mastery experiences. Since past experiences strongly influence self-efficacy, increased F/V consumption is likely low for those with past experiences associated with low F/V consumption. Other influences of self-efficacy include secondhand experiences, social persuasion, and emotional influences (Kelder et al., 2015).

In a study conducted by Bernales-Korins et al. (2017), self-efficacy and the stages of change for F/V intake were evaluated after economic barriers to purchasing F/V were reduced. This study included 45 adults in Manhattan, New York, who were divided into the control group, and the intervention group, who received a 50% discount on all F/V purchases at participating grocery stores for 8 weeks (Bernales-Korins et al., 2017). Participants were surveyed at baseline, 4 weeks before the start of the experiment, during the 8-week intervention, and 4 weeks after the intervention concluded. Results from the experiment showed that the intervention significantly increased self-efficacy, and stage of change, leading to a 4.6 times higher amount of dollars spent on the purchase of F/V. Additionally, participants in the intervention group reported consuming 2.5 times as many servings of F/V than participants in the control group (Bernales-Korins et al.,

2017). These findings show the strong correlation between healthy eating and self-efficacy, which are supported by several studies.

Kushida et al. (2017), conducted a cross-sectional study to examine self-efficacy and its association with F/V intake among 395 Japanese workers from eight different workplaces to determine the usefulness of self-efficacy when developing an intervention. Other variables studied included social support and knowledge about F/V consumption. A survey was administered at baseline, and the results showed that the mean self-efficacy score was higher for fruit than for vegetables (7.8 vs. 7.4) and that self-efficacy was higher in female workers than male workers. Additionally, there was a significant positive association between self-efficacy and F/V consumption, with the odds ratio for self-efficacy being higher than the odds ratio for both social support and knowledge on F/V consumption (Kushida et al., 2017).

Similar results were found by Lo et al., (2019) in a cross-sectional study across 22 states to examine the psychological social and environmental factors that influence F/V consumption. The individual analysis revealed that participants demonstrated an increase of an additional one cup of F/V ($p<0.001$) for every one-unit increase in healthy eating self-efficacy. Other determinants such as cooking confidence, perceived stress, healthy eating, social support, and the perceived food environment were examined; however, in the combined analysis, self-efficacy was the only determinant that remained significantly associated with F/V consumption ($p<0.001$). de Menezes et al. (2018), found similar results. For every one-unit increase in self-efficacy, F/V consumption increased by 35.10 grams (de Menezes et al., 2018). Additionally, those with the lowest self-efficacy had the

lowest F/V consumption (Menezes et al., 2018). Therefore, it is deemed a vital determinant to address when examining F/V consumption.

Interestingly, other studies showed a lack of correlation between self-efficacy and F/V consumption. Zhou et al. (2017), investigated the effects of self-efficacy, action planning, and social support to determine the interdependent relationship of the variables as a method of explaining F/V consumption. One hundred and fifty-six college students in Beijing China were surveyed at four different time intervals, and the results showed no direct effect of self-efficacy on F/V consumption, even after controlling for intake and action planning (Zhou et al., 2017). However, self-efficacy at baseline was associated with the development of an action plan to consume more F/V in the future (Zhou et al., 2017). Another study of truck drivers in Australia found self-efficacy to be a mediator between outcome expectancies, such as noticed health improvements and F/V consumption (Hamilton et al., 2015). Therefore, further research was needed to determine the effects of self-efficacy on F/V consumption for the target population proposed in this study.

Cooking Confidence

During the late 20th century, home cooking trends decreased while away from home dining, fast food, and convenience food consumption increased (Tallie, 2018). Consuming fewer home-cooked meals has been associated with a decreased consumption in the overall intake of F/V's and increased consumption of high or ultra-processed foods (Hanson et al., 2019; Martins et al., 2020; Reicks et al., 2018; Seguin et al., 2016; Utter et al., 2018). There are several reasons for the decline in home cooking, including lack of

time, cost, and a lack of cooking skills and knowledge (Tallie, 2018; Wolfson et al., 2016). Recent research and intervention efforts had highlighted the increasing need for cooking skills as a method of improving overall diet quality (Deliens et al., 2018; Reicks et al., 2018; Tallie, 2018; Utter et al., 2018). However, other research studies have shown little difference in F/V consumption if the frequency of home cooking is increased, and more research is needed.

Adams et al. (2015), assessed the prevalence of cooking among adults in the United Kingdom to determine the socio-demographics associated with the amount of time spent cooking. The results showed factors that deter the frequency of cooking included employment and less education. Also, women cooked more than men, and 60% of the women surveyed reported 30 minutes of continuous cooking most days of the week (Adams et al., 2015). In other studies, women were also reported to conduct most of the home cooking (Mills et al., 2017; Tallie, 2018; Wolfson, 2016). However, according to Adams et al., (2015), women living with another adult, and having children in the home was significantly associated with more time cooking. For men, having another adult in the household was associated with less time spent cooking, but this could be associated with the other adult being female and taking more of the cooking responsibilities (Adams et al., 2015). Similar results were found by McMorrow et al., (2016) who reported a lack of cooking skills to be a barrier to eating healthy and consuming the recommended F/V.

Though some studies reported no difference in the diet's healthfulness when cooking more from scratch at home, the bulk of the evidence supports cooking at home as a method of increasing F/V consumption (Milles et al., 2017). A cross-sectional study of

adults (n= 11,396) from Cambridgeshire, United Kingdom, measured diet quality indicators compared to the frequency of home-cooked meals (Mills et al., 2017). Results showed that consuming home-cooked meals three to five times per week or more was associated with higher consumption of F/V as well as other health benefits. Further consuming home-cooked meals five or more times per week lead to an increase in fruit consumption by 62.3 grams per day and an increase in vegetable consumption by 97.8grams per day (Mills et al., 2017). Further, reporting a lack of cooking skills were found to reduce the probability of meeting the recommended F/V by 10.4% for women (McMorrow et al., 2016).

Increased fruit and vegetable consumption was also evidenced by Fertig et al., (2018), who examined the nutritious quality of home-cooked meals compared to pre-prepared meals in 150 families from various racial/ethnic backgrounds. Eight consecutive days of meal preparation and nutritional quality data were collected to reveal that approximately half of all meals were home-cooked (Fertig et al., 2018). Of the home-cooked meals analyzed, the probability of including F/V in these meals was significantly higher than eating at a restaurant or making a pre-prepared meal (Fertig et al., 2018). However, the percentage of home cooking did vary by income and race/ethnic background with non-Hispanic black families consuming fewer home-cooked meals, and Hispanic families consuming the most (Fertig et al., 2018). The highest amount of home cooking was noticed among low-income families to stretch food dollars, but other studies revealed that individuals of higher income levels viewed home cooking as more of a

hobby instead of a necessity (Adams et al., 2015; Dammann & Smith, 2009; Fertig et al., 2018).

With the majority of studies reporting home cooking or cooking from scratch as a method of increasing the likelihood of F/V consumption, more is needed to determine the amount of cooking confidence to promote home cooking among Nebraska residents. Many studies show perceived cooking skills as a perceived barrier to consuming more F/V (Damman & Smith, 2009; Deliens et al., 2018; McMorrow et al., 2016). An intervention study by Brown & Hermann (2005), conducted cooking classes to improve basic knowledge and cooking skills among Oklahoma youth and adults. Pre/test and post/test surveys were administered to reveal that following the intervention; there was a significant increase in the number of servings of F/V consumed. More specifically, youth reported consuming 1.2 more servings of F/V per day, and adults reported consuming 0.6 more servings of F/V per day (Brown & Hermann, 2005). This intervention was also found to significantly increase the variety of F/V consumed (Brown & Hermann, 2005).

Another study to assess the impact of a cooking skills intervention on dietary quality also showed promising results. Of the 102 adults who were surveyed following the end of the program intervention, the median confidence in cooking using basic ingredients scores were significantly higher for all participants than at the beginning of the intervention (Garcia et al., 2013). Additionally, results showed that the frequency of F/V consumption per week increased and remained one year following the end of the intervention (Garcia et al., 2013). These results are similar to another study by Utter et al. (2018), who sought to determine whether perceived cooking skills were associated with

more nutritious dietary behavior later in life. Students from Minnesota, age 18-23 years old, were surveyed and then administered a follow-up survey ten years later regarding their perceived cooking skills. Students who perceived their cooking skills to be adequate between the ages of 18-23 were shown to have more healthful diets later in life (Utter et al., 2018). Further, reporting adequate cooking skills resulted in being 3.5 times more likely to prepare meals with vegetables most days of the week. It also predicted eating three or more servings of vegetables per day (Utter et al., 2018).

These long-term positive effects on increasing cooking confidence make it a valid point for understanding the determinants of F/V consumption. However, the results are mixed. Other studies have found perceived cooking confidence is not significantly associated with increased F/V consumption (Hanson et al., 2019; Lo et al., 2019). As previously mentioned, this determinant is variant depending on sociodemographic variables. Therefore, more research is needed on the perceived cooking confidence of different populations.

Perceived Family Support

Social support and influence are also deemed essential factors that can influence dietary behaviors and increase F/V consumption (Kushida et al., 2017; Smith et al., 2019; Zhou et al., 2017). This support can come from and include friends, family, peers, coworkers, neighbors, religious affiliations and leaders, and other social encounters (Baruth et al., 2011; Bateman et al., 2017; Kushida et al., 2017). Social roles have also been suggested to be incorporated into strategies to promote F/V consumption at the state

and local level food councils (CDC, 2011). However, family support is highly influential because of their proximity and frequent interaction with the individual.

Family support is most commonly cited in parent/child relationships and support. For example, parental modeling and support have been found to significantly increase the amount of F/V consumed by children in the home (Alexander et al., 2018; Deliens et al., 2018; Di Noia & Byrd-Bredbenner, 2013). This was also evidenced by Haidar et al., (2019), who studied the association between perceived peer and perceived parental support on adolescent dietary behaviors. Results from this study showed that adolescents whose parents disapproved of eating unhealthy foods reported significantly higher perceived parental support ($p<0.001$), and there was found to be 1.8 times higher odds of healthier foods being present in the home ($p<0.001$). Additionally, the adolescents had 1.96 times higher odds of consuming two or more servings of F/V per day if their parents disapproved of unhealthy eating ($p=0.001$) (Haidar et al., 2019).

However, the impact of family influence can operate in reverse, where the child preferences can influence the family's dietary behaviors. In a qualitative study of 68 low-income adults from North Carolina, focus groups were conducted to determine the perceived barriers to F/V consumption (Haynes-Maslow et al., 2013). One of the themes mentioned was the change of family norms, in that no longer are children required to eat what they were served or finish their vegetables. Instead, parents change what is served to please the child, offering foods that they know the child will eat (Haynes-Maslow et al., 2013). Stluka et al. (2015), further evidenced this fact., who also found family food preferences profoundly influence F/V purchasing and consumption patterns.

To analyze the determinants of fruit and vegetable consumption among Native American populations in rural South Dakota compared to other racial/ethnic groups in South Dakota, researchers surveyed 230 adults (Cho et al., 2015). Results showed that high amounts of perceived pressure from family members consume more significant amounts of F/V's than non-Native American participants. However, Native American participants reported that they also perceived a considerable resistance from their families to follow through with the behavior. (Cho et al., 2015).

A study by Heredia et al., (2020), sought to reveal individual, social, neighborhood level variables that correlated with increased the successfulness of having higher levels of physical activity and greater intakes of F/V per day simultaneously among African American adults (n=1009) in the Houston area. Results showed that of all the participants sampled, only 18% were classified as having high levels of physical activity and high levels of F/V consumption (Heredia et al., 2020). Further, those who performed high amounts of physical activity and had high F/V consumption perceived themselves to have relatively high social statuses in their community and in the United States as a whole (Heredia et al., 2020). These individuals also reported greater social cohesion, greater participation in social networks or organizations, and having more people around them who also met the high physical activity and high F/V consumption recommendations (Heredia et al., 2020). These results suggest that social support is a significant factor in meeting health recommendations.

In comparison, a study of neighborhood, friend, and family norms and support among individuals of low socioeconomic position found that family norms and support

for F/V consumption varied by race/ethnicity (Dulin et al., 2018). Hispanics and those with lower reported family income reported higher family norms and family support for F/V consumption compared to individuals from other racial/ethnic backgrounds and higher reported family income. Among all race/ethnic participants, having an increased family norm was associated with an increase in fruit consumption by 0.18 cups per day, and a family social support was associated with an increase in consumption by 0.30 cups of vegetables per day (Dulin et al., 2018). These results show strong potential for F/V consumption interventions by addressing family support.

Disappointingly the perceived support to consume more F/V does not always lead to an increase in actual F/V consumption (Cho et al., 2015). Other studies have found the effects of social and family support to be minimal. A survey of 518 adult women across 22 different U.S. states examined the influence of psychological, social, and environmental determinants on F/V intakes (Lo et al., 2019). This study showed that individually perceived social support was not associated with F/V consumption (Lo et al., 2019). The mixed results regarding the impact of social and family support, demonstrated the need for further investigation on its influence on F/V consumption.

Perceived Access to Fruits and Vegetables

To exercise self-efficacy, cooking confidence, and social support for F/V consumption, a supportive food environment is needed (Hawkes et al., 2015). Many studies have deemed access as a critical determinant of dietary behavior and an increased or decreased F/V consumption (Hawkes et al., 2015; Haynes-Maslow et al., 2013; Haynes-Maslow et al., 2015; Story et al., 2008). Fan et al., (2018), sought to determine

food prices in food deserts compared to non-food deserts to find that households living in food deserts did face a smaller variety and lower access to supermarkets. Food cost is a significant determinant of dietary behavior, as observed by Gailey and Bruckner (2019). They also determined that low food access was associated with a risk of obesity for low-income populations. A study of healthy food access to for two locations in New York among Hispanic residents (n=4,019) found that the higher the number of grocery stores and supermarkets within a 400 meter and 800-meter radius did improve the perception of having greater access to F/V produce (Co & Bakken, 2018).

However, research results are mixed on the impact of building a new supermarket in low access communities, and its effect on increasing F/V consumption. A study by Elbel et al., (2015), compared two low-income low access communities in the Bronx, New York, with similar neighborhood demographics and socioeconomic status to understand the impact of a new supermarket. In one community, a new supermarket was constructed, and the other community was used as a control. Residents from both communities were surveyed two months before the opening of the new supermarket, one to three months after the opening of the new supermarket, and then one year following the opening of the new supermarket (Elbel et al., 2015). Using a 24-hour dietary recall, results from the surveys revealed no significant improvements to dietary intake for children's living in the community with the new supermarket even though access had increased (Elbel et al., 2015).

Similar results were found by Mook et al. (2016), who also found that entry of a new supermarket, which increases access to F/V, did not significantly increase

consumption of F/V. To highlight the differences between dietary patterns between the higher and lower socioeconomic populations, Allcott et al. (2018) investigated the relationship between neighborhood access and the effect of building a new supermarket in a low access community. Results from this study found that zip code and access to retail supermarket chains only explained 30% of the nutritional inequality between the different populations (Allcott et al., 2018). Further, the distance from the home to the supermarket only accounted for only 1.5% of the difference in nutritional inequality (Allcott et al., 2018). Bodor et al. (2007), found similar results that access by distance to the store was not significantly correlated to F/V consumption but found instead car ownership to be a more prominent determinant. Car ownership may mitigate the distance to the store as a determinant, as it appears households are willing to travel for their food.

When comparing access to F/V access in urban and rural communities, the results were mixed. In urban communities, access may be limited as a result of a lack of transportation, time, and convenience. However, in rural communities access may be reduced because the distance to the store in a lack public transportation (Dean & Sharkey, 2011; Haynes-Maslow et al., 2015) In rural regions of the United States there are fewer supermarkets, which forces rural residents to travel great distances to shop there. In turn, the larger distance can decrease the access to a larger variety of F/V and makes reliance on small locally owned grocery stores and farmers markets necessary for fresh produce (Valdez et al., 2016). If the rural neighborhood residence is located in an agricultural setting, research suggests that access to fresh produce may be greater via farmers' markets (Valdez et al., 2016). Again the results are mixed. A qualitative study by Haynes-Maslow

et al., (2015), focus group participants from North Carolina found farmers markets to be too expensive, unable to accept Supplemental Nutrition Assistance Program (SNAP) benefits using the electronic benefits transfer (EBT) cards, and open at inconvenient times, which was a barrier for participants with jobs (Evans et al., 2015; Haynes-Maslow et al., 2015). Other studies of small local grocery stores found the produce to be significantly more expensive while offering fewer options and lower quality produce (Fan et al., 2018). Additionally, Vogel et al., (2019), found that shopping in a food environment where unhealthy foods are more abundant and favorably priced can reduce the perceived access to healthier food such as fruits and vegetables.

Review of the literature on perceived access to healthy foods and F/V also produced mixed results on its effects regarding actual F/V consumption. De Menzes et al. (2018), conducted a research study to determine if there was an association between the perceived food environment, self-efficacy, and F/V consumption. Study participants (n=3,414) from Belo Horizonte, Brazil, were interviewed to reveal that those who reported extreme confidence in their perceived food access, consumed significantly more F/V's than those who did not express perceived food access (de Menezes et al., 2018). However, the results were strongest when coupled with high levels of self-efficacy (de Menzes et al., 2018).

However, Flint et al. (2013) examined the perceived availability, affordability, and acceptability of the neighborhood food environment to determine its impact on F/V consumption of adults (n=1263). A cross-section sample of data was taken from the Philadelphia Neighbourhood Food Environment Study, which compared two

neighborhoods matched by race/ethnicity, socioeconomic characteristics, and food environment characteristics (Flint et al., 2013). The study results showed that 55% perceived local access to include good variety, while 45% disagreed (Flint et al., 2013). Interestingly, those who perceived local access to include good variety did not display a significant increase in self-reported F/V consumption (Flint et al., 2013). Therefore, more research is needed to determine the effect of perceived access among the target population presented in this study.

Perceived Cost of Fruits and Vegetables

After reviewing the literature, the cost has been expressed frequently as a barrier to the food environment (Briz et al., 2017; Bernales-Korins et al., 2017; Evans et al., 2015; Haynes-Maslow et al., 2013). Qualitative interviews with adults about their F/V shopping and purchasing behaviors revealed that many different methods are employed to make F/V affordable such as shopping in season, looking for sales, price matching, menu planning, buying in bulk, using coupons, and shopping at supermarkets which were perceived as having lower prices (Askelson et al., 2018; Darko et al., 2013). In some regions of the United States, one study showed that the cost of healthy food was almost twice as high as unhealthy food options (Kern et al., 2017). Due to the high cost per calorie, F/V are often passed over among low-income families to purchase foods that improved satiety and stretch the food budget (Askelson et al., 2018; Evans et al., 2015).

Confidence about one's ability to afford F/V is associated with higher F/V consumption among adults (de Menezes et al., 2018). Not surprisingly, higher-income adults have been found to consume more F/V than adults who are considered low-income

(Chapman et al., 2017; Dulin et al., 2018). A study of low-income adults who did receive SNAP benefits to adults who were income-eligible but did not receive SNAP benefits revealed that purchasing F/V often varies from week to week because of when SNAP benefits or paychecks were received (Darko et al., 2013). Meaning when the money runs out at the end of the month, F/V are among the first food groups to be reduced to stretch the food budget.

Bernales-Korins et al. (2017) conducted an experimental study to examine self-efficacy and the stages of change for F/V consumption when the perceived high-cost barrier was removed. Twenty-four-hour dietary recalls were used to examine F/V consumption for the control group and the experimental group who received a 50% discount on F/V purchases (Bernales-Korins et al., 2017). Results found that during the discount period, gross weekly purchases of F/V for the experimental group was two times higher than the control group (p=0.0005) (Bernales-Korins et al., 2017). However, after the discount period expired, F/V purchasing reduced back to a volume similar to purchases at baseline (Bernales-Korins et al., 2017). Similarly, F/V intakes also increased 2.5 times higher for the experimental group during the intervention discount period compared to the control group. Additionally, F/V intake remained higher for the experimental group after the intervention discount period compared to baseline (Bernales-Korins et al., 2017).

