2018

Life Chaos as a Predictor of Diet Quality in U.S. Adults

HEIDI Barbara Buchert Egan
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

Heidi Buchert Egan

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Derrick Copper, Committee Chairperson, Psychology Faculty
Dr. Keely Cline, Committee Member, Psychology Faculty
Dr. Thomas Edman, University Reviewer, Psychology Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2018

Abstract

Life Chaos as a Predictor of Diet Quality in U.S. Adults

by

Heidi Buchert Egan

MS, Walden University, 2015

MS, New York Chiropractic College, 2008

BS, Brigham Young University, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Psychology

Walden University

August 2018

Abstract

Poor diet quality is a source of morbidity and mortality within the United States. Previous researchers have examined psychosocial influences on diet; however, the relationship between life chaos, a psychosocial measure, and diet quality was not known. The purpose of this cross-sectional survey study was to use the Life Chaos Scale and the Healthy Eating Index–2010 to collect data on life chaos and diet quality, consistent with the biopsychosocial model of health, from a sample of 103 U.S. adults. Regression analysis was used to construct a predictive model. According to the study results, life chaos was not a significant predictor of diet quality ($p = .699$), although household income, when added to the model, was a predictor of diet quality ($p = .011$). Although there was no relationship between life chaos and diet quality, life chaos could be found universally throughout household income levels. Additionally, diet quality had a negative correlation with household income. Life chaos was not a significant predictor of diet quality, while confirming the role of income in diet quality. As inequalities of health and nutrition continue to be better understood through studies such as this, social change efforts can be targeted in an evidence-based way to bring the health benefits of a high quality diet to more Americans starting with greater outreach to low-income individuals.

Life Chaos as a Predictor of Diet Quality in U.S. Adults

by

Heidi Buchert Egan

MS, Walden University, 2015

MS, New York Chiropractic College, 2008

BS, Brigham Young University, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Psychology

Walden University

August 2018

Dedication

To my father and mother for their unceasing faith in my abilities in spite of years of contrary evidence.

For my daughters and son for their patience and support. If all you got from this was the ability to cook and clean, it was well worth it.

To my husband, the best cheerleader, editor, and sounding board I could ever hope for.

Many thanks to my brother Chris for his mad coding skills. You are right: everyone should know how to code. I'm ready to learn now.

With genuine gratitude and deepest regard to my dream team committee: Dr. Copper, Dr. Cline, and Dr. Edman. I am a better scholar, and a better educator because of you.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Diet quality is a measure of nutritional adequacy within a person's general food intake (Skibicky, 2011). Diet quality in the United States is poor, in spite of decades of public health campaigns educating the public in this area (Hiza, Casavale, Guenther, & Davis, 2013). Simultaneously, diet-related diseases in the United States are on the rise, with half of the adult population in the United States having a preventable, diet-related disease, and one quarter of the adult population suffering from multiple diet-related diseases (Ward, Schiller, & Goodman, 2014). Furthermore, more than 70% of U. S. adults are overweight or obese (National Center for Health Statistics, 2016). Improving diet quality is an essential element of efforts to reduce these diseases; however, there is still much to learn about diet quality.

Although there has been a growing understanding of the psychosocial influences on diet, there is a dearth of research on the relationship between life chaos on diet quality. Life chaos is the microenvironment of an adult, and it includes daily routines, personal organization, life stability, and the ability to make plans and keep appointments (Smolderen & Whooley, 2013; Viswanath, Wilkerson, Breckenridge, & Selwyn, 2016; Wong, Sarkisian, Davis, Kinsler, & Cunningham, 2007; Zullig et al., 2013). The focus of this study was on the potential link between life chaos and diet quality. I extended the knowledge in the discipline of diet quality research by determining if life chaos was a significant predictor of diet quality.

There was potential for social change from this research: significant findings could assist diet-related public health efforts to include training and support to stabilize individuals who are at risk of life chaos. Increasing the understanding of the influence of life chaos on diet will provide more effective behavioral change programs and better public health campaigns. Understanding the significance of life chaos on diet quality could lead to increased emphasis on household and personal management as part of diet regulation and diet-related disease control.

In this chapter, I will offer a background of this subject, the problem statement, and the purpose of this study to address the problem. I will also outline the research questions and hypotheses. I will provide a review of the theoretical foundation upon which this study is rooted, as well as a brief description of the nature of the study. Next, I will offer definitions of the key terms used in this study, an explanation of the assumptions of this study, and an overview of the scope and delimitations. Finally, I will describe the limitations of this study and explain the significance of this study within the field of diet quality research.

Background

Although there is a paucity of research linking life chaos and diet quality, there is a significant body of literature on these subjects individually. In this section, I will summarize the literature regarding diet quality and then provide a summary of the literature on life chaos. I will then identify the gap in the knowledge that this study will address. Finally, I will end this section explaining why this study is needed.

Diet Quality

There is not a universal definition for the term diet quality (Reedy et al., 2014). The reason for this lack of definition is in part due to the different methods of studying diet (Alkerwi, 2014; Elmadfa & Meyer, 2012; Ocké, 2013), but also due to the multifactorial nature of diet (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). Current practice is to define diet quality based on whichever measurement tool is being used (Bibiloni, Pons, & Tur, 2015; Chiuve et al., 2012; Collins, Lacy, Campbell, & McNaughton, 2016; Guenther et al., 2013b; Vyncke et al., 2013). This practice is not without reason: the tools used to measure diet quality are designed and developed by multidisciplinary committees with a mix of research, clinical, and practical backgrounds (Guenther et al., 2014; Guenther, Reedy, & Krebs-Smith, 2008). Many of these tools will be described in Chapter 2.

In this study, I measured diet quality using the Healthy Eating Index (HEI) – 2010, which is a measure of dietary adherence to the Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). Within this study, diet quality was defined as how closely a person's diet reflects the Dietary Guidelines for Americans. The HEI has been used in two main ways. It is the tool used by governmental agencies to monitor diet quality in the U.S. population as part of ongoing public health research (Guenther et al., 2013a). It is also used to assess the protective nature of diet against disease (Chiuve et al., 2012; Fulgoni, Chu, O'Shea, Slavin, & DiRienzo, 2015; Reedy et al., 2014), thus enabling the mandatory refinement

of the Dietary Guidelines for Americans every 5 years (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015).

Diet quality measures are also used to better understand psychosocial predictors of diet. Some of these psychosocial influences include the cost of food (Rehm, Monsivais, & Drewnowski, 2015), stress (Groesz et al., 2012; Roohafza, Sarrafzadegan, Sadeghi, & Rafieian-Kopaei, 2013; Tryon, DeCant, & Laugero, 2013), local food environment (Carroll-Scott et al., 2013; Caspi, Sorensen, Subramanian, & Kawachi, 2012), mealtime culture (Fiese, Hammons, & Grigsby-Toussaint, 2012; Fiese, Jones, & Jarick, 2015; Fulkerson et al., 2014), sleep patterns (Quick et al., 2015), emotional state (Canetti, Bachar, & Berry, 2002), and household income (da Fonseca, 2014; Leung et al., 2012; Robaina & Martin, 2013). Cogent to this study, the psychosocial influence of life chaos has not yet been studied in relation to diet quality.

Life Chaos

Life chaos is a construct that pertains to the microenvironment of an adult, consisting of daily routine, personal organization, life stability, and the ability to make and keep appointments (Smolderen & Whooley, 2013; Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013). The study of life chaos is a recent outgrowth of the study of household chaos and, as such, cannot be discussed without also addressing its antecedent construct. Like life chaos, household chaos represents a microenvironment; however, household chaos focuses on the microenvironment and dynamic of a home rather than an individual (Matheny, Wachs, Ludwig, & Phillips, 1995). Like life chaos, household chaos is multifaceted in nature, with noise, order, crowding, family stability, and routines

among the aspects that construct encompasses (Coldwell, Pike, & Dunn, 2006; Deater-Deckard, Chen, Wang, & Bell, 2012; Johnson, Martin, Brooks-Gunn, & Petrill, 2008; Levin, Kichler, & Polfuss, 2013; Matheny et al., 1995). However, unlike life chaos, research on household chaos has almost exclusively been done in low-income, family settings. Although there has been speculation that household chaos is not income linked (Fiese, Gundersen, Koester, & Jones, 2016), there are no data to support such claims. By contrast, research on life chaos has covered a socioeconomic spread and found life chaos present in many socioeconomic strata (Crowley et al., 2015; Wong et al., 2007; Zullig et al., 2013).

To date, research on life chaos has focused on treatment adherence. Thus far, there have been two studies regarding life chaos and treatment adherence in heart disease and post myocardial infarction (Crowley et al., 2015; Zullig et al., 2013), five studies that correlate life chaos with HIV/AIDS treatment adherence (Horvath, Carrico, et al., 2013; Horvath, Oakes, et al., 2013; Kalichman & Kalichman, 2016; Wawrzyniak et al., 2015; Wong et al., 2007), and one study on the rate of life chaos with chronic health condition self-care after disruptive life events (Lauffenburger, Gagne, Song, Brill, & Choudhry, 2016). The literature also contains one study regarding the role of life chaos in men who engaged in transactional sex (Viswanath et al., 2016). At this time, there is no research concerning life chaos and diet quality. There is currently no published research on diet quality with the more studied construct of household chaos.

There is, however, research on household chaos and diet-related issues. Household chaos has been correlated with food insecurity (Fiese et al., 2016; Pinard,

Calloway, Fricke, & Yaroch, 2015), although there are mixed results on the correlation of diet quality and food insecurity (Gamba, Leung, Guendelman, Lahiff, & Laraia, 2016; Leung, Epel, Ritchie, Crawford, & Laraia, 2014). Household chaos is also associated with poor glucose control in children (Levin et al., 2013); however, it is still unclear if glucose control and diet quality are correlated (Schroeder, 2014). Additionally, household chaos has been negatively correlated with meal planning (Fiese et al., 2016), while meal planning has been positively correlated with diet quality in children (Chu, Storey, & Veugelers, 2014). There is a logical connection between diet quality and household chaos; however, it is not explicit.

I anticipated that this study would begin to fill several gaps in the research. First, although diet quality has been examined through many psychosocial lenses, it had not yet been examined through the lens of life chaos. Although the inability to plan and affect structure in a person's life (concepts inherent in life chaos) would negatively correlate with diet quality, there remain gaps in the research in this area. Second, although diet-related issues have been found to be related to household chaos, it has yet to be determined if this relationship is altered by household income because scholars have only focused on low-income households.

Income and chaos may work synergistically to negatively influence a desirable health outcome. For example, greater financial flexibility could protect against the potential effects of life chaos on diet quality, thus acting as a moderator of life chaos on diet quality. Poverty and life chaos increase the barriers to HIV treatment beyond what researchers expected from cumulative risk levels (Wawrzyniak et al., 2015). These

findings support the hypothesis of an interaction effect between household income and life chaos on as they relate to other health behaviors such as diet quality.

An alternative hypothesis for this interaction could be that life chaos acts as a mediator of household income on diet quality. The relationship between household income and diet quality could partially be accounted for through life chaos. Previous researchers have shown this type of mediation between poverty and chaos in predictions of HIV treatment adherence (Kalichman & Kalichman, 2016) and in the socioemotional development of teens (Evans, Eckenrode, & Marcynyszyn, 2008; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). Insufficient household income influenced their respective outcomes (HIV treatment adherence and socioemotional development of teens) through the life chaos that often follows poverty. However, there no research to confirm or deny these conjectures as they relate to diet quality.

This study was not only needed to begin filling the aforementioned gaps in the research, it was needed because public health campaigns addressing diet quality – a major source of morbidity and mortality – have not been as successful as desired (Hiza, et al., 2013). It is essential to understand modifiable risk factors to enact social change in this critical area. Psychosocial factors are implicated in diet quality (Traill, Chambers, & Butler, 2012); however, a complete picture of factors contributing to diet quality does not yet exist. Life chaos was expected to be a contributing factor to diet quality based on implications of prior research, but its role was not yet known. This study begins to address this gap.

Problem Statement

Diet quality in the United States low (Guenther et al., 2013a; Hiza, Casavale, et al., 2013). This is in spite of decades of public health education and outreach (Guenther et al., 2014). On average, carbohydrates are empty (Nicklas et al., 2013), and fruit and vegetable consumption continues to drop (Centers for Disease Control and Prevention, 2009; Moore & Thompson, 2015; National Fruit and Vegetable Alliance, 2015).

It is no coincidence that while diet quality in the United States is low, diet-related diseases in the United States are on the rise. The rate of obesity remains high (National Center for Health Statistics, 2016; Ogden, Carroll, Kit, & Flegal, 2014), and the rate of diabetes has been increasing (Guariguata et al., 2014; Ward et al., 2014). A full half of the adult population in the United States has a preventable, diet-related disease (Ward et al., 2014). Twenty-five percent of the adult population have more than one preventable, diet-related disease (Ward et al., 2014). Improving diet quality is an imperative part of public health efforts to reduce these diseases (Ley, Hamdy, Mohan, & Hu, 2014; Rizza, Veronese, & Fontana, 2014). Understanding the influences on diet quality is also an imperative if public health workers are to reverse these health trends.

There are many influences on diet quality (Traill et al., 2012). Household income has been shown to influence diet quality (da Fonseca, 2014; Leung et al., 2012; McIntosh et al., 2010; Robaina & Martin, 2013). Other psychosocial influences include local food environment (Carroll-Scott et al., 2013; Caspi et al., 2012), mealtime culture (Fiese et al., 2012, 2015; Fulkerson et al., 2014), sleep patterns (Quick et al., 2015), and emotional state (Canetti et al., 2002). One unstudied influence to diet quality could be life chaos.

Life chaos refers to the stability and predictability of a person's life (Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013). This conceptually includes routines, schedules, and an individual's ability to be where a person needs to be (Wong et al., 2007). Although it seems reasonable to believe that the ability to have routine or keep a schedule could predict diet quality, there is currently no research to confirm or deny such supposition. Additionally, although household income is related to diet quality (Leung et al., 2012; McIntosh et al., 2010; Robaina & Martin, 2013), there is a gap in the literature regarding the combined role of household income and life chaos as they relate to diet quality. This research begins to address this gap in the literature.

Purpose of the Study

The purpose of this quantitative survey study was to examine the relationship between life chaos and diet quality in U.S. adults to determine if life chaos was a predictor of diet quality. Additionally, I sought to understand how the relationship between life chaos and diet quality changes as a function of household income. The independent variable was life chaos, and the dependent variable was diet quality. The covariate variable was household income.

Research Questions

RQ1. Is life chaos, as measured by the Life Chaos Scale, a predictor of diet quality, as measured by the HEI – 2010, in U.S. adults?

$H_0$1: Life chaos is not a significant predictor of diet quality in U.S. adults.

$H_1$1: Life chaos is a significant predictor of diet quality in U.S. adults. It is predicted that higher scores on the Life Chaos Scale would correlate with lower scores on the HEI-2010.

RQ2. Does the relationship between life chaos, as measured by the Life Chaos Scale, and diet quality, as measured by the HEI-2010, change as a function of household income, as measured by self-report?

$H_0$2: The relationship between life chaos and diet quality does not change as a function of household income.

$H_1$2: The relationship between life chaos and diet quality changes as a function of household income. Based on previous research this change could be expected to come either as mediation or moderation.

Theoretical Framework

The conceptual framework for this study was the biopsychosocial model of health (Engel, 1977). According to biopsychosocial model of health, the health of an individual, and the choices an individual makes about his or her health, are not only dependent upon the biology of the individual, but also on the psychological and social events that combine to build health and wellness (Schiavo, 2014). The biopsychosocial model is the theoretical backbone of health psychology (Suls, Krantz, & Williams, 2013). The biopsychosocial model is a good fit for studies regarding diet because diet is a multidisciplinary construct (Sobal, Bisogni, & Jastran, 2014). Researchers have focused on diet and psychosocial (Cornell Food Choice Research Group, 2016), environmental (Caspi et al., 2012), neurological (Doucerain & Fellows, 2012), and biochemical factors

(Briganti et al., 2015). Although other theoretical or conceptual frameworks may partially address these issues, the biopsychosocial model is preferred for its comprehensive coverage of diet (Sobal et al., 2014) including the social and environmental construct of life chaos.

Nature of the Study

This study was a quantitative, Internet-based survey study where the key variables were life chaos, household income, and diet quality. Questionnaire-based studies can be most efficiently run by using an Internet-based survey (Uhlig, Seitz, Eter, Promesberger, & Busse, 2014). Additionally, response rates in Internet surveys are higher than paper-based survey design (Hunter, Corcoran, Leeder, & Phelps, 2012).

The key variables in this study were life chaos, household income, and diet quality. Life chaos refers to the stability and predictability of a person's life (Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013). This conceptually includes routines, schedules, and an individual's ability to be where he or she needs to be (Wong et al., 2007). Life chaos was measured using the Life Chaos Scale (Wong et al., 2007). This scale uses self-report data to generate a single score using a 5-point Likert scale; a higher score represents a greater level of household chaos and disorder in a person's life. Household income was measured by self-report along with other demographic information. Diet quality is a measure of dietary adherence to dietary recommendations (Moeller et al., 2007). Diet quality data were collected via 24-hour diet recall and were assessed using the HEI – 2010 (Guenther et al., 2013b), which uses the United States

Department of Agriculture (USDA) and Health and Human Services Dietary Guidelines for Americans as the standard by which dietary adherence is measured.

Data were collected via the Internet using Amazon's Mechanical Turk participant pool as a sampling frame. The sample included U. S. adults ages 18-60. Data were analyzed by regression analysis, and a model was derived to explain the relationship between the independent variables and the dependent variable.

Definitions

Diet quality: There is ongoing debate regarding the definition of diet quality (Alkerwi, 2014; Elmadfa & Meyer, 2012), which is addressed in further detail in Chapter 2. In this study diet quality was defined as how closely a diet reflects the USDA and NIH's Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015).

Household chaos: The microenvironment of a home including noise level, crowding, order, family stability, and routines (Deater-Deckard et al., 2012; Levin, Kichler, & Polfuss, 2013; Matheny., Wachs, Ludwig, & Phillips, 1995).

Life chaos: The microenvironment of an adult, including daily routine, personal organization, life stability, and the ability to make plans and keep appointments (Smolderen & Whooley, 2013; Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013).

Protective foods: Foods that that have been shown to protect against future disease when included in the diet regularly (Chiuve et al., 2012).

Predictive foods: Foods that have been shown to predict future disease when included in the diet regularly (Chiuve et al., 2012).

Assumptions

I used an Internet-based survey to learn about the respondents' diets. In the survey, I also asked about various aspects of the respondents' lives and routines to establish how chaotic their lives are, as well as asking personal demographic questions regarding their household income. The first assumption regarding the respondents was that they were honest when responding to the survey. This assumption was critical to the design of the study. The study could not otherwise be conducted if each response had to be independently validated. Self-report is a legitimate way to obtain these kinds of responses (Brener, Billy, & Grady, 2003). Without this assumption, the results of this study would be invalid. Although there has been debate to the veracity of self-report diet data due to social desirability bias (Herbert, Clemow, Pbert, Ockene, & Ockene, 1995), scholars have shown that 24-hour diet recalls are not impacted by social desirability bias in the same way that food frequency questionnaires and four day diet diaries are (Mossavar-Rahmani et al., 2013).

It was also assumed that all participants read English and understood the questions and rating scales. This assumption was necessary for the development of the study. Because of my limited language abilities, survey construction and analysis of the results must be in the English language. Care was taken to make these questions and rating scales clear and easily understandable (Guenther et al., 2013b; Wong et al., 2007).

Scope and Delimitations

I sought to reveal the nature of the relationship between life chaos and diet quality. Because this area has not been previously examined, the scope of this study was, focused on the U.S. adult population with few restrictions, albeit with some limitations due to the structure of the study. There were no published data in this area to which findings may be compared. Future scholars may examine subpopulations to find variation in either life chaos or diet quality; however, a baseline needs to be established by which to compare these subpopulations. I established that preliminary baseline.