Another intervention study was conducted among low-income residents in Washington, where $10 F/V vouchers were distributed via prescription by health care providers (Marcinkevage et al., 2019). Surveys were used to collect process and outcome

evaluations, which revealed that only 54.4% of the prescription vouchers were used (Marcinkevage et al., 2019). However, among those who did redeem the voucher, 86.8% did find an increased ability to afford F/V, 88.2% reported increased consumption of F/V, and 70.1% reporting new F/V (Marcinkevage et al., 2019). Similarly, even a 10% price reduction of F/V cost has been shown to potentially increase F/V consumption in men by 21.2 grams per day and 63.6 grams per day if the price is reduced by 30% (Pearson-Stuttard et al., 2017).

However the study of the consumption of F/V's in relation to perceived cost are mixed. Though it is often listed as a prominent barrier, reducing perceive cost is not always associated with increased F/V purchasing and consumption (Deliens et al., 2018; Flint et al., 2013, McMorrow et al., 2016; Pinho et al., 2018). Lo et al., (2019), surveyed older adult women across 22 states in rural locations also found perceived cost not to be significantly associated with F/V consumption. Chapman et al., (2017) studied cost as a perceived barrier to F/V consumption and found it to be a significant barrier to fruit consumption but not vegetable consumption.

Further McMorrow et al., (2016) conducted a cross-sectional study using secondary data from the Scottish Health Survey to understand the relationship of perceived barriers on healthy eating (PBHE) which included F/V consumption. This nationwide study collected the top three perceived PBHE, in addition to knowledge, attitudes, and motivation to consume F/V among adults (n=8404) (McMorrow et al., 2016). Results showed that few study participants achieved the recommended 400g/day of F/V, and that the top three perceived barriers included a lack of will power, cost, and

hedonics or not liking F/V (McMorrow et al., 2016). However the regression analysis showed that perceiving cost as a barrier was insignificant even though it was the second most cited barrier (McMorrow et al., 2016). These results show that perceived barriers are not always strong predictors of actual F/V consumption.

Another study de Menstral et al., (2020), sought to determine the association between perceived barriers and healthy eating among Swiss adults. Cross-sectional data were used from the 2012 Swiss Health Survey (n=15,450), and participants' 24-hr dietary recalls to report the amount of daily F/V consumption, and identified the barriers that they felt prevented them from having a healthy diet (de Menstral et al., 2020). Results showed that less than 40% of the study participants consumed the recommended F/V amount per day, but interestingly, reporting price as a barrier to consuming the recommended amount of F/V was positively associated with increased adherence to dietary guidelines which include consuming 400g of F/V per day (de Menstral et al., 2020). Therefore research is needed to understand the impact of F/V cost among populations in other regions of the United States.

Perceived Quality of Fruits and Vegetables

The perceived quality of F/V is defined as the judgments made by consumers about the excellence or superiority of a product. (Martinez-Carrasco et al., 2012). However, objective quality and perceived quality are comparable. A study by Alber et al. (2018), conducted a cross-sectional study to determine the relationship between perceived and observed availability, quality, and price of food in four Philadelphia neighborhoods. Results from this study demonstrated a positive relationship between the

perceived quality of F/V and the observed availability of F/V (r=0.34, p<0.001) (Alber et al., 2018). Further, the perceived availability and perceived quality of F/V's in the studied neighborhoods and the home was associated with a significant increase in daily F/V consumption (Alber et al., 2018).

This judgment of perceived quality is conducted by using search attributes identified by inspecting the product before purchase, experience tasting the product, and credence attributes, including nutritional value and wholesomeness (Martinez-Carrasco et al., 2012). Martinez-Carrasco et al., (2012), surveyed 400 tomato buyers from Alicante in 2008, and determined that flavor was the greatest attribute when determining tomato quality, followed by external damage, firmness, color, price and finally aroma. The brand was also an attribute of quality but considered less often and deemed not as important (Martinez-Carrasco et al., 2012). These study results highlight the significant variation in perceived quality.

Perceived higher quality F/V has been associated with a higher cost (Dean & Sharkey, 2011). However, other studies have determined price to be less of a determinant of perceived quality, except when other quality indicators are unavailable such as aroma or taste (Martinez-Carrasco et al., 2012). Higher quality produce is also perceived to be found at large supermarkets that can carry greater quality due to increased produce turnover (Cassady et al., 2007; Haynes-Maslow et al., 2013). The perceived higher quality F/V at supermarkets may limit access for some populations who do not live near a supermarket and may deter them from wanting to purchase or consume more F/V (Dean & Sharkey, 2011). Additionally, a lack of quality produce has been reported to reduce

consumption of F/V and be significantly correlated with BMI (Alber et al., 2018; Evans et al., 2015; Haynes-Maslow et al., 2015). The lack of quality produce has sparked the encouragement of increasing the number of farmers markets to increase quality. However, this may not produce significant results if farmers' markets are deemed inaccessible or too expensive to most of the population (Haynes-Maslow et al., 2015; Valdez et al., 2016;). Therefore, more research is needed to understand the perceived quality of F/V in the panhandle of Nebraska to determine its impact on the study participants regarding F/V consumption.

Perceived Versus Objective Measure

Perceptions of the individual, social, and environmental determinants cannot be used as direct correlations of determinants at higher levels of the SEM. Direct correlation of higher level determinants would require additional objective measures of social and environmental determinants. This has been evidenced by other studies that have compared objective and subjective measures of diet or barriers to healthy eating (Gustafson et al., 2011; Harray et al., 2017; Powell-Wiley et al., 2014; Vogel et al., 2019). A research study by Vogel et al., (2019) sought to test the relative importance environmental and psychological factors and how they were associated with diet behavior of women living in the United Kingdom with children (n=753). The studied psychological factors affecting diet behavior included perceived control, perceived affordability, and perceived food accessibility, and the studied environmental factors included spatial access to food stores, the in-store environments, and the nutrition of the children’s centers that participants frequently visited (Vogel et al., 2019). All of the

psychological and environmental variables showed significant associations with their corresponding construct ($p<0.001$) and 37% of the difference in diet was attributed to the psychological and environmental constructs (Vogel et al., 2019). Women who shopped in healthier in stores with food environments recorded having greater psychological perceptions of their food environment which therefore resulted in healthier eating ($p<0.001$). For those who perceived greater challenges with food affordability had a poorer diet ($p<0.001$) (Vogel et al., 2019). Further, Vogel et al., (2019) found that the association between dietary behavior and psychological perception had the largest effect size, compared to other objective measures of the food environment.

In contrast, other studies have shown that subjective measures of diet quality do not always align with objective measures of diet quality (Harray et al., 2017; Xue et al., 2020). In a study to compare subjective and objective measures of the diet quality among cancer survivors (n=25,475) in the United States, researchers reviewed secondary data from the 2005-2014 NHANES study (Xue, et al., 2020). On average participants scored a 53 out of 100 on the Healthy Eating Index (HEI), and few consumed the recommended number of servings of F/V per day (Xue, et al., 2020). A total of 79.35% of the study participants perceived their eating healthiness to be excellent, very good, or good, however, analysis showed a low agreement between perceived eating healthiness and actual eating healthiness as indicated by their HEI scores (Xue, et al., 2020). This agreement between perceived and objective eating healthiness was generally low across all racial backgrounds (Xue et al., 2020). However, evidence has shown that even though those who perceive their diet to be healthy may not be accurate in their perception

compared to the objective measure, they do tend to have healthier diets than those who rate their diet as poor (Sharif et al., 2016; Xue et al., 2020).

Similar results were found by Gustafson et al., (2011), who sought to present the objective and subjective similarities and differences of participants store and neighborhood environments and determine the relationship between subjective and objective measures of the food environment on F/V intakes and weight status. Results showed that living in a community with a supermarket and a convenience store increased the odds of perceiving the neighborhood as having a high availability food that were deemed healthy (OR=6.87). In controversy, decreasing numbers of healthy food choices in a store resulted in increased perception of store having high availability of healthy foods (Gustafson et al., 2011). Further, participants residing in a census tract that had a supercenter and a convenience store actually consumer fewer F/V per day (Gustafson et al., 2011). The contrasting results of these studies suggest the need for greater future studies comparing the objective and subjective measures of individual and environmental level factors of the SEM on F/V intake.

Summary and Conclusions

In conclusion, many different determinants can increase or decrease an individual's F/V consumption. After exploration of the literature, self-efficacy, cooking confidence, family and social support, and perceived access, cost, and quality all have been shown to have a significant impact on the purchasing and consumption of F/V. One of the most prominent determinants found to be effective at increasing F/V consumption was self-efficacy. However, it was still variant depending on influences from the social

and physical food environment. Within the food environment, perceived cost, perceived access, and perceived quality were all found to be interdependent on one another but in varying degrees. The variation in previous research results for each of these determinants is likely the result of different sociodemographic characteristics, location, and study participants. Therefore, more research was needed to understand the impact of self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality on F/V intake among residents of the Panhandle of Nebraska.

Chapter 3: Research Method

The purpose of this study was to examine the determinants of F/V consumption at the individual level of the SEM for adults residing in the panhandle of Nebraska. In Chapter 2, a review of the literature revealed that determinants researched in previous studies have been shown to impact F/V consumption differently for different populations. Therefore, more research was needed to understand the impact of these determinants for adults in the panhandle of Nebraska to provide information for more tailored intervention efforts in the future. To answer the research questions, this chapter will describe the research design and rationale, methodology, data analysis plan, and threats to validity.

Research Design and Rationale

A quantitative cross-sectional research design was used to collect data from adults living in the panhandle of Nebraska about healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived quality, and perceived cost of F/V consumption. A quantitative design was the best method for this research problem because it examined the association between the perceived determinant variables and the dependent variable (see Babbie, 2017). As indicated by Babbie (2017), the quantification of the data into a numerical format. Therefore, the data collected for my study was transformed into numerical format to allow the following research questions to be answered using statistical analysis. The following research questions were answered.

RQ1: To what degree is healthy eating self-efficacy correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 1_1$: Healthy eating self-efficacy is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 1_1$: Healthy eating self-efficacy is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 1_2$: Healthy eating self-efficacy is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 1_2$: Healthy eating self-efficacy is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ2: To what degree is cooking confidence correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 2_1$: Cooking confidence is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 2_1$: Cooking confidence is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 2_2$: Cooking confidence is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 2_2$: Cooking confidence is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ3: To what degree is perceived family support correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 3_1$: Perceived family support is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_a3_1: Perceived family support is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_03_2: Perceived family support is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

H_a3_2: Perceived family support is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ4: To what degree is perceived access to fruits and vegetables correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_04_1: Perceived access to fruits and vegetables is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_a4_1: Perceived access to fruits and vegetables is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_04_2: Perceived access to fruits and vegetables is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

H_a4_2: Perceived access to fruits and vegetables is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ5: To what degree is perceived cost correlated with fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_05_1: The perceived cost of fruits and vegetables is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

H_a5_1: The perceived cost of fruits and vegetables is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 5_2$: The perceived cost of fruits and vegetables is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 5_2$: The perceived cost of fruits and vegetables is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ6: To what degree is perceived quality of fruits and vegetables correlated with and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 6_1$: Perceived quality is not significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_a 6_1$: Perceived quality is significantly correlated with fruit consumption among adults in the panhandle of Nebraska.

$H_0 6_2$: Perceived quality is not significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

$H_a 6_2$: Perceived quality is significantly correlated with vegetable consumption among adults in the panhandle of Nebraska.

RQ7: To what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 7_1$: Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are not predictors of fruit consumption among adults in the panhandle of Nebraska.

H_a7_1: Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are predictors of fruit consumption among adults in the panhandle of Nebraska.

H_07_2: Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are not predictors of vegetable consumption among adults in the panhandle of Nebraska.

H_a7_2: Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are predictors of vegetable consumption among adults in the panhandle of Nebraska.

I used a version of the Strong Women Follow Up Study survey developed by Seguin et al. (2008) and modified by Lo et al. (2019). The survey was initially designed and tested to assess the physical activity and healthy eating of the community based participatory research health program (Seguin et al., 2008). Lo et al. made further modifications of the survey to include questions about healthy eating self-efficacy, cooking confidence, perceived stress, healthy eating social support, the perceived food environment, and self-reported F/V consumption. Lo et al. calculated Cronbach's α., and each of the independent variable constructs was considered acceptable with a value of $\geq$0.70. This value is deemed to be adequate for internal reliability (Salazar et al., 2015).

The survey instrument contains 47 questions, and measures the following independent variables: (a) healthy eating self-efficacy, (b) cooking confidence, (c) perceived family support, (d) perceived access, (e) perceived cost, and (f) perceived quality of F/V. The survey also collects self-reported data on the dependent variable,

which is the amount measured in cups of F/V consumed per day. Fruit would include any type of fruit that is fresh, canned, or frozen, excluding fruit juice, that was consumed at any mealtime or as a snack. Vegetables would include any of the five subgroups as determined by the USDA *Choose MyPlate* (n.d.) dark-green vegetables, starchy vegetables, red and orange vegetables, beans and peas, and other vegetables in the form of fresh, frozen, canned, or dried/dehydrated. Further sociodemographic variables that were collected include age, gender, race/ethnicity, marital status, household income, level of educational attainment, and employment status.

Methodology

Population

The population included for this study included all adults age 18-65 with a permanent residence in the panhandle of Nebraska. This includes the following counties: Banner, Box Butte, Cheyenne, Dawes, Deuel, Garden, Grant, Kimball, Morrill, Scotts Bluff, Sheridan, and Sioux. According to the 2019 United States Census, the total population of these 12 counties was approximately 83,500 people (United States Census Bureau, 2019). Further there were approximately 64,000 adults, who were 18 years of age or older (United States Census Bureau, 2019).

Sampling and Sampling Procedures

A representative sample of adults ages 18 years and older were surveyed by sending an electronic copy of the survey in the form of a link, to all members of a listserv provided by the PPHD. This listserv includes the owners and employees of 797 businesses throughout the panhandle of Nebraska and an additional 76 businesses who

subscribe to the PPHD Worksite Wellness Program (Appendix D). The survey was also distributed using the PPHD online Facebook platform, which is used to alert the panhandle region about health, news, and upcoming events in the region. I sent the survey request to the gatekeepers of the listserv and online platform, which included the survey link and invitation for participation in the study. Currently, PPHD's Facebook platform has 3,297 followers (J. Davies, personal communication, August 4, 2020).

Convenience sampling was most beneficial to this study because population access is determined by preexisting groups such as a classroom, support group, or employees of a workplace (see Gertsman, 2015, p. 163). This sampling method introduces sampling bias due to the increased likelihood that the sample does not accurately reflect the actual population (Gertsman, 2015). The listserv used for survey distribution targets working adults. Further, many of these adults are working for or are employed by companies or businesses who subscribe to the PPHD worksite wellness program (J. Davies, personal communication, August 4, 2020). These working adults may be already inclined to live healthier lifestyles due to the incentives and promotional activities distributed through the worksite wellness program (J. Davies, personal communication, August 4, 2020). However, due to the COVID-19 pandemic, the listservs now reach more companies that do not subscribe to the Panhandle Worksite Wellness Program, which provided an accurate reflection of the target population (J. Davies, personal communication, August 4, 2020).

To reduce this sampling bias, the distribution of the survey via the PPHD Facebook platform further helped to distribute the survey to adults who are self-

employed, unemployed, or working at a business that is not included in the listserv. Facebook is still the most used social media platform among adults (Perrin, & Anderson, 2019). Approximately 69% of all adults in the United States report the use of Facebook, and 74% of those reported visiting Facebook daily (Perrin & Anderson, 2019). Further, PPHD has had an increase in followers of their Facebook page due to the recent pandemic (J. Davies, personal communication, August 4, 2020).

The inclusion criteria for this study were adults age 18 years and older, males and females, and having a permanent residence in one of the 12 counties previously mentioned. The exclusion criteria for this study were children and adolescents. G*Power 3.1 software was used to determine the minimum sample size needed. I used the statistical test for linear regression: Fixed model, R^2 deviation from zero, and a prior compute required sample size given $\propto$, power, and effect size. The power level was set at 0.95 (95%), significance was 0.05, the number of predictor variables was six, and the effect size was 0.15. The minimum sample size calculated was 98. However, a greater sample size is desired to account for data cleaning and filtering. A usable response rate of 80% is the goal, therefore the number need to complete the survey is 125 participants.

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

The institutional review board (IRB) approval number for this study is 12-28-20-0603382 and it expires on December 27, 2021. The flyers used in this study were submitted to the Walden University IRB for acceptance before electronic distribution. These flyers included the study purpose, participant requirements, my contact information and directed the potential participants to the electronic survey. Electronic

distribution of the version of the Strong Women Follow-up survey was used to collect data from the target population. PPHD agreed to allow usage of their listserv and online Facebook platform (Appendix D). The gatekeeper of the PPHD listserv distributed the survey flyer, which included the survey link. SurveyMonkey was online survey platform used to collect all the informed consent documents and data responses. Nonidentifiable data was collected, which reduced the ethical risk associated with primary data collection. Informed consent was obtained before the beginning of the survey initiation. Once the informed consent was agreed to, the remainder of the survey continued. Should the participant decide to exit the study, they had the choice to exit the survey at any time. There were no follow up procedures after the survey. Participants were referred to the upcoming PPHD annual report for study results.

Instrumentation and Operationalization of Constructs

This study used a version of the Strong Women Follow-Up Survey. The survyer was initially used in 2006 to collect data about the Strong Women Program to provide evidence-informed data about the effectiveness of the community-based exercise program to increase access to and knowledge about regular strength training exercises to middle-aged and older women (Seguin et al., 2008). The survey was amended to collect additional data regarding dietary factors such as healthy eating self-efficacy, cooking confidence, perceived stress, healthy eating social support, and the perceived food environment (Lo et al., 2019). A sample of the survey instrument can be found in Appendix A. The survey construct regarding perceived stress was not requested. Survey items regarding cooking confidence were added from a previously validated 10-item

survey instrument developed by Condrasky et al., (2011) with a Cronbach's $\alpha = 0.91$ (Lo et al., 2019). Survey items regarding healthy eating self-efficacy were added from a previously validated 16-item survey by Sallis et al., (2018) with Cronbach's $\alpha=0.90$ (Lo et al., 2019). Survey items regarding healthy eating social support were added from a previously validated Social Support and Eating Habits Survey used by Sallis et al., (1987) with Cronbach's α ranging between 0.70 to 0,85 for the four subscales (Lo et al., 2019). Finally, survey items regarding the perceived food environment were added from a previously validated survey by Echeverria et al. (2004) with Cronbach's $\alpha=0.92$ (Lo et al., 2019).

Permission to use the survey sections D-1, D-2, D-3, D-4, and E-2 as amended and used by Lo et al., (2019), was granted (Appendix B). Constructs of the survey requested from Lo et al. (2019) included sociodemographic variables and other factors, nutrition and eating, healthy eating self-efficacy, cooking confidence, perceived social support, and the perceived food environment. This survey is appropriate for use in this study because the survey questions will provide an overview of the personal beliefs about healthy eating self-efficacy, cooking confidence, perceived family support, and the perceived food environment for this region of Nebraska. Survey construct has also been used in their previous validation studies for both men and women, in a variety of settings, for various racial and ethnic populations (Condrasky et al., 2011; Echeverria et al., 2004; Sallis et al., 1987, 1988).

Threats to measurement validity include self-reported data. This has the potential to affect data collected because self-reported data can be impacted by survey wording,

and the different types of response options available (Crosby et al., 2015). Additionally, there was a risk of social desirability bias. Social desirability bias occurs when the responses to the survey questions are altered to cast a more positive perspective on the research problem, leading to inaccurate recall bias (Crosby et al., 2015). The study participants potentially could recall the amount of F/V they consumed using their own personally created reality.

To overcome inaccurate recall bias, the proposed study used a validated survey that asks questions regarding F/V consumption, healthy eating self-efficacy, cooking confidence, perceived family support, and the perceived food environment in an appropriate manner that increases the likelihood of accurate responses. The number of days in the past 30 days to report consumption of a product or food item can be difficult to recall for some people (Crosby et al., 2015; p.195). Therefore, a calendar month is more appropriate and a more common method of organizing a survey question (Crosby et al., 2015; p. 195). The survey chosen for this study provided a range of time options, including consumption per month, consumption per week, and consumption per day to give a more accurate reflection of the amount of F/V consumed (Appendix A). Study participants were also reminded of the confidentiality measures that were conducted to protect their survey responses, and therefore encourage more realistic answers to the survey questions. This confidentiality helped to reduce social desirability bias (Crosby et al., 2015).