Additionally, although it is known regarding the influences of household income on diet quality (da Fonseca, 2014; Imamura et al., 2015; Leung et al., 2012; Robaina & Martin, 2013; Traill et al., 2012), there is little research on life or household chaos that includes a range of household income levels. There is no published literature regarding life chaos and diet quality, and all the published research about dietary issues and household chaos have been studied in low-income samples. By broadening my sample to include all income levels, I was able to examine a potential influence of higher income levels on life chaos and diet quality. I expected to see higher incomes modifying the role of life chaos on diet quality; however, that has yet to be examined or supported in the literature.

This study's sample included U.S. adults 18 years and older. Participants were not excluded based on income level as a variety of income levels were desired for this study. The results of this study are generalizable only to U.S. adults ages 18 and older.

Additionally, the results of this study only produced a predictive model, and did not establish claims of causality.

Limitations

This study has limitations in both its methodology and its scope. Although the scope of this study is broad, it is limited in its depth. Many psychosocial influences diet quality; however it is beyond the scope of this study to account for them all. To address this limitation care has been given in the discussion section to remind the reader of the multifaceted nature of diet quality and to emphasize the preliminary nature of this research.

The Internet-based format of this survey study was chosen to expand the sample population, increase the expected response rate (Hunter et al., 2012), and optimize the efficiency of the study (Gosling & Mason, 2015). However, this limits the reach of this study to those who have access to the Internet. Although there is still some variability in Internet access by income level, the vast majority of U.S. adults do have access to the Internet (File & Ryan, 2014; Perrin & Duggan, 2015; Poushter, 2016). Efforts were made to ensure sufficient representation from income levels where Internet access is lower than others. This was done in part through the use of Mechanical Turk as a sampling frame, as Mechanical Turk workers report lower than average income (Huff & Tingley, 2015; Mason & Suri, 2012). Additionally, methods were proposed to ensure balanced representation of lower income levels if initial results did not yield such, including a second Mechanical Turk request being sent out specifically to low-income Mechanical Turk workers, through Amazon's target marketing within Mechanical Turk, and

statistical weighting. Neither of these measures were necessary as further discussed in Chapter 4.

This study was also limited by its use of the Mechanical Turk platform as its sampling frame. Mechanical Turk workers have been shown to be more diverse than traditional convenience samples (Berinsky, Huber, & Lenz, 2012; Buhrmester, Kwang, & Gosling, 2011; Chandler & Shapiro, 2016; Mason & Suri, 2012); however, they differ from the overall adult population in several ways. Mechanical Turk workers tend to be younger (Huff & Tingley, 2015; Mason & Suri, 2012; Paolacci & Chandler, 2014), have more education (Paolacci & Chandler, 2014), and report lower income (Huff & Tingley, 2015; Mason & Suri, 2012) than the average U.S. adult. Although these averages are different from the general adult population, there is still a range of diversity within these categories represented on Mechanical Turk (Huff & Tingley, 2015; Mason & Suri, 2012). Demographic data were collected to compare the response rates in these areas to national averages.

Additional methodological limitations came as a result of the survey relying on self-report data. Direct measures of diet quality were beyond my financial means, and direct measures of life chaos and household income are invasive and time consuming. However, care was given to select measurement tools that were valid and reliable. Details regarding these tools are expounded in Chapter 3.

Because of the nature of the questions asked in the survey, this study had the potential to be influenced by social desirability bias. Social desirability bias happens when research subjects do not respond to research questions in a way that reflects their

true actions or feelings, but rather in a way that reflects the social norms (Herbert et al., 1995). Herbert et al (1995) reported significant social desirability bias in self-report diet measures. Researchers have found much less social desirability bias in self-report diet measures (Mossavar-Rahmani et al., 2013). In fact, Mossavar-Rahmani et al. (2013) found a slight decrease in total caloric intake and protein in groups prone to social desirability bias when reporting diet by self-report. Researchers found no detectable social desirability bias when testing the HEI-2010 for reliability and validity (Guenther et al., 2013b, 2014). In fact, Guenther et al. (2014) found that participants with low diet quality were just as likely to report accurately as those with higher diet quality.

Significance

There are numerous psychosocial influences on diet quality (Sobal et al., 2014). One influence that has not yet been studied is the role of life chaos on diet. I sought to initiate research in this area by establishing a baseline from which future studies can build. If life chaos had proven to be a significant predictor of diet quality, public health outreach regarding diet can expand to include this factor, and diet improvement plans can include aspects of order and planning to help bring stability to the dieter.

Additionally, I also expanded the understanding of how household income interacts with life chaos, particularly in regards to its influence on diet quality. Because studies of life and household chaos have, until this point, been restricted to low-income populations, this study had the potential to expand the understanding of which segments of the population are experiencing life chaos and the impact this has on diet across the income spectrum.

Summary

I aimed to further explore the psychosocial influences on diet quality. Building on the biopsychosocial model of health, I examined the role of life chaos on diet quality. Life chaos could be a predictor of diet quality; yet until this study, this potential connection had yet to be explored.

In this chapter, I discussed the background research upon which this study builds. I reviewed the problem statement and purpose of the study. I proposed my research questions and discussed the nature of this study. I provided key definitions, and described my assumptions, scope, and delimitations. Finally, I discussed the limitations and significance of this study. In the following chapter, I will explain my literature search strategy, describe the theoretical foundation of the study, and provide a comprehensive literature review of the key variables associated with this study.

Chapter 2: Literature Review

Introduction

Diet quality is a measure of dietary adherence to diet recommendations (Alkerwi, 2014), and diet quality in the United States is low in spite of decades of diet education public health campaigns (Guenther et al., 2014). At the same time diet-related diseases in the United States are common. The rate of obesity remains high, and the rate of diabetes has been increasing (Guariguata et al., 2014; Ogden et al., 2014). Additionally, the decline in heart disease that was observed at the beginning of this century has decelerated, which could lead to an increased public burden in dealing with the results of this disease (Sidney et al., 2016). Improving diet quality is a part of public health efforts to reduce these diseases (Ley et al., 2014; Rizza et al., 2014). Thus, understanding influences on diet quality is imperative if public health workers are to effectively address these health trends.

There are many influences on diet quality (Traill et al., 2012). One influence on diet quality could be life chaos. Life chaos refers to the stability and predictability of a person's life (Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013). This conceptually includes routines, schedules, and a person's ability to be where he or she needs to be (Wong et al., 2007). Wong et al. (2007) developed and validated a scale to measure the elements of life chaos by adapting the existing household chaos scale, the Confusion, Hubbub, and Order Scale (CHAOS; Matheny et al., 1995), to fit all adults rather than just households with children.

The newer concept of life chaos has not been studied in the context of diet quality, although tangentially related concepts have been studied with regard to household chaos: food insecurity (Fiese et al., 2016; Pinard et al., 2015), meal planning (Fiese et al., 2016), glycemic control (Levin et al., 2013), and childhood obesity (Appelhans et al., 2014). At present, there is no published literature on the influence of life chaos on diet quality. As household income has been shown to be related to diet quality, there is a gap in the literature regarding the combined role of household income and life chaos on diet quality.

The purpose of this quantitative, survey study was to examine the relationship between life chaos and diet quality in U. S. adults. Additionally, I sought to understand how the relationship between life chaos and diet quality changes as a function of household income. The psychosocial aspects of life chaos have not been included in diet research, making this study unique.

This chapter serves several functions. First, I will discuss my literature search strategies. This will include the databases I searched, key words and phrases I used in my search, the scope of the literature I reviewed in terms of years, and the types of documents I included in the literature review. Next, I will address the theoretical foundations of this study. I will offer an overview of the biospychosocial model of health, its origins, how it has previously been applied in the literature, the rationale for basing this study on this theory, and how this study builds upon this theory. This will be followed by a review of the literature related to the key concepts of life chaos and diet quality. First, I will explore the construct of life chaos. Next, I will address the construct of diet quality. For each of these concepts, I will define and operationalize the variable,

describe ways that the concepts and variables have been previously studied, review and synthesize research related to each variable, and justify my choice of variables. I will conclude this chapter with a summary of what is known about this subject, as well as what is still unknown. I will make clear how this study fills a gap in the literature and how it will extend the knowledge in the discipline.

Literature Search Strategy

Because the nature of my study branches beyond the domain of psychology, I found that the psychology databases in the Walden library did not contain empirical literature necessary in starting my literature search. Searches of *household chaos and diet quality* and *life chaos and diet quality* returned no results. Searches for *household chaos* and *life chao*s did not produce literature that was pertinent to this study. This was likely due to diet quality research being more commonly associated with biomedical research rather than psychological research. After consulting with the Walden librarians, I broadened my search through other search engines that would include biomedical research.

Using Google Scholar connected to the Walden library, I was successful in initiating my literature search. My key search terms were *life chaos*, *household chaos*, and *diet quality*. I also searched using the combined search terms *household chaos and diet quality*, *household chaos and diet*, *life chaos and diet quality*, and *life chaos and diet*. At first I limited my search to research published no earlier than 2011. However, when I expanded my search by using Google's algorithm to suggest related articles, my search results went back as late as the 1990s. This allowed me to find and include seminal

research within my field, as well as track the progression of current understanding in this field over the past 2 decades.

I again expanded my literature search through the PubMed database. Using seminal literature in my field, I again searched for related articles, articles that had cited the seminal works, and for works using the same MESH terms as the seminal literature of this study.

After my initial literature searches, I returned to Google Scholar and expanded my search terms to include measurement tools *CHAOS*, *Healthy Eating Index*, *HEI*, *HEI-2005*, and *HEI-2010*, and *Life Chaos*. The results of these searches included seminal works, peer-reviewed journal articles, dissertations, and PDFs of peer-reviewed posters.

One of my search terms, *life chaos* returned few pertinent results. This construct, as measured by the Life Chaos Scale, is still in the early stages of use in research. It is related to the construct of household chaos, which has been studied to a much larger extent. In the following literature review, I discuss the differences between these two constructs, and I address how other researchers have dealt with the less studied construct of life chaos.

Literature Review

This literature review serves to define and describe the two main constructs of interest in this study: life chaos and diet quality. I will first address the construct of life chaos and its antecedent construct household chaos, followed by a discussion of the construct of diet quality. In each section, I will define and operationalize the constructs, review and synthesize the literature related to these constructs consistent with the scope

of this study, and justify from the literature the rationale for the selection of these variables within the study. I will conclude this section with a review of the current literature on household chaos and diet-related issues.

Household/Life Chaos

Household chaos and life chaos are related constructs. Study of the construct of household chaos leads to the development and study of the construct of life chaos (Wong et al., 2007). This historical and conceptual relationship makes it important to understand the construct of household chaos before addressing the consequent construct of life chaos. Additionally, it is important to know that household chaos is a construct that has been studied in low-income family populations (Deater-Deckard et al., 2012); whereas, life chaos research has not been limited by income or childrearing. In the following section, I will demonstrate that there is room to explore these constructs in relation to diet quality. In this section I will first explain the construct of household chaos followed by an explanation of the construct life chaos. This will be followed by review of the current literature regarding life chaos. Finally, I will justify my rationale for the inclusion of this variable in the proposed study.

Household chaos. Household chaos represents the microenvironment of a home (Matheny et al., 1995). Household chaos is a multifaceted construct. Noise, crowding, order, family stability, and routines are aspects of household chaos (Coldwell et al., 2006; Deater-Deckard et al., 2012; Johnson et al., 2008; Levin et al., 2013; Matheny et al., 1995). This pattern of environmental confusion was first studied in association with child development and led to the CHAOS (Matheny et al., 1995), which will be discussed at

length later in Chapter 3. Following Bronfenbrenner's (1994) ecological systems theory, researchers have focused on the microsystems and mesosystems surrounding the topic of interest. For example, scholars have focused on the microsystem of household chaos (Johnson et al., 2008), finding a negative association between homes that are more chaotic (noisy, crowded, lack regular routines, and family stability) and expressive vocabulary in children. Similarly, child behavior (Coldwell et al., 2006; Martin, Razza, & Brooks-Gunn, 2012; Raver, Blair, & Garrett-Peters, 2015; Vernon-Feagans, Garrett-Peters, Willoughby, & Mills-Koonce, 2012; Vernon-Feagans, Willoughby, & Garrett-Peters, 2016) and child cognitive development (Deater-Deckard, 2014; Deater-Deckard et al., 2012; Evans et al., 2008; Pike, Iervolino, Eley, Price, & Plomin, 2006; Raver et al., 2015) have been studied through the lens of the microsystem of household chaos. More chaotic homes are associated with less desirable developmental outcomes.

Scholars have tried to explain connections between the elements of household chaos and poor developmental outcomes. These explanations range from physical and emotional exhaustion that comes from managing high chaos (Evans et al., 2008) to depletion of neurotransmitters associated with executive function (Deater-Deckard et al., 2012). Simply put, household chaos reflects levels of stress that compromises a person's ability to interact with his or her environment in a deliberate way (Fiese et al., 2016).

Life chaos. High levels of stress are not restricted to households with children. Similar patterns of chaos can be seen in adults, and the construct of life chaos is an outgrowth of the construct household chaos (Srinivasan, 2014). The Life Chaos Scale is a newly validated and tailored version of the older, more widely used and validated

CHAOS, and the process of its development will be described in more detail in Chapter 3. Life chaos represents the microenvironment of an adult, addressing daily routine, personal organization, life stability, and the ability to make plans and keep appointments (Smolderen & Whooley, 2013; Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013). Although there is much research regarding household chaos, there is much less incorporating this new concept of life chaos. Scholars have mainly focused on treatment adherence, although the idea is starting to generate some discussion among editorial writers (Smolderen & Whooley, 2013; Srinivasan, 2014).

HIV treatment adherence. The first researchers to use life chaos as a lens to examine the microenvironment of adults did so as part of an investigation of barriers to treatment adherence of HIV-infected, low-income adults in Los Angeles (Wong et al., 2007). Wong et al. (2007) adapted the 15 question CHAOS (Matheny et al., 1995) to better reflect the concepts measured by the CHAOS in an adult life. Wong et al. established reliability and validity for this new version of the CHAOS or what is now called the Life Chaos Scale. Further discussion of this process and findings will be covered in Chapter 3. Researchers found that increased life chaos was negatively associated with regular treatment visits (odds ratio = 0.44, $P = .007$), as well as other markers of treatment adherence (Wong et al., 2007).

These findings have been corroborated in later research. In an online survey of 387 HIV-positive men who have sex with men, Horvath, Carrico, et al. (2013) found that greater levels of chaos was correlated with missing at least one HIV-related treatment appointments within the past year (relative risk ratio = 1.17, $P = 0.0000$), as well as not

being in HIV medical care at all (relative risk ratio = 1.11, $P = 0.065$). Life chaos was also negatively associated with treatment attendance in a study of HIV patients (both male and female) who received treatment from the University of Miami's Adult HIV Outpatient Clinic (Wawrzyniak et al., 2015). Wawrzyniak et al. (2015) found higher levels of life chaos in those who did not attend treatments versus those who regularly attended treatments (average Life Chaos Scale scores 12.02 vs. 13.59, $P = 0.010$). Moreover, Wawrzynik et al. (2015) found that barriers to treatment adherence, including life chaos and income, work synergistically, modifying the expected outcomes to greater than expected levels. There is a need to test for similar synergistic interactions that could take place between life chaos and household income in regards to diet quality.

The most recent published research in this area, Kalichman & Kalichman (2016) found a significant negative correlation between life chaos and HIV treatment adherence. In a study of 92 HIV positive adults in Atlanta Georgia, the direct effects of life chaos on HIV treatment adherence was significant ($\beta = -0.10$, $t = 2.2$, $p < 0.05$; Kalichman & Kalichman, 2016). Additionally, Kalichman and Kalichman found that life chaos significantly mediated the effects of poverty on HIV treatment adherence ($\beta = 0.07$, $p = <0.01$). The relationship between life chaos and diet quality will change when income is accounted for.

Cardiovascular disease treatment adherence. Life chaos has also been examined as a factor in cardiovascular disease treatment adherence with similar findings to those of HIV treatment adherence. Zullig et al. (2013) used the Life Chaos Scale to examine if life chaos was a factor in treatment adherence in patients who had suffered a previous heart

attack. This study was part of the Secondary Prevention Risk Interventions via Telemedicine and Tailored Patient Education (SPRITE) study, which is an ongoing study designed to compare various methods of treatment post heart attack (Zullig et al., 2013). The 406 participants were randomly assigned to different treatment groups, and measures of medication adherence, life chaos, and social support were taken, along with several other measures of disease risk specific to this condition (Zullig et al., 2013). Researchers found that life chaos was significantly associated with medication nonadherence, after adjusting for other risk factors (odds ratio 1.07; 95% *CI*[1.02-1.12] . Likewise, greater levels of life chaos were negatively correlated with treatment adherence (odds ratio 1.10; *CI*[1.05-1.15], $p = <0.001$), even when additional demographic and psychosocial factors were accounted for (odds ratio 1.06; *CI*[1.00-1.11], $p = 0.04$; Crowley et al., 2015).

Treatment adherence in additional chronic diseases. Instead of relying on self-report data from the Life Chaos Scale, Lauffenburger et al. (2016) defined life chaos as disruptive life events in the patient's own life or in the life of an immediate family member. These chaos causing life events included personal injury, emergency room visits, and acute stress reactions such as anxiety and panic attacks (Lauffenburger et al., 2016). Data for this study were collected from United Health Care, a nationwide health care claims database, and included de-identified (but family linked) patient-level medical claims for inpatient, outpatient, and emergency treatment, as well as prescription dispensing (Lauffenburger et al., 2016). Chronic disease was determined by dispensing of prescription oral hypoglycemic, antihypertensive, and/or statin drugs, and interruption to treatment adherence was determined by a disruption in the normal dispensing of said

prescriptions (Lauffenburger et al., 2016). Life chaos in the form of personal injury (odds ratio 1.19, 95% *CI*[1.12-1.42]), emergency room visit (odds ratio 1.19, 95% *CI*[1.13-1.26]), and acute stress reaction (odds ratio 1.19 95% *CI*[1.08-1.31]) were all associated with disruptions in treatment adherence (Lauffenburger et al., 2016). Although this study did not directly parallel my study, Lauffenburger et al. highlighted the growing awareness of the role of life chaos within the literature.

Life chaos and risky health behaviors. Viswanath et al. (2016) focused on assessing the risk factors associated with transactional sex in men who have sex with men and also use methamphetamines. This study was part of the ongoing research regarding the spread of HIV. The sample of this study was 325 men who had sex with men, who may or may not be out, and who were also high functioning in spite of being regular users of methamphetamine (Viswanath et al., 2016). Viswanath et al. found that greater life chaos was a risk factor for transactional sex in this sample; however, and more significant to my research, Viswanath et al. found a significant amount of high life chaos in an educated, middle class population. Previous scholars have found that household chaos (the construct of home microenvironment that lead to the study of life chaos) is linked to low-income status (Deater-Deckard et al., 2012; Pinard et al., 2015). Viswanath et al. found results that challenge this association. Viswanath et al. suggested that this life chaos can be found in populations who may not be challenged by low income constraints, thus allowing exploration of a range of possible combinations of income level and life chaos.

Justification for studying life chaos. The above-mentioned studies are significant to this study because, as described more fully below, diet quality is a measure of adherence to a set of dietary guidelines or a proposed diet. Wong et al. (2007) established a precedent in the literature for the Life Chaos Scale to be used in studies that measure adherence. Additionally, Viswanath et al. (2016) found less careful attention to personal health comes with greater chaos; this led me to expect to see lowered diet quality when there is greater life chaos present.

Diet Quality

Although diet is a ubiquitous term in our society, defining a quality diet can be remarkably difficult (Reedy et al., 2014). This is in part because of the multifactorial nature of diet (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015), but it also is due to the array of methods used to define and study diet (Alkerwi, 2014; Ocké, 2013). In this section, I will first address the main theory that is used to undergird research on the human diet. Next, I will discuss the ongoing debate regarding the definition of the concept of diet quality. This will be followed by a review of the current literature related to diet quality as it is defined in this study. Finally, I will justify my choice of this construct within the study

Theories of Diet Quality. The conceptual framework best used to understand and study diet quality is the biopsychosocial model of health (Engel, 1977). In reaction to the reductionist biomedical model of health, Engle proposed a more holistic approach that was neither "ephemeral" nor "monistic" (Borrell-Carrio, Suchman, & Epstein, 2004). Rather, Engel's (1977) model embraced the complexity of the human condition, while

still expecting scientific rigor and clinical standards. The biopsychosocial model of health asserts that the health of an individual, and the choices an individual makes about his or her health, are not only dependent upon the biology of the individual, but also on the psychological and social events that combine to build health and wellness (Schiavo, 2014). Within the biopsychosocial model of health, these divergent influences interact, however not necessarily in a linear fashion. The biological, psychological, and social influences that affect health are in a dynamic flux that can be examined, but not isolated from each other (Borrell-Carrio et al., 2004). The biopsychosocial model is the backbone of health psychology (Suls et al., 2013) and diet-related research (Sobal et al., 2014).

The biopsychosocial model has not always been seen as a well-established construct in the study of human health related phenomena (Smith, Fortin, Dwamena, & Frankel, 2013). However, there is a growing body of research that shows how psychosocial influences impact health outcomes (Beijers, Buitelaar, & de Weerth, 2014; Borrell-Carrio et al., 2004; Collier, van Beusekom, Bos, & Sandfort, 2013), and the existence of Health Psychology as a field of study and practice seem to refute these claims. Complex issues of health and wellness need not be reduced to a purely biomedical model but should include all factors that impact well-being (Collen, 2015).

The biopsychosocial model is a particularly good fit for studies regarding diet because diet is a multidisciplinary construct (Sobal et al., 2014). Ongoing research into diet focuses on psychosocial (Cornell Food Choice Research Group, 2016), environmental (Caspi et al., 2012), neurological (Doucerain & Fellows, 2012), and biochemical factors (Briganti et al., 2015). Although other theoretical or conceptual

frameworks may partially address these issues, the biopsychosocial model is preferred for its comprehensive coverage of diet (Sobal et al., 2014) including the social and environmental constructs of household chaos and/or life chaos.

In recent years, research regarding diet using the biopsychosocial model has increased in response to the growing need to better understand the psychosocial influences of diet-related illnesses. Because of the vastness of the field of study, a comprehensive review of the literature that addresses all dietary issues from a biopsychosocial perspective is neither feasible in the context of this study, nor useful as an explanatory tool. However, examples of how this theoretical model has been used in ways similar to this study follow.

In a study of low income, pregnant, overweight African American mothers, researchers used the biopsychosocial model to explore the barriers to healthy eating (Reyes, Klotz, & Herring, 2013). In addition to the above mentioned inclusion criteria to this study, the researchers also qualitatively explored the themes of cost, taste, convenience, misconceptions of dietary advice, as well as the lack of direct control of diet that comes from sharing a multigenerational home. The researchers concluded that the barriers to healthy eating are multifactorial (Reyes et al., 2013), corroborating Sobal et al. (2014) who assert that diet patterns are not suitably explained by a monistic biomedical model of health. Similarly, researchers building a model of gestational weight gain concluded that psychosocial influences as well as health behaviors were important factors to consider (Hill, Skouteris, Fuller-Tyszkiewicz, Kothe, & McPhie, 2016). The biopsychosocial model has been used as the lens to explore diet and cognitive aging

(Knight, Bryan, & Murphy, 2016), diet quality and gestational weight gain (Shin, Bianchi, Chung, Weatherspoon, & Song, 2013), the relationship between health behaviors and fruit and vegetable intake (Canter, Roberts, & Davis, 2016), the relationship between eating competence and sleep behaviors in college students (Quick et al., 2015), and countless others studies, that similarly conclude that diet research should be explored through an inclusive and comprehensive lens, such as the biopsychosocial model of health. This research study has built on this model, by examining the interaction of life chaos, household income, and diet quality.

Diet quality definition. Historically, defining the concept of diet quality has been left to each research team who has studied this concept (Alkerwi, 2014) and as such, the definition has changed over time with current concerns being the focus of any given definition (Elmadfa & Meyer, 2012). The first published diet quality index never directly defined diet quality, but instead relied on "commonsense principles" (Patterson, Haines, & Popkin, 1994, pg.5) and left it to diet and nutrition researchers to extrapolate a working definition. In the case of Patterson, Haines, and Popkin's Diet Quality Index (1994), that working definition was that a high quality diet more closely followed the National Academy of Sciences' Diet and Health recommendations. Their justification for this is that a multidisciplinary committee, who devised these diet and health recommendations, based their recommendations on research and clinical evidence about diet-related health outcomes (Patterson et al., 1994). Similarly, the HEI-2010 defers to the USDA and National Institutes of Health's Dietary Guidelines for Americans (Guenther et al., 2014), inferring that closer adherence to these guidelines increases diet quality.

Not all studies have used these standards to set their definition of diet quality. For example, the Mediterranean adaptation of the Diet Quality Index-International (Bibiloni et al., 2015) and the Mediterranean Diet Scale (Trichopoulou, Costacou, Bamia, & Trichopoulos, 2003) use the traditional Mediterranean Diet (high in vegetables, fruits, whole grains, and olive oil, and low in red meats and sugars) as the standard of high quality diet. The Alternative Healthy Eating Index bases its working definition of diet quality on a large body of research that found certain foods and nutrients to be either protective, or predictive of chronic disease risk (Chiuve et al., 2012). Under these conditions a diet higher in protective foods and nutrients (foods and nutrients that have been shown to protect against future disease when included in the diet regularly), and lower in predictive foods and nutrients (foods and nutrients that have been shown to predict future disease when included in the diet regularly) constitutes a high quality diet. Studies have defined diet quality as adherence to The British Food-based Dietary Guidelines (Vyncke et al., 2013), the Australian Dietary Guidelines and Nutrient Reference Values for Australian and New Zealand (Collins et al., 2016), the Dietary Approaches to Stop Hypertension (DASH) Diet (Fung et al., 2008), and countless more.

This lack of consensus on the definition of diet quality has led to some discussion on how to address this issue (Alkerwi, 2014; Ocké, 2013; Wirt & Collins, 2009). Although some assert the limited worth of diet quality studies until such parameters are clearly defined (Wirt & Collins, 2009), others stress that the differing measures of diet quality, and by association, the differing definitions of diet quality, are suitable for the different settings where the term is used: clinical, educational, or basic research. Part of

this debate concerns not only the multifaceted nature of diet, but the multidisciplinary nature of diet research (Cornell Food Choice Research Group, 2016). Alkerwi (2014) emphasized the need for a coordinated effort to define diet quality from a holistic public health perspective and include not only nutritional aspects of this term, but the sociological, economic, and industry characteristics as well.

Because there is not a standard definition of the term diet quality I have been required, as others in the literature, to piece together a working definition in a way that best suits the goals of this study. For the purposes of this study diet quality was defined as how closely what people eat follows the USDA Dietary Guidelines for Americans (8th Edition) (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). This definition was adopted based on the multidisciplinary collaboration and research that went into developing these dietary guidelines, as well as the national standard for diet that they represent at this time in the United States (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). Diet quality was operationalized as a score on the HEI-2010, where increased diet quality (i.e. healthier diets) resulted in a higher score and lower diet quality (i.e. a poor or unhealthy diet) resulted in a lower score (Guenther et al., 2014).

Recent research using the Healthy Eating Index. Because diet quality studies are dependent on their measurement tools to define their scope, the following literature review will be based on the HEI, the measurement tool this study used. The HEI is the tool used by governmental agencies such as the USDA and the Health and Human Services (HHS) to monitor dietary patterns in the United States (Guenther et al., 2013b).

Ongoing research uses both the 2005 and 2010 versions of the HEI, depending on when the research was started. There are two main categories of studies that use the HEI: studies that monitor population diet patterns, and studies that assess the dietary standards. In this section I will review some of the recent research within both of these categories.

Population monitoring. Because the USDA and the HHS use the Dietary Guidelines for Americans as the basis of food-related public policy (Guenther et al., 2013b), there is a great deal of interest in monitoring the dietary patterns of the U.S. population to ensure public health efforts and policy are meeting the needs of U.S. citizens. This type of research is concerned with long-term patterns, which can be accomplished by comparing two or more snapshot years, or by assessing a pattern over a number of successive years. The snapshot approach was used by Guenther et al (2013a) in examining the diet quality of the general population in 2-year stretches before and after the 2005 changes to the Dietary Guidelines for Americans, in order to assess if the changes to the standards had translated into differences in the general population. The snapshot approach has also been used to determine differences in diet quality based on demographic differences (Hiza, Casavale, et al., 2013). Researchers also use the snapshot approach to examine diet quality in smaller segments of time, such as holiday seasons where diet quality may be significantly different than other times of the year (Jahns et al., 2016).

The pattern approach, where diet quality is tracked over successive units of time, most often years, has been used to assess patterns of diet quality within specific groups or to find differences in diet quality between groups. For example this approach was used to

asses the diet quality of U.S. children over a period of 8 years that bridged changes in the Dietary Guidelines for Americans (Hiza, Guenther, & Rihane, 2013). This approach has also been used to determine if specific foods or nutrients are associated with better diet quality. One such study found that oatmeal consumption was associated with better diet quality and lower body mass, a pattern that was assessed by comparing 10 years of diet quality data (Fulgoni et al., 2015). Based on the broad range of diet quality monitoring research, decisions can be made on how best to make changes to nutrition policy, and who to reach out to via public health efforts.

Dietary standards assessment. The second category of study that uses the HEI is research that assesses dietary standards for disease prevention and protection (Guenther et al., 2013b). Because the HEI assesses how closely a diet follows the Dietary Guidelines for Americans, there have been multiple studies that use this scale to see if following these guidelines are protective or predictive of diet-related disease. Using research from this category, the USDA and HHS fulfill their mandate to publish dietary guidelines for the general public (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015).

Because of the ongoing nature of research, this category of research has used both the older HEI -2005 and the current HEI -2010. The following is a brief overview of current findings using the HEI. Using data from the Nurses' Health Study and the Health Professionals Follow-Up Study, Chiuve et al. (2012) assessed if diet quality was associated with chronic disease risk. Major chronic disease risk (cardiovascular disease, coronary heart disease, stroke, diabetes, and cancer) was inversely associated with HEI -

2005 scores (Chiuve et al., 2012). These results were consistent with those of Reedy et al. (2014) who found HEI-2010 scores to be inversely correlated with death from cardiovascular disease and cancer. Similarly, meta-analyses found that the updated HEI - 2010 was also inversely associated with risk of cardiovascular disease and cancer, as well as diabetes and all-cause mortality (Schwingshackl & Hoffmann, 2015). Research in this general category also assessed correlation between diet quality and other disease markers such as body mass index (BMI) (Fulgoni et al., 2015) and diet predictors such as cost (Rehm et al., 2015).

Justification for studying diet quality as measured by the HEI. I used the HEI because it reflects the most public standards of diet quality, the Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). These standards are at the root of all federal nutrition guidance, and shape public policy on nutrition (Guenther et al., 2013b). Furthermore, the standards which the HEI measures conformity to were developed by a multidisciplinary advisory committee, taking into account the multifaceted nature of diet (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015).

At this point there is no published literature on how life chaos is associated with diet quality. However, the concept of chaos has begun to make its way into studies regarding diet. The following section will describe how the original CHAOS has been used to study diet-related issues.

Household Chaos And Diet Quality

To date there is no research directly linking household chaos or life chaos to diet quality. However, there is a small, but growing body of research that links household chaos with other diet-related issues. This section will briefly review these studies.

Food insecurity. Food insecurity is the lack of regular access to enough food to sustain a healthy life (Pinard et al., 2015). Household chaos has been shown to be linked with food insecurity (Fiese et al., 2016; Pinard et al., 2015). A cross sectional study of low-income families in several Midwestern cities found that increased household chaos was associated with increased risk of food insecurity (Pinard et al., 2015). These findings were corroborated by findings from the Food and Family Project which showed that households reporting food insecurity were also more likely to report increased household chaos when compared to food secure households (Fiese et al., 2016).

Although there is a correlation between household chaos and food insecurity, an association between food insecurity and diet quality has not been unshakably established. Data from the NHANES study has shown mixed results: one study found that diet quality and food insecurity are not correlated in pregnant women (Gamba et al., 2016) whereas another found that in the general population food insecurity was associated with lowered diet quality (Leung et al., 2014). Even where statistical significance was found, the results are clouded by the study design which was specifically looking at lower income adults (Leung et al., 2014), low income having already been established to have a negative impact on diet quality (da Fonseca, 2014; Robaina & Martin, 2013). At this time

food insecurity, cannot be used as a stand-in for diet quality to link household or life chaos to diet quality; household chaos and diet quality still required study.

Meal planning. Meal planning is a measure of mealtime behaviors such as food shopping, food preparation, and the scheduling involved to allow for a household to sit and eat together (Fiese et al., 2016). In a study of low income, food insecure families, greater household chaos was negatively correlated with meal planning. Although meal planning has been associated with a higher quality diet (Hammons & Fiese, 2011; Hersey et al., 2001), it is not a direct measure of diet quality.

Glycemic control. In diet-related illnesses such as diabetes, long term health is reliant on patients carefully planning and monitoring what they eat (National Diabetes Education Program, n.d.). Diet control is often measured by checking the patient's blood glucose levels over time, measured by hemoglobin A1C (National Diabetes Education Program, n.d.). In a study of 104 children with type 1 diabetes, researchers found that greater household chaos was linked to lower glycemic control as measured by hemoglobin A1C (Levin et al., 2013). This study is another piece of compelling evidence that household chaos can influence diet in a measurable way. However, the relationship between chaos and diet quality had not yet been directly assessed.

Summary and Conclusions

To summarize, there are several themes that can be extracted from this literature review. In this section I will first summarize the themes surrounding life chaos. Next, I will summarize the themes surrounding diet quality. This will be followed by a description of what is known and unknown regarding these subjects related to the

proposed study. I will address how this study began to fill these gaps in the literature and how doing so will extend the knowledge of health psychologists working with diet-related issues.

Life Chaos Themes

Because the research about life chaos is limited, it is difficult to draw meaningful themes from the literature. However, when looking at the combined body of work regarding life chaos and household chaos, it is easy to conclude that higher levels of chaos lead to less desirable outcomes, whether those outcomes be developmental (Coldwell et al., 2006; Deater-Deckard, 2014; Pike et al., 2006), health- (Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013), or diet-related (Fiese et al., 2016; Levin et al., 2013).

Diet Quality Themes

Perhaps in part because of the complex nature of diet, defining diet quality is challenging. There is no agreed upon definition of diet quality within the existing body of literature. In fact, the lack of consensus has sparked a debate within the field on how to address the issue (Alkerwi, 2014). This lack of consensus on definition has not hindered research on diet quality. Instead, the burgeoning body of literature on this subject has developed in two main directions: that of measuring diet quality as a level of adherence to a prescribed diet recommendation, and that of searching for factors within the data to establish data driven definitions of diet quality. By far the most common method is to measure diet quality by adherence to a prescribed diet, even if agreement cannot be reached on which prescribed diet is best.

Research Gaps

To date, we know that there are many influences on diet quality (Traill et al., 2012). Cogent to this study, we know that household income influences diet quality (Leung et al., 2012; Robaina & Martin, 2013). It seems reasonable that life chaos influences diet quality; however, that direct relationship has not yet been shown in the literature. Additionally, it is logical that higher household income could mediate the influence of chaos on diet quality; however, that is still unstudied in the literature as well.

The present study fills several gaps in the research. First, although diet quality has been examined through many psychosocial lenses (Sobal et al., 2014), it has not yet been examined through the lens of life chaos, nor even through the mores studied lens of household chaos. Second, although diet-related issues have been found to be influenced by household chaos (Deater-Deckard et al., 2012; Fiese et al., 2016; Pinard et al., 2015), it has yet to be determined if these effects are altered or modified by household income because the literature to date has only focused on low-income households.

This study extended the knowledge in the discipline of diet quality research by determining if life chaos has a significant influence on diet quality. Additionally, this study extended the knowledge of the discipline by deepening the understanding of how household income interacts with life chaos to impact diet quality.

In this chapter I have discussed my literature search strategy and described the theoretical foundation of this study. I have also provided a comprehensive literature review of the key variables associated with this study, diet quality, and life chaos. In the following chapter I will explain the research design and rationale, fully describe my

methodology including my sampling procedures, recruitment, and data collection, describe threats to the validity of this study, and explain the ethical procedures I will preserve.

Chapter 3: Research Method

Introduction

The purpose of this study was to determine if life chaos was a predictor of diet quality and to determine if this relationship changed as a function of household income. In this chapter, I will first address the research design and rationale. I will then offer a comprehensive description of my methodology, a discussion of potential threats to validity, and ethical procedures implemented for this study.

Research Design and Rationale

In this section, I will address the research design and rationale of the study. I will begin by stating the study variables, followed by a description of the research design and its connection to the research questions. Next, I will explain the time and resource constraints associated with this design choice. Finally, I will describe how my design choice is consistent with the research designs needed to advance knowledge in this discipline.

Study Variables

There were three key variables in this study. The predictor variable was life chaos as measured by the Life Chaos Scale (Wong et al., 2007). The outcome variable was diet quality as assessed by the HEI – 2010 (Guenther et al., 2013b). It was unknown if the third variable, household income, was a moderating, or mediating variable. Household income was measured by study participant self-report.

Study Design

I used an Internet-based survey design. This is consistent with designs needed to advance the research in this area for several reasons. First, the most efficient way to collect the 24-hour diet recalls that are needed to calculate a HEI-2010 score is through the National Cancer Institutes Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA24; Thompson et al., 2015), which is only available in a virtual setting. Second, the response rate of Internet-based surveys are higher than paper-based surveys (Hunter et al., 2012). This is important because this survey could be quite long (possibly taking up to 45 minutes), which could discourage potential participants from agreeing to take part in the study. Finally, due to the constrained funding of this study, the financial savings associated with an Internet-based survey design enabled me to self-fund this study.

Although the study design does reduce some of the associated resource expenditures associated with this study, there are other anticipated resource constraints associated with this study design. Because the length of this survey varied depending on how much food was eaten in the preceding 24 hours by each participant, the financial compensation for participants' time had the potential to become sizable without being excessive. This anticipated expense added favor to a research design that is financially efficient.

Methodology

This section includes the methodology of this study. I will begin by defining the target population of this study. This will be followed by an explanation of the sampling

procedures, followed by a description of the procedures for recruitment, participation, and data collection. Next, I will explain the instrumentation and operationalization of constructs, followed by the operationalization of each of the variables. Following this, I will explain my data analysis plan. I will then discuss any threats to the validity of this study and clarify my ethical procedures. Finally, I will describe the treatment of my data and offer justification for the use of incentives within this study.

Population

The purpose of this section is to define and estimate the size of the target population of this study. The target population of this study was the adult population of the United States. This population included all people ages 18 and older living in the United States. This population included both sexes and all racial groups. I did not delineate between socioeconomic statuses or those working in the public or private sector. According to the most recent (2010) census, the size of this population was 234,564,071 people, or 76% of the total population of the United States (Howden & Meyer, 2011).

Sampling

In this section, I will identify and justify the sampling strategy of this study. I will explain how the sample was drawn and describe the sampling frame, including the inclusion and exclusion criteria. I will conclude this section with an explanation of my sample size.

Sampling strategy. I used a self-selection sampling strategy. I used Amazon's Mechanical Turk as my sampling frame (described in more detail below), and self-

selection was the sampling strategy inherent in this sampling frame. Self-selection is common in human research studies (Eysenbach & Wyatt, 2002; Khazaal et al., 2014), with thousands of published studies having used this strategy through Amazon's Mechanical Turk (Chandler & Shapiro, 2016). Since its inception, thousands of researchers have used this crowd-sourced marketplace to manage the recruitment and participant compensation of their social science studies (Chandler & Shapiro, 2016).

Sampling procedure. Using the Mechanical Turk Requester (Amazon.com, Inc., 2017), Mechanical Turk participants were notified that I was seeking participants for this study. The study was advertised on Mechanical Turk's Worker website (Amazon.com, Inc., 2017) until the required number of surveys and 24-hour diet recalls were submitted. Workers who met the inclusion criteria and chose to participate read the informed consent and gave consent by linking through to the study's website.