Data Analysis Plan

For data analysis, the IBM Statistical Package for the Social Sciences (SPSS) Statistics, version 25, was used. Least squares regression was used for statistical analysis to determine which independent variable significantly influences fruit and vegetable consumption while holding constant the other explanatory or independent variables constant (Gertsman, 2015). To answer research question RQ1: To what degree is healthy eating self-efficacy a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that self-efficacy has on fruit consumption, and to what degree the influence that self-efficacy has on vegetable consumption. To answer the question, RQ2: To what degree is cooking confidence a determinant of F/V consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that cooking confidence has on fruit consumption, and to what degree the influence that confidence has on vegetable consumption. To answer the question RQ3: To what degree is perceived family support a determinant of F/V consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that family support has on fruit consumption and the degree of influence that family support has on vegetable consumption. To answer the question, RQ4: To what degree is perceived access to F/V a determinant of F/V consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that perceived access to F/V has on fruit consumption, and the degree of influence that perceived access to F/V has on

vegetable consumption. To answer the question, RQ5: To what degree is perceived cost a determinant of F/V consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that the perceived cost of F/V has on the consumption of fruit and the degree of influence that the perceived cost of F/V has on the consumption of vegetables. To answer the question RQ6: To what degree is perceived quality, a determinant of F/V consumption among adults in the panhandle of Nebraska? A least squares regression analysis was used to determine the degree of influence that perceived quality of F/V has on the consumption of fruit, and the degree of influence that perceived quality of F/V has on the consumption of vegetables. To answer the question RQ7: To what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska? A multiple linear regression analysis was used to determine the degree of influence that healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality are predictors of fruit and vegetable consumption. Perceived cost, perceived quality, and perceived access variables were first recoded using simple coding and then analyzed using a multiple regression analysis with the other independent variables that were at the scale level.

The online survey platform used for data collection was SurveyMonkey. The approximate time to take the survey was estimated to be 20 minutes. The data was collected and stored. The informed consent document and Strong Women Follow-up Survey was presented in usable documents for data collection and then stored on the

SurveyMonkey platform, before being exported to SPSS statistical software version 27 for analysis. Further, the data was cleaned and filtered, removing any participants' data that was incomplete. I reviewed all of the responses collected to ensure that all the questions were answered correctly. Additionally, any participant listing a zip code outside of the panhandle of Nebraska was removed from the dataset. Use of the All-Day Screening Scorer from the National Cancer Institute was used to convert survey results from participants into cups of F/V consumption per day (See appendix E). Graphical displays such as charts, graphs, and tables were used to display statistically significant results at $p \leq 0.05$.

Threats to Validity

External Validity

A threat to external validity for the proposed study include volunteer bias. Volunteer bias occurs because persons who are likely to volunteer for a research study do not always possess the same characteristics as the persons who do not volunteer (Crosby et al., 2015; University of Missouri, n.d.). This phenomenon threatens the validity of the study results because the sample of volunteers will likely not have the same characteristics as the population, thereby reducing the generalizability of the study results (Salazar et al., 2015). For example, some research has presented that women show a greater interest in health (Kushida et al., 2017). Further persons who participate in this study could potentially already have an increased interest in health if they are following the PPHD Facebook page or have employment that subscribes to the PPHD worksite wellness program. However, the listserv does include both large and small businesses that

do and do not participate in the Panhandle Worksite Wellness Program. It is possible that the sample participants used for this study do not accurately reflect the population therefore, future research that utilizes a different sampling method may be needed. Volunteer bias may be reduced by ensuring the confidentiality of the data collected (Crosby et al., 2015). Statements about the usage and security measures being used during and after data collection were included in the informed consent document to reassure participants about the confidentiality of the information they submit.

Internal Validity

The proposed study is observational in design using cross-sectional data. This type of study design is used to measure the differences between people or phenomena instead of measuring change (Salazar et al., 2015). Cross-sectional designs are also used to record the prevalence of health issues, and has the ability to assess the relationship between variables of the study population (Salazar et al., 2015). However, a weakness of this design does not allow the researcher to suggest causal relationship between variables (Salazar et al., 2015; Sproull, 2002). Further a cross-sectional design does not control for cohort effects, which could open up the potential for other cohort factors influence results (Salazar et al., 2015).

However use of this study design is appropriate because the intent is to calculate the correlation between the perceived barriers and the health behavior which is F/V consumption. A major strength of the cross-sectional design is to assess the relationship between variables for a chosen population (Salazar et al., 2015; Sproull, 2002). The study design also allowed for participants to take part in the study in their natural environment

(Sproull, 2002). It is best to include a large random sample of participants to improve the generalizability of the study results (Salazar et al., 2015). This type of observational research is also considered a preliminary study method to guide future research of experimental design in order to make causal inference (Salazar et al., 2015).

Construct Validity

Construct validity is the degree to which a hypothetical construct can be measured as expected based on the theoretical framework used (Sproull, 2002). Construct validity is best achieved for concepts if measured with multiple questions or items (Crosby et al., 2015; p. 182). The survey questions are distinct effect indicators of the construct that are able to relate the construct to the outcome variable (Crosby et al., 2015; p. 182). The survey used in the proposed study included multiple effect indicators for each of the independent variables, which improved the validity measurement of the construct.

The inability to directly associated the perceived social support, perceived access, perceived cost, and perceived quality, with higher levels of the SEM is considered a weakness of this construct. Results from this research study allowed for me to make only strong conclusions the individual level of the SEM. However, since the subjective measures of the proposed study are related to the objective social and physical environments of these participants, the data collected and analyzed in this study was only be used to draw conclusions based on extensions of the SEM theory, with the understanding that future research is needed.

Ethical Procedures

All ethical precautions were taken to protect the research participants in this study. All of the data collected from the participants were kept on file on a separate thumb drive in a secure document that is password protected. I was the only person who had access to the data. Further IRB approval was granted from Walden University to protect human subjects, and be sure that the study outline complies with the university's ethical standards as well as U.S. federal standards. The proposed sample is not considered among the vulnerable population categories.

Participants who choose to volunteer, and participate in the study were provided a link from the Panhandle Public Health District listserv and Facebook platform gatekeeper. Participants were also provided an electronic informed consent document to read and sign before the initiation of the survey. The participants were informed that there are no associated risks for participating in the study and that they can stop and exit the survey at any point in time. Only non-identifying data was collected and used for data analysis.

Summary

The purpose of this study was to examine the different determinants of the SEM on F/V consumption for adults age 18 years and older residing in the panhandle of Nebraska. In this chapter, I have outlined the rationale for using a quantitative cross-sectional study design due to the reduced time and financial constraints associated with this design (Babbie, 2017). I also discussed the study population and sampling technique that was used and reviewed the ethical consideration needed to be compliant with IRB

and federal regulations for protecting research participants. G power and sample size were calculated for the target population. Further, I have described the survey instrument and provided documentation regarding consent to use it and its validity.

To collect the data for the proposed study, SurveyMonkey was used as the online platform to distribute and to gather data using the Strong Women Follow-up survey. The link to the survey was distributed via the Panhandle Public Health Department listserv and Facebook platform. After data collection, SPSS software version 27 was used to store, code, and analyze the data. Then the relationship between healthy eating self-efficacy, cooking confidence, family support, perceived quality, perceived access, and perceived cost was analyzed to determine its correlation to the dependent variables fruit consumption and vegetable consumption. I provide a comprehensive review of the data results in Chapter 4.

Chapter 4: Results

As outlined in the literature in Chapter 2, there are many determinants at all levels of the SEM that can influence F/V consumption (see Briz et al., 2017; Colapinto et al., 2018; Lee-Kwan et al., 2017). However, determinants can vary by location, and for different populations (Allcott et al., 2018; Briz et al., 2017; Colon-Ramos et al., 2015; de Menezes et al., 2018). To my knowledge no studies regarding the determinants of dietary behavior have been conducted in the panhandle of Nebraska. Therefore, the purpose of this study was to examine the determinants of F/V consumption at the individual level of the SEM for adults residing in the panhandle of Nebraska. Quantitative data were collected about the following determinants: healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality. The design of this study provided insight on the degree that each determinant influences F/V consumption among adults in the panhandle of Nebraska. The design of this study may also provide insight for future study regarding the influence of higher levels of the SEM on F/V consumption in the panhandle of Nebraska.

Data were collected for this study using the Strong Women Follow-up survey, which consisted of 47 questions (See Appendix A). The following research questions guided this study:

RQ1: To what degree is healthy eating self-efficacy a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ2: To what degree is cooking confidence a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ3: To what degree is perceived family support a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ4: To what degree is perceived access to fruits and vegetables a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ5: To what degree is perceived cost a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ6: To what degree is perceived quality of fruits and vegetables a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

RQ7: To what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska?

The findings discussed in this chapter will provide in understanding of the influence the determinants of F/V consumption for adults living in the panhandle of Nebraska. Chapter 4 covers the following: data collection, and study results. This chapter also summarizes the answers to the research questions, and the interpretation of the research findings.

Data Collection

A total of 144 participants completed the survey which was administer via the PPHD Facebook page and listserv. Data collection took place from December 30, 2020,

until January 21, 2021. Of the 144 surveys collected, four (2.7%) were unusable because the participant had a zip code outside of the panhandle of Nebraska. These four responses were excluded from the sample and the statistical analyses. Another respondent was excluded due to the significant lack of questions answered. The final sample size totaled 139 participants and statistical power was achieved with this sample.

Demographics of the Sample

As shown in Tables 1, 2, and 3, descriptive statistics of the sample were evaluated. The sample did have some difference from the total population of the panhandle of Nebraska. Approximately 40% of the panhandle population have a high school diploma or less, compared to 3.5% of the sample (PPHD, 2017). The sample had a significantly higher percentage of college graduates and persons with professional degrees compared to the panhandle population, and 65.5% of the sample was employed full-time. Further, the percentage of the sample (94.2%) who are non-Hispanic White is higher than the approximately 80% of the panhandle residents who also report being non-Hispanic White (PPHD, 2017). Further, the panhandle the median household income is approximately $53,000, with the majority (20.3%) having annual household income between $50,000 and $74,999 per year (PPHD, 2017). Similarly, 22.3% of the sample reported an annual household income between $50,000 -74,999.

Study Results

The mean fruit consumption per day in cups (M = 0.581 cups, SD = 0.631), and the mean vegetable consumption in cups per day (M= 1.387 cups, SD = 1.080) were lower than the recommended two cups of fruit and two and a half cups of vegetables

(Table 4). When asked if the cost of fruit and vegetables kept participants from buying them the mode was 2 (*IQR = 2-3*), where 1=never, 2 = rarely, 3=sometimes, and

Table 1

Distribution of Study Participants Across the 12 Panhandle Counties

County	*N=Participants*	*%*
Banner County	2	1.4%
Box Butte County	10	7.2%
Cheyenne County	6	4.3%
Deuel County	1	0.7%
Dawes County	69	49.6%
Garden County	4	2.9%
Grant County	1	0.7%
Kimball County	0	0%
Morrill County	1	0.7%
Scotts Bluff County	29	20.9%
Sheridan County	11	7.9%
Sioux County	5	3.6%

*Note: All 12 counties are located in the northwest panhandle of Nebraska.

Table 2

Descriptive Frequencies and Percentages for Research Participants Characteristics

Characteristics	*N*	*%*
Gender		
Male	28	20.7
Female	109	77.8
Age		
20-29 years	13	9.3
30-39 years	37	26.6
40-49 years	30	21.5
50-59 years	26	18.7
60-69 years	27	19.4
70+ years	4	2.8
Race		
White	131	94.2
Non-White	6	4.3
Income		
<$14,999	5	3.6
$15,000-24,999	5	3.6
$25,000-$34,999	15	10.8
$35,000 $49,999	16	11.5
$50,000-$74,999	31	22.3
$75,000-$99,999	32	23
$100,000-$149,999	22	15.8
$150,000 +	7	5

Table 3

Distribution of Education Attainment and Employment Status

Education Attainment	*N*	*%*
Diploma/GED	5	3.6
Technical or vocational school	6	4.3
Some College	30	21.6
College Graduate	51	36.7
Post Grad or Professional Degree	42	30.2
Employment Status		
Employed (full-time)	91	65.5
Employed (part-time)	10	7.2
Not working	33	23.7

*Note: No participants sampled had less than a high school diploma. Five respondents did not answer this question. Not working included those who were out of work, homemakers, students, retired, or those unable to work.

4 = often. The mode for the response when asked if the produce in my community is of high quality was 3 (*IQR = 2-4*), where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree (Table 4).

Respondents were also surveyed regarding perceived access to F/V's. When asked if it was easy to purchase fruits and vegetables in my community the mode response was 4 (*IQR = 2-4*), where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree (See Table 5). Additionally, the mean cooking confidence for residents of the panhandle of Nebraska was 4.2568 (*SD*=0.7885), where a score of five signifies complete confidence. Mean healthy eating self-efficacy was 3.2032 (*SD*=0.81494), where a score of five suggests complete confidence, and mean family support was 2.0677 (SD=0.89031) where a score of five indicates that the family supports very often (See Table 4).

Table 4

Descriptive Statistics Summary of Continuous Independent and Dependent Variables

Variable	*N*	Mean	Minimum	Maximum	*SD*
Mean Cooking Confidence	132	4.257	2.20	5	0.789
Mean Healthy Eating Self-Efficacy	127	3.203	1.31	5	0.815
Mean Family Support	133	2.068	1	5	0.890
Fruit Consumption	139	0.581	0	4.5	0.631
Vegetable Consumption	136	1.387	.15	6.85	1.080

*Note: Mean cooking confidence was assess by taking the average of a series of 10 questions using a Likert scale. Mean healthy eating self-efficacy was calculated by taking the average of 16 questions using a Likert scale. Mean family encouragement was calculated by taking the average of 5 questions. Fruit consumption and vegetable consumption are displayed in cups per day. For calculations see Appendix E. Mean (SD) are presented for continuous data.

Table 5

Distribution of Frequency for Ordinal Independent Variables

Variable	Frequency	%
Food Cost		
Often	10	7.2%
Sometimes	67	48.2%
Rarely	37	26.6%
Never	25	18%
Food Quality		
Strongly Disagree	17	12.2
Disagree	36	25.9
Neutral	45	32.4
Agree	30	21.6%
Strongly Agree	8	5.8%
Food Access		
Strongly Disagree	12	8.6%
Disagree	24	17.3%
Neutral	25	18.0%
Agree	52	37.4%
Strongly Agree	26	18.7%

*Note: Cost, quality, and access were used to assess the perceived food environment and if it determined F/V consumption using a Likert scale. For the variables cost and quality 1- strongly disagree, 2- disagree, 3-neutral, 4- agree, and 5- strongly disagree. For the variable cost 1 – never, 2- rarely, 3- sometimes, 4-often.

Linear Regression

Research Question 1

A bivariate regression analysis was conducted to determine to what degree healthy eating self-efficacy is a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 1_1$: Healthy eating self-efficacy is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 1_1$: Healthy eating self-efficacy is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 1_2$: Healthy eating self-efficacy is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 1_2$: Healthy eating self-efficacy is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. Outliers were assessed using histogram which revealed two outliers. Outliers can have a robust influence on the results of regression analysis (Gertsman, 2015). Therefore, I removed these three outliers before regression analysis, which revealed stronger output results. Multicollinearity was assessed using the variance inflation factor (VIF) shown in Table 6. According to Craney and Surles, (2007), a VIF of one indicates no correlation, and anything greater than five warrants the need for further investigation into the relationship between variables. Further a VIF value of 10 or greater would warrant

serious concerns about multicollinearity (Craney & Surles, 2007). Homoscedasticity and linearity were assessed using the scatterplots with no concerns. The result of the bivariate regression was significant $F(1, 122) = 10.51$, $p=0.002$, $R^2 = 0.079$. The R^2 (.079) value indicated that approximately 7.9% of the variation in fruit consumption is accounted for by healthy eating self-efficacy (Table 6). Therefore, I accepted the alternative hypothesis that healthy eating self-efficacy is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

Table 6

Bivariate Regression Analysis Results for Healthy Eating Self-Efficacy and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Healthy Eating Self-Efficacy	.173	.054	.282	3.242	.002	.079	1.000

Note. $N = 122$. Dependent Variable: Total fruit consumption in cups per day. * significance is found if $p \leq 0.05$

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 7. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the bivariate regression was significant $F(1, 119) = 23.915$, $p<0.001$, $R^2 = 0.167$. The R^2 (.167) value indicated that approximately 16.7% of the variation in vegetable consumption is accounted for by healthy eating self-efficacy (Table 7). Therefore, I

rejected the null hypothesis, and assumed that healthy eating self-efficacy is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 7

Bivariate Regression Analysis Results for Healthy Eating Self-Efficacy and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Healthy Eating Self-Efficacy	.449	.092	.409	4.890	.001	.167	1.000

Note. Dependent Variable: Total vegetable consumption in cups per day. * significance is found if $p \leq 0.05$.

Research Question 2

A bivariate regression analysis was conducted to determine to what degree is cooking confidence a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 2_1$: Cooking confidence is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 2_1$: Cooking confidence is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 2_2$: Cooking confidence is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 2_2$: Cooking confidence is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 8. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the bivariate regression was significant $F(1, 127) = 4.363$, $p=0.039$, $R^2 = 0.033$. The R^2 (.033) value indicated that approximately 3.3% of the variation in fruit consumption is accounted for by cooking confidence (Table 8). Therefore, I rejected the null hypothesis and assumed that cooking confidence is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

Table 8

Bivariate Regression Analysis Results for Cooking Confidence and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Cooking Confidence	.129	.062	.182	2.089	.039	.022	1.000

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 9 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the bivariate regression was not significant $F(1, 124) = 2.925$, $p=0.090$, $R^2 = 0.023$. The R^2 (.023) value indicated that approximately 2.3% of the variation in fruit consumption is accounted for by cooking confidence (Table 9). Therefore, I failed to reject the null hypothesis that cooking confidence is not a

significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 9

Bivariate Regression Analysis Results for Cooking Confidence and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Cooking Confidence	.193	.113	.152	1.710	.090	.023	1.000

Note. Dependent Variable: Total vegetable consumed in cups per day * significance is found if $p \leq 0.05$

Research Question 3

A bivariate regression analysis was conducted to determine to what degree is perceived family support a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 3_1$: Perceived family support is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 3_1$: Perceived family support is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 3_2$: Perceived family support is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 3_2$: Perceived family support is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The

outliers were removed. Multicollinearity was assessed using the VIF shown in Table 10 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the bivariate regression was not significant $F(1, 128) = 2.492$, p=0.117, $R^2 = 0.019$. The R^2 (.019) value indicated that approximately 1.9% of the variation in fruit consumption is accounted for by perceived family support (Table 10). Therefore, I failed to reject the null hypothesis that perceived family support is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The

Table 10

Bivariate Regression Analysis Results for Perceived Family Support and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Family Support	0.075	.048	.138	1.579	.117	.019	1.000

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$

outliers were removed. Multicollinearity was assessed using the VIF shown in Table 11 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the bivariate regression was not significant $F(1, 125) = 0.024$, p=0.878, $R^2 = 0.000$. The R^2 (.000) value indicated that approximately 0% of the variation in vegetable consumption is accounted for by perceived family support (Table 11). Therefore, I failed to reject the null hypothesis that perceived family support is not a

significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 11

Bivariate Regression Analysis Results for Perceived Family Support and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Family Support	.014	.091	.014	.154	.878	.000	1.000

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$

Research Question 4

A bivariate regression analysis was conducted to determine to what degree is perceived access to fruits and vegetables is a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 4_1$- Perceived access to fruits and vegetables is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 4_1$-Perceived access to fruits and vegetables is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 4_2$- Perceived access to fruits and vegetables is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 4_2$-Perceived access to fruits and vegetables is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 12 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. Simple variables were created to compare respondents answers to the question "It is easy to purchase fresh fruits and vegetables in my community", with a five-point Likert scale; 1- Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree. Respondents who answered 1=Strongly Disagree was used as a reference point of comparison in this regression analysis. From the analysis output, results indicated that none of the response categories were significant determinants of fruit consumption $F(4, 131)= 1.747$, $p=0.144$, $R^2=0.051$. The R^2 (0.051) value indicates that approximately 5.1% of the variation in fruit consumption is accounted for by perceived access but the overall model is not statistically significant (Table 12). Therefore, I failed to reject the null hypothesis that perceived access is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 13 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the regression was not significant $F(4, 128) = 0.215$, $p=0.930$, $R^2 = 0.007$. The R^2 (.007) value indicated that less than 1% of the variation in vegetable consumption is accounted for by perceived access (Table 13). Therefore, I failed to reject

the null hypothesis that perceived access is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 12

Bivariate Regression Analysis Results for Perceived Access and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Access					.144	.051	
2= Disagree	-.042	.120	-.048	-.349	.728		2.568
3= Neutral	-.099	.119	-.115	-.835	.405		2.620
4= Agree	-.050	.108	-.074	-.464	.644		3.537
5= Strongly Agree	-.123	.117	.147	1.047	.297		2.271

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 1=Strongly disagree was removed and used as the reference point of comparison in this analysis.

Table 13

Bivariate Regression Analysis Results for Perceived Access and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Access					.930	.041	
2= Disagree	-.050	.230	-.031	-.218	.827		2.671
3=Neutral	-.138	.227	-.090	-.609	.544		2.786
4= Agree	-.014	.209	-.012	-.068	.946		3.761
5= Strongly Agree	-.007	.225	-.005	-.031	.975		2.896

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 1=Strongly disagree was removed and used as the reference point of comparison in this analysis.

Research Question 5

A bivariate regression analysis was conducted to determine to what degree perceived quality of fruits and vegetables is a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 5_1$- Perceived quality of fruits and vegetables is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 5_1$-Perceived quality of fruits and vegetables is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 5_2$- Perceived quality of fruits and vegetables is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 5_2$-Perceived quality of fruits and vegetables is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 14 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the regression was not significant $F(4, 131) = 2.162$, $p=0.077$, $R^2 = 0.062$. The R^2 (.062) value indicated that 6.2% of the variation in fruit consumption is accounted for by perceived quality (Table 14). Therefore, I failed to reject the null hypothesis that perceived quality is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 15 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the regression was not significant $F(4, 128) = 1.251$, p=0.293, $R^2 = 0.038$. The R^2 (.038) value indicated that 3.8% of the variation in vegetable consumption is accounted for by perceived quality (Table 15). Therefore, I failed to reject the null hypothesis that perceived quality is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 14

Bivariate Regression Analysis Results for Perceived Quality and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Quality					.077	.062	
2= Disagree	-.123	.093	-.164	-1.330	.186		2.111
3= Neutral	-.118	.089	-.169	-1.328	.186		2.254
4= Agree	.047	.096	.058	.490	.625		1.988
5= Strongly Agree	.108	.137	.077	.789	.431		1.337

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 1=Strongly disagree was removed and used as the reference point of comparison in this analysis.

Table 15

Bivariate Regression Analysis Results for Perceived Quality and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Quality					.171	.038	
2= Disagree	-.108	.173	-.079	-.624	.534		2.150
3= Neutral	-.208	.166	-.165	-1.250	.213		2.305
4= Agree	.090	.178	.062	.502	.617		2.042
5= Strongly Agree	-.180	.253	-.072	-.711	.478		1.358

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 1=Strongly disagree was removed and used as the reference point of comparison in this analysis.

Research Question 6

A bivariate regression analysis was conducted to determine to what degree perceived cost of fruits and vegetables is a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 6_1$- Perceived cost of fruits and vegetables is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 6_1$-Perceived cost of fruits and vegetables is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 6_2$- Perceived cost of fruits and vegetables is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 6_2$-Perceived cost of fruits and vegetables is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 16 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the regression was not significant $F(3, 132) = 2.571$, p=.057, $R^2 = 0.055$. The R^2 (.055) value indicated that 5.5% of the variation in fruit consumption is accounted for by perceived cost (Table 16). Therefore, I failed to reject the null hypothesis that perceived cost is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska. However, when asked if the cost of fruit and vegetables kept participants from buying them, the responses "often"

Table 16

Bivariate Regression Analysis Results for Perceived Cost and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Cost					.057	.055	
1=Often	-.348	.146	-.230	-2.386	.018		1.297
2=Sometimes	-.214	.092	-.270	-2.330	.021		1.879
Rarely	-.192	.101	-.215	-1.897	.060		1.794

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 4=Never was removed and used as the reference point of comparison in this analysis.

and "sometimes" were significant in the final model which suggests further research may be needed (See Table 16).

For the second hypothesis and alternative hypothesis, the assumptions of multicollinearity, outliers, normality, linearity, and homoscedasticity were assessed. The outliers were removed. Multicollinearity was assessed using the VIF shown in Table 17 with no concerns. Homoscedasticity and linearity were assess using the scatterplots with no concerns. The result of the regression was not significant $F(3, 129) = .932$, $p=0.427$, $R^2 = 0.021$. The R^2 (.021) value indicated that 2.1% of the variation in vegetable consumption is accounted for by perceived cost (Table 17). Therefore, I failed to reject the null hypothesis that perceived cost is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Table 17

Bivariate Regression Analysis Results for Perceived Cost and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	R^2	*VIF*
Perceived Cost					.427	.021	
1=Often	-.220	.279	-.077	-.790	.431		1.268
2=Sometimes	-.257	.169	-.180	-.1.520	.131		1.853
Rarely	-.092	.187	-.058	-.495	.622		1.780

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$. The simple variable 4=Never was removed and used as the reference point of comparison in this analysis.

Multiple Regression

Research Question 7

A multiple regression analysis was conducted to determine to what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 7_1$- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of fruit consumption among adults in the panhandle of Nebraska.

$H_a 7_1$- Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are predictors of fruit consumption among adults in the panhandle of Nebraska.

$H_0 7_2$- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 7_2$- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are predictors of vegetable consumption among adults in the panhandle of Nebraska.

For the first hypothesis and alternative hypothesis, three multiple linear regression analyses were conducted, each with one ordinal variable, healthy eating self-efficacy, cooking confidence, and family support to determine if any of the variables could significantly predict fruit consumption. The assumptions of multicollinearity, outliers,

normality, linearity, and homoscedasticity were assessed. Outliers and normality were assessed via the normal probability plots where 2 outliers were identified who had significantly higher fruit consumption compared to the sample, so they were removed before analysis. Multicollinearity using VIF values which revealed no concerns (See Table 18). Linearity and homoscedasticity were assessed using the scatterplot which also revealed no concerns.

The results of the multiple linear regression with the simple coded food cost variables, healthy eating self-efficacy, cooking confidence, and family support were significant $F(6, 108) = 3.410$, $p=0.004$, $R^2 = 0.159$. The R^2 (.159) value indicated that approximately 15.9% of the variation in fruit consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family support, perceived cost) (Table 18). In the final model, healthy eating self-efficacy ($t=2.417$, $p<0.017$) was the only significant contribution.

The results of the multiple linear regression with the simple coded food quality variables, healthy eating self-efficacy, cooking confidence, and family support were significant $F(7, 107) = 3.219$, $p=0.004$, $R^2 = 0.174$. The R^2 (.174) value indicated that approximately 17.4% of the variation in fruit consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family support, perceived quality) (Table 19). In the final model, healthy eating self-efficacy ($t=2.197$,

Table 18

Multivariate Regression Analysis Results for Scale Independent Variables, Food Cost and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.004		.159
Healthy Eating Self-Efficacy	.146	.061	.236	2.417	.017	1.221	
Cooking Confidence	.100	.068	.145	1.481	.142	1.236	
Perceived Family Support	.093	.051	.169	1.840	.068	1.079	
Perceived Cost (Often)	-.256	.153	-.173	-1.674	.097	1.371	
Perceived Cost (Sometimes)	-.122	.099	-.153	-1.237	.219	1.955	
Perceived Cost (Rarely)	-.169	.105	-.190	-1.602	.112	1.807	

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$ $p<0.030$) and perceived family support ($t = 2.097$, $p<.038$) were the only significant contributors.

The results of the multiple linear regression with the simple coded food access variables, healthy eating self-efficacy, cooking confidence, and family support were significant $F(7, 107) = 2.723$, $p=0.012$, $R^2 = 0.151$. The R^2 (.151) value indicated that approximately 15.1% of the variation in fruit consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family support,

Table 19

Multivariate Regression Analysis Results for Scale Independent Variables, Food Quality and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.004		.174
Healthy Eating Self-Efficacy	.151	.059	.243	2.557	.012	1.169	
Cooking Confidence	.101	.069	.146	1.459	.148	1.294	
Perceived Family Support	.106	.051	.192	2.097	.038	1.088	
Perceived Quality (Disagree)	-.132	.099	-.173	-1.326	.188	2.195	
Perceived Quality (Neutral)	-.124	.097	-.175	-1.281	.203	2.424	
Perceived Quality (Agree)	-.005	.102	-.006	-.045	.964	2.099	
Perceived Quality (Strongly Agree)	.077	.136	.059	.567	.572	1.410	

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$

perceived quality) (Table 20). In the final model, healthy eating self-efficacy ($t=2.417$, $p<0.017$) was the only significant contribution. Therefore, I rejected the null hypothesis that healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of fruit consumption among adults in the panhandle of Nebraska.

To test the second hypothesis for research question seven, three separate multiple regression analyses were conducted each using one of the ordinal variables (perceived

Table 20

Multivariate Regression Analysis Results for Scale Independent Variables, Food Access and Fruit Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.012		.151
Healthy Eating Self-Efficacy	.146	.060	.235	2.417	.017	1.188	
Cooking Confidence	.120	.069	.173	1.741	.084	1.243	
Perceived Family Support	.099	.051	.179	1.922	.057	1.096	
Perceived Access (Disagree)	-.004	.132	-.004	-.027	.979	2.371	
Perceived Access (Neutral)	-.053	.128	-.061	-.415	.679	2.708	
Perceived Access (Agree)	.001	.115	.001	.006	.996	3.552	
Perceived Access (Strongly Agree)	.097	.121	.121	-.801	.425	2.867	

Note. Dependent Variable: Total fruit consumed in cups per day. * significance is found if $p \leq 0.05$

cost, quality or access) and the scale variables healthy eating self-efficacy, cooking confidence, and perceived family support to determine their effect on vegetable consumption. The results of the multiple linear regression with the simple coded food cost variables, healthy eating self-efficacy, cooking confidence, and family support were significant $F(6, 105) = 4.020$, $p=0.001$, $R^2 = 0.187$. The R^2 (.187) value indicated that approximately 18.7% of the variation in vegetable consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family

support, perceived cost) (Table 21). In the final model, healthy eating self-efficacy ($t=4.145$, $p<0.001$) was the only significant contribution.

Table 21

Multivariate Regression Analysis Results for Scale Independent Variables, Food Cost and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.001		.187
Healthy Eating Self-Efficacy	.460	.111	.403	4.145	.001	1.220	
Cooking Confidence	.071	.125	.056	.571	.569	1.232	
Perceived Family Support	.072	.093	.070	.773	.441	1.068	
Perceived Cost (Often)	-.076	.293	-.027	-.261	.794	1.338	
Perceived Cost (Sometimes)	-.086	.182	-.058	-.473	.637	1.925	
Perceived Cost (Rarely)	-.101	.193	-.062	-.523	.602	1.789	

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$

The results of the multiple linear regression with the simple coded food quality variables, healthy eating self-efficacy, cooking confidence, and family support on vegetable consumption were significant $F(7, 104) = 3.904$, $p=0.001$, $R^2 = 0.208$. The R^2 (.208) value indicated that approximately 20.8% of the variation in vegetable consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family support, perceived quality) (Table 22). In the final

model, healthy eating self-efficacy ($t=4.148$, $p<0.001$) was the only significant contribution.

Table 22

Multivariate Regression Analysis Results for Scale Independent Variables, Food Quality and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.001		.208
Healthy Eating Self-Efficacy	.447	.108	.391	4.148	.001	1.169	
Cooking Confidence	.074	.126	.058	.590	.557	1.282	
Perceived Family Support	.084	.093	.082	.903	.369	1.082	
Perceived Quality (Disagree)	-.112	.186	-.079	-.602	.548	2.235	
Perceived Quality (Neutral)	-.166	.181	-.125	-.915	.362	2.461	
Perceived Quality (Agree)	.063	.190	.042	.331	.742	2.153	
Perceived Quality (Strongly Agree)	-.209	.251	-.087	-.836	.405	1.435	

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$

The results of the multiple linear regression with the simple coded food access variables, healthy eating self-efficacy, cooking confidence, and family support were significant $F(7, 104) = 3.106$, $p=0.001$, $R^2 = 0.198$. The R^2 (.198) value indicated that approximately 19.8% of the variation in vegetable consumption is accounted for by the set of predictors (healthy eating self-efficacy, cooking confidence, perceived family

support, perceived access) (Table 23). In the final model, healthy eating self-efficacy ($t=4.333$, $p<0.001$) was the only significant contribution. Therefore, I rejected the null

Table 23

Multivariate Regression Analysis Results for Scale Independent Variables, Food Access and Vegetable Consumption

Variable	*B*	*SE B*	β	*t*	*p*	*VIF*	R^2
					.001		.198
Healthy Eating Self-Efficacy	.474	.109	.415	4.333	.001	1.198	
Cooking Confidence	.083	.124	.065	.667	.506	1.231	
Perceived Family Support	.076	.094	.074	.808	.421	1.086	
Perceived Access (Disagree)	.143	.249	.079	.574	.567	2.445	
Perceived Access (Neutral)	-.013	.240	-.008	-.053	.958	2.865	
Perceived Access (Agree)	.146	.216	.115	.674	.502	3.756	
Perceived Access (Strongly Agree)	.017	.227	.012	-.075	.940	3.049	

Note. Dependent Variable: Total vegetable consumed in cups per day. * significance is found if $p \leq 0.05$

hypothesis that healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of vegetable consumption among adults in the panhandle of Nebraska.

Summary

A total of 144 panhandle residents completed the survey, and five participants were removed for having a zip code outside of the panhandle or a significant amount of

data missing. The resulting research sample was $N = 136$. Descriptive statistical analysis indicated that the participants racial composition was mostly White which is representative of the panhandle of Nebraska. Further, most of the sample participants were female and reported higher income and educational attainment compared to the adult population in the panhandle of Nebraska.

After initial analysis were conducted three sample responses were identified as outliers and were removed from final analysis. I used a bivariate linear regression to answer research questions one, two, three, four, five, and six. To explore the relationship between each of the independent variables healthy eating self-efficacy, cooking confidence, and perceived family support on the dependent variables, and I reviewed the unstandardized coefficient values produced by the regression analysis. To explore the relationship between each of the independent variables perceived cost, perceived access, and perceived quality and the dependent variables, I first used simple coding for the ordinal variables and then conducted my regression analysis. The results indicated that healthy eating self-efficacy was a significant determinant of fruit consumption and vegetable consumption. Further, cooking confidence was a significant determinant of fruit consumption but not vegetable consumption. The independent variables including perceived family support, perceived access, perceived quality, and perceived cost were not significant determinants of fruit consumption or vegetable consumption.

I used a multivariate linear regression to answer research question seven addressing the fruit consumption in the null hypothesis and alternative hypothesis one, was significant. In the final model a statistically significant relationship was between

healthy eating self-efficacy and fruit consumption in each of the multivariate regression analysis for fruit consumption. Additionally, perceived family support was also found to be significant, but only in the multivariate regression analysis for scale independent variables, food quality and fruit consumption. I used a multivariate linear regression to answer research question seven addressing the vegetable consumption in the null hypothesis and alternative hypothesis two was significant. In the final model the only statistically significant relationship was between healthy eating self-efficacy and vegetable consumption. All other independent variables were not found to be statistically significant in the multivariate regression. In Chapter 5, I discuss in greater detail the relationship between healthy eating self-efficacy and F/V consumption. The differences between the sample and the target population will be discussed in Chapter 5 as well and how those differences could be affecting the study results. I also discuss the lack of relationship between cooking confidence, perceived family support, perceived access, perceived quality, and perceived cost on F/V consumption. Further I discuss the limitations and implications of the study for health professionals, the social change impact of the study, and recommendations for the future.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to examine the determinants of F/V consumption among adults living in the panhandle of Nebraska at the individual level of the SEM. Few Nebraskans meet the recommended daily intake of F/V, and little research has previously been conducted to understand the determinants of dietary intake in the panhandle of Nebraska (CDC, 2018). This chapter provides discussion and conclusions drawn from the results of this study, as well as recommendations for the future.

Interpretation of Findings

Most of the sample participants for this study were from Dawes County and Scotts Bluff County. Additionally, majority respondents were non-Hispanic White (94.2%), female (77.8%), employed full-time (65.5%), between 30-40 years of age (48.1%), and had a college degree or higher (66.9%). Results of the study revealed that the mean fruit consumption for the sample was approximately a 1/2 cup of fruit per day, and approximately 1 1/3 cup of vegetables per day. This finding is lower than the USDA recommended 1.5-2.0 cups of fruit and 2-3 cups of vegetables per day (United States Department of Agriculture, 2015).

Healthy Eating Self-Efficacy

I conducted two separate bivariate regression analyses for RQ1 to explore the relationship between the healthy eating self-efficacy and fruit consumption and healthy eating self-efficacy and vegetable consumption. The results showed that healthy eating self-efficacy was a significant predictor of fruit consumption (p=0.002), and of vegetable consumption (p<0.001). Healthy eating self-efficacy accounted for 7.9% of the variation

of fruit consumption and 16.7% of the variation of vegetable consumption for adults living in the panhandle of Nebraska.

These results are like other studies that also found strong relationships between healthy eating self-efficacy and F/V consumption (see de Menezes et al., 2018; Kushida et al., 2017; Lo et al., 2019). For example, Lo et al. (2019), found for every one unit increase in healthy eating self-efficacy, study participants consumed an additional one cup of F/V per day among women. The increase in self-efficacy gives the individual confidence in implementing and maintaining healthy behaviors (Fernandez et al., 2014). Another study by de Menezes et al., (2018) found that the highest consumption of F/V was among those with the highest self-efficacy reporting, even after adjusting for age, sex, education, or food environment perceptions. Only one study did not show any significant associations between F/V consumption and self-efficacy. Zhou et al. (2017) sought to determine investigate the relationship between self-efficacy, action planning and social support among 156 college students in Bejing. Self-efficacy was a significant predictor of action planning strategies which then was a significant predictor of F/V consumption (Zhou et al., 2017). However, after controlling for actual F/V intakes and action planning, self-efficacy was no longer a direct statistically significant predictor of F/V consumption (Zhou et al., 2017). Overall, the strength of the significance in this study and other still suggests that healthy eating self-efficacy is a strong determinant of fruit and vegetable consumption in the panhandle of Nebraska.

Cooking Confidence

I conducted two separate bivariate regression analyses for RQ2, to explore the relationship between cooking confidence and fruit consumption and cooking confidence and vegetable consumption. The results showed that cooking confidence was a significant predictor of fruit consumption (p=0.039) but not for vegetable consumption (p=0.090). This result was unusual, since fruit consumption is associated with less cooking preparation and skills (see Lo et al., 2019). In contrast, Hanson et al. (2019), found cooking confidence not to be a significant predictor of either F/V consumption. However, other studies did find that cooking confidence was significant. According to Lo et al. (2019), results from a bivariate analysis of 518 women in rural locations from 22 states revealed that for each one unit increase in cooking, confidence participants consumed an additional 0.59 cups of F/V (p<0.001). However, in the final combined model cooking confidence was no longer significant (Lo et al., 2019).

McMorrow et al. (2016) found cooking skills combined with willpower and preparation time were significant predictors of F/V consumption among women. Similarly, Williams et al. (2010) also found cooking confidence to be a predictor of F/V consumption among older women. Utter et al. (2018) also revealed cooking confidence as a predictor of increased vegetable consumption among adults. Another study seeking to determine the correlation between parents' cooking confidence and the consumption of ultra-processed foods in Brazil did reveal significant findings (Martins et al., 2020). For every 10 points increase in parents cooking confidence, there was a 1.5% decrease in ultra-processed foods but did not report increased F/V consumption (Martins et al.,

2020). These results also align with Pinho et al. (2018), who found that cooking meals at home significantly increased F/V consumption. However, the definitions of cooking skills and cooking confidence do not always align across academic research articles (Martins et al., 2020; McMorrow et al., 2016). Due to the possibility of a Type 1 error in the bivariate regression analysis the significance of cooking confidence on fruit consumption would need to be interpreted with caution and need further investigation.

Perceived Family Support

I conducted two separate bivariate regression analyses for RQ3 to explore the relationship between the perceived family support and fruit consumption and perceived family support and vegetable consumption. The results showed that perceived family support was not a significant predictor of fruit consumption (p=0.117) or vegetable consumption (p=0.878). These results are contradicted by many other studies that did find significant correlations between social support and F/V consumption (see Cho et al., 2015; Kushida et al., 2017; Williams et al., 2010; Zhou et al., 2017). However, according to McSpadden et al. (2016), perceived social support does have a moderating effect on healthy eating motivation.