Sampling frame. As stated above, I used Amazon's Mechanical Turk as my sampling frame. Mechanical Turk was created by Amazon.com as an online marketplace for human intelligence tasks (Amazon.com, Inc., 2017) and has been used extensively for psychology research over the past 10 years (Chandler & Shapiro, 2016).

Mechanical Turk reports that their sampling frame includes 500,000 registered users from 190 countries (Amazon.com, Inc., 2017). Independent examinations of this sampling frame suggest that the active participants in this pool are closer to 7,300 individuals during any period of time that a study may be running (Stewart et al., 2015) and that most reside in the United States and India (Paolacci & Chandler, 2014). Samples drawn from Mechanical Turk's workers are more diverse than traditional convenience

samples drawn from university populations or the towns in which a university resides (Berinsky et al., 2012; Buhrmester et al., 2011; Chandler & Shapiro, 2016; Mason & Suri, 2012). Additionally, the quality of data retrieved from Mechanical Turk participants is higher than expected from a university drawn convenience sample (Berinsky et al., 2012; Buhrmester et al., 2011; Paolacci & Chandler, 2014).

Inclusion criteria. Participants must have participated in Amazon.com, Inc's Mechanical Turk crowd-sourcing human intelligence task pool. They must have been older than 18 years of age and reside in the United States. Because ASA24 is based on the U. S. food stream (Subar et al., 2012) all participants were residents of the United States.

Exclusion criteria. Respondents who did not complete the survey or the 24-hour diet recall were excluded from the study.

Sample size. Using G*Power 3.1.9.2 (Faul, Erdfelder, Buchner, & Lang, 2009) set for regression, I calculated that I needed a minimum 99 participants to power my study at the 0.95 level. This calculation was based on a conservative estimate of effect size grounded in the literature regarding the effects of chaos (both life and household) on health behaviors and diet-related issues as shown in Table 1. The first eight items on the table are the closest conceptually to my study; these items measure the effect of life chaos on health-related behaviors. Because these studies published such high effect sizes, my sample size would have been extremely low if they were used to drive the calculations for my sample size. The last two items in Table 1 are tangentially related to my study, in that they relate household chaos to diet-related issues, one issue being a long-term

measure of dietary control, and the other being food insecurity. These scholars showed much smaller effect sizes, resulting in larger sample sizes for my study, were they used to drive the power calculations. My sample size of 103 exceeded calculated sample sizes needed even if the smallest of these published effect sizes were used to power the study, and it far exceeded the sample size that would be needed if a larger effect size were used to power the study.

Effects sizes from two studies (Horvath, Oakes, et al., 2013; Lauffenburger et al., 2016) were not included in these calculations. The first (Horvath, Oakes, et al., 2013) did not include this information within the publication as it was somewhat ancillary to the main area of their research. The second (Lauffenburger et al., 2016) used a different form of measurement of life chaos than what was used in this study. Given the high effect sizes found in this second study (Lauffenburger et al., 2016), the calculated sample size of 99 still far exceeds a sample size grounded on these findings.

Table 1

Calculated Sample Size Based on Published Effect Size in the Related Literature

Study	What was measured	Published effect size	Calculated sample size
Wong et al., 2007	Chaos and health care use in HIV patients	0.46	48
Wong et al., 2007	Chaos and health care use in HIV patients – 12 month follow up	0.78	31
Horvath, Carrico, et al., 2013	Chaos and missed HIV clinic visits in past 12 months	1.17	17
Zullig et al., 2013	Chaos and medication nonadherence in post myocardial infarction patients	1.86	16
Zullig et al., 2013	Chaos and all influences on medication nonadherence in post myocardial infarction patients	1.07	24
Crowley et al., 2015	Chaos and medication nonadherence in post myocardial infarction patients	1.10	18
Crowley et al., 2015	Chaos and all influences on medication nonadherence in post myocardial infarction patients	1.06	18
Viswanath et al., 2016	Chaos on transactional sex in high functioning methamphetamine users	1.7	17
Levin et al., 2013	Household chaos on A1C levels in children	.46	48
Pinard et al., 2015	Household chaos on food insecurity in low income families with children	.21	99

Procedures

In this section, I will describe the recruiting procedures and the demographic information that was collected. I will describe how participants were provided informed consent and describe how the data were collected. Finally, I will explain how study participants exited the study and the follow-up procedures associated with the study.

Recruitment procedures. A notice was placed on Mechanical Turk's Worker page notifying Mechanical Turk workers that my study was seeking participants. This notification included the inclusion criteria, the time the study was expected to take, and the compensation that the participants would receive upon completion of the study. By selecting the preview tab associated with the notice potential, participants could read the informed consent and the instructions on how to participate. Consent was given by clicking on the "accept" button at the top right-hand corner of the preview page and participants were then taken to the study's website.

Informed consent. Informed consent was provided to participants on a preview page before they agreed to participate in the study. Participants confirmed their consent by clicking on the accept button, whereupon they were redirected to a website designed for this study. The landing page for the study's website repeated the informed consent, and participants again confirmed their consent before proceeding. This redundancy was necessary so that even if Mechanical Turk participants bypassed the preview page, all participants would be ensured to have consented to the terms and expectations of the study.

Demographic information to be collected. Demographic information was collected as a part of this study. In addition to household income, necessary to answer Research Question 2, I also collected information regarding the participants' age, gender, and race to be able to compare my sample with the general adult population.

Data collection. Upon confirming consent, participants were issued a unique identifier that masked the participant identity from their recorded responses. Participants responded to a brief survey including demographic data and the Life Chaos Scale. Data from these responses were automatically added to a password-protected CSV file, which was downloaded from the data collection site upon the completion of the study. Following completion of the survey, participants were redirected to the ASA24 (National Cancer Institute Division of Cancer Control and Population Sciences, 2017) where they logged in with their unique identifier allowing the data from the two parts of the study to be linked in analysis, and yet preserving the confidentiality of the participant. Dietary intake data for 24-hour recalls were collected and analyzed using the ASA24 Dietary Assessment Tool, version (2016), developed by the National Cancer Institute, Bethesda, MD. Data from ASA24 were automatically collected into a spreadsheet securely housed and password protected on my ASA24 site.

Study exit. When the participants completed their survey and 24-hour diet recall, they were given the option to see an analysis of their reported diet. This analysis was provided in real time from ASA24 and was calculated based on the participants 24-hour diet recall. This diet analysis included reports of both macro and micro nutrients and how they compared to published dietary recommendations (U.S. Department of Health and

Human Services and U. S. Department of Agriculture, 2015). Participants exited the study at this point. There was no debriefing; however, participants were given a link to a website where the results of the study will be posted upon completion and approval of this dissertation. Participants received token remuneration for their time. This was done after the participant completed both the survey and the 24-hour diet recall. Remuneration came through Amazon's Mechanical Turk. Funds were released to participants within 24 hours of completion of their involvement in the study.

Follow-up procedures. There were no follow-up procedures associated with this study.

Instrumentation

In this section, I will discuss the instruments I used to collect and analyze my data. I will start with the HEI. This will be followed by a discussion of ASA24, the automated 24-hour diet recall website. I will conclude this section with a discussion of the Life Chaos Scale.

Healthy Eating Index. In this section, I will cover the development of the HEI, including who developed it and when. I will explain why this instrument is appropriate for this study. Finally, I will clarify my permission to use this tool, and offer the published reliability and validity of this tool.

Development. The HEI was developed by the USDA in the late 1980s as a tool to monitor increases in national diet-related diseases. The HEI has since been updated several times to reflect the changes that have been made to the national dietary guidelines (Guenther et al., 2014, 2008). An update to reflect the recently revised Dietary Guidelines

for Americans 2015-2020 (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015) is under development; the HEI-2015 has been released, however, the associated material services for researchers, including tests of reliability and validity and calculation macros, were not yet published at the time of this study. The most current complete rendition of this tool at the time of data collection was the HEI – 2010, which was published in 2014 (Guenther et al., 2014).

The original HEI was tested for validity and reliability over a 2-year period with diet data that were collected as part of the USDA's Continuing Survey of Food Intake by Individuals (Kennedy, Ohls, Carlson, & Fleming, 1995). Subjects included 7,500 U.S. citizens ages 2 years and older. Diet data included both 24-hour recalls and 2-day diet diaries. The sample was representative of the United States population at the time. Validity was established by comparing HEI scores to nutrient intake. Correlation coefficients for HEI scores and individual nutrients (i.e. individual vitamins and minerals), and energy consumption were all positive, and ranged from .06 to .42 showing small to moderate, though statistically significant, effects size, confirming that higher HEI scores correlate to higher nutrient intake (Kennedy et al., 1995). This shows that closer adherence to the Dietary Guidelines of the time would lead to a higher HEI score, indicated better diet quality. Additionally, the HEI scores were compared to self-reports of diet quality and were found to generally correspond with individual's perception of their own diet quality.

Appropriateness to study. The HEI was appropriate for use in this study because it reflected the most public standards of diet quality, the Dietary Guidelines for

Americans (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). As stated in chapter 2, the HEI measures adherence to the Dietary Guidelines for Americans, which guidelines have shaped public policy on nutrition (Guenther et al., 2013b).

Permission to use. HEI is free and open to use in research and academic settings (National Cancer Institute, 2016).

Reliability and validity. The reliability of the HEI-2010 was measured by assessing the internal consistency of the scale. The Cronbach's co-efficient α for the HEI -2010 was 0.68 which is slightly under the commonly accepted standard of 0.70 for reliability, however, this was expected due to the complexity of construct being measured (Guenther et al., 2014). As such, the internal consistency of the scale is considered high for the construct (Guenther et al., 2014).

Validity of the HEI - 2010 was measured in several different ways. First, scores were computed for model menus that were designed by nutrition experts as examples of high quality diets following four widely used and publicly available diet plans (Guenther et al., 2014). The HEI -2010 scores for these diet plans were nearly perfect (total scores ranged from 87.8-100), with the expected exceptions where the diet plans in question did not philosophically match the 2010 Dietary Guidelines for Americans (in particular, the exclusion of dairy in the Harvard's Healthy Eating Pyramid) (Guenther et al., 2014). Next, scores were calculated from nutritional data collected as part of the National Health and Nutrition Examination Survey (NHANES). This was a data set of 24-hour dietary recalls for 8,262 participants, male and female, including children through the elderly.

The HEI -2010 was successful in detecting meaningful differences in diet quality between groups with known differences in diet quality (e.g. children, and the elderly), as well as separating diet quality from diet quantity (Guenther et al., 2014). Finally, principle component analysis confirmed that there is not an underlying linear relationship between different components of the scale to explain the variation in the data (Guenther et al., 2014).

The HEI measures diet quality in reference to the USDA and Health and Human Services Dietary Guidelines for Americans (Guenther et al., 2013b). As such, content validity is determined by how closely the index measures all aspects of said guidelines. Content validity of the HEI -2010 was reestablished through the combined efforts of the USDA Center for Nutrition Policy and Promotion and the Nation Cancer Institute by realigning the content of the HEI-2005 to reflect the updated Dietary Guidelines for Americans (Guenther et al., 2013b). The resulting update is the HEI -2010. As stated earlier, an update of the HEI to reflect the most recent Dietary Guidelines for Americans is expected, but is not currently available.

ASA24. In this section I will briefly cover the development of the ASA24 including who developed it and when. I will clarify why this instrument was appropriate for this study. I will show my permission to use this tool, and finally, discuss how reliability and validity of this tool were established.

Development. The ASA24 was collaboratively developed by the National Cancer Institute, the National Institutes of Health, and the research firm Westat (Subar et al.,

2012). Development of the ASA24 began in 2006 (Subar et al., 2007), and the publicly available version was released in 2009 (Subar et al., 2010; Zimmerman et al., 2009).

Appropriateness to study. This tool was appropriate to this study inasmuch as it accurately collects the data necessary to calculate a HEI score for each participant. When compared to the alternative, and former gold standard, of interviewer-administered 24-hour dietary recalls the ASA24 is equally valid and reliable (discussed below) while also lessening the participant burden associated with lengthy diet recall interviews (Thompson et al., 2015).

Permission to use. The ASA24 is freely available for educational, clinical, or research purposes (National Cancer Institute Division of Cancer Control and Population Sciences, 2017; Subar et al., 2012).

Reliability and validity. When compared to data from the NHANES researchers report satisfactory face validity, although they do not report statistical support for these claims (Subar et al., 2012). Reliability and validity were also established by comparing actual food intake to reported food intake over several days (Kirkpatrick et al., 2014; Thompson et al., 2015). Researchers found no significant difference in reported food intake between groups using the ASA24 and the more costly gold standard, the USDA's Automated Multiple Pass Method (Kirkpatrick et al., 2014; Thompson et al., 2015). No values of overall reliability or validity are published; however, the National Cancer Institute reports that more than 270,000 recalls have been collected using this tool, and on average, more than 40 new studies register at the site each month (National Cancer

Institute Division of Cancer Control and Population Sciences, 2017) showing that this tool is widely accepted as valid and reliable within the field of diet research.

This tool currently reflects the U.S., Canadian, and Australian food streams and is available in English, Spanish, and French (National Cancer Institute Division of Cancer Control and Population Sciences, 2017). It has been validated in both adult populations (Kirkpatrick et al., 2014, 2016; Subar et al., 2010; Thompson et al., 2015) as well as children (Baranowski et al., 2012; Diep et al., 2015; Douglass et al., 2013; Kirkpatrick et al., 2017).

Life Chaos Scale. In this section I will briefly cover the development of the Life Chaos Scale, including who developed it and when. I will justify why this instrument was appropriate for this study. I will explain how I received permission to use this tool, and offer the published reliability and validity of this tool. I will also briefly review the literature review on this tool, explaining how this tool has been previously used.

Development. The Life Chaos Scale was developed by Wong et al. (2007) between 2004 and 2005. This scale was first published in 2007 by the developers (Wong et al., 2007). The Life Chaos Scale is a revision of the CHAOS. As such, it is important to understand how this antecedent scale was developed, validated, and found reliable. This will be followed by a discussion of the creation of the Life Chaos Scale.

Development of the CHAOS. The CHAOS was first developed by Matheny Jr. et al. as a cost-effective way to measure household environment in families with young children (Matheny Jr. et al., 1995). Matheny Jr. and collaborators were interested in measuring the "potentially stressful, nonspecific background factors" (Matheny Jr. et al.,

1995, p. 430) that were becoming of interest to researchers at that time. Matheny Jr. and his team (1995) initially termed these factors environmental confusion. Development of the scale grew out of data from the Louisville Twin Study (Matheny Jr., Wilson, & Thoben, 1987; Wilson, 1983). Thirty potential items for the scale were taken from interviews and interviewer narratives from the Louisville Twin Study (Matheny Jr. et al., 1995). These items were then reduced to reject items that reflected on the construction of the home or furniture, as well as items that reflected on slovenly or unsanitary behavior of family members (Matheny Jr. et al., 1995). The resultant scale of 15 true/false items was then used in two studies to establish reliability and validity.

Reliability of the CHAOS. To establish reliability, the CHAOS was administered to 123 mothers of small children and babies. Correlation coefficients were established for each item to show the relationship between each item and the total score of the CHAOS. All items, save one, had correlations above 0.30, and the coefficient alpha for all items was 0.79 (Matheny Jr. et al., 1995). To further establish reliability, a subset of the original participants (n=42) repeated the questionnaire 12 months later. Test-retest stability coefficient was 0.74, and no significant changes in the mean or variance was found.

Validity of the CHAOS. To establish validity, researchers had the mothers of 52 infants respond to the CHAOS questionnaire, while the researchers measured the home environment during in-home visits (Matheny Jr. et al., 1995). Home environment was measured via the Purdue Home Stimulation Inventory which measured noise intensity, number of sound sources, crowding as measured by room to people ratio, and home

traffic patterns measured by the number of people coming and going in the home. Matheny and his team found that higher CHAOS scores were significantly related to higher physical and social environmental chaos as measured by the Purdue Home Stimulation Inventory (1994). Additionally, higher scores on the CHAOS were associated with behavioral changes in the mother and infant that would be expected in settings with greater environmental confusion (Matheny Jr. et al., 1995).

Revising the CHAOS to reflect Life Chaos. Understanding that the core concept of household chaos is not solely the domain of families with children, Wong et al. (2007) thought to revise the CHAOS to reflect the concept of life chaos in general adult populations. To be clear, the revised CHAOS has not been published as an official revision, but has been used as such in the published studies that have used Wong et al's (2007) work as a reference. Although Wong and his collaborators (2007) did not offer an official name for this new scale, it has been used in other publications as the Life Chaos Scale (Crowley et al., 2015; Horvath, Carrico, et al., 2013; Horvath, Oakes, et al., 2013; Viswanath et al., 2016; Wawrzyniak et al., 2015).

Table 2
Items in the Life Chaos Scale

Item	Item-score correlation
1. My life is organized	0.64
2. My life is unstable	0.71
3. My routine is the same from week to week	0.50
4. My daily activities from week to week are unpredictable	0.50
5. Keeping a schedule is difficult for me	0.69
6. I do not like to make appointments too far in advance because I do not know what might come up	0.64

Response scale is 1) strongly agree, 2) agree, 3) unsure, 4) disagree, and 5) strongly disagree. Responses to items 2, 4, 5, and 6 are reversed so that a higher score indicates more chaos. Item-score correlation is the correlation between each item and the scale of the combined items excluding that item. Chronbach's alpha = .67 (Wong et al., 2007, p. 1288)

Although trying to measure similar concepts, the changes to the CHAOS were significant. The text of the items in the Life Chaos Scale now reflect general life rather than being restricted only to home life (Wong et al., 2007). Additional items were included to reflect the role of money, employment, housing, and one's ability to keep appointments (Wong et al., 2007). The initial list of 30 items was trimmed to 12, and then further pared during statistical analysis to only reflect items which correlated with the new scale in item-score correlations (Wong et al., 2007). The six resultant items with their item-score correlations are shown in table 2. The Life Chaos Scale uses a five-point response scale that ranges from "definitely true" to "definitely false" (Wong et al., 2007, p. 1287). Also of note, four of the six items are reversed scored so that a higher score on the Life Chaos Scale reflects more chaos (Wong et al., 2007).

Validity. Construct validity for this tool was based on the previous work of Wong and his team that lead to each item being included on the scale. The construct validity of

this scale is bolstered by the work of Zullig et al (2013) who also found the scale items to represent the construct of life chaos in their work with treatment adherence. Furthermore, discriminant validity was established through statistical analysis, which found that none of the items on the scale correlated with other indicators of treatment adherence more than they did with the construct of life chaos.

Reliability. Internal consistency reliability of the Life Chaos Scale was measured by Chronbach's alpha, which was equal to 0.67 (Wong et al., 2007). Even stronger results were reported by Zullig et al (2013) who reported Chronbach's alpha = 0.92.

Appropriateness to study. The Life Chaos Scale offers a reliable and valid way to quickly measure life chaos in someone's life. It has been successfully used in other studies of adult behaviors, including adherence to beneficial health behaviors (Wong et al., 2007; Zullig et al., 2013). It was also appropriate to this study, which assessed the relationship between diet quality and life chaos as a function of income, because it has been shown to detect life chaos in populations of different incomes (Viswanath et al., 2016; Zullig et al., 2013). Significant to this study's methodology, it can easily be administered via an Internet survey.

Permission to use. Permission to use this study was given via email from the lead author.

Literature review. At the time of this writing, the Life Chaos Scale has been used in seven studies. Four of these studies sought to understand the role of life chaos on medication/treatment adherence in HIV patients (Horvath, Carrico, et al., 2013; Horvath, Oakes, et al., 2013; Wawrzyniak et al., 2015; Wong et al., 2007). Two studies used the

Life Chaos Scale to correlate life chaos with post myocardial infarction medication and treatment adherence (Crowley et al., 2015; Zullig et al., 2013). The final study found life chaos to be a predictor of risky sexual behavior (Viswanath et al., 2016).

Operationalization

In this section I will operationalize the three variables in this study: life chaos, diet quality, and household income. For each of these variables I will offer an operational definition, an explanation of how it will be measured and scored and what the scores represent, and an example item.