Other studies did not show significant correlations between perceived social support and F/V consumption (Lo et al., 2019). Only two studies specifically studied family support. Haidar et al. (2019) revealed an increase in F/V consumption among adolescents if their parents were encouraging and supportive of healthy eating. Similarly, a study of the effectiveness of the Live Well/Viva Vien F/V intervention found that friend and family support in combination was associated with a 0.42 cup increase in F/V

consumption per day (Dulin et al., 2018). Overall, perceived family support was not a significant determinant of F/V consumption in this research study but future research regarding objective measures of family support may still need to be investigated since perceived and objective measures do not always align.

Perceived Access

I conducted two separate regression analyses for RQ4 to explore the relationship between perceived access and fruit consumption and perceived access and vegetable consumption. The results showed that perceived access was not a significant predictor of fruit consumption (p=0.144) or vegetable consumption (p=0.930). These findings do align with many other studies that look at access to fruits and vegetables as a barrier or perceived barrier to healthy eating or the results of living in a food desert (see Allcott et al., 2018; Gustofson et al., 2011; Lo et al., 2019; Valdez eta l., 2016; Vogel et al., 2019).

Allcott et al. (2018) found that zip code or access to retail chain groceries explained less than 30% of the nutrition inequality issues. Further, the driving distance to a grocery store explained less than 1.5% of the differences between healthy eating index scores, which suggested that people are willing to drive for food (Allcott eta l., 2018). Elbel et al. (2015) examine the effects of opening a new supermarket in a low-income community in New York City. The results determined no significant changes to dietary intake or improvements in overall nutrition one year after the new grocery store opened (Elbel et al. 2015). This result is like Gustafson et al. (2011), who compared perceived and objective measures of the food access environment. Results showed that participants who lived in a census tract that had a supercenter ate fewer servings of F/V than those

who lived in a census tract that did not have a supercenter (Gustofson et al., 2011). Further, women who shopped at grocery stores with many healthy foods were less likely to perceive their food stores as high in availability or access (Gustofson et al., 2011). These findings may demonstrate some discrepancies between perceived and objective measures of food access.

Other studies did find significant correlations between access and F/V when measuring variables using subjective and objective measures of the physical environment (Blitstein et al., 2012; Co & Bakken, 2018). Another study that measured the perceived quality and access in inner-city Chicago did find that participants were 2.13 to 4.42 times more likely to eat three or more servings of F/V per day (Blitstein et al., 2012). Some studies that conducted qualitative interviews also noticed that access to F/V was mentioned frequently as a perceived barrier to F/V consumption (Haynes-Maslow et al., 2013). Potentially, the sample use for this study may also be used to driving long distances for food purchasing, since the panhandle of Nebraska is considered mostly rural. Therefore, it is not a significant determinant in this study.

Perceived Quality

I conducted two separate regression analyses for RQ5 to explore the relationship between the perceived quality and fruit consumption and perceived quality and vegetable consumption. The results showed that perceived quality was not a significant predictor of fruit consumption (p=0.077) or vegetable consumption (p=0.171). These findings align with many other studies that look at the quality of fruits and vegetables as a barrier or perceived barrier to healthy eating and did not find any significant correlation (see Flint

et al., 2013; Lo et al., 2019). The study by Flint et al. (2013) sought to understand how the perceived food environment could predict F/V consumption among Philadelphia residents. Results concluded that higher perceptions of quality produce did not increase F/V consumption (Flint et al., 2013).

Other studies did find a correlation between quality and F/V consumption (see Alber et al., 2018; Blitsein et al., 2012; de Menezes et al., 2018). A study that analyzed the correlation between the food environment, self-efficacy, and F/V consumption, found that when the perceived food environment, which included access to quality produce, in combination with high levels of self-efficacy was the only time that perceived food environment had a significant positive association with F/V consumption (de Menezes et al., 2018). These results are like those of Alber et al. (2018), who also found that increased perceived quality of the produce was associated with increases in daily F/V consumption. However, this perception is relative to previous living environments and experiences, which may differ from other objective measures (Martinez-Carrasco et al., (2012). Overall, the quality of F/V was not a significant determinant in this study, but future studies may be needed to ask more questions regarding the perceived quality and compare it to objective measures of quality in the panhandle of Nebraska.

Perceived Cost

I conducted two separate regression analyses for RQ6 to explore the relationship between the perceived cost and fruit consumption and perceived cost and vegetable consumption. The results showed that perceived cost was not a significant predictor of fruit consumption (p=0.057) or vegetable consumption (p=0.427). These findings align

with many other studies where perceived cost was suggested to be a prominent barrier but not supported in the study conclusions (see Deliens et al., 2018; Lo et al., 2019; McMorrow et al., 2016; Pinho et al., 2018). Lo et al., (2019). These results were contradictory to Deliens et al.'s (2018) study of 185 Belgian university students who are already subjected to restricted budgets. Reasons for this could be the large sample of participants who had income levels that were higher than the mean annual income for the panhandle of Nebraska.

Other studies have also mentioned cost as a prominent barrier in both objective and subjective cost measurement studies (see de Menezes et al., 2018; Haynes-Maslow et al., 2015; Marckinkevage et al., 2019). When prices for fresh produce were reduced, consumption of F/V was significantly increased (Bernales-Korins et al., 2017; Marcinkevage et al., 2019; Pearson-Stuttard et al., 2017). Further, after the intervention period was overconsumption was reduced to consumption quantities like preintervention amounts (Bernales-Korins et al., 2017). This evidence suggests that cost is still a contributing factor to overall F/V consumption, but there may be discrepancies between perceived cost and objective cost measures.

Multiple Regression for RQ7

To answer RQ7, I conducted multiple regression analyses to explore the relationship between healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived quality, and perceived cost and fruit and vegetable consumption. All regression analysis of all the independent variables were significant for of fruit consumption. Healthy eating self-efficacy was the only significant predictor of

fruit consumption all the final models ($p<0.05$). However, in the multivariate regression analysis results for the scale independent variables, food quality, and fruit consumption, the variable perceived family support was also found to be a significant determinant of fruit consumption ($p<0.038$).

For the second hypothesis for RQ7 three sets of multiple regression analysis were conducted with scale variables and one ordinal variable. The multiple regression analysis of the independent variables was substantial ($p<0.05$) in predicting vegetable consumption. Additionally, 18.7% of the variation in vegetable consumption was accounted for by the scale independent variables and perceived cost. Further the variation in vegetable consumption was 20.8% in the analysis of scale independent variables and perceived quality, and 19.8% for the independent variables and perceived access. In the final model, healthy eating self-efficacy was the only independent variable that was statistically significant ($p<0.05$). These results suggest that healthy eating self-efficacy is still the strongest determinant of F/V consumption.

Socioecological Model

I used the SEM to guide this study. Overall, the SEM incorporates and encourages the consideration of higher-order influences on health behavior. These higher-order influences include social, community, and societal or policy, and can all impact individual health behavior (see Bronfenbrenner 1994; Robinson, 2008; Story et al., 2008). This study did not show statistical significance for any of the higher orders of the SEM. Still, participants were only asked to report about perceived measures that do not directly correlate with objective measures of higher orders on the SEM. Studies by

Gustofson et al. (2011), Harray et al. (2017), and Powell-Wiley et al. (2014) have all compared subjective with objective measures of higher orders of the SEM on dietary intake, which revealed differences of reporting. Therefore, additional studies to objectively measure the social and physical food environments may still be needed.

There may have also been other factors of the individual level of the SEM that were not accounted for in the present study that could have impacted F/V consumption. For example, at the individual level include nutrition knowledge, motivation, and action planning (Evans et al., 2015; Fernandez et al., 2014; Lo et al., 2019). Additionally, the SEM level of social impact may need to be expanded to include extended family or friends. These social influences have also been shown to potentially have a role on F/V consumption (Haidar et al., 2019; Heredia et al., 2020).

Limitations of the Study

The present study results are subject to several limitations. Future studies would need to compare perceived family support with objective measures of family support in the panhandle of Nebraska. Likewise, future studies would need to compare aspects of the perceived food environment with objective measures of the food environment to determine the influence on F/V consumption in the panhandle of Nebraska, as previous studies have identified discrepancies (see Gustofson et al., 2011; Harray et al., 2017; and Powell-Wiley et al., 2014). Further, the sample distribution from each county was not well distributed across each of the 12 counties. For example, Deuel County, Grant County, and Morrill County each only had one participant respond to the survey, which does not accurately represent all residents' perspectives and the diversity from that

county. Therefore, future studies may need to utilize other sampling methods to acquire representative samples from each of the 12 counties.

This study also utilized the PPHD listservs and Facebook page to distribute the survey to members of their worksite wellness program. This is likely why the number of participants who had a college degree and a postgraduate or professional degree was higher than that of the total panhandle population. The mean income was also higher for the sample than that of the target population. These individuals were also likely more caring about their health and more educated about health topics. Even though the required sample size was exceeded, the sample participants were mostly female, which is also not representative of the panhandle of Nebraska. Since the data in this study suggested information about higher orders of the SEM, future studies need to be conducted to study objective measures of the social and food environment to compare it to the perceived measures of the social and food environment. Finally, the study utilized self-reported data, which has been demonstrated to frequently overestimate F/V consumption (see Dean & Sharkey, 2011; Lo et al., 2019; Williams et al., 2010). Therefore, the study results should be used cautiously when applying to the general population of the panhandle of Nebraska and beyond.

Recommendations

The individual-level seeks to address health behavior change from an internal perspective through educational programs and activities (Robinson, 2008). There are specific characteristics at the individual level that can encourage or discourage health behavior change, such as self-efficacy, ability, knowledge, skill, and experience (Rosa &

Trudge, 2013). In this study, healthy eating self-efficacy was the only significant determinant of F/V consumption, suggesting the need for increased educational opportunities and activities that will help increase self-efficacy among residents of the panhandle. However, other individual-level characteristics were not thoroughly explored. Therefore, it may be necessary to complete a more in-depth exploration of these individual-level characteristics.

The individual level is embedded within the SEM's social and environmental levels, which merits the need for greater exploration of how these higher levels influence F/V consumption. This study investigated perceived determinants of family support, perceived access, perceived quality, and perceived cost, which cannot be assumed to reflect the social and physical environments accurately. Further study needs to be conducted to expand the social environment concepts to include close friends and maybe even work environments. Data collection using more questions such as the questionnaire developed by Baruth et al., (2011) would offer more insight to the different facets of social support. Future studies also need to include more in-depth perceptions of the food environment using more than just one question to assess these perceptions.

It may be necessary to gather data regarding F/V consumption using more objective measures. A survey of the food environment to compare supply differences between the different counties by determining each county's supermarket densities may be appropriate to measure access objectively. Additionally, future research may need to include the use of the Nielsen Homescan Panel to measure household grocery purchases in the panhandle. This would help to determine food purchases from grocery stores,

which may provide some insight into the amount of product being purchased in the panhandle of Nebraska (Allcott et al., 2018). Even though it does not reflect actual consumption, it could be used as a guide or reference for potential F/V consumption and compared to self-reported intakes of F/V. Objective data may need to be collected to determine the cost variances of F/V around the panhandle and compare it to other regions of Nebraska. As Allcott et al. (2018) mentioned, vehicle ownership may be a greater predictor of F/V consumption since people are willing to travel to access produce if they have adequate transportation methods. Another study by Dulin et al. (2018) suggested the number of hours worked could be a barrier to increase F/V consumption that may need greater exploration in the panhandle. Studies that gathered this data and more would assess these higher SEM levels more accurately and determine the areas that need to be addressed to increase support for increase F/V consumption for adults in the panhandle of Nebraska.

Implications

My study's research findings posit that positive social change at the individual level is achieved by focusing on improving the healthy eating self-efficacy of those living in the panhandle. The data supplied from this study may be used to develop and tailor intervention efforts to support social change towards increasing F/V consumption. This study provides data that may be used for other regions of the United States or Nebraska that have similar geographic, economic, and population demographics. The study also highlights the need for future studies to be conducted to gain better insight into the determinants of F/V consumption, especially at the social and environmental level of the

SEM. Overall, this study contributes to the understanding of the problem of understanding which determinants impact consumption of F/V among Nebraskans. The findings help support the SEM because healthy eating self-efficacy was the only significant independent variable that determined F/V consumption, which suggests other determinants, possibly in other higher orders of the SEM, may have contributed to the reduced F/V consumption. Further, the results of this study support social change by highlighting the need of additional research and interventions to increase F/V consumption among residents of the panhandle of Nebraska.

Conclusions

There have been many campaigns to encourage F/V consumption, but this may be easier said than done. In this study, results have shown that other factors need to be addressed first before behavior change is likely to occur. Self-efficacy was revealed as the only significant determinant of F/V consumption at the individual level, while perceived social and food environmental determinants were found to be insignificant. However, other studies may need to be conducted to thoroughly investigate the determinants of F/V consumption, especially at higher SEM levels.

In this study, I provided significant information to the field of public health. The findings outlined in Chapter 4 were comparable to the findings of other studies outlined in the literature review in Chapter 2. This research provided a look at determinants of F/V consumption in an area of Nebraska that had previously never been studied. Furthermore, this study highlighted how healthy eating self-efficacy is a key determinant of F/V consumption for adults in the panhandle of Nebraska. Similarly, throughout the literature

review, self-efficacy was also shown to be a key determinant. Public health agencies and other organizations can use this information to tailor intervention efforts and build the healthy eating self-efficacy of adults who live in this area of Nebraska. However, more determinants need to be explored to further the literature gap and improve the eating behaviors of adults in the panhandle of Nebraska.

References

Adams, J., & White, M. (2015). Prevalence and sociodemographic correlates of time spent cooking by adults in the 2005 U.K. time use survey. Cross-sectional analysis. *Appetite*, *92*, 185-191. http://dx.doi.org/10.1016/j.appet.2015.05.022

Alber, J. M., Green, S. H., & Glanz, K. (2018). Perceived and observed food environments, eating behaviors, and BMI. *American Journal of Preventive Medicine*, *54*(3), 423-429.

Askelson, N. M., Meier, C., Baquero, B., Frilberg. J., Montgomery, D., & Hradek, C. (2018). Understanding the process of prioritizing fruit and vegetable purchases in families with low incomes: "A peach may not fill you up as much as hamburger". *Health Education & Behavior*, *45*(5), 817-823. https://doi.org/10.1177/109019811752790

Alexander, G. L., Lindberg, N., Firemark, A., L., Rukstalis, M. R., & McMullen, C. (2018). Motivations of young adults for improving dietary choices: Focus group findings prior to the MENU genY dietary change trial. *Health Education & Behavior*, *45*(4), 492-500. https://doi.org/10.1177/1090198117736347

Allcott, H., Diamond, R., Dubé, J.-P., Handbury, J., Rahkovsky, I., & Schnell, M. (2018). Food deserts and the causes of nutritional inequality. *Quarterly Journal of Economics*, *134*(4), 1793-1844. https://doi.org/10.1093/qje/qjz015

Applton, K. M., Hemingway, A., Saulais, L., Dinnella, C., Monteleone, E., Depezay, L., Morizet, D., Perez-Cueto, A. F. J., Bevan, A., & Hartwell, H. (2016). Increasing vegetable intakes; Rationale and systematic review of published interventions.

European Journal of Nutrition, *55*, 869-896. https://doi.org.10.1007/s00394-015-1130-8

Babbie, E. (2017). *The basics of social research* (7th ed.). Cengage Learning.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychology Review*, *84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Baruth, M., Wilcox, S., & Condrasky, M. D. (2011). Perceived environmental church support is associated with dietary practices among African-American Adults. *Journal of American Dietetic Association*, *111*, 889-983. http://doi.org/10.1016/j.jada.2011.03.014

Bateman, L. B., O'Neal, L. T., Smith, T., Li, Y., Wynn, T. A., Dai, C., & Fouad, M. N. (2017). Policy, system and environmental correlates of fruit and vegetable consumption in a low-income African American population in the southeast. *Ethnicity & Disease*, *27*(1), 355-362. https://doi.org/10.18865/ed.27.S1.355

Bernales-Korins, M., Ang, I. Y. H., Khan, S., & Geliebter, A. (2017). Psychosocial influences on fruit and vegetable intake following a NYC supermarket discount. *HHS Public Access*, *25*(8), 1321-1328. https://doi.org/10.1002/oby.21876

Bertoia, M. L., Mukamal, K. J., Cahill, L. E., Hou, T., Ludwig, D. S., Mozaffarian, D., Willett, W. C., Hu, F. B., & Rimm, E. B. (2015). Changes in intake of fruits and vegetables and weight change in United States men and women followed for up to 24 years: Analysis from three prospective cohort studies. *PLoS Medicine*, *12*(9), e1001878. https://doi.org/10.1371/journal.pmed.1001878

Bodor, J. N., Rose, D., Farley, T. A., Swalm, C., & Scott, S. K. (2007). Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutrition*, *11*(4), 413-420. https://doi.org/10.1017/S1368980007000493

Briz, T., Ward, R. W., & Ortega, L., E. (2017). Relative impacts of health and obesity on U.S. household servings of fruit and vegetables. *Renewable Agriculture and Food Systems*, *33*(2), 150-162. https://doi.org/10.1017/s1742170517000011

Broadband Now. (2020). *Broadband service in Nebraska*. https://broadbandnow.com/Nebraska

Bronfenbrenner, U. (1994). *Ecological models of human development*. (2nd ed., 3-8). Freeman.

Brown, B. J., & Hermann, J. R. (2005). Cooking classes increase fruit and vegetable intake and food safety behaviors in youth and adults. *Journal of Nutrition Education and Behavior*, *37*, 104-105. https://doi.org/10.1016/S1499-4046(06)60027-4

Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nurture reconceptualized in developmental perspective: A bioecological model. *Psychological Review*, *101*(4), 568-586. https://doi.org/10.1037/0033-295X.101.4.568

Cassady, D., Jetter, K. M., & Culp, J. (2007). Is price a barrier to eating more fruits and vegetables for low-income families? *Journal of American Dietetic Association*, *107*, 1909-1905. https://doi.org/10.1016/j.jada.2007.08.015

Centers for Disease Control and Prevention. (2011). Strategies to prevent obesity and other chronic diseases: The CDC guide to strategies to increase the consumption of fruits and vegetables https://www.cdc.gov/obesity/downloads/strategies-fruits-and-vegetables.pdf

Centers for Disease Control and Prevention [CDC]. (2018). *State indicator report on fruits and vegetables, 2018*. https://www.cdc.gov/nutrition/data-statistics/2018-state-indicator-report-fruits-vegetables.html

Centers for Disease Control and Prevention (2019). *Adult obesity facts*. https://www.cdc.gov/obesity/data/adult.html

Chai, W., Fan, J. X., & Wen, M. (2018). Association of individual and neighborhood factors with home food availability: Evidence from the national health and nutrition examination survey. *Journal of the Academy of Nutrition and Dietetics*, *118*(5), 815-823. https://doi.org/10.1016/j.jand.2017.11.009

Chapman, K., Goldsbury, D., Watson, W., Havill, M., Wellard, L., Hughes, C., Bauman, A., & Allman-Farinelli, M. (2017). Exploring perceptions and beliefs about the cost of fruit and vegetables and whether they are barriers to higher consumption. *Appetite*, *113*, 310-319. https://doi.org/10.2016/j.appet.2017.02.043

Cho, S. H., Chang, K. L., Yeo, J., Wounded Head, L., Zastrow, M., Zdorovtsov, C., Skjonsberg, L., & Stluka, S. (2015). Comparison of fruit and vegetable consumption among Native and non-Native American populations in rural communities. *International Journal of Consumer Studies*, *39*, 67-73. https://doi.org/10.1111/ijcs.12153

Co., M. C., & Bakken, S. (2018). Influence of the local food environment on Hispancs'' perceptions of healthy food access in New York City. *Hispanic Health Care International*, *16*(2), 76-84. https://doi.org/10.1177/1540415318788068

Colapinto, C. K., Graham, J., & St-Pierre, S. (2018). Trends and correlates of frequency of fruit and vegetable consumption, 2007 to 2014. *Health Reports*, *29*(1), 9-14. https://doi.org/10.3747/co.25.4071

Colon-Ramos, U., Rutten L. J. F., Moser, R. P., Colon-Lopez, V., Ortiz, A. P., & Yaroch, A. L. (2015). The association between fruit and vegetable intake, knowledge of the recommendations, and health information seeking within adults in the U.S. mainland and in Puerto Rico. *Journal of Health Communication*, *20*, 105-111. https://doi.org.10.1080/10810730.2014.914607

Condrasky, M. D., Williams, J. E., Catalano, P. M., & Griffin, S. F. (2011). Development of psychosocial scales for evaluating the impact of a culinary nutrition education program on cooking and healthful eating. *Journal of Nutrition Education and Behavior*, *43*(6), 511-516. https://doi.org.10.1016/j.jneb.2010.09.013

Craney, T. A., & Surles, J. G. (2007). Model-dependent variance inflation factor cutoff values. *Quality Engineering*, *14*(3), 391-403. https://doi.org/10.1081/QEN-120001878

Crosby, R. A., Salazar, L. F., Clayton, R. R., & DiClemente, R. J. (2015). Measurement in health promotion. In Salazar, L. F., Crosby, R. A., DiClemente, R. J. (Ed.), *Research methods in health promotion* (2 ed., pp. 177-208). Jossey-Bass.