Life chaos. Life chaos is the microenvironment of an adult, including daily routine, personal organization, life stability, and the ability to make plans and keep appointments (Smolderen & Whooley, 2013; Viswanath et al., 2016; Wong et al., 2007; Zullig et al., 2013).

Operational definition. For the purposes of this study life chaos was operationalized as a score on the Life Chaos Scale (Wong et al., 2007).

Measurement. The Life Chaos Scale consists of 6 statements. Respondents rate each statement on a Likert scale (1-5 where 1 is strongly agree, and 5 is strongly disagree). Four of the items are reverse scored. On this scale, a higher score represents greater chaos.

Example. An example of an item on the Life Chaos Scale is "My life is organized" (Wong et al., 2007, p. 1288). The full list of items in the Life Chaos Scale can be found in Table 1 earlier in this chapter.

Diet quality. At this time, there is not an agreed upon definition of diet quality within the discipline (Alkerwi, 2014; Elmadfa & Meyer, 2012). As discussed and defended earlier, for the purposes of this study diet quality was defined as how closely a diet reflects the USDA and NIH's Dietary Guidelines for Americans (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015).

Operational definition. Diet quality was operationalized as a score on the HEI - 2010 (National Cancer Institute, 2016).

Measurement. Scores on the HEI-2010 were calculated using 24-hour diet recall data collected on ASA24 (National Cancer Institute, 2016). To calculate a HEI -2010 score, the amount of each relevant dietary constituent within the individual 24-hour diet recall is determined. These constituent values are then used to create ratios of what was consumed to recommended dietary guidelines. These ratios are then assigned a point value based on scoring standards resulting in a score out of 100. A higher score represents greater diet quality.

To eliminate possible errors due to the complicated nature of calculating scores on this scale, the National Cancer Institute offers SAS Macros which mesh seamlessly with ASA24 data output (National Cancer Institute, 2016; National Cancer Institute Division of Cancer Control and Population Sciences, 2017). Upon completion of data collection, I imported the dataset from ASA24 directly into the SAS macro for the 2010 version of the HEI, thus ensuring that my HEI-2010 scores were calculated correctly.

Example. An example of an item on the HEI-2010 is the adequate consumption of fruit. This construct is allotted a total of 10 points in the overall possible scale. The 10

possible points are further divided between total fruit consumed and the amount of whole fruit consumed, each being assigned a possible 5 points each. From the 24 hour diet recall the total fruit consumed would be tallied and calculated into ratio form, total fruit consumed/total fruit recommended. The maximum 5 points is awarded when the total fruit ratio is ≥0.8 cup (whole fruit ≥0.4 cup) and the minimum score of 0 points is awarded when there were no fruits consumed (no whole fruits consumed) (National Cancer Institute, 2016).

Household income. Household income is the total financial income of a household including all members of the household 15 years and older, related to each other or not (Posey, 2016).

Operational definition. For the purposes of this study, household income was operationalized as a 9-point ordinal scale of possible incomes, as used by the U.S. Census Bureau to report household income demographics (Proctor, Semega, & Kollar, 2016).

Measurement. Household income was measured by self-report. Respondents picked one of the 9 options representing a range of household incomes, where the greater the number on the scale, the greater the household income.

Example. Participants were asked to choose the range that best reflects their household. The scale starts with item 1 representing household incomes of less than $15,000/year. Item 2 represents yearly household incomes of $15,000-$24,999. The scale continues in like manner until reaching item 9, which represents household incomes of greater than $200,000/year.

Data Analysis

In this section I will first explain what software I used for my analysis. This will be followed by an explanation of my data cleaning and screening procedures. The remaining portion of this section will address the details of the analysis plan of each of my stated research questions.

Software. HEI-2010 scores were calculated using SAS software, University Edition of the SAS System (2017) for Mac OS. This is because the macros used to calculate HEI-2010 scores from ASA24 data are only available in SAS software at this time (National Cancer Institute, 2016). All other statistical analyses will be performed on SPSS statistical analysis software (version 23.0).

Data screening and cleaning. This Internet based survey employed question and page logic, skip patterns, and data validation to preemptively screen and clean data. All data were exported directly to the statistical software to avoid errors associated with manual entry. Incomplete submissions were removed.

Research question analysis. This section will describe the statistical analyses used to test each of the proposed research questions. RQ2 will include the rationale for the inclusion of potential covariates and/or confounding variables. Each section will end with how the results were interpreted. I will begin with RQ1 followed by RQ2.

RQ1. RQ1. Is life chaos, as measured by the Life Chaos Scale, a predictor of diet quality, as measured by the HEI – 2010, in U.S. adults?

Hypothesis 1_0: Life chaos is not a significant predictor of diet quality in U.S. adults.

Hypothesis 1_A: Life chaos is a significant predictor of diet quality in U.S. adults.

RQ1 was tested via linear regression using SPSS statistical software. A regression model was constructed and tested for overall goodness of fit using the Deviance goodness-of-fit test and Pearson goodness-of-fit test (Field, 2013; Laerd Statistics, 2015). Results were interpreted for significance at the $p = .05$ level and will be expressed as a 95% confidence interval.

RQ2. Does the relationship between life chaos, as measured by the Life Chaos Scale, and diet quality, as measured by the HEI-2010, change as a function of household income, as measured by self-report?

Hypothesis 2_0: The relationship between life chaos and diet quality does not change as a function of household income.

Hypothesis 2_A: the relationship between life chaos and diet quality changes as a function of household income. Based on previous research this change could be expected to come either as mediation or moderation.

RQ2 was tested via multiple regression using SPSS statistical software. A regression model was constructed and tested for fit using the multiple correlation coefficient and the statistical significance of the model (Field, 2013). It was decided that moderation would be determined by a significant interaction between the variables *life chaos* and *household income* ($p = .05$) (Fairchild & MacKinnon, 2009). It was decided that mediation would be tested using the Sobel test (Sobel, 1982). Results were interpreted for significance at the $p = .05$ level. It was decided that confidence intervals would be computed using bootstrapping (Field, 2013).

Threats to Validity

In this section I will discuss the potential threats to the validity of this study and how I protected against these threats. I will begin with threats to the external validity of this study followed by the threats to the internal validity of this study. I will close this section discussing potential threats to the construct and statistical conclusion validity of this study.

External validity. External validity is the ability to generalize the results of a study to a broader population. This section will discuss two threats to the external validity of this study. I will discuss the possibility of volunteer bias. This will be followed by a brief discussion of how participant compensation could threaten the external validity of this study. A more detailed discussion of this subject will follow later in this chapter.

One of the potential threats to the external validity of this study was volunteer bias. Because I used a self-selection sampling strategy there is a risk my results will not be generalizable to the wider population. Although this is a potential threat to the validity of my study, it is not unique to my study. Self-selection is typical in human research studies (Eysenbach & Wyatt, 2002; Khazaal et al., 2014). The thousands of social science studies that have used this same sampling strategy on the Mechanical Turk platform are testament that this potential threat to validity is not insurmountable (Chandler & Shapiro, 2016). First, the diversity of samples drawn from Mechanical Turk's workers is more representative of the general population than other traditional self-selection sampling frames such as university populations (Berinsky et al., 2012; Buhrmester et al., 2011; Chandler & Shapiro, 2016; Mason & Suri, 2012). The collection of demographic data can

help to elucidate the extent of a bias should there be one. Second, because this study was concerned more with modeling a relationship rather than describing a population, the main concern was recruiting a sample large enough to capture the differences within that relationship rather than to mirror the population as a whole (Chandler & Shapiro, 2016). Because previous research regarding household chaos and diet-related issues have been conducted primarily on low income populations (Appelhans et al., 2014; Chae et al., 2016; Fiese et al., 2016; Levin et al., 2013; Pinard et al., 2015), including this stratum of the population in this sample was essential in order to parallel prior research. There is also reason to believe that life chaos can be measured in population strata who are not low-income (Viswanath et al., 2016; Zullig et al., 2013), making it necessary to include a variety of income groups within the sample in order to effectively capture the differences within this variable. One of the documented differences between the Mechanical Turk worker population and the general population is that the Mechanical Turk population tends to report a lower household income than the general population (Huff & Tingley, 2015; Mason & Suri, 2012; Paolacci & Chandler, 2014). Therefore, this population echoed prior research in low-income groups, but also did not exclusively include this population, which helped to ensure that a variety of income levels were represented in the resulting model.

The other potential threat to the external validity of this study was also a reflection of the sampling frame. Because remuneration is inherent in the Mechanical Turk platform, there was the potential to have the level of compensation influence who chose to participate in this study. This topic will be discussed in greater detail below;

however, it suffices here to say that I protected against this threat by ensuring that the compensation offered was modest or token, rather than disproportionately large compared to the expected time participants spent taking the survey.

Internal validity. Internal validity concerns the presence of possible confounding effects upon the outcome of the study. Two possible threats to internal validity were volunteer bias and compensation; these have been previously addressed. Additional confounding effects in diet research could include age, sex, and race/ethnicity (Hiza, Casavale, et al., 2013). These demographic data were collected to assess and protect the internal validity of the study.

Validity threats that are associated with the passing of time or retesting were not a concern to this study, as this study was cross-sectional and the data collection window was quite small. Threats of this nature could include history, repeated testing, maturation, experimental mortality, and regression to the mean. Statistical regression was not anticipated as a threat because all members of the Mechanical Turk workers pool were invited to participate rather than selecting the sample on baseline scores.

Construct and statistical conclusion validity. To protect the construct validity of this study I have used published tools that have been found to be valid and reliable (Guenther et al., 2014; Subar et al., 2012; Wong et al., 2007). The lack of consensus on the definition of diet quality was of course of concern to the construct validity of this study. Discussion regarding this subject can be found in chapter 2. For the purposes of this section, it is enough to repeat that this construct has been operationalized based on the Dietary Guidelines for Americans (U.S. Department of Health and Human Services

and U. S. Department of Agriculture, 2015) which is the Federal standard by which public records on this subject are gauged. Statistical conclusion validity was protected by the statistical procedures discussed earlier in this chapter. For example, the use of multiple tests for goodness of fit, bootstrapping in computing confidence intervals, and posthoc analyses to determine if models are still significant with the inclusion of other demographic data are all steps that were taken to protect the statistical conclusion validity of study.

Ethical Procedures

Ensuring the ethical treatment of human participants is a key concern of all research. In this section I will discuss the procedures that I followed to protect the human research subjects of this study. I will first discuss the agreements needed to gain access to the participants. Next, I will describe the treatment of the human participants, including IRB approval, ethical concerns related to my recruitment materials, as well as concerns related to possible issues that could occur during data collection.

Access to participants. Access to participants was gained through the Mechanical Turk website (Amazon.com, Inc., 2017). As part of my IRB application I included my registration as a requester on the Mechanical Turk platform, which included prefunding the study through Amazon Payments (Amazon.com, Inc., 2017).

Treatment of human participants. Before any data were collected, or participants were recruited, I sought and obtained IRB approval. There were no ethical concerns related to the recruitment materials associated with this study. As stated earlier,

the informed consent was part of the recruitment materials and all potential participants had the choice to participate or not, with no risk of repercussions.

A common ethical concern during data collection is that of participants withdrawing from a study prior to study completion. This was not a concern for this study due again to the nature of the Mechanical Turk platform. Participants who did not complete both sections of the study (the survey and the 24-hour diet recall) were not compensated, nor was there an expectation that they would be, within the Mechanical Turk workers pool. Standard practice within Mechanical Turk is that the agreed upon remuneration for time will only be given upon full completion of the agreed upon task (Amazon.com, Inc., 2017). Participants were welcome to withdraw from the study at any time, without any negative repercussions. I did not leave feedback regarding the quality of the work for any participant, regardless of their status of completion of the task. All data remained anonymous. As anticipated, I was not notified of any adverse events associated with this study, as participation did not entail any risks outside of everyday events.

Treatment of Data

Data were dealt with in two steps. First, in order to ensure proper remuneration to participants, participants were given a user name and password. This data were kept confidential, in password-protected files on password-protected computers with secure, remote back-up and were be kept until remuneration for participation of all participants has been distributed. No paper files of this data were generated for storage or backup. I

did not at any time have any access to financial information of participants, as remuneration for time was handled by Mechanical Turk (Amazon.com, Inc., 2017).

Next, HEI scores were calculated and added to the dataset from the first half of the study (the survey containing the Life Chaos Scale and demographic questions). At this stage, data were only accessed by me and this was clearly stated in the informed consent. Participants were informed that de-identified and aggregate data may be published to further research within this field, but no identifiable data would ever be distributed. De-identified data will be maintained for 5 years and then destroyed.

Justification of Incentives

One final issue that needs to be addressed in this study was the justification of incentives. Remuneration for time is standard practice and expected on Mechanical Turk (Amazon.com, Inc., 2017); however, past practices have been to protect the validity of a study by offering a very small, or token amount in exchange for participation (Buhrmester et al., 2011; Paolacci & Chandler, 2014). This has led to the unethical use of participant's time without fair compensation. Current best practice in crowd-sourced research suggests that remuneration should be based on minimum wage for the time participants are expected use for participation in a study (Chandler & Shapiro, 2016; Mason & Suri, 2012). The median time for respondents to complete their first recall using the ASA24 is 28 minutes (National Cancer Institute Division of Cancer Control and Population Sciences, 2017), however this time could be longer depending on how complex the respondents previous day's diet was. It was conceivable that a participant could spend 45 minutes participating in this study but unlikely that it would take a full

hour. With the Federal minimum wage currently at $7.25/hour (United States Department of Labor, 2017), remuneration for 45 minutes (the upper limit of expected time for participation) would be $5.44. For ease of administration this was be rounded up to $5.50 per participant. Such a modest amount would not be considered an inducement.

Summary

This chapter has presented the research design and rationale of my proposed study. I have presented my proposed methodology including discussions of sampling, procedures, instrumentation, and operationalization of constructs. I have addressed my data analysis plan, potential threats to the validity of my study and the steps that I will take to ensure the fair and ethical treatment of my study participants. In the following chapter I will report my data.

Chapter 4: Results

Introduction

The purpose of this study was to determine if life chaos was a predictor of diet quality and to determine if this relationship changed as a function of household income. There were two research questions associated with the purpose of this study. Is life chaos a predictor of diet quality in U.S. adults? It was hypothesized that life chaos would indeed be a predictor of diet quality. Does the relationship between life chaos and diet quality change as a function of household income. Again, it was predicted that the relationship between life chaos and diet quality would change when household income was included in the model. It was unclear at the time if this change would come in the form of moderation or mediation. In this chapter, I will report the findings of this study. I will include a detailed report of the data collection, followed by an account of the statistical analyses used to answer each research question.

Data Collection

In this section, I will describe the time frame for data collection, as well as the actual recruitment and response rates. Next, I will report the data cleaning methods and the resultant sample size. Finally, I will offer the descriptive and demographic characteristics of the sample including an explanation of how representative the sample was of the overall population.

Time Frame

Institutional review board approval for the study was granted on November 8, 2017. Recruitment and data collections started on December 18 2017 and concluded on

December 19 2017. Data collection ended when a sufficient number of usable responses had been gathered. Recruitment proceeded as proposed.

Response Rates

A total of 140 participants completed the first half of the study. Participants used their ASA24 username or password as a completion code when requesting payment through Mechanical Turk. One hundred and fifteen participants requested payment. With one exception, all participants who submitted a request for payment were payed within 24 hours of submitting their request. The one participant who did not get paid had submitted a username and password that had not been used to sign into ASA24. Efforts were made through Mechanical Turk to clarify with the participant in hopes that a recording error had occurred; however, that was not the case.

Data Cleaning

The target sample size of this study was based on previously published effect sizes and calculated by a power analysis using G*Power 3.1.9.2 (Faul, Erdfelder, Buchner, & Lang, 2009) set for regression at the 0.95 level. In the results, I found a required minimum sample size $n = 99$ to power the study. As an Internet-based survey, I used page logic, skip patterns, and data validation to preemptively screen and clean the data. The resultant data set was further cleaned by removing records that did not contain a diet recall record or a record of payment through Mechanical Turk. Data were collected in two waves, the first where the majority (82%) of the responses were recorded, and the second after data cleaning highlighted the possibility of not collecting enough complete submissions to reach my proposed sample size. Of the original 140 submission attempts,

37 records were excluded due to missing data or lack of proof of payment. This resulted in a sample size of $n = 103$. As per the study research methodology, diet recall data from ASA24 were transformed into HEI-2010 scores using SAS software and the macros provided by the National Cancer Institute (National Cancer Institute, 2016). In Table 3, the frequency and percentage of the categorical data are reported that describe the demographic characteristics of the sample

Table 3

Demographic Data for Participants Compared to Percent U.S. General Population

Demographic	Subgroup	Frequency	% Sample	% U. S. Population
Gender				
	Male	65	63.1	49.2[a]
	Female	38	36.9	50.8[a]
	Total	**103**	**100**	**100**
Age				
	18 to 24 years	6	5.8	9.9[a]
	25 to 44 years	84	81.1	26.6[a]
	45 to 64 years	12	11.7	26.4[a]
	65 and over	1	1.0	13.0[a]
	Total	**103**	**~100**	**75.9**
Race				
	White	76	73.8	72.4[b]
	Black or African American	12	11.7	12.6[b]
	American Indian and Alaska Native	1	1.0	0.9[b]
	Asian	11	10.7	4.8[b]
	Native Hawaiian and Other Pacific Islander	0	0	0.2[b]
	Some Other Race	0	0	6.2[b]
	Two or more races	3	2.9	2.9[b]
	Total	**103**	**~100**	**100**

Note. [a] (Howden & Meyer, 2011), [b] (Humes, Jones, & Ramirez, 2011)

Descriptive and Demographics

This sample was disproportionately male (63.1%), and significantly younger than the general U.S. adult population with 81% of the sample reporting being between the ages of 25 and 44. The racial background of this sample was much closer to that of the overall population of the United States. As shown in Table 3, the proportion White and Black or African American participants within this sample are within 1 percentage point of the overall U. S. population. The anomalies from this pattern were that significantly more participants reported being Asian within this sample (10.7%), and unlike the overall U. S. population, no participants reported being from some other race. The differences from the overall U. S. population within this sample are as expected based on the demographics of the Mechanical Turk Workers pool (Huff & Tingley, 2015). Table 4 shows the dummy coding, frequency, and percentage of household income within the sample. It also shows the percentage of household income within each category in the overall U. S. population.

Table 4

Household Income of Study Participants Compared to General U.S. Population

Household Income	Dummy	Frequency	% Sample	% U. S. Population
less than $15,000/year	1	6	5.8	11.6[a]
$15,000 - $24,999/year	2	11	10.7	10.5[a]
$25,000 - $34,999/year	3	21	20.4	10.0[a]
$35,000 - $49,999/year	4	14	13.6	12.7[a]
$50,000 - $74,999/year	5	23	22.3	16.7[a]
$75,000 - $99,999/year	6	18	17.5	12.1[a]
$100,00 - $149,999/year	7	8	7.8	14.1[a]
$150,000 - 199,999/year	8	0	0	6.2[a]
$200,000 and over	9	2	1.9	6.1[a]
Total		103	100	100

Note. [a] *(Proctor et al., 2016)*

One of the key variables in RQ2 was household income. Groupings within this variable were taken from the U. S. Census (Proctor et al., 2016) and dummy coded for analysis. Although household income in this sample is generally normally distributed, it does vary from the overall U. S. population on every level except two ($15,000 - $24,999/year, and $35,000 - $49,999/year), which are within 1 percentage point of the overall population. As with the above-mentioned demographics, the differences in household income within this sample compared to the overall U. S. population are expected (Huff & Tingley, 2015).

Results

In this section, I will first report the descriptive statistics of this sample. Next, I will evaluate the statistical assumptions necessary to this study. This will be followed by a report of the statistical analysis organized by research question, RQ1 followed by RQ2. Finally, I will report the results of additional statistical tests of hypotheses that emerged from the analysis of the main hypotheses.

Descriptive Statistics

Prior to the constructing a regression model to answer my research questions, HEI-2010 scores were calculated from ASA24 diet recall data. Additionally, household income levels were dummy coded. The resulting HEI-2010 scores are included in the descriptive statistics found in Table 5. Table 5 shows the means and standard deviations of the main variables used in this study.