Dammann, K., W., & Smith, C. (2009). Factors affecting low-income women's food choices and the perceived impact of dietary intake and socioeconomic status on their health and weight. *Journal of Nutrition and Education Behavior*, *41*(4), 242-253. https://doi.org.10.1016/j.jneb.2008.07.003

Darko, J., Eggett, D. L., & Richards, R. (2013). Shopping behaviors of low-income families during a 1-month period of time. *Journal of Nutrition Education and Behavior*, *45*(1), 20-29. http://dx.doi.org/10.1016/j.jneb.2012.05.016

Dean, W. R., & Sharkey, J. R. (2011). Rural and urban differences in the associations between characteristics of the community food environment and fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, *43*(6), 426-433. https://doi.org/10.1016/j.jneb.2010.07.001

Deliens, T., Verhoeven, H., de Bourdeaudehuij, I., Huybrechts, I., Mullie, P., Clarys, P., & Deforche, B. (2018). Factors associated with fruit and vegetable and total fat intake in university students: A cross-sectional explanatory study. *Nutrition & Dietetics*, *75*, 151-158. https://doi.org/10.1111/1747-0080.12399

de Menezes, M. C., Roux, A. V. D., & Lopes, A. C.S. (2018). Fruit and vegetable intake: Influence of perceived food environment and self-efficacy. *Appetite*, *127*, 249-256. https://doi.org/10.1016/j.appet.2018.05.011

de Mestral. C., Khalatbari-Soltani, S., Stringhini, S., & Marques-Vidal., P. (2020). Perceived barriers to healthy eating and adherence to dietary guidelines: Nationwide study. *Clinical Nutrition*, *39*, 2580-2585. https://doi.org/10.1016/j.clnu.2019.11.025

Di Noia, J., & Byrd-Bredbenner, C. (2013). Adolescent fruit and vegetable intake: Influence of family support and moderation by home availability of relationships with Afrocentric values and taste preferences. *Journal of the Academy of Nutrition and Dietetics*, *113*, 803-808. https://doi.org/10.1016/j.jand.2013.02.001

Dulin, A., Risica, P. M., Mellow J., Ahmed, R., Carey, K. B., Cardel, M., Howe, C. J., Nadimpalli, S., & Gans, K. M. (2018). Examining neighborhood and interpersonal norms and social support on fruit and vegetable intake in low-income communities. *BMC Public Health*, *18*, 455-465. https://doi.org/10.1186/s12889-018-5356-2

Echeverria, S. E., Diez-Roux, A. V., & Link, B. G. (2004). Reliability of self-reported neighborhood characteristics. *Journal of Urban Health:Bulletin of the New York Academy of Medicine*, *81*(4), 682-701. https://doi.org/10.1093/jurban/jth151

Elbel, B., Moran, A., Dixon, L. B., Kiszko, K., Cantor, J., Abrams, C., & Mijanovich, T. (2015). Assessment of a government-subsidized supermarket in a high-need area on household food availability and children's dietary intakes. *Public Health Nutrition*, *18*(15), 2881-2890. https://doi.org/10.1017/S1368980015000282

Evans, A., Banks, K., Jennings, R., Nehme, E., Nemec, C., Sharma, S., Hussaini, A., & Yaroch, A. (2015). Increasing access to healthful foods: A qualitative study with residents of low-income communities. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), S5. https://doi.org/10.1186/1479-5868-12-S1-S5

Fan, L., Baylis, K., Gundersen, C., & Ver Ploeg, P. (2018). Does a nutritious diet cost more in food deserts? *Journal of the International Association of Agricultural Economists*, *49*(5), 587-597. https://doi.org/10.1111/agec.12444

Fernandez, B. R., Warner, L., M., Knoll, N., Montenegro, E. M., & Schwarzer, R. (2014). Synergistic effects of social support and self-efficacy on dietary motivation predicting fruit and vegetable intake. *Appetite, 87*, 330-335. https://dx.doi.org/10.1016/j.appet.2014.12.223

Fertig, A., Loth, K. A., Trofhoz, A. C., Tate, A. D., Miner, M., Neumark-Sztainer, D., & Berge, J. M. (2019). Compared to pre-prepared meals, fully and partly home-cooked meals in diverse families with young children are more likely to include nutritious ingredients. *Journal of the Academy of Nutrition and Dietetics*, *119*(5), 818-830. https://doi.org/10.1016/j.jand.2018.12.006

Flint, E., Cummins, S., & Matthews, S. (2013). Do perceptions of the neighbourhood food environment predict fruit and vegetable intake in low-income neighbourhoods? *Health & Place*, *24*, 11-15. http://dx.doi.org/10.1016/j.healthplace.2013.07.005

Gailey, S., & Bruckner, T. A. (2019). Obesity among black women in food deserts: An "omnibus" test of differential risk. *Population Health*, *7*, 1-7. https://doi.org/10.1016/j.ssmph.2019.100363

Garcia, A. L., Vargas, E., Lam, P. S., Shennan, D. B., Smith, F., & Parrett, A. (2013). Evaluation of a cooking skills programme in parents of young children - A

longitudinal study. *Public Health Nutrition*, *17*(5), 1013-1021. https://doi.org10.1017/S1368980013000165

Gertsman, B., B. (2015). *Basic biostatistics: Statistics for public health practice*. (2nd ed., p. 175-196). Jones & Bartlett Learning.

Gustafson, A. A., Sharkey, J., Samuel-Hodge, C. D., Jones-Smith, J., Folds, M. C., Cai, J., A., & Ammerman, A. S. (2011). Perceived and objective measures of the food store environment and the association with wight and diet among low-income women in North Carolina. *Public Health Nutrition*, *14*(6), 1032-1038. https://doi.org/10.1017/S1368980011000115

Haidar, A., Ranjit, N., Saxton, D., Hoelscher, D. M. (2019). Perceived parental and peer social support is associated with healthier diets in adolescents. *Journal of Education and Behavior, 51*(1), 23-31. https://doi.org/10.1016/j.jneb.2018.10.003

Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C., L. (2020). Prevalence of obesity and severe obesity among adults: United States, 2017-2018. *Medical Benefits*, *37*(4), 4-5. https://www.cdc.gov/nchs/products/index.htm.

Hamilton, K., Vayro, C., & Schwarzer, R. (2015). Social cognitive antecedents of fruit and vegetable consumption in truck drivers: A sequential mediation analysis. *Journal of Nutrition Education & Behavior*, *47*, 379-384. http://dx.doi.org/10.1016/j.jneb.2015.04.325

Hanson, A. J., Kattelmann, K. K., McCormack, L. A., Zhou, W., Brown, O. N., Horacek, T. M., Shelnutt, K. P., Kidd, T., Opoku-Acheampong, A., Franzen-Castel, L. D., Olfert, M. D., & Colby, S. E. (2019). Cooking and meal planning as predictors of

fruit and vegetable intake and BMI in first-year college students. *International Journal of Environmental Research and Public Health*, *16*. http://doi.org/10.3390/ijerph16142462

Harray, A. J., Boushey, C. J., Pollard, C. M., Panizza, C., E., Delp, E. J., Dhaliwal, S. S. & Kerr, D. A. (2017). Perception v. actual intakes of junk food and sugar-sweetened beverages in Australian young adults: Assessed using the mobile food record. *Public Health Nutrition*, *20*(13), 2300-2307. https://doi.org/10.1017/S1368980017000702

Hawkes, C., Smith, T. G., Jewell, J., Wardle, J., Hammond, R. A., Friel, S., Thow, A. M., & Kain, J. (2015). Smart food policies for obesity prevention. *Lancet*, *385,* 2410-2421. http://doi.org/10.1016/S0140-6736(14)61745-1

Haynes-Maslow, L., Parsons, S. E., Wheeler, S. B., & Leone, L. A. (2013). A qualitative study of perceived barriers to fruit and vegetable consumption among low-income populations, North Carolina, 2011. *Preventing Chronic Disease*, *10*, 120206 http://dx.doi.org/10.5888/pcd10.120206

Haynes-Maslow, L., Auvergne, L., Mark, B., Ammerman, A., & Weiner, B. J. (2015). Low-income individuals'' perceptions about fruit and vegetable access programs: A qualitative study. *Journal of Nutrition Education and Behavior*, *47*(4), 317-324. https://doi.org/10.1016/j.jneb.2015.03.005

Heredia, N., Nguyen, N., & McNeill, L. H. (2020). The importance of the social environment in achieving high levels of physical activity and fruit and vegetable

intake in African American church members. *American Journal of Health Promotion*, *34*(8). https://doi.org/10.1177/0890117120925361

Hruby, A., Manson, J. E., Qi, L., Malik, V. S., Rimm, E. B., Sun, Q., Willett, W. C., & Hu, F. B. (2016). Determinants and consequences of obesity. *American Journal of Public Health*, *106*, 1656-1662. https://doi.org/10.2105/AJPH.2016.303326

Kelder, S. H., Hoelscher, D., & Perry, C. L. (2015). How individuals, environments, and health behaviors interact. In K. Glanz, B. K. Rimer, & K. Viswanath. (Eds.), *Health behavior: Theory research, and practice* (5 ed., pp. 159-181). Jossey-Bass.

Kern, D. M., Auchnicloss, A. H., Stehr, M. F., Roux, A. V. D., Moore, L. V., Kanter, G. P., & Robinson, L. F. (2017). Neighborhood prices of healthier and unhealthier foods and associations with diet quality: Evidence from the multi-ethnic study of atherosclerosis. *International Journal of Environmental Research and Public Health*, *14*, 1394-1408. http://doi.org/10.3390/ijerph14111394

Kleinert, S., & Horton, R. (2015). Rethinking and reframing obesity. *Lancet*, *385*, 2326-2328. https://doi.org/10.1016/S0140-6736(15)60163-5

Kleinman, N., Abouzaid, S., Andersen, L., Wang, Z., & Powers, A. (2014). Cohort analysis assessing medical and nonmedical cost associated with obesity in the workplace. *Journal of Occupational and Environmental Medicine*, *56*(2), 161-170. https://doi.org/10.1097/JOM.0000000000000099

Kushida, O., Iriyama, Y., Murayama, N., Saito, T., & Yoshita, K. (2017). Associations of self-efficacy, social support, and knowledge with fruit and vegetable consumption

in Japanese workers. *Asian Pacific Journal of Clinical Nutrition*, *26*(4), 725-730. https://doi.org.10.6133/apjcn.062016.06

Lauby-Secretan, B., Scoccianti, C., Loomis, D., Grosse, Y., Bianchini, F., & Straif, K. (2016). Body fatness and cancer-Viewpoint of the IARC working group. *New England Journal of Medicine*, *375*, 794-798. https://doi.org/10.1056/NEJMsr1606602

Lee, J., Kubik, M. Y., Fulkerson, J. A., Kohli, N., & Garwick, A. E. (2020). The identification of family social environment typologies using latent class analysis: Implications for future family-focused research. *Journal of Family Nursing*, *26*(1), 26-37. https://doi.org/10.1177/1074840719894016

Lee-Kewan, S. H., Moore, L. V., Blanck, H. M., Harris, D. M., & Galuska, D. (2017). Disparities in state: Specific adult fruit and vegetable consumption- United States, 2015. *Centers for Disease Control Morbidity and Mortality Weekly Report*, *66*(45), 1241-1247. https://doi.org/10.15585/mmwr.mm6645a1

Lo, B. K., Loui, C., Folta, S. C., Flickinger, A., Connor, L. M., Liu, E., Megiel, S., & Seguin, R. A. (2019). Self-efficacy and cooking confidence are associated with fruit and vegetable intake in a cross-sectional study with rural women. *Eating Behaviors*, *33*, 34-39. https://doi.org/10.1016/j.eatbeh.2019.02.005

Marcinkevage, J., Auvinen, A., & Nambuthiri, S. (2019). Washington state's fruit and vegetable prescription program: Improving affordability of healthy foods for low-income patients. *Preventing Chronic Disease*, *16*(E91). https://doi.org/105888/pcd16.180617

Martinez-Carrasco, L., Brugarolas, M., Martinez-Poveda, A., Ruiz, J. J., & Garcia-Martinez, S. (2012). Modelling perceived quality of tomato by structural equation analysis. *British Food Journal*, *114*(10), 1414-1431. https://doi.org/10.1108/00070701211262993

Martins, C. A., Machado, P. P., da Costa Louzada, M. L., Levy, R. B., & Monteiro, C. A. (2020). Parents cooking skills confidence reduce children's consumption of ultra-processed foods. *Appetite*, *144*. https://doi.org/10.1016/j.appet.2019.104452

McMorrow, L. Ludbrook, A., Macdiarmid, J. I., & Olajide, D. (2016). Perceived barriers towards healthy eating and their association with fruit and vegetable consumption. *Journal of Public Health*, *39*(2), 330-338. https://doi.org/10.1093/pubmed/fdw038

McSpadden, K. E., Patrick H., Oh, A. Y., Yaroch, A. L., Dwyer, L. A., & Nebeling, L. C. (2016). The association between motivation and fruit and vegetable intake: The moderating role of social support. *Appetite*, *96*, 87-94. http://dx.doi.org.10.1016/j.appet.2015.08.031

Middaugh, A., Fisk, P. S., Brunt, A., Rhee, Y. S. (2012). Few associations between income and fruit and vegetable consumption. Journal of Nutrition Education and Behavior, 44, 196-203. https://doi.org/10.1016/j.jneb.2011.10.003

Mills, S., Brown, H., Wrieden, W., White, M., & Adams, J. (2017). Frequency of eating home cooked meals and potential benefits for diet and health: Cross-sectional analysis of a population-based cohort study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*,109-120. https://doi.org/10.1186/s12966-017-0567-y

Mihai, V. C., & Remus, P. A. (2018). Risk factors for diabetes type 2 development. Comparison of 6 major risk factors prevalence between newly diagnosed diabetes patients from Bihor County and the population with normal glucose tolerance from predator study. *Internal Medicine*, *15*(3), 33-38. https://doi.10.2478/inmed-2018-0020

Mook, K., Laraia, B. A., Oddo, V. M., & Jones-Smith, J. C. (2016). Food security status and barriers to fruit and vegetable consumption in two economically deprived communities of Oakland, California, 2013-2014. *Preventing Chronic Disease*, *13*(E21). Http://dx.doi.org/105888/pcd13.150402

Panhandle Public Health District [PPHD]. (2017). *Community health needs assessment*. http://www.pphd.org/Site/Documents/CHIP/2017%20CHNA_v07.14.2017.pdf

Pearson-Stuttard, J., Bandosz, P., Rehm, C. D., Afshin, A., Penalvo, J. L., Whitsel, L., Danaei, G., Micha, R., Gaziano, T., Loyd-Williams, F., Capewell, S., Mozaffarian, D., & O'Flaherty, M. (2017). Comparing effectiveness of mass media campaigns with price reductions targeting fruit and vegetable intake on US cardiovascular disease mortality and race disparities. *American Journal of Clinical Nutrition*, *106*, 199-206. https://doi.org/10.3945/ajcn.116.143925

Perrin, A., & Anderson, M. (2019). Share of U.S. adults using social media, including Facebook, is mostly unchanged since 2018. https://www.pewresearch.org/fact-tank/2019/04/10/share-of-u-s-adults-using-social-media-including-facebook-is-mostly-unchanged-since-2018/

Pinho, M. G. M., Mackenbach, J. D., Charreire, H., Oppert, J. -M., Bardos, H., Glotni, K., Compernolle, S., De Boudeaudhuij, I., Beulens, J. W. J., Brug, J., & Lakerveld, J. (2018). Exploring the relationship between perceived barriers to healthy eating and dietary behaviours in Eropean adults. *European Journal of Nutrition*, *57*, 1761-1770. https://doi.org/10.1007/s00394-017-1458-3

Powell-Wiley, T. M., Miller, P. E., Agyemang, P., Agurs-Collins, & Reedy, J. (2014). Perceived and objective diet quality in US adults: A cross-sectional analysis of the national health and nutrition examination survey (NHANES). *Public Health Nutrition*, *17*(12), 2641-2649. https://doi.org/10.1017/S1368980014000196

Radding, A. (2015). Food policy opportunities for Nebraska: Growing healthy food systems. *Center for Rural Affairs*. https://www.cfra.org/sites/default/files/publications/Growing%20Healthy%20Food%20Systems%20Aug2015.pdf

Reicks, M., Kocker, M., & Reeder, J. (2018). Impact of cooking and home food preparation interventions among adults: A systematic review (2011-1016). Journal of *Nutrition Education and Behavior*, *50*(2), 148-172. https://doi.org/10.1016/j.jneb.2017.08.004

Robinson, T. (2008). Applying the socioecological model to improving fruit and vegetable intake among low-income African Americans. *Journal of Community Health*, *33*(6), 395-406. https://doi.org/10.1007/s10900-008-9109-5

Rosa, E. M., & Trudge, J. (2013). Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. *Journal of Family Theory & Review*, *5*(4), 243-258. https://doi.org/10.1111;jftr.12022

Sallis, J. & Owen, N. (2015). Ecological models of health behavior. In Glanz, K., Rimer, B. K., & Viswanath, K. (Ed.), *Health behavior: Theory research, and practice* (5 ed., pp.43-64). Jossey-Bass.

Sallis, J. F., Pinski, R. B., Grossman, R. M., Patterson, T. L., & Nader, P. R. (1988). The development of self-efficacy scales for health related diet and exercise behaviors. *Health Education Research*, *3*(3), 283-292.

Sallis, J. F., Grossman, R. M., Pinski, R. B., Patterson, T. L., & Nader, P. R. (1987). The development of scales to measure social support for diet and exercise behaviors. *Preventive Medicine*, *16*(6), 825-836. http://www.ncbi.nlm.nig.gov/pubmed/3432232

Salazar, L. F., Crosby, R. A., & DiClemente R. J. (2015). Observational research designs. In Salazar, L. F., Crosby, R. A., & DiClemente, R. J.(Ed.), *Research methods:In health promotion* (2nd ed., pp. 81-114). Jossey-Bass.

Seguin, R. A., Aggarwal, A., Vermeylen, F., & Drewnowski, A. (2016). Consumption frequency of foods away from home linked with higher body mass index and lower fruit and vegetable intake among adults: A cross-sectional study. *Journal of Environmental and Public Health*, *2016*. http://dx.doi.org/10.1155/2016/3074241

Shaikh, A. R., Yaroch, A. L., Nebeling, L., Yeh, M., Resnicow, K. (2008). Psychosocial predictors of fruit and vegetable consumption in adults: A review of the literature. American Journal of Preventive Medicine, 34(6), 535-543. doi:10.1016/j.amepre.2007.12.028

Sharif, M. Z., Rizzo, S., Marino, E., Belin, T. R., Glik, D. C., Kuo, A. A., Ortega, A. N., & Prelip, M. L. (2016). The association between self-rated eating habits and dietary behavior in two latino neighborhoods: Findings from Proyecto MercadoFRESCO. *Preventive Medicine Reports*, *3,* 270-275. http://dx.doi.org/10.1016/j.pmedr.2016.03.002

Singh, M. G., Danaei, G., Farzadar, F., Stevens, G. A., Woodward, M., Wormser, D., Kaptoge, S., Whitlock, G., Qiao, Qing, Lweington, S., Di Angelatonio, E., vander Hoorn, S., Lawes, C. M. M. & Prospective Studies Collaboration. (2013). The age-specific quantitative effects of metabolic risk factors on cardiovascular disease and diabetes: A pooled analysis. *PLoS One*, *8*(7), e65174 https://doi.org/10.1371/journal.pone.0065174

Smith, M. L., Lee, S., Towne, S. D., Han, G., Quinn, C., Pena-Purcell, N. C., & Ory, M. G. (2019). Impact of a behavioural intervention on diet, eating, patterns, self-efficacy, and social support. *Journal of Nutrition Education and Behavior*, *52*(2), 180-186. https://doi.org10.1016/j.jneb.2019.06.008

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, *29,* 253-272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Stluka, S., Zastrow, M., Zdorovstov, C., & Chang, K. (2015). Review of fruit & vegetable food system in South Dakota: Application and policy suggestions for

other rural states. *Journal of Human Sciences and Extension*, *3*(3), 124-142. www.jhseonline.com

Salazar, L. F., Crosby, R. A., & DiClemente R. J. (2015). Observational research designs. In Salazar, L. F., Crosby, R. A., & DiClemente, R. J.(Ed.), *Research methods:In health promotion* (2nd ed., pp. 81-114). Jossey-Bass.

Sproull, N. L. (2002). Handbook of research methods: A guide for practitioners and students in the social sciences. (2nd ed., pp 152-154). Scarecrow Press Inc.

Tallie, L. S. (2018). Who's cooking? Tends in US home food preparation by gender, education, and race/ethnicity from 2003 to 2016. Nutrition Journal, 17(41). Https://doi.org/10.1186/s12937-018-0347-9

The GBD 2015, O. C. (2017). Health effects of overweight and obesity in 195 countries over 25 years. *The New England Journal of Medicine*, *377*(1), 13-27. http://doi.org/10.1056/NEJMoa1614362

United States Census Bureau [USDA]. (2019). QuickFacts. https://www.census.gov/quickfacts/fact/table/grantcountynebraska/PST045219

United States Department of Agriculture Economic Research Service. (2019). Food environment Atlas. https://www.ers.usda.gov/data-products/food-environment-atlas/go-to-the-atlas/

United States Department of Agriculture [USDA]. (n.d.). Choose MyPlate. https://www.choosemyplate.gov/eathealthy/vegetables

United States Department of Agriculture [USDA]. (2019). Definitions. https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/#definitions

United States Department of Agriculture [USDA]. (2015). *Dietary Guidelines for Americans 2015-2020* (8th ed). https://health.gov/sites/default/files/2019-09/2015-2020_Dietary_Guidelines.pdf

University of Missouri. (n.d.). Threats to internal and external validity. Retrieved from geriatrictoolkit.missouri.edu/eb/threats.rtf

Utter, J., Larson, N., Laska, M. N., Winkler, M., & Neumark-Sztainer, D. (2018). Self-perceived cooking skills in emerging adulthood predict better dietary behaviors and intake 10 years later: A longitudinal study. *Journal of Nutrition Education and Behavior, 50*(5), 494-500. https://doi.org/10.1016/j.jneb.2018.01.021

Valdez, Z., Ramirez, A. S., Estrada, E., Grassi, K., &Nathan, S. (2016). Community perspective on access to and availability of healthy food in rural, low-resource, Latino communities. *Preventing Chronic Disease*, *13*(E170). Https://doi.org.105888/pcd13.160250

Vogel, C., Abbott, G., Ntani, G., Barker, M., Cooper, C., Moon, G., Ball, K., & Baird, J. (2019). Examination of how food environment and psychological factors interact in their relationship with dietary behaviours: Test of a cross-sectional model. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(12). https://doi.org/10.1186/s12966-019-0772-y

Williams L., Ball, K., & Crawford, D. (2010). Why do some socioeconomically disadvantaged women eat better than others? An investigation of the personal, social, and environmental correlates of fruit and vegetable consumption. *Appetite*, *55*, 441-446. https://doi.org/10.1016/j.appet.2010.08.004

Wolfson, J. A., Bleich, S. N., Smith, K. C., & Frattaroli, S. (2016). What does cooking mean to you?: Perceptions of cooking and factors related to cooking behavior. *Appetite*, *97*, 146-154. http://dx.doi.org/10.1016/j.appet.2015.11.030

World Health Organization. (2020). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail.obesity-and-overweight

Xia, X., Chen, W., Li, J., Chen, X., Rui, R., Liu, C., Sun, Y., Liu, L., Gong, J., & Yuan, P. (2014). Body mass index and risk of breast cancer: A nonlinear dose-response meta-analysis of prospective studies. *Scientific Reports*, *4*. https://doi.org/10.1038/srep07480

Xue, H., Liu, J., Cheskin, L. J., & Sheppard, V. B. (2020). Discrepancy between perceived diet quality and actual diet quality among US adult cancer survivors. *European Journal of Clinical Nutrition*. https://doi.org/10.1038/s41430-020-0619-2

Zhou, G., Gan, Y., Hamilton, K., & Schwarzer, R. (2017). The role of social support and self-efficacy for planning fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, *49*(2), 100-106. https://doi.org/10.1016/j.jneb.2016.09.005

Appendix A: Sample of the Strong Women Follow-up Survey Instrument

Version of strong women follow-up survey

SECTION D: NUTRITION AND FOOD

Section D-1: Nutrition and Eating

D-1.1 Over the **last month**, how many times per month, week, or day did you drink 100% juice such as orange, apple, grape, or grapefruit juice? **Do not count** fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all mealtimes and between meals.

- ☐1 1-3 times last month
- ☐2 1-2 times per week
- ☐3 3-4 times per week
- ☐4 5-6 times per week
- ☐5 1 time per day
- ☐6 2 times per day
- ☐7 3 times per day
- ☐8 4 times per day
- ☐9 5 or more times per day
- ☐10 Never (Skip to D-1.3)

Each time you drank 100% juice, how much did you usually drink? D-1.2

- ☐1 Less than 3/4 cup (less than 6 ounces)
- ☐2 3/4 to 1 1/4 cups (6 to 10 ounces)
- ☐3 1 1/4 to 2 cups (10 to 16 ounces)
- ☐4 More than 2 cups (more than 16 ounces)

D-1.3 Over the **last month**, how many times per month, week, or day did you eat fruit? Count any kind of fruit-fresh, canned, and frozen. **Do not count** juices. Include fruit you ate at all mealtimes and for snacks.

- ☐$_{1}$ 1-3 times last month
- ☐$_{2}$ 1-2 times per week
- ☐$_{3}$ 3-4 times per week
- ☐$_{4}$ 5-6 times per week
- ☐$_{5}$ 1 time per day
- ☐$_{6}$ 2 times per day
- ☐$_{7}$ 3 times per day
- ☐$_{8}$ 4 times per day
- ☐$_{9}$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.5)

D-1.4 Each time you ate fruit, how much did you usually eat?

- ☐$_{1}$ Less than 1 medium fruit
- ☐$_{2}$ 1 medium fruit
- ☐$_{3}$ 2 medium fruits
- ☐$_{4}$ More than 2 medium fruits

D-1.5 Over the **last month**, how often did you eat lettuce salad (with or without other vegetables)?

- ☐$_{1}$ 1-3 times last month
- ☐$_{2}$ 1-2 times per week
- ☐$_{3}$ 3-4 times per week
- ☐$_{4}$ 5-6 times per week
- ☐$_{5}$ 1 time per day
- ☐$_{6}$ 2 times per day
- ☐$_{7}$ 3 times per day
- ☐$_{8}$ 4 times per day
- ☐$_{9}$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.7)

D-1.6 Each time you ate lettuce salad, how much did you usually eat?

- ☐1 About 1⁄2 cup
- ☐2 About 1 cup
- ☐3 About 2 cups
- ☐4 More than 2 cups

D-1.7 Over the **last month**, how often did you eat French fries or fried potatoes?

- ☐1 1-3 times last month
- ☐2 1-2 times per week
- ☐3 3-4 times per week
- ☐4 5-6 times per week
- ☐5 1 time per day
- ☐6 2 times per day
- ☐7 3 times per day
- ☐8 4 times per day
- ☐9 5 or more times per day
- ☐10 Never (Skip to D-1.9)

D-1.8 Each time you ate French fries or fried potatoes, how much did you usually eat?

- ☐1 Small order or less (About 1 cup or less)
- ☐2 Medium order (About 1 1⁄2 cups)
- ☐3 Large order (About 2 cups)
- ☐4 Super Size order (About 3 cups or more)
- ☐5 More than 1 Super Size Order

D-1.9 Over the **last month**, how often did you eat other white potatoes? Count baked, boiled, and mashed potatoes, potato salad, and white potatoes that were not fried.

- ☐$_1$ 1-3 times last month
- ☐$_2$ 1-2 times per week
- ☐$_3$ 3-4 times per week
- ☐$_4$ 5-6 times per week
- ☐$_5$ 1 time per day
- ☐$_6$ 2 times per day
- ☐$_7$ 3 times per day
- ☐$_8$ 4 times per day
- ☐$_9$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.11)

D-1.10 Each time you ate these potatoes, how much did you usually eat?

- ☐$_1$ 1 small potato or less (1⁄2 cup or less)
- ☐$_2$ 1 medium potato (1⁄2 to 1 cup)
- ☐$_3$ 1 large potato (1 to 11⁄2 cups)
- ☐$_4$ 2 medium potatoes (1 1⁄2 cup)
- ☐$_5$ More than 2 medium potatoes

D-1.11 Over the **last month**, how often did you eat cooked dried beans? Count baked bean soup, refried beans, pork and beans and other bean dishes.

- ☐$_1$ 1-3 times last month
- ☐$_2$ 1-2 times per week
- ☐$_3$ 3-4 times per week
- ☐$_4$ 5-6 times per week
- ☐$_5$ 1 time per day
- ☐$_6$ 2 times per day
- ☐$_7$ 3 times per day
- ☐$_8$ 4 times per day
- ☐$_9$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.14)

D-1.12 Each time you ate these beans, how much did you usually eat?

☐1 Less than 1/2 cup
☐2 1⁄2 to 1 cup
☐3 1 to 1 1⁄2 cups
☐4 More than 1 1⁄2 cups

D-1.13 Over the **last month**, how often did you eat other vegetables?

DO NOT COUNT:

- Lettuce salads
- White potatoes
- Cooked dried beans
- Vegetables in mixtures, such as in sandwiches, omelets, casseroles, Mexican dishes, stew, stir-fry, soups, etc.
- Rice

COUNT:

- All other vegetables-raw, cooked, canned, and frozen

☐1 1-3 times last month
☐2 1-2 times per week
☐3. 3-4 times per week
☐4 5-6 times per week
☐5 1 time per day
☐6 2 times per day
☐7 3 times per day
☐8 4 times per day
☐9 5 or more times per day
☐10 Never (Skip to D-1.15)

D-1.14 Each of these times that you ate other vegetables, how much did you usually eat?

☐1 Less than 1/2 cup
☐2 1⁄2 to 1 cup
☐3 1 to 2 cups
☐4 More than 2 cups

D-1.15 Over the **last month**, how often did you eat tomato sauce? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.

- ☐$_{1}$ 1-3 times last month
- ☐$_{2}$ 1-2 times per week
- ☐$_{3}$ 3-4 times per week
- ☐$_{4}$ 5-6 times per week
- ☐$_{5}$ 1 time per day
- ☐$_{6}$ 2 times per day
- ☐$_{7}$ 3 times per day
- ☐$_{8}$ 4 times per day
- ☐$_{9}$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.17)

D-1.16 Each time you ate tomato sauce, how much did you usually eat?

- ☐$_{1}$ Less than 1/4 cup
- ☐$_{2}$ About 1⁄2 cup
- ☐$_{3}$ About 1 cup
- ☐$_{4}$ More than 1 cup

D-1.17 Over the **last month**, how often did you eat vegetable soups? Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.

- ☐$_{1}$ 1-3 times last month
- ☐$_{2}$ 1-2 times per week
- ☐$_{3}$ 3-4 times per week
- ☐$_{4}$ 5-6 times per week
- ☐$_{5}$ 1 time per day
- ☐$_{6}$ 2 times per day
- ☐$_{7}$ 3 times per day
- ☐$_{8}$ 4 times per day
- ☐$_{9}$ 5 or more times per day
- ☐$_{10}$ Never (Skip to D-1.19)

D-1.18 Each time you ate vegetable soup, how much did you usually eat?

- ☐1 Less than 1cup
- ☐2 1 to 2 cups
- ☐3 2 to 3 cups
- ☐4 More than 3 cups

D-1.19 Over the **last month**, how often did you eat mixtures that included vegetables? Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.

- ☐1 1-3 times last month
- ☐2 1-2 times per week
- ☐3 3-4 times per week
- ☐4 5-6 times per week
- ☐5 1 time per day
- ☐6 2 times per day
- ☐7 3 times per day
- ☐8 4 times per day
- ☐9 5 or more times per day
- ☐10 Never (Skip to D-1.21

Section D-2: Nutrition-Related Social Support and Self-Efficacy

D-2.1 Please list your closest adult friends and family members. Start the list with the people you spend the most time with outside of work hours. Fill in your relationship with that person and answer the following statements below by writing **YES** or **NO** in the boxes.

#	Relationship (e.g. spouse, friend, cousin, etc.)	This person is overweight. Yes or No	This person eats a healthy diet all or most of the time. Yes or No	This person lives a physically active lifestyle. Yes or No
Example: My husband		Yes	No	Yes
1				

2				
3				
4				
5				
6				
7				
8				
9				
10				

D-2.2 Please rate each question twice. Under family, rate how often anyone living in your household has said or done what is described during the last three months. Under friends, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months. Please select **one number** (1-5) corresponding to the word choices above it. **Place an X in the box for questions that do not apply.**

Never	**Rarely**	**A few times**	**Often**	**Very Often**	**Does not Apply**
1	**2**	3	4	**5**	**X88**

	Family	Friends
Example: Helped me make an exercise plan.	4	X
a. Encouraged me not to eat "unhealthy foods" (cake, salted chips).		
b. Discussed my eating habit changes with me (asked me how I'm doing with eating healthy).		
c. Reminded me not to eat high fat, high salt foods.		
d. Complimented me on changing or maintaining my healthy eating habits ("Keep it up", "We are proud of you").		
e. Commented if I seemed to be reverting to unhealthy eating.		
f. Ate high fat or high salt foods in front of me.		
g. Refused to eat the healthy foods I was eating.		
h. Brought home foods I'm trying not to eat.		
i. Got angry when I encouraged them to eat low salt, low fat foods.		
j. Offered me food I'm trying not to eat.		

D-2.3 Whether you are trying to change your eating habits or not, please rate how confident you are that you could motivate yourself to do things like these consistently, for at least six months. **Put an X in the box to indicate your answer.**

	Not at all confident	Somewhat confident	Moderately confident	Very confident	Completely confident	Don't Know
a. Eat fruits and/or vegetables every day at most meals.	1	2	3	4	5	88
b. Include more "healthy" fats in your diet.	1	2	3	4	5	88
c. Eat more 100% whole grain foods.	1	2	3	4	5	88
d. Eat more low-and nonfat dairy products.	1	2	3	4	5	88
e. Stick to low fat, low salt foods when you feel depressed, bored, or tense.	1	2	3	4	5	88
f. Stick to low fat, low salt foods when there is high fat, high salt food readily available (e.g. at a party).	1	2	3	4	5	88
g. Stick to low fat, low salt foods when dining with friends or co-workers.	1	2	3	4	5	88
h. Stick to low fat, low salt foods when you are alone, with no one to watch you.	1	2	3	4	5	88
i. Eat smaller portions.	1	2	3	4	5	88

j. Eat salads for lunch.	1	2	3	4	5	88
k. Avoid adding salt at the table.	1	2	3	4	5	88
l. Skip dessert, even if other people are eating it.	1	2	3	4	5	88
m. Substitute low or non-fat milk for whole milk.	1	2	3	4	5	88
n. Cut down on gravies and cream sauce.	1	2	3	4	5	88
o. Eat baked or grilled poultry and fish instead of red meat at dinner.	1	2	3	4	5	88
p. Cook from basic ingredients (e.g. fresh vegetables, whole grains, raw chicken).	1	2	3	4	5	88

Section D-3: Cooking, Preserving and Producing

The next few questions ask about cooking at home, preparing food, and gardening in your household.

D-3.1 Indicate the extent to which you feel confident about performing each of the following activities at home using basic preparation and cooking techniques. **Put an X in the box to indicate your answer.**

	Not at all confident	Somewhat confident	Moderately confident	Very confident	Completely confident	Don't Know

a. Chopping and slicing by hand (basic knife skills)	1	2	3	4	5	88
b. Steaming	1	2	3	4	5	88
c. Sautéing or stir-frying	1	2	3	4	5	88
d. Grilling	1	2	3	4	5	88
e. Poaching or stewing	1	2	3	4	5	88
g. Baking or roasting	1	2	3	4	5	88
j. Preparing fresh or frozen green vegetables (e.g. spinach)	1	2	3	4	5	88
k. Preparing root vegetables (e.g. potatoes, beets)	1	2	3	4	5	88
l. Preparing fruit (e.g. watermelon)	1	2	3	4	5	88
m. Using herbs and spices (e.g. basil, cayenne pepper)	1	2	3	4	5	88

D-3.2 Indicate the degree to which you agree or disagree with each statement. **Put an X in the box to indicate your answer.**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
a. I don't like to cook because it takes too much time.	5	4	3	2	1	88
b. Cooking is an expression of my creativity.	5	4	3	2	1	88
c. It is too much work to cook.	5	4	3	2	1	88

d. Cooking is fun and/or relaxing.	5	4	3	2	1	88
e. I find cooking tiring or frustrating.	5	4	3	2	1	88
f. I don't like to cook because I don't know how.	5	4	3	2	1	88
g. I have access to decent quality pans/pots, knives, and other cooking tools on hand if I want to cook my food.	5	4	3	2	1	88

D-3.3 Who does the cooking in your household on MOST days of the week? **Check only one.**

☐1 I do

☐2 My spouse does

☐77 Other (please specify): _____

The next questions ask about **preserving and producing food** (by you or someone in your household).

D-3.4 Do you can/jar, freeze, dry, or preserve food another way?

☐1 Yes

☐0 No (Skip to D-3.7)

D-3.5 What do you typically preserve? **Put an X in the box to indicate your answer.**

	Can	**Freeze**	**Dry**	**Smoke**	**Other**	**I do NOT preserve this food**
a. Fruit	1	2	3	4	77	0
b. Vegetables	1	2	3	4	77	0
c. Meats	1	2	3	4	77	0

d. Fish	1	2	3	4	77	0
e. Other _____	1	2	3	4	77	0

D-3.6 Why do you preserve food? **Check all that apply.**

☐1 Cost

☐2 Tradition

☐3 To have local foods year-round

☐4 Because there is too much to eat when it's in season

☐77 Other (specify): _____

D-3.7 In the past 2 years, have you grown or produced food (e.g. vegetables, herbs, fruit, milk, poultry, rabbit, fish, etc.)?

☐1 Yes

☐0 No (Skip to Section D-4)

D-3.8 Where do you grow or produce food? **Put an X in the box to indicate your answer. Check all that apply.**

	At home, inside	**At home, outside** (includes greenhouse)	**Community garden/space**	**Other**	**I do NOT produce this food**
a. Vegetables, herbs, fruit	1	2	3	77	0
b. Eggs or milk	1	2	3	77	0
c. Meat, poultry, rabbit	1	2	3	77	0
d. Fish	1	2	3	77	0

D-3.9 Do you sell or trade/barter any food that you produce for money, goods, or services?

☐1 Yes
☐0 No

Section D-4: Food Environment. The following questions ask about the availability, cost, and quality of food ***in your community***. This includes any stores or markets where you shop for food, including grocery stores, supermarkets, farmers market, pharmacy, Dollar Store, Wal-Mart, etc. Community is defined as the place where you live, including your neighborhood and the neighborhoods within a **30-minute walk OR 5-10 minute drive from your home** .

D-4.1 Please indicate whether you agree with the following statements. **Put an X in the box to indicate your answer.**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
a. It is easy to purchase fresh fruits and vegetables in my community	5	4	3	2	1	88
b. There is a large selection of fresh fruits and vegetables in my community	5	4	3	2	1	88
c. The produce in my community is of high quality	5	4	3	2	1	88
d. It is easy to purchase low-fat products (such as low fat milk or lean meats) in my community	5	4	3	2	1	88
e. There is a large selection of low-fat products available in my community	5	4	3	2	1	88
f. The low-fat products in my community are of high quality	5	4	3	2	1	88

D-4.2 How would you rate the cost of fresh fruits and vegetables where you shop?