Assumptions

In this section, I will evaluate the statistical assumptions of this study. I divide this section by research question, starting with RQ1 and concluding with RQ2.

RQ1. RQ1 was analyzed via linear regression. It is assumed in linear regression that there is a continuous dependent variable and continuous independent variable. The variables in this research question (diet quality as measured by the Healthy Eating Index -

Table 5
Means and Standard Deviations for all Variables

Variable	*(a) N*	Min	Max	Mean	*(b) SD*
HEI-2010	103	17.4619	86.0031	47.8118	15.1799
Life Chaos Scale	103	6	30	14.56	5.392
Household Income*	103	1	9	4.31	1.788

Note. *descriptive statistics reported here reference the dummy coding listed in Table 4

2010, and life chaos as measured by the Life Chaos Scale) were both continuous. There were no outliers as measured via standardized residuals of greater than +/-3 standard deviations.

Another assumption of linear regression is independence of observations. Although the design of this study gave no reason to suspect a serial correlation error, this was tested using residuals. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.951.

Homoscedasticity is the assumption that variance of residuals is evenly distributed across range of the predictor variable (Field, 2013). Homoscedasticity was assessed by visual inspection of a plot of standardized residuals versus standardized predicted values. The assumption of homoscedasticity was met (Appendix A Figure 4).

Although linear regression analysis is fairly robust against deviations from normality (Laerd Statistics, 2015), it is assumed that the residuals are normally distributed. Residuals were normally distributed as assessed by visual inspection of a normal probability plot (Appendix B).

RQ2. RQ2 was analyzed via multiple regression. As in linear regression, it is assumed in multiple regression that there is a continuous dependent variable. The dependent variable in this analysis was continuous (diet quality as measured by the Healthy Eating Index – 2010). In multiple regression, it is also assumed that there will be at least two or more independent variables that can be either continuous or categorical. The independent variables in this analysis were life chaos as measured by the Life Chaos Scale (continuous), and household income (categorical).

As in RQ1, another assumption of multiple regression is independence of observations. The design of this study gave no reason to suspect a serial correlation error;

however, this was tested using residuals. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.896.

As with RQ1, there was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values (Appendix B; Figure 5). Residuals were normally distributed as assessed by visual inspection of a normal probability plot (Appendix A).

Multicollinearity could occur within this study if life chaos and household income were highly correlated with each other. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1 (*Tolerance* = .984 VIF 1.016).

The data set was examined for outliers, leverage values, or influential points as measured by Cook's distance. There were no outliers as measured via standardized residuals of greater than +/-3 standard deviations. There were no leverage values greater than 0.2. There were no values for Cook's distance above 1.

RQ1 Results

A linear regression was run to predict diet quality from life chaos. Life chaos was not found to be a statistically significant predictor of diet quality $F(1,101) = .150$, $p = .699$. The regression equation was predicted diet quality = 49.391 + -.108*life chaos (95% *CI*, -0.664 to 0.447). The results failed to reject the null hypothesis.

RQ2 Results

A multiple regression was run to predict diet quality from life chaos and household income. R^2 for the overall model was 8.6% with an adjusted R^2 of 6.8%. The overall model showed that life chaos and household income together statistically

significantly predicted diet quality, $F(2,100) = 4.707$, $p = .011$. However, only household income added significantly to the prediction, $p = .003$. Life chaos did not add statistically significantly to the prediction, $p = .985$.

It was determined that there was no moderating effect of household income on life chaos within the model. This was tested via interaction between the variables life chaos and household income. No significant interaction was found between these two variables ($r = -.125$, $p = .104$).

It was determined that there was no mediating effect within this model. The first assumption for testing mediation via the Sobel test is a linear relationship between the predictor and the predicted variables. The results of the linear regression analysis in RQ1 being insignificant break this first and key assumption, meaning mediation is not a possible explanation for the statistical significance of the multiple regression model in RQ2.

Despite the statistical significance of the overall model, the lack of contribution to the model by life chaos leads me to not reject the null hypothesis. I found that in this model, household income predicts diet quality, but life chaos does not.

Summary

In this chapter, I reported my data collection process and described my sample. I presented the results of my statistical analyses, and I failed to reject the null hypothesis in both research questions. In this study, I hypothesized that there was a relationship between life chaos and diet quality. I found that life chaos was not a significant predictor of diet quality. Additionally, I predicted that including household income would change

the predictive value of a model predicting diet quality from life chaos. Although household income did increase the predictive value of the model, life chaos was not found to be a significant contributor to the model.

In the final chapter, I offer an interpretation of my findings. I will present the limitations of my study and offer recommendations for further research in this area. Finally, I will address the implications of my study and discuss the potential social impact of this research.

Chapter 5

Introduction

Because psychosocial influences impact diet, it is important to understand these influences in order to develop evidence-informed interventions that could decrease the trend of diet-related illnesses in the United States. The purpose of this quantitative, survey study was to examine the relationship between one such possible influence, life chaos, and diet quality in U.S. adults. It was hypothesized that life chaos would be a predictor of diet quality. Furthermore, I sought to understand if, and if so, how, the relationship between life chaos and diet quality would change as a function of household income.

I did not find that life chaos was a statistically significant predictor of diet quality. Although the relationship between life chaos and diet quality changed when household income was included in the predictive model, life chaos was still not a significant predictor in the model. Rather than acting as a moderator or mediator of life chaos, household income was its own influence on diet quality.

In this chapter, I explore the findings of this study further. First, I will offer a literature-based interpretation of the findings. Next, I will describe the limitations of the study, followed by recommendations for further research in this area. Finally, I will explain the implications of this study and the related possibilities for social change stemming from this research.

Interpretation of Findings

In this section, I will interpret the findings of this study. This section will be divided into two main sections, with the first discussing the findings of this study within the field of life chaos research, and the second, within the field of diet quality. Within each of these sections, I will discuss how this research confirms, disconfirms, or extends the knowledge in the discipline.

Life Chaos.

Previous research in the field of chaos has been mixed regarding the occurrence of chaos throughout the socioeconomic spectrum. Chaos (household and life) is inevitably linked to low-income status (Deater-Deckard et al., 2012; Kalichman & Kalichman, 2016; Pinard et al., 2015), with poverty predicting chaos (Kalichman & Kalichman, 2016). Most research on the earlier construct of household chaos focused exclusively on low-income households (Appelhans et al., 2014; Deater-Deckard et al., 2012; Evans et al., 2008, 2005; Fiese et al., 2016; Pinard et al., 2015; Raver et al., 2015; Vernon-Feagans et al., 2012). Conversely, life chaos research has been mixed. Some scholars have focused on participants in poverty (Kalichman & Kalichman, 2016; Wawrzyniak et al., 2015), while other researchers have covered a wide income spectrum (Crowley et al., 2015; Viswanath et al., 2016; Zullig et al., 2013).

My data contradicted the current understanding of chaos by showing life chaos distributed broadly throughout household income levels (Figure 1). This continues to hold true when life chaos is categorized as high/low at the median (Figure 2) as per the methodology in prior life chaos research (Viswanath et al., 2016). Further division of life

chaos, to compare only the highest levels of chaos proved fruitless, as even at this high level, chaos was distributed widely throughout the income levels (Figure 3). Although only ancillary to the primary focus of this study, these findings should be investigated further in future research.

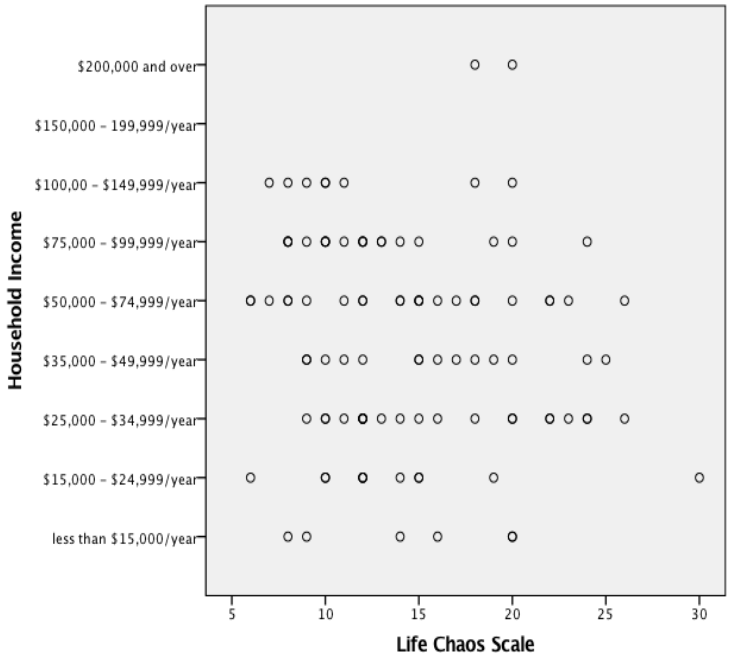

Figure 1.Life Chaos by Household Income. A scatterplot of life chaos scores by household income shows life chaos varies widely throughout all levels of household income. Greater values on the Life Chaos Scale indicate higher levels of chaos reported.

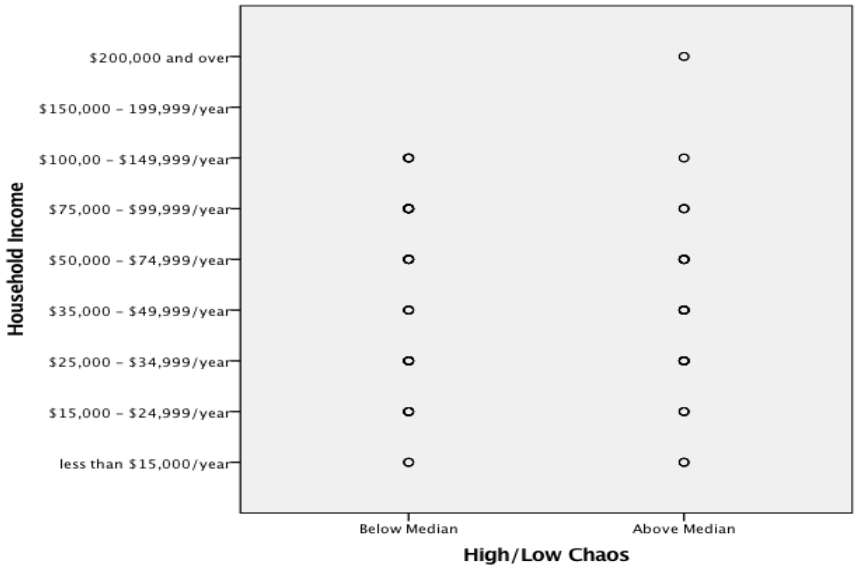

Figure 2.High/Low Life Chaos by Household Income. A scatterplot of life chaos scores by household income. Life Chaos scores are divided at the median (a Life Chaos Scale score of 14) to provide high chaos and low chaos groupings. Both high and low chaos are distributed widely throughout all household income

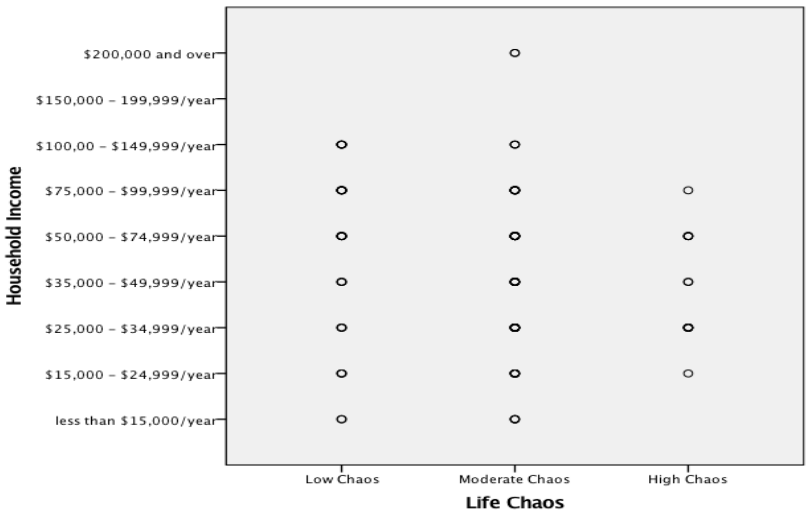

Figure 3. High/Moderate/Low Life Chaos by Household Income. .Scatter plot of life chaos by household income where life chaos scores were divided into thirds at scores of 10 and below, 11-20, 21 and above. High levels of chaos were found throughout low and middle income levels.

Diet Quality

In this section, I will interpret the findings of this study as they relate to the field of diet quality research. Based on the findings of this study, diet quality cannot be predicted by life chaos in this sample. There was no statistically significant correlation between life chaos and diet quality (r = -.125, p = .208). However, I confirmed previous research showing low diet quality in U.S. adults, and reaffirms the correlation between household income and diet quality.

Diet quality within this study sample was low. This is to be expected among U.S. adults and confirms current understanding of diet quality within the U. S. adult population. Average HEI-2010 scores calculated from National Health and Nutrition Examination Survey (NHANES) was 49.9 (Guenther et al., 2014), whereas the mean for this sample was 47.8. The standard error of the mean of the current study (+/-1.5) was greater than that of the NHANES study (+/-0.5; Guenther et al., 2014), but this was to be expected given the differences in sample size between these two studies, the NHANES study having many more participants (n = 8262) than this study (n=103).

I also confirmed the current understanding of the influence household income plays on diet quality. Although diet quality in the United States is generally low throughout socioeconomic levels, poverty and low income levels are particularly strained (da Fonseca, 2014; Leung et al., 2014; Robaina & Martin, 2013; Traill et al., 2012; Wang et al., 2014). In a nationally representative sample of 29,124 U.S. adults (aged 20-85), Wang et al. (2014) found that diet quality disparities between income levels are increasing. Although my study was cross sectional rather than longitudinal, the results of

RQ2 confirm the findings of previous research. RQ2 asked if life chaos and household income combined could predict diet quality. The resulting model was significant; however, household income was the only contributing factor to the model, explaining 8.5% of the variance. This confirms the longstanding, and well-supported correlation between diet quality and household income level.

Limitations of the study

In this section I will describe the limitations to generalizability, validity, and reliability that arose from the execution of the study. First I will discuss limitations to the generalizability of this study. This will be followed by a discussion of the validity and reliability of this study due to issues regarding the timing of this study.

The sample for this study was drawn from Mechanical Turk workers. As discussed in chapter 4, the sample was not representative of the U.S. adult population. Although these differences were expected, and within reasonable probabilities of a random sample (Huff & Tingley, 2015), they do limit the generalizability of the results to the overall American population.

This study represented a snapshot of diet quality in U.S. adults on December 18-19, 2017. The average diet quality of this sample was in line with what would be expected from the overall population. However, this study was conducted during traditional American winter holiday season which could have affected the outcomes of this study. Previous research has found that diet quality in middle aged women is significantly different at the end of the year compared to the rest of the year (Jahns et al., 2016), starting at Thanksgiving and ending at New Year's Day. Additionally, I had two

participants who emailed me to tell me that their diet for 24 hours that they were reporting was not an accurate representation of their normal diet, but an accurate reporting of that particular day's diet. It is to be expected that diet quality will fluctuate from day to day, but in such a small sample, these fluctuations could be overrepresented. This represents both a limitation to the validity and the reliability of this study. I will discuss how these particular issues could be addressed in future studies in the following section.

Recommendations for Further Research

In this section I will describe recommendations for further research within this area of study. Some of these recommendations are derived from the previously examined limitations of the current study. These will be discussed first. Next, I will discuss my recommendations regarding the role of income level in life chaos research. An additional recommendation is drawn from changes that have been made to the HEI and have been published since this study was performed. A final recommendation for further research is based in the literature review of life and household chaos and will follow the primary recommendations.

As discussed earlier, the validity and reliability of this study was limited by the snapshot design of the study. Because diet quality will vary day-by-day, diet quality measures based on a single 24-hour diet recall might not be representative of overall diet quality. Where possible, I would recommend that future research in this area collect diet quality data for multiple consecutive days rather than the single 24-hour diet recall that this study collected. Additionally, because of the possibility that diet quality may vary

based on holiday seasons, I would recommend that future research take these seasonal changes into consideration when conducting diet quality research.

Another recommendation for future research within this area came from not collecting data that would allow me to calculate if participants fell under the poverty line. Although I collected information on the household income of each participant, I did not gather data on household size, resulting in the inability to determine which participants were living in poverty. This information was not directly related to the research questions of this study, but collecting this demographic data would allow future researchers to further explore the connection between diet quality and chaos as it relates to poverty rather than household income level on a broader scale. It is still possible that the stressors of poverty unduly influence life chaos and diet quality.

Although there is still a logical possibility that poverty disproportionately impacts both life chaos and diet quality, it is clear from the data in this study that lower incomes are not the only areas on the income spectrum that experience life chaos. I would recommend that future research in areas of both life and household chaos examine this phenomenon more fully.

This study used a single 24-hour diet recall to calculate diet quality. This was done using macros provided by the National Cancer Institute that are specific to single and/or nonconsecutive diet recalls using the HEI – 2010 (National Cancer Institute, 2016). As discussed earlier, at the time this study was conducted, a more recent version of the Healthy Eating Index, the HEI – 2015 had just been released, but supporting materials were not yet available. In the interim time, some of those materials have

become available, and clarifications have been made regarding the efficacy of single recall data. Although the National Cancer Institute still offers computational macros to support single and nonconsecutive diet recalls, they now recommend diet quality scores be calculated from diet recall data from multiple consecutive days to establish a diet quality scores based on habitual dietary intake levels rather than a single given day's intake (National Cancer Institute, 2018). Thus, I would recommend future research in this area collect diet recall data following current HEI – 2015 recommendations.

Finally, I would recommend that future research examine the relationship between household chaos and diet quality within a family setting. Although this study did not find a relationship between life chaos and diet quality, the variables within the construct of household chaos are somewhat different than those measured in life chaos (Wong et al., 2007). Previous research on the impact household chaos might have on diet-related issues has been discussed more thoroughly in the literature review of this study, and includes correlations between household chaos and food insecurity (Fiese et al., 2016; Pinard et al., 2015), family meal planning (Fiese et al., 2016), and child glycemic control (Levin et al., 2013). Additionally, the diet quality of families is significantly different than that of the general adult population (Cason, 2006; Collins et al., 2016), raising possibilities of additional psychosocial influences to diet quality in families such as household chaos.

Implications

In spite of having no significant findings to my research questions, I believe there are still implications stemming from this research. First, on a theoretical level, the data

from this research suggest that life chaos is not relegated to the ranks of the poor. This should be explored more thoroughly and could impact the future direction of research in both life chaos and household chaos.

Second, this research confirmed that diet quality in the United States is significantly lower than recommendations by the U.S. Department of Health and Human Services (U.S. Department of Health and Human Services and U. S. Department of Agriculture, 2015). It also confirmed that income level still has a significant and measureable influence on diet quality. Although this is not new information, this supports the need for continued research into the psychosocial influences on diet. It also suggests that efforts for positive social change in this area would have reason to start in lower income communities and groups.

Conclusion

This study examined the relationship between life chaos and diet quality. Although the data did not support the hypothesized outcomes, it clearly supported our current understanding of diet quality in America. Diet quality in U.S. adults is uniformly poor. This study did not find diet quality and life chaos to be related, although diet quality improved slightly with increased household income.

Despite the insignificant findings for the research questions, this study highlighted the need for increased investigation into the relationship between household income and life chaos. Additionally, this study confirmed established findings regarding the role of household income on diet quality. Research into the psychosocial influences on diet quality should continue. As we continue to uncover the social inequalities of health and

nutrition, social change efforts can be targeted to bring the health benefits of a high quality diet to more Americans.