☐3 Very expensive
☐2 Somewhat expensive
☐1 Not expensive

D-4.3 Does the cost of fresh fruits and vegetables keep you from buying them?

☐1 Never
☐2 Rarely
☐3 Sometimes
☐4 Often

D-4.4 Please tell us about the ***unique*** strengths and weaknesses in your community that positively or negatively influence your healthy eating or healthy food choices?

Strengths:
Weaknesses:

D-4.5 How often do you obtain food for yourself or family from the following places/methods?

Put an X in the box to indicate your answer.

	Never	**Rarely** (Less than once a month)	**Sometimes** (1-2 times a month)	**Often** (3+ times a month)	**Don't Know/ Not Sure**
a. Supermarket	1	2	3	4	88
b. Wal-Mart	1	2	3	4	88
c. Convenience Store such as quick stops or minute marts	1	2	3	4	88

d. Small grocery store or market	1	2	3	4	88
e. Bakery	1	2	3	4	88
f. Farmer's market or produce store	1	2	3	4	88
g. Pharmacy	1	2	3	4	88
h. Dollar Store (or similar)	1	2	3	4	88
i. Neighbors "store" inside their home	1	2	3	4	88
j. Neighborhood food cart, truck, or carriage	1	2	3	4	88
k. Seasonal roadside food stand	1	2	3	4	88
l. Hunting or fishing	1	2	3	4	88
m. Other: please describe type and frequency:					

Section E-2: Sociodemographic and Other Factors

E-2.1 What is your date of birth (month and year only)?
__ __ Month __ __ __ __ Year

E-2.2 What is your gender?

☐$_1$ Female
☐$_2$ Male

E-2.3 Are you Hispanic, Latino, or Spanish origin?

☐$_1$ Yes
☐$_0$ No

E-2.4 What is your race? Choose one or more.

- ☐$_1$ White
- ☐$_2$ Black/African American
- ☐$_3$ Native Hawaiian/Other Pacific Islander
- ☐$_4$ Asian
- ☐$_5$ American Indian/Alaska Native
- ☐$_{77}$ Other (please specify): _____

E-2.5 Are you:

- ☐$_1$ Married
- ☐$_2$ A member of an unmarried couple
- ☐$_3$ Divorced
- ☐$_4$ Widowed
- ☐$_5$ Separated
- ☐$_6$ Never been married

E-2.6 Do you live alone?

- ☐$_1$ Yes (Skip to E-2.8)
- ☐$_0$ No

E-2.7 How many adults and/or children live in your household with you?

__ __ Adults
__ __ Children (18 years of age and younger)

E-2.8 What is your annual household income from all sources?

- ☐$_1$ a. Less than $ 14,999
- ☐$_2$ b. Between $ 15,000 and $24,999
- ☐$_3$ c. Between $ 25,000 and $34,999
- ☐$_4$ e. Between $ 35,000 and $49,999
- ☐$_5$ f. Between $ 50,000 and $74,999
- ☐$_6$ g. Between $ 75,000 and $99,999
- ☐$_7$ h. Between $ 100,000 and $149,999
- ☐$_8$ i. $150,000 or more

E-2.9 What is the highest grade or year of school you completed?

- ☐1 Eighth grade or less
- ☐2 Some high school
- ☐3 High school or GED certificate
- ☐4 Technical or vocational school
- ☐5 Some college
- ☐6 College graduate
- ☐7 Post grad or professional degree

E-2.10 Are you currently (answer the one that best describes you):

- ☐1 Employed (full-time)
- ☐2 Employed (part-time)
- ☐3 Out of work for more than 1 year
- ☐4 Out of work for less than 1 year
- ☐5 A homemaker
- ☐6 A student
- ☐7 Retired
- ☐8 Unable to work

E-2.11 How many motor vehicles in working order (e.g. cars, trucks, motorcycles) are there at your household?

____ Motor Vehicles

☐88 Don't know/Not sure

Appendix B: Authorization to use Strong Women Follow-up Survey

Verification of Permission to use Version of Strong Women Follow-Up Survey

Subject: Re: Permission to use the Strong Women Follow-up Study
Date: Sunday, May 3, 2020 at 2:06:37 PM Mountain Daylight Time
From: Brian Lo
To: Erin Norman
Attachments: StrongWomen Follow-up survey for Erin Norman.pdf

Hi Erin,

Sorry for the delay. You will find the requested items in the attached pdf. We request you to cite our work accordingly if you decided to use any of these items.

Let me know if you have any further questions, and good luck to your work.

Best,
Brian

From: Erin Norman [redacted]
Sent: Monday, April 27, 2020 4:07 PM
To: Brian Lo [redacted]
Subject: Re: Permission to use the Strong Women Follow-up Study

Hi Brian,

Yes, I am planning on using the intrapersonal, interpersonal, and environmental levels of the SEM. My variables are self-efficacy, cooking skills, perceived social support, and percieved cost, access, and quality.

Thank you,

Erin Norman

From: Brian Lo [redacted]
Sent: Monday, April 27, 2020 12:50 PM
To: Erin Norman [redacted]
Subject: Re: Permission to use the Strong Women Follow-up Study

Hi Erin,

Thanks for reaching out and I hope you are doing well. Would you mind telling me which portions (i.e. constructs) of our survey that you are specifically looking for?

Best,
Brian

Appendix C: Research Questions by Level of the Socioecological Model

Research Questions That Address Each of the Levels of the Socioecological Model

RESEARCH QUESTIONS BY LEVEL OF THE SOCIOECOLOGICAL MODEL

Intrapersonal Questions:

RQ1- Quantitative: To what degree is healthy eating self-efficacy a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 1_1$-Healthy eating self-efficacy is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 1_1$-Healthy eating self-efficacy is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 1_2$-Healthy eating self-efficacy is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

$H_a 1_2$-Healthing eating self-efficacy is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

RQ2- Quantitative: To what degree is cooking confidence a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

$H_0 2_1$- Cooking confidence is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_a 2_1$- Cooking confidence is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

$H_0 2_2$- Cooking confidence is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

H_a2_2- Cooking confidence is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

RQ3- Quantitative: To what degree is perceived family support a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_03_1- Perceived family support is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_a3_1- Perceived family support is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_03_2- Perceived family support is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

H_a3_2- Perceived family support is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

RQ4- Quantitative: To what degree is perceived access to fruits and vegetables a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_04_1- Perceived access to fruits and vegetables is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_a4_{1-} Perceived access to fruits and vegetables is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_04_2- Perceived access to fruits and vegetables is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

H_a4_2- Perceived access to fruits and vegetables is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

RQ5- Quantitative: To what degree is perceived cost a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_05_1- The perceived cost of fruits and vegetables is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_a5_1- The perceived cost of fruits and vegetables is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_05_2- The perceived cost of fruits and vegetables is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

H_a5_2- The perceived cost of fruits and vegetables is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

RQ6- Quantitative: To what degree is perceived quality of fruits and vegetables a determinant of fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_06_1- Perceived quality is not a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_a6_1- Perceived quality is a significant determinant of fruit consumption among adults in the panhandle of Nebraska.

H_06_2- Perceived quality is not a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

H_a6_2- Perceived quality is a significant determinant of vegetable consumption among adults in the panhandle of Nebraska.

Additional Question

RQ7- Quantitative: To what degree are healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, predictors of fruit and vegetable consumption among adults in the panhandle of Nebraska?

H_07_1- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of fruit consumption among adults in the panhandle of Nebraska.

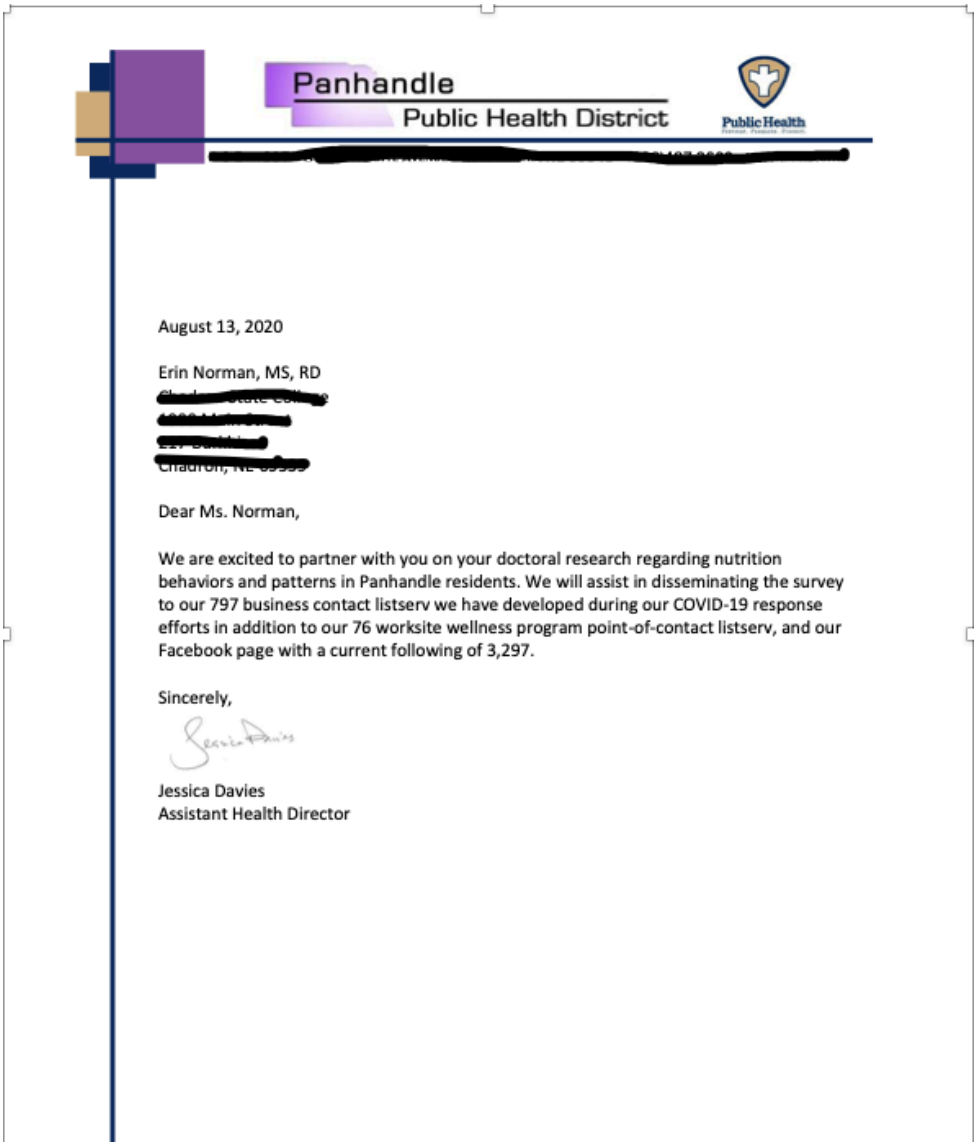
H_a7_1- Healthy eating self-efficacy, perceived cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are predictors of fruit consumption among adults in the panhandle of Nebraska.

H_07_2- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are not predictors of vegetable consumption among adults in the panhandle of Nebraska.

H_a7_2- Healthy eating self-efficacy, cooking confidence, perceived family support, perceived access, perceived cost, and perceived quality, are predictors of vegetable consumption among adults in the panhandle of Nebraska.

Appendix D: Authorization Letter from Panhandle Public Health District

Verification of Permission to use Panhandle Public Health Department's Facebook Platform and Listservs for survey distribution.



Panhandle
Public Health District

Public Health

August 13, 2020

Erin Norman, MS, RD
[redacted]

Dear Ms. Norman,

We are excited to partner with you on your doctoral research regarding nutrition behaviors and patterns in Panhandle residents. We will assist in disseminating the survey to our 797 business contact listserv we have developed during our COVID-19 response efforts in addition to our 76 worksite wellness program point-of-contact listserv, and our Facebook page with a current following of 3,297.

Sincerely,

Jessica Davies
Assistant Health Director

Appendix E: Data Conversion Steps for Independent and Dependent Variables

Calculation of Dependent Variables

1. Per the National Cancer Institute's Scoring the All-Day Screener document, I assumed that the skipping of a *Frequency of intake for individual foods* question meant that they did not eat that food. Therefore these were replaced with a 10 which means never, and 0 for the portion size. See the All-Day Screener Scoring Document: https://epi.grants.cancer.gov/diet/screeners/fruitveg/scoring/allday.html
2. Frequency of Juice, Fruit, Lettuce salad, French Fries, Other White Potatoes, Dried Beans, Other Vegetables, Tomato Sauce, and Vegetable Soups consumption were all individually transformed to the following values per directions from the All-Day Screener Scoring tool. https://epi.grants.cancer.gov/diet/screeners/fruitveg/scoring/allday.html

Frequency Response	Times Per Day
Never	0.0
1-3 times per month	0.067
1-2 times per week	0.214
3-4 times per week	0.5
5-6 times per week	0.786
1 time per day	1.0
2 times per day	2.0
3 time per day	3.0
4 times per day	4.0
5 or more times per day	5.0

3. Volume or how much of Juice, Fruit, Lettuce salad, French Fries, Other White Potatoes, Dried Beans, Other Vegetables, Tomato Sauce, and Vegetable Soups consumption as assigned the cup equivalents for each portion size categories per directions from the All-Day Screener Scoring tool. https://epi.grants.cancer.gov/diet/screeners/fruitveg/scoring/allday.html

	MyPyramid Cup Equivalents for each Portion Size Category			
Food	**1**	**2**	**3**	**4**
Juice	.5	1.0	1.625	2.5
Fruit (units)	.25	.5	1.0	1.5

Food	MyPyramid Cup Equivalents for each Portion Size Category			
	1	2	3	4
Fruit (cups)	.25	.5	1.0	1.5
Lettuce salad	.25	.5	1.0	1.5
French fries	.2	.5	.75	1.3
Other white potatoes	.25	.75	1.2	2.0
Dried beans	.25	.75	1.25	2.0
Other vegetables	.25	.75	1.5	2.25
Tomato sauce	.25	.5	1.0	1.5
Vegetable soups	.3	1.0	1.6	2.25

4. The following variable transfers were computed to such following the use of the All-day Screener Scoring.
   For example, under the variable Juice if a participant reported consuming juice "3-4 times per week" the value label would be a 3. This variable was then converted to 0.5 per use of the All-Day Screening Scorer under the new variable name Juice2.
   HowMuchJuice was also converted using the All-Day Screening Scorer. For example, under the variable HowMuchJuice if a participant reported consuming "3/4 to 1 ¼ cups (6 to 10 ounces)" the value label would be a 2. This variable was then converted to 1 cup per use of the All-DayScreening Scorer under the new variable name HowMuchJuice2. The same steps were taken to convert the variables listed below.
   a. Juice → Juice2
   b. HowMuchJuice →HowMuchJuice2
   c. Fruit→Fruit2
   d. HowMuchFruit→HowMuchFruit2
   e. Lettuce→Lettuce2
   f. HowMuchLettuce→HowMuchLettuce2
   g. FFries→FFries2
   h. HowMuchFFries→HowMuchFFries2
   i. OtherPotatoes→OtherPotatoes2
   j. HowmuchOtherPot→HowMuchOtherPot2
   k. DriedBeans→DriedBeans2
   l. HowMuchBeans→HowMuchBeans2
   m. Vegetables→Vegetables2
   n. HowMuchVeg→HowMuchVeg2
   o. TomSauce→TomSauce 2
   p. HowMuchTomSauce2 →HowMuchTomSauce 2
   q. VegSoup→VegSoup2
   r. HowMuchVegSoup→HowMuchVegSoup2

5. The following calculations were then conducted to generate the amount in cups of each fruit or vegetable category.
    a. Juice2 x HowMuchJuice2= DailyJuiceConsumed
    b. Fruit2 x HowMuchFruit2 = DailyFruitConsumed
    c. Lettuce2 x HowMuchLettuce2 = DailyLettuceConsumed
    d. FFries2 x HowMuchFFries2= DailyFFriesConsumed
    e. OtherPotatoes2 x HowMuchOtherPot2= DailyOtherPotatoesConsumed
    f. DriedBeans2 x HowMuchBeans2 = DailyDriedBeansConsumed
    g. Vegetables2 x HowMuchVeg2= DailyVegetablesConsumed
    h. TomSauce 2 x HowMuchTomSauce 2 = DailyTomatoSauceConsumed
    i. VegSoup2 x HowMuchVegSoup2 = DailyVegSoupConsumed

6. The daily fruit and fruit juice consumption were added together to produce the dependent variable = Total Fruit Consumption

7. Daily vegetable consumption was calculated by adding the DailyVegSoupConsumed + DailyTomatoSauceConsumed, + DailyVegetablesConsumed + DailyDriedBeansConsumed, + DailyOtherPotatoesConsumed + DailyFFriesConsumed + DailyVegetablesConsumed =TotalVegetableConsumption

Calculations of Independent Variables

1. Healthy Eating Self-efficacy

    A. Healthy Eating Self-efficacy was calculated using section D-2.3 a through p. These 16 questions were renamed under the following variable labels.
    D 2.3a → HLTHEATSE1
    D 2.3b → HLTHEATSE2
    D 2.3c → HLTHEATSE3
    D 2.3d → HLTHEATSE4
    D 2.3e → HLTHEATSE5
    D 2.3f → HLTHEATSE6
    D 2.3g → HLTHEATSE7
    D 2.3h → HLTHEATSE8
    D 2.3i → HLTHEATSE9
    D 2.3j → HLTHEATSE10
    D 2.3k → HLTHEATSE11
    D 2.3l → HLTHEATSE12
    D 2.3m → HLTHEATSE13
    D 2.3n → HLTHEATSE14

D 2.3o → HLTHEATSE15
D 2.3p → HLTHEATSE16

B. HLTHEATSE1-16 were added together and then divided by 16 to calculate a mean healthy eating self-efficacy score. Variable label = MeanHLTHeatingSE
C. Higher scores were associated with higher healthy eating self-efficacy.

2. Cooking Confidence

A. Cooking Confidence was calculated using section D-3.1a through m. These 10 questions were renamed under the following variable names.

D3.1a→CC1
D3.1b→CC2
D3.1c→CC3
D3.1d→CC4
D3.1e→CC5
D3.1f→CC6
D3.1g→CC7
D3.1h→CC8
D3.1i→CC9
D3.1j→CC10

B. CC1-10 were added together and then divided by 10 to calculate a cooking confidence score. Variable label = MeanCookConf
C. Higher scores were associated with higher perceived cooking confidence.

3. Mean Family Support

A. Family Support was calculated using section D-2.2 a through j, but only the questions regarding family. Support from friends was omitted from the equation. The 10 family support questions were renamed under the following variable names.

B. D2.2a →FAMENC1
D2.2b→FAMENC2
D2.2c →FAMENC3
D2.2d →FAMENC4
D2.2e →FAMENC5
D2.2f →FAMDIS1
D2.2g →FAMDIS2
D2.2h →FAMDIS3

D2.2i →FAMDIS4
D2.2j →FAMDIS5

D. FAMENC1-5 were added together and then divided by 5 to calculate a mean family encouragement score. Variable label = MeanFamENC
E. FAMDIS1-5 were added together and then divided by 5 to calculate a mean family encouragement score. Variable label = MeanFamDIS
F. A score for each subscales was used where a high score indicated greater family encouragement or discouragement.

4. Food Access

A. Food Access was calculated using section D-4.1 question a. The question was renamed under the following variable name: FOODaccess1
B. Value Labels
   1.0 = Strongly Disagree
   2.0 = Disagree
   3.0 = Neutral
   4.0 = Agree
   5.0 = Strongly Agree
   6.0 = Don't know
C. Higher scores were associated with higher perceived access to F/V.

5. Food Quality

A. Food Quality was calculated using section D -4.1 question c. The question was renamed under the following variable name: FOODquality1
B. Value Labels
   1.0 = Strongly Disagree
   2.0 = Disagree
   3.0 = Neutral
   4.0 = Agree
   5.0 = Strongly Agree
   6.0 = Don't know
C. Higher scores were associated with higher perceived access to F/V.

D. Food Cost

A. Food cost was calculated using question D -4.3. The question was renamed under the following variable name: COST
B. Value Labels
   1.0 = Often
   2.0 = Sometimes

3.0 = Rarely
4.0 = Never