References

Alkerwi, A. ’a. (2014). Diet quality concept. *Nutrition*, *30*(6), 613–618. https://doi.org/10.1016/j.nut.2013.10.001

Amazon.com, Inc. (2017). Mechanical Turk. Retrieved from https://requester.mturk.com

Appelhans, B. M., Fitzpatrick, S. L., Li, H., Cail, V., Waring, M. E., Schneider, K. L., … Pagoto, S. L. (2014). The home environment and childhood obesity in low-income households: indirect effects via sleep duration and screen time. *BMC Public Health*, *14*. https://doi.org/10.1186/1471-2458-14-1160

Baranowski, T., Islam, N., Baranowski, J., Martin, S., Beltran, A., Dadabhoy, H., … Subar, A. F. (2012). Comparison of a Web-based versus traditional diet recall among children. *Journal of the Academy of Nutrition and Dietetics*, *112*(4), 527–532. https://doi.org/10.1016/j.jada.2011.10.002

Beijers, R., Buitelaar, J. K., & de Weerth, C. (2014). Mechanisms underlying the effects of prenatal psychosocial stress on child outcomes: beyond the HPA axis. *European Child & Adolescent Psychiatry*, *23*(10), 943–956. https://doi.org/10.1007/s00787-014-0566-3

Berinsky, A. J., Huber, G. A., & Lenz, G. S. (2012). Evaluating Online Labor Markets for Experimental Research: Amazon.com’s Mechanical Turk. *Political Analysis*, *20*(03), 351–368. https://doi.org/10.1093/pan/mpr057

Bibiloni, M. del M., Pons, A., & Tur, J. (2015). Diet quality of Mediterranean adolescents evaluated by Mediterranean adaptation of the Diet Quality Index-Internationa(DQI I):socioeconomic, anthropometric, lifestyle and body image

determinants. *Journal of Clinical Nutrition & Dietetics*. Retrieved from http://clinical-nutrition.imedpub.com/abstract/diet-quality-of-mediterranean-adolescents-evaluated-by-mediterranean-adaptation-of-the-diet-quality-indexinternationadqi-isocioeconomic-anthropometric-lifestyle-and-body-image-determinants-0.html

Borrell-Carrio, F., Suchman, A. L., & Epstein, R. M. (2004). The Biopsychosocial Model 25 Years Later: Principles, Practice, and Scientific Inquiry. *The Annals of Family Medicine*, *2*(6), 576–582. https://doi.org/10.1370/afm.245

Brener, N. D., Billy, J. O. G., & Grady, W. R. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. *Journal of Adolescent Health*, *33*(6), 436–457. https://doi.org/10.1016/S1054-139X(03)00052-1

Briganti, S., Ermetici, F., Malavazos, A. E., Dozio, E., Giubbilini, P., Rigolini, R., … Romanelli, M. M. C. (2015). Effect of an isocaloric diet containing fiber-enriched flour on anthropometric and biochemical parameters in healthy non-obese non-diabetic subjects. *Journal of Clinical Biochemistry and Nutrition*, *57*(3), 217–222. https://doi.org/10.3164/jcbn.14-133

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A New Source of Inexpensive, Yet High-Quality, Data? *Perspectives on Psychological Science*, *6*(1), 3–5. https://doi.org/10.1177/1745691610393980

Canetti, L., Bachar, E., & Berry, E. M. (2002). Food and emotion. *Behavioural Processes*, *60*(2), 157–164.

Canter, K. S., Roberts, M. C., & Davis, A. M. (2016). The role of health behaviors and food insecurity in predicting fruit and vegetable intake in low-income children. *Children's Health Care*, *0*(0), 1–20. https://doi.org/10.1080/02739615.2015.1124772

Carroll-Scott, A., Gilstad-Hayden, K., Rosenthal, L., Peters, S. M., McCaslin, C., Joyce, R., & Ickovics, J. R. (2013). Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: The role of built, socioeconomic, and social environments. *Social Science & Medicine (1982)*, *95*, 106–114. https://doi.org/10.1016/j.socscimed.2013.04.003

Cason, K. L. (2006). Family Mealtimes: More than Just Eating Together. *Journal of the American Dietetic Association*, *106*(4), 532–533. https://doi.org/10.1016/j.jada.2006.01.012

Caspi, C. E., Sorensen, G., Subramanian, S. V., & Kawachi, I. (2012). The local food environment and diet: A systematic review. *Health & Place*, *18*(5), 1172–1187. https://doi.org/10.1016/j.healthplace.2012.05.006

Centers for Disease Control and Prevention. (2009, September 29). Majority of Americans not Meeting Recommendations for Fruit and Vegetable Consumption [cdc.gov]. Retrieved from http://www.cdc.gov/media/pressrel/2009/r090929.htm

Chae, M., Taylor, B. J., Lawrence, J., Healey, D., Reith, D. M., Gray, A., & Wheeler, B. J. (2016). Family CHAOS is associated with glycaemic control in children and adolescents with type 1 diabetes mellitus. *Acta Diabetologica*, *53*(1), 49–55. https://doi.org/10.1007/s00592-015-0736-x

Chandler, J., & Shapiro, D. (2016). Conducting Clinical Research Using Crowdsourced Convenience Samples. *Annual Review of Clinical Psychology*, *12*(1), 53–81. https://doi.org/10.1146/annurev-clinpsy-021815-093623

Chiuve, S. E., Fung, T. T., Rimm, E. B., Hu, F. B., McCullough, M. L., Wang, M., … Willett, W. C. (2012). Alternative Dietary Indices Both Strongly Predict Risk of Chronic Disease. *Journal of Nutrition*, *142*(6), 1009–1018. https://doi.org/10.3945/jn.111.157222

Chu, Y. L., Storey, K. E., & Veugelers, P. J. (2014). Involvement in Meal Preparation at Home Is Associated With Better Diet Quality Among Canadian Children. *Journal of Nutrition Education and Behavior*, *46*(4), 304–308. https://doi.org/10.1016/j.jneb.2013.10.003

Coldwell, J., Pike, A., & Dunn, J. (2006). Household chaos--links with parenting and child behaviour. *Journal Of Child Psychology And Psychiatry, And Allied Disciplines*, *47*(11), 1116–1122.

Collen, M. (2015). Operationalizing Pain Treatment in the Biopsychosocial Model: Take a Daily "SWEM"—Socialize, Work, Exercise, Meditate. *Journal of Pain & Palliative Care Pharmacotherapy*, *29*(3), 290–299. https://doi.org/10.3109/15360288.2015.1063563

Collier, K. L., van Beusekom, G., Bos, H. M. W., & Sandfort, T. G. M. (2013). Sexual Orientation and Gender Identity/Expression Related Peer Victimization in Adolescence: A Systematic Review of Associated Psychosocial and Health

Outcomes. *Journal of Sex Research*, *50*(3-4), 299–317. https://doi.org/10.1080/00224499.2012.750639

Collins, L. J., Lacy, K. E., Campbell, K. J., & McNaughton, S. A. (2016). The Predictors of Diet Quality among Australian Children Aged 3.5 Years. *Journal of the Academy of Nutrition and Dietetics*, *116*(7), 1114–1126.e2. https://doi.org/10.1016/j.jand.2015.12.014

Cornell Food Choice Research Group. (2016). Food choice research group webpage. Cornell University, Division of Nutritional Sciences, Ithaca, NY. Retrieved from Cornell Food Choice Research Group. (2013). Food choice research group webpage. Cornell University, Division of Nutritional Sciences, Ithaca, NY. Retrieved from www.human.cornell. edu/dns/foodchoice/

Crowley, M. J., Zullig, L. L., Shah, B. R., Shaw, R. J., Lindquist, J., Peterson, E., & Bosworth, H. B. (2015). Medication non-adherence after myocardial infarction: an exploration of modifying factors., Medication Non-Adherence After Myocardial Infarction: An Exploration of Modifying Factors. *Journal of General Internal Medicine, Journal of General Internal Medicine*, *30, 30*(1, 1), 83, 83–90. https://doi.org/10.1007/s11606-014-3072-x, 10.1007/s11606-014-3072-x

da Fonseca, M. A. (2014). Eat or heat? The effects of poverty on children's behavior. *Pediatric Dentistry*, *36*(2), 132–137.

Deater-Deckard, K. (2014). Family matters: Intergenerational and interpersonal processes of executive function and attentive behavior. *Current Directions in Psychological Science*, *23*(3), 230–236. https://doi.org/10.1177/0963721414531597

Deater-Deckard, K., Chen, N., Wang, Z., & Bell, M. A. (2012). Socioeconomic Risk Moderates the Link between Household Chaos and Maternal Executive Function. *Journal of Family Psychology*, *26*(3), 391–399. https://doi.org/10.1037/a0028331

Diep, C. S., Hingle, M., Chen, T.-A., Dadabhoy, H. R., Beltran, A., Baranowski, J., … Baranowski, T. (2015). The Automated Self-Administered 24-Hour Dietary Recall for Children, 2012 Version, for Youth Aged 9 to 11 Years: A Validation Study. *Journal of the Academy of Nutrition and Dietetics*, *115*(10), 1591–1598. https://doi.org/10.1016/j.jand.2015.02.021

Doucerain, M., 2, maf052@mail.harvard.com, & Fellows, L. K. . (2012). Eating Right: Linking Food-Related Decision-Making Concepts From Neuroscience, Psychology, and Education. *Mind, Brain & Education*, *6*(4), 206–219.

Douglass, D., Islam, N., Baranowski, J., Chen, T.-A., Subar, A. F., Zimmerman, T. P., & Baranowski, T. (2013). Simulated adaptations to an adult dietary self-report tool to accommodate children: impact on nutrient estimates. *Journal of the American College of Nutrition*, *32*(2), 92–97. https://doi.org/10.1080/07315724.2013.789339

Elmadfa, I., & Meyer, A. L. (2012). Diet Quality, a Term Subject to Change over Time. *International Journal for Vitamin and Nutrition Research*, *82*(3), 144–147. https://doi.org/10.1024/0300-9831/a000104

Engel, G. (1977). The need for a new medical model: a challenge for biomedicine. *Science*, *196*(4286), 129–136. https://doi.org/10.1126/science.847460

Evans, G. W., Eckenrode, J., & Marcynyszyn, L. (2008). Poverty and chaos. *Cornell University's College of Human Ecology Human Development HD Today E-NEWS: Highlighting Faculty Research and Outreach*, 225–238.

Evans, G. W., Gonnella, C., Marcynyszyn, L. A., Gentile, L., & Salpekar, N. (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science*, *16*(7), 560–565.

Eysenbach, G., & Wyatt, J. (2002). Using the Internet for Surveys and Health Research. *Journal of Medical Internet Research*, *4*(2), e13. https://doi.org/10.2196/jmir.4.2.e13

Fairchild, A. J., & MacKinnon, D. P. (2009). A General Model for Testing Mediation and Moderation Effects. *Prevention Science : The Official Journal of the Society for Prevention Research*, *10*(2), 87–99. https://doi.org/10.1007/s11121-008-0109-6

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Field, A. P. (2013). *Discovering statistics using IBM SPSS statistics: and sex and drugs and rock "n" roll* (4th edition). Los Angeles: Sage.

Fiese, B. H., Gundersen, C., Koester, B., & Jones, B. (2016). Family chaos and lack of mealtime planning is associated with food insecurity in low income households. *Economics & Human Biology*, *21*, 147–155. https://doi.org/10.1016/j.ehb.2016.01.004

Fiese, B. H., Hammons, A., & Grigsby-Toussaint, D. (2012). Family mealtimes: A contextual approach to understanding childhood obesity. *Economics & Human Biology*, *10*(4), 365–374. https://doi.org/10.1016/j.ehb.2012.04.004

Fiese, B. H., Jones, B. L., & Jarick, J. M. (2015). Family mealtime dynamics and food consumption: An experimental approach to understanding distractions. *Couple and Family Psychology: Research and Practice*, *4*(4), 199–211. https://doi.org/10.1037/cfp0000047

File, T., & Ryan, C. (2014). Computer and Internet use in the United States: 2013. *American Community Survey Reports*, *28*, 1–16.

Fulgoni, V. L., Chu, Y., O'Shea, M., Slavin, J. L., & DiRienzo, M. A. (2015). Oatmeal consumption is associated with better diet quality and lower body mass index in adults: the National Health and Nutrition Examination Survey (NHANES), 2001-2010. *Nutrition Research*, *35*(12), 1052–1059. https://doi.org/10.1016/j.nutres.2015.09.015

Fulkerson, J. A., Neumark-Sztainer, D., Story, M., Gurvich, O., Kubik, M. Y., Garwick, A., & Dudovitz, B. (2014). The Healthy Home Offerings via the Mealtime Environment (HOME) Plus study: design and methods. *Contemporary Clinical Trials*, *38*(1), 59–68. https://doi.org/10.1016/j.cct.2014.01.006

Fung, T. T., Chiuve, S. E., McCullough, M., Rexrode, K., Logroscino, G., & Hu, F. B. (2008). Adherence to a DASH-Style Diet and Risk of Coronary Heart Disease and Stroke in Women. *Archives of Internal Medicine*, *168*(7), 713. https://doi.org/10.1001/archinte.168.7.713

Gamba, R., Leung, C. W., Guendelman, S., Lahiff, M., & Laraia, B. A. (2016). Household Food Insecurity Is Not Associated with Overall Diet Quality Among Pregnant Women in NHANES 1999–2008. *Maternal and Child Health Journal*, 1–9. https://doi.org/10.1007/s10995-016-2058-1

Gosling, S. D., & Mason, W. (2015). Internet Research in Psychology. *Annual Review of Psychology*, *66*(1), 877–902. https://doi.org/10.1146/annurev-psych-010814-015321

Groesz, L. M., McCoy, S., Carl, J., Saslow, L., Stewart, J., Adler, N., … Epel, E. (2012). What is eating you? Stress and the drive to eat. *Appetite*, *58*(2), 717–721. https://doi.org/10.1016/j.appet.2011.11.028

Guariguata, L., Whiting, D. R., Hambleton, I., Beagley, J., Linnenkamp, U., & Shaw, J. E. (2014). Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Research and Clinical Practice*, *103*(2), 137–149. https://doi.org/10.1016/j.diabres.2013.11.002

Guenther, P. M., Casavale, K. O., Kirkpatrick, S. I., Reedy, J., Hiza, H. A. B., Kuczynski, K. J., … Krebs-Smith, S. M. (2013a). Diet quality of Americans in 2001-02 and 2007-08 as measured by the Healthy Eating Index-2010. *USDA Center for Nutrition Policy and Promotion: Nutrition Insight*, *51*. Retrieved from http://www.cdc.gov/nchs/nhanes/nhanes

Guenther, P. M., Casavale, K. O., Kirkpatrick, S. I., Reedy, J., Hiza, H. A. B., Kuczynski, K. J., … Krebs-Smith, S. M. (2013b). Update of the Healthy Eating Index: HEI-

2010. *Journal of the Academy of Nutrition and Dietetics*, *113*(4). https://doi.org/10.1016/j.jand.2012.12.016

Guenther, P. M., Kirkpatrick, S. I., Reedy, J., Krebs-Smith, S. M., Buckman, D. W., Dodd, K. W., … Carroll, R. J. (2014). The Healthy Eating Index-2010 Is a Valid and Reliable Measure of Diet Quality According to the 2010 Dietary Guidelines for Americans. *The Journal of Nutrition*, jn.113.183079. https://doi.org/10.3945/jn.113.183079

Guenther, P. M., Reedy, J., & Krebs-Smith, S. M. (2008). Development of the Healthy Eating Index-2005. *Journal of the American Dietetic Association*, *108*(11), 1896–1901. https://doi.org/10.1016/j.jada.2008.08.016

Hammons, A. J., & Fiese, B. H. (2011). Is Frequency of Shared Family Meals Related to the Nutritional Health of Children and Adolescents? *Pediatrics*, *127*(6), e1565–e1574. https://doi.org/10.1542/peds.2010-1440

Herbert, J., Clemow, L., Pbert, L., Ockene, I., & Ockene, J. (1995). Social desirabiliy bias in dietary self-report may compromise the validity of dietary intake measures. *International Journal of Epidemiology*, *24*(2), 389–398.

Hersey, J., Anliker, J., Miller, C., Mullis, R. M., Daugherty, S., Das, S., … Thomas, H. O. (2001). Food Shopping Practices Are Associated with Dietary Quality in Low-Income Households. *Journal of Nutrition Education*, *33*, S16–S26.

Hill, B., Skouteris, H., Fuller-Tyszkiewicz, M., Kothe, E. J., & McPhie, S. (2016). A path model of psychosocial and health behaviour change predictors of excessive

gestational weight gain. *Journal of Reproductive and Infant Psychology*, *34*(2), 139–161. https://doi.org/10.1080/02646838.2015.1118021

Hiza, H. A. B., Casavale, K. O., Guenther, P. M., & Davis, C. A. (2013). Diet Quality of Americans Differs by Age, Sex, Race/Ethnicity, Income, and Education Level. *Journal of the Academy of Nutrition and Dietetics*, *113*(2), 297–306. https://doi.org/10.1016/j.jand.2012.08.011

Hiza, H. A. B., Guenther, P. M., & Rihane, C., I. (2013). Diet quality of children age 2-17 years as measured by the Healthy Eating Index-2010. *USDA Center for Nutrition Policy and Promotion: Nutrition Insight*, *52*.

Horvath, K. J., Carrico, A. W., Simoni, J., Boyer, E. W., Amico, K. R., & Petroll, A. E. (2013). Engagement in HIV Medical Care and Technology Use among Stimulant-Using and Nonstimulant-Using Men who have Sex with Men [Research article]. Retrieved July 27, 2017, from https://www.hindawi.com/journals/art/2013/121352/abs/

Horvath, K. J., Oakes, J. M., Rosser, B. R. S., Danilenko, G., Vezina, H., Amico, K. R., … Simoni, J. (2013). Feasibility, Acceptability and Preliminary Efficacy of an Online Peer-to-Peer Social Support ART Adherence Intervention. *AIDS and Behavior*, *17*(6), 2031–2044. https://doi.org/10.1007/s10461-013-0469-1

Howden, L., & Meyer, J. (2011, May). Age and sex composition: 2010. U. S. Department of Commerce Econoics and Statistics Administration United States Census Bureau.

Huff, C., & Tingley, D. (2015). "Who are these people?" Evaluating the demographic characteristics and political preferences of MTurk survey respondents. *Research & Politics*, *2*(3), 2053168015604648. https://doi.org/10.1177/2053168015604648

Humes, K. R., Jones, N. A., & Ramirez, R. R. (2011, March). Overview of Race and Hispanic Origin- 2010. U. S. Department of Commerce Econoics and Statistics Administration United States Census Bureau.

Hunter, J., Corcoran, K., Leeder, S., & Phelps, K. (2012). Is it time to abandon paper? The use of emails and the Internet for health services research - a cost-effectiveness and qualitative study: Using emails and the Internet in research. *Journal of Evaluation in Clinical Practice*, no – no. https://doi.org/10.1111/j.1365-2753.2012.01864.x

Imamura, F., Micha, R., Khatibzadeh, S., Fahimi, S., Shi, P., Powles, J., & Mozaffarian, D. (2015). Dietary quality among men and women in 187 countries in 1990 and 2010: a systematic assessment. *The Lancet Global Health*, *3*(3), e132–e142. https://doi.org/10.1016/S2214-109X(14)70381-X

Jahns, L., Johnson, L. K., Scheett, A. J., Stote, K. S., Raatz, S. K., Subar, A. F., & Tande, D. (2016). Measures of Diet Quality across Calendar and Winter Holiday Seasons among Midlife Women: A 1-Year Longitudinal Study Using the Automated Self-Administered 24-Hour Recall. *Journal of the Academy of Nutrition and Dietetics*, *0*(0). https://doi.org/10.1016/j.jand.2016.07.013

Johnson, A. D., Martin, A., Brooks-Gunn, J., & Petrill, S. A. (2008). Order in the House! Associations among Household Chaos, the Home Literacy Environment, Maternal

Reading Ability, and Children's Early Reading. *Merrill-Palmer Quarterly (Wayne State University. Press)*, *54*(4), 445–472. https://doi.org/10.1353/mpq.0.0009

Kalichman, S. C., & Kalichman, M. O. (2016). HIV-Related Stress and Life Chaos Mediate the Association Between Poverty and Medication Adherence Among People Living with HIV/AIDS. *Journal of Clinical Psychology in Medical Settings*, *23*(4), 420–430. https://doi.org/10.1007/s10880-016-9481-8

Kennedy, E., Ohls, J., Carlson, S., & Fleming, K. (1995). The Healthy Eating Index: Design and Applications. *Journal of the American Dietetic Association*, *95*(10), 1103–1108. https://doi.org/10.1016/S0002-8223(95)00300-2

Khazaal, Y., Singer, M. van, Chatton, A., Achab, S., Zullino, D., Rothen, S., … Thorens, G. (2014). Does Self-Selection Affect Samples' Representativeness in Online Surveys? An Investigation in Online Video Game Research. *Journal of Medical Internet Research*, *16*(7), e164. https://doi.org/10.2196/jmir.2759

Kirkpatrick, S. I., Gilsing, A. M., Hobin, E., Solbak, N. M., Wallace, A., Haines, J., … Whelan, H. K. (2017). Lessons from Studies to Evaluate an Online 24-Hour Recall for Use with Children and Adults in Canada. *Nutrients*, *9*(2). https://doi.org/10.3390/nu9020100

Kirkpatrick, S. I., Potischman, N., Dodd, K. W., Douglass, D., Zimmerman, T. P., Kahle, L. L., … Subar, A. F. (2016). The Use of Digital Images in 24-Hour Recalls May Lead to Less Misestimation of Portion Size Compared with Traditional Interviewer-Administered Recalls. *The Journal of Nutrition*, *146*(12), 2567–2573. https://doi.org/10.3945/jn.116.237271

Kirkpatrick, S. I., Subar, A. F., Douglass, D., Zimmerman, T. P., Thompson, F. E., Kahle, L. L., … Potischman, N. (2014). Performance of the Automated Self-Administered 24-hour Recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. *The American Journal of Clinical Nutrition*, *100*(1), 233–240. https://doi.org/10.3945/ajcn.114.083238

Knight, A., Bryan, J., & Murphy, K. (2016). Is the Mediterranean diet a feasible approach to preserving cognitive function and reducing risk of dementia for older adults in Western countries? New insights and future directions. *Ageing Research Reviews*, *25*, 85–101. https://doi.org/10.1016/j.arr.2015.10.005

Laerd Statistics. (2015). Ordinal logistic regression using SPSS Statistics.

Lauffenburger, J. C., Gagne, J. J., Song, Z., Brill, G., & Choudhry, N. K. (2016). Potentially disruptive life events: what are the immediate impacts on chronic disease management? A case-crossover analysis. *BMJ Open*, *6*(8), e010958. https://doi.org/10.1136/bmjopen-2015-010958

Leung, C. W., Ding, E. L., Catalano, P. J., Villamor, E., Rimm, E. B., & Willett, W. C. (2012). Dietary intake and dietary quality of low-income adults in the Supplemental Nutrition Assistance Program. *American Journal of Clinical Nutrition*, *96*(5), 977–988. https://doi.org/10.3945/ajcn.112.040014

Leung, C. W., Epel, E. S., Ritchie, L. D., Crawford, P. B., & Laraia, B. A. (2014). Food Insecurity Is Inversely Associated with Diet Quality of Lower-Income Adults. *Journal of the Academy of Nutrition and Dietetics*, *114*(12), 1943–1953.e2. https://doi.org/10.1016/j.jand.2014.06.353

Levin, L., Kichler, J. C., & Polfuss, M. (2013). The Relationship Between Hemoglobin A1C in Youth With Type 1 Diabetes and Chaos in the Family Household. *The Diabetes Educator*, 0145721713496872. https://doi.org/10.1177/0145721713496872

Ley, S. H., Hamdy, O., Mohan, V., & Hu, F. B. (2014). Prevention and Management of Type 2 Diabetes: Dietary Components and Nutritional Strategies. *Lancet (London, England)*, *383*(9933), 1999–2007. https://doi.org/10.1016/S0140-6736(14)60613-9

Martin, A., Razza, R., & Brooks-Gunn, J. (2012). Specifying the Links Between Household Chaos and Preschool Children's Development. *Early Child Development and Care*, *182*(10), 1247–1263. https://doi.org/10.1080/03004430.2011.605522

Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods*, *44*(1), 1–23. https://doi.org/10.3758/s13428-011-0124-6

Matheny Jr., A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology*, *16*(3), 429–444. https://doi.org/10.1016/0193-3973(95)90028-4

Matheny Jr., A. P., Wilson, R. S., & Thoben, A. S. (1987). Home and mother: Relations with infant temperament. *Developmental Psychology*, *23*(3), 323–331. https://doi.org/10.1037/0012-1649.23.3.323

McIntosh, W. A., Kubena, K. S., Tolle, G., Dean, W. R., Jan, J., & Anding, J. (2010). Mothers and meals. The effects of mothers' meal planning and shopping motivations on children's participation in family meals. *Appetite*, *55*(3), 623–628. https://doi.org/10.1016/j.appet.2010.09.016

Moeller, S. M., Reedy, J., Millen, A. E., Dixon, L. B., Newby, P. K., Tucker, K. L., … Guenther, P. M. (2007). Dietary Patterns: Challenges and Opportunities in Dietary Patterns Research: An Experimental Biology Workshop, April 1, 2006. *Journal of the American Dietetic Association*, *107*(7), 1233–1239. https://doi.org/10.1016/j.jada.2007.03.014

Moore, L. V., & Thompson, F. E. (2015). Adults meeting fruit and vegetable intake recommendations—United States, 2013. *MMWR. Morbidity and Mortality Weekly Report*, *64*(26), 709–713.

Mossavar-Rahmani, Y., Tinker, L. F., Huang, Y., Neuhouser, M. L., McCann, S. E., Seguin, R. A., … Prentice, R. L. (2013). Factors relating to eating style, social desirability, body image and eating meals at home increase the precision of calibration equations correcting self-report measures of diet using recovery biomarkers: findings from the Women's Health Initiative. *Nutrition Journal*, *12*(1), 63. https://doi.org/10.1186/1475-2891-12-63

National Cancer Institute. (2016, May 10). HEI Tools for Researchers. Retrieved from http://epi.grants.cancer.gov/hei/tools.html#sas

National Cancer Institute. (2018, February 12). Research Uses of the HEI. Retrieved from http://epi.grants.cancer.gov/hei/tools.html#sas

National Cancer Institute Division of Cancer Control and Population Sciences. (2017, January 9). Automated Self-Administered 24-Hour (ASA24®) Dietary Assessment Tool. Retrieved from https://epi.grants.cancer.gov/asa24/

National Center for Health Statistics. (2016). *Health, United States, 2015: With special feature on racial and ethnic health disparities.* Hyattsville, MD: United States Department of Health and Human Services.

National Diabetes Education Program. (n.d.). Step 3: Manage Your Diabetes. Retrieved November 15, 2016, from https://www.niddk.nih.gov/health-information/health-communication-programs/ndep/living-with-diabetes/manage-your-diabetes/Pages/manageyourdiabetes.aspx

National Fruit and Vegetable Alliance. (2015). *National Action Plan to Promote Health Through Increased Fruite and Vegetable Consumption, 2015 Report Card.*

Nicklas, T. A., Jahns, L., Bogle, M. L., Chester, D. N., Giovanni, M., Klurfeld, D. M., … Tucker, K. L. (2013). Barriers and Facilitators for Consumer Adherence to the Dietary Guidelines for Americans: The HEALTH Study. *Journal of the Academy of Nutrition and Dietetics*, *113*(10), 1317–1331. https://doi.org/10.1016/j.jand.2013.05.004

Ocké, M. C. (2013). Evaluation of methodologies for assessing the overall diet: dietary quality scores and dietary pattern analysis. *The Proceedings of the Nutrition Society*, *72*(2), 191–199. https://doi.org/http://dx.doi.org.ezp.waldenulibrary.org/10.1017/S0029665113000013

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the united states, 2011-2012. *JAMA*, *311*(8), 806–814. https://doi.org/10.1001/jama.2014.732

Paolacci, G., & Chandler, J. (2014). Inside the Turk: Understanding Mechanical Turk as a participant pool. *Current Directions in Psychological Science*, *23*(3), 184–188.

Patterson, R. E., Haines, P. S., & Popkin, B. M. (1994). Diet quality index: Capturing a multidimensional behavior. *Journal of the Academy of Nutrition and Dietetics*, *94*(1), 57–64. https://doi.org/10.1016/0002-8223(94)92042-7

Perrin, A., & Duggan, M. (2015, June). America's internet access: 200-2015. As internet use nears saturation for some groups, a look at patterns of adoption. Pew Research Center. Retrieved from http://www.pewinternet.org/files/2015/06/2015-06-26_internet-usage-across-demographics-discover_FINAL.pdf

Pike, A., Iervolino, A. C., Eley, T. C., Price, T. S., & Plomin, R. (2006). Environmental risk and young children's cognitive and behavioral development. *International Journal of Behavioral Development*, *30*(1), 55–66. https://doi.org/10.1177/0165025406062124

Pinard, C., Calloway, E., Fricke, H., & Yaroch, A. (2015). A Cross-Sectional Exploration of Food Security, Depression, and CHAOS in Low-Income Households with Children. *Journal of Applied Research on Children: Informing Policy for Children at Risk*, *6*(2). Retrieved from http://digitalcommons.library.tmc.edu/childrenatrisk/vol6/iss2/6

Posey, K. (2016). Houshold Income: 2015. *Washington, DC: United States Census Bureau, September*. Retrieved from https://www.census.gov/content/dam/Census/library/publications/2011/acs/acsbr10-03.pdf

Poushter, J. (2016). Smartphone ownership and internet usage continues to climb in emerging economies. *Pew Research Center*, *22*. Retrieved from http://s1.pulso.cl/wp-content/uploads/2016/02/2258581.pdf

Proctor, B. D., Semega, J. L., & Kollar, M. A. (2016). Income and poverty in the United States: 2015. *Washington, DC: United States Census Bureau, September*. Retrieved from http://www.uah.org/wp-content/uploads/2016/09/here.pdf

Quick, V., Shoff, S., Lohse, B., White, A., Horacek, T., & Greene, G. (2015). Relationships of eating competence, sleep behaviors and quality, and overweight status among college students. *Eating Behaviors*, *19*, 15–19. https://doi.org/10.1016/j.eatbeh.2015.06.012

Raver, C. C., Blair, C., & Garrett-Peters, P. (2015). Poverty, household chaos, and interparental aggression predict children's ability to recognize and modulate negative emotions. *Development and Psychopathology*, *27*(3), 695–708. https://doi.org/10.1017/S0954579414000935

Reedy, J., Krebs-Smith, S. M., Miller, P. E., Liese, A. D., Kahle, L. L., Park, Y., & Subar, A. F. (2014). Higher Diet Quality Is Associated with Decreased Risk of All-Cause, Cardiovascular Disease, and Cancer Mortality among Older Adults. *The Journal of Nutrition*, *144*(6), 881–889. https://doi.org/10.3945/jn.113.189407

Rehm, C. D., Monsivais, P., & Drewnowski, A. (2015). Relation between diet cost and Healthy Eating Index 2010 scores among adults in the United States 2007–2010. *Preventive Medicine*, *73*, 70–75. https://doi.org/10.1016/j.ypmed.2015.01.019

Reyes, N. R., Klotz, A. A., & Herring, S. J. (2013). A qualitative study of motivators and barriers to healthy eating in pregnancy for low-income, overweight, african-american mothers. *Journal of the Academy of Nutrition and Dietetics*, *113*(9), 1175–1181. https://doi.org/10.1016/j.jand.2013.05.014

Rizza, W., Veronese, N., & Fontana, L. (2014). What are the roles of calorie restriction and diet quality in promoting healthy longevity? *Ageing Research Reviews*, *13*, 38–45. https://doi.org/10.1016/j.arr.2013.11.002

Robaina, K. A., & Martin, K. S. (2013). Food Insecurity, Poor Diet Quality, and Obesity among Food Pantry Participants in Hartford, CT. *Journal of Nutrition Education and Behavior*, *45*(2), 159–164. https://doi.org/10.1016/j.jneb.2012.07.001

Roohafza, H., Sarrafzadegan, N., Sadeghi, M., & Rafieian-Kopaei, M. (2013). The association between stress levels and food consumption among Iranian population. *Archives of Iranian Medicine*, *16*(3), 145.

Schiavo, R. (2014). *Health communication: from theory to practice* (Second edition). San Francisco: Jossey-Bass.

Schroeder, J. (2014). *A1c and diet quality using the Healthy Eating Index-2010 in low-income African Americans with Type 2 diabetes*. RUSH UNIVERSITY. Retrieved from http://gradworks.umi.com/15/26/1526175.html

Schwingshackl, L., & Hoffmann, G. (2015). Diet Quality as Assessed by the Healthy Eating Index, the Alternate Healthy Eating Index, the Dietary Approaches to Stop Hypertension Score, and Health Outcomes: A Systematic Review and Meta-Analysis of Cohort Studies. *Journal of the Academy of Nutrition and Dietetics*, *115*(5), 780–800.e5. https://doi.org/10.1016/j.jand.2014.12.009

Shin, D., Bianchi, L., Chung, H., Weatherspoon, L., & Song, W. O. (2013). Is Gestational Weight Gain Associated with Diet Quality During Pregnancy? *Maternal and Child Health Journal*, *18*(6), 1433–1443. https://doi.org/10.1007/s10995-013-1383-x

Sidney, S., Quesenberry, C. P., Jaffe, M. G., Sorel, M., Nguyen-Huynh, M. N., Kushi, L. H., … Rana, J. S. (2016). Recent Trends in Cardiovascular Mortality in the United States and Public Health Goals. *JAMA Cardiology*, *1*(5), 594–599. https://doi.org/10.1001/jamacardio.2016.1326

Skibicky, U. (2011, February). *The impact of long-term exercise on self-regulation capacity and obesity/overweight* (Doctoral Dissertation). Walden University.

Smith, R. C., Fortin, A. H., Dwamena, F., & Frankel, R. M. (2013). An evidence-based patient-centered method makes the biopsychosocial model scientific. *Patient Education and Counseling*, *91*(3), 265–270. https://doi.org/10.1016/j.pec.2012.12.010

Smolderen, K. G., & Whooley, M. A. (2013). Psychological Distress and Medication Adherence Creating Order Out of Chaos? *Circulation: Cardiovascular Quality*

and Outcomes, *6*(6), 615–616. https://doi.org/10.1161/CIRCOUTCOMES.113.000633

Sobal, J., Bisogni, C. A. ., & Jastran, M. (2014). Food Choice Is Multifaceted, Contextual, Dynamic, Multilevel, Integrated, and Diverse. *Mind, Brain & Education*, *8*(1), 6–12. https://doi.org/10.1111/mbe.12044

Sobel, M. E. (1982). Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models. *Sociological Methodology*, *13*, 290–312. https://doi.org/10.2307/270723

Srinivasan, M. (2014). Life Chaos and Intrinsic Motivation. *Journal of General Internal Medicine*, *29*(9), 1213–1214. https://doi.org/10.1007/s11606-014-2952-4

Stewart, N., Ungemach, C., Harris, A. J., Bartels, D. M., Newell, B. R., Paolacci, G., & Chandler, J. (2015). The average laboratory samples a population of 7,300 Amazon Mechanical Turk workers. *Judgment and Decision Making*, *10*(5), 479.

Subar, A. F., Crafts, J., Zimmerman, T. P., Wilson, M., Mittl, B., Islam, N. G., … Thompson, F. E. (2010). Assessment of the Accuracy of Portion Size Reports Using Computer-Based Food Photographs Aids in the Development of an Automated Self-Administered 24-Hour Recall. *Journal of the American Dietetic Association*, *110*(1), 55–64. https://doi.org/10.1016/j.jada.2009.10.007

Subar, A. F., Kirkpatrick, S. I., Mittl, B., Zimmerman, T. P., Thompson, F. E., Bingley, C., … Potischman, N. (2012). The Automated Self-Administered 24-Hour Dietary Recall (ASA24): A Resource for Researchers, Clinicians and Educators from the

National Cancer Institute. *Journal of the Academy of Nutrition and Dietetics*, *112*(8), 1134–1137. https://doi.org/10.1016/j.jand.2012.04.016

Subar, A. F., Thompson, F. E., Potischman, N., Forsyth, B. H., Buday, R., Richards, D., … Baranowski, T. (2007). Formative Research of a Quick List for an Automated Self-Administered 24-Hour Dietary Recall. *Journal of the American Dietetic Association*, *107*(6), 1002–1007. https://doi.org/10.1016/j.jada.2007.03.007

Suls, J., Krantz, D. S., & Williams, G. C. (2013). Three strategies for bridging different levels of analysis and embracing the biopsychosocial model. *Health Psychology*, *32*(5), 597–601. https://doi.org/10.1037/a0031197

Thompson, F. E., Dixit-Joshi, S., Potischman, N., Dodd, K. W., Kirkpatrick, S. I., Kushi, L. H., … Subar, A. F. (2015). Comparison of Interviewer-Administered and Automated Self-Administered 24-Hour Dietary Recalls in 3 Diverse Integrated Health Systems. *American Journal of Epidemiology*, *181*(12), 970–978. https://doi.org/10.1093/aje/kwu467

Traill, W. B., Chambers, S. A., & Butler, L. (2012). Attitudinal and demographic determinants of diet quality and implications for policy targeting. *Journal of Human Nutrition & Dietetics*, *25*(1), 87–94 8p. https://doi.org/10.1111/j.1365-277X.2011.01218.x

Trichopoulou, A., Costacou, T., Bamia, C., & Trichopoulos, D. (2003). Adherence to a Mediterranean Diet and Survival in a Greek Population. *New England Journal of Medicine*, *348*(26), 2599–2608. https://doi.org/10.1056/NEJMoa025039

Tryon, M. S., DeCant, R., & Laugero, K. D. (2013). Having your cake and eating it too: A habit of comfort food may link chronic social stress exposure and acute stress-induced cortisol hyporesponsiveness. *Physiology & Behavior*, *114-115*, 32–37. https://doi.org/10.1016/j.physbeh.2013.02.018

Uhlig, C. E., Seitz, B., Eter, N., Promesberger, J., & Busse, H. (2014). Efficiencies of Internet-Based Digital and Paper-Based Scientific Surveys and the Estimated Costs and Time for Different-Sized Cohorts. *PLoS ONE*, *9*(10), e108441. https://doi.org/10.1371/journal.pone.0108441

United States Department of Labor. (2017). Minimum Wage. Retrieved from https://www.dol.gov/general/topic/wages/minimumwage

U.S. Department of Health and Human Services and U. S. Department of Agriculture. (2015). 2015-2020 Dietary Guidelines for Americans. 8th Edition. Retrieved from https://health.gov/dietaryguidelines/2015/guidelines/

Vernon-Feagans, L., Garrett-Peters, P., Willoughby, M., & Mills-Koonce, R. (2012). Chaos, Poverty, and Parenting: Predictors of Early Language Development. *Early Childhood Research Quarterly*, *27*(3), 339–351. https://doi.org/10.1016/j.ecresq.2011.11.001

Vernon-Feagans, L., Willoughby, M., & Garrett-Peters, P. (2016). Predictors of Behavioral Regulation in Kindergarten: Household Chaos, Parenting and Early Executive Functions. *Developmental Psychology*, *52*(3), 430–441. https://doi.org/10.1037/dev0000087

Viswanath, H., Wilkerson, J. M., Breckenridge, E., & Selwyn, B. J. (2016). Life Chaos and Perceived Social Support Among Methamphetamine-Using Men Who Have Sex With Men Engaging in Transactional Sexual Encounters. *Substance Use & Misuse*, 1–8. https://doi.org/10.1080/10826084.2016.1222620

Vyncke, K., Fernandez, E. C., Fajó-Pascual, M., Cuenca-García, M., Keyzer, W. D., Gonzalez-Gross, M., … Huybrechts, I. (2013). Validation of the Diet Quality Index for Adolescents by comparison with biomarkers, nutrient and food intakes: the HELENA study. *British Journal of Nutrition*, *109*(11), 2067–2078. https://doi.org/10.1017/S000711451200414X

Wang, D. D., Leung, C. W., Li, Y., Ding, E. L., Chiuve, S. E., Hu, F. B., & Willett, W. C. (2014). Trends in Dietary Quality Among Adults in the United States, 1999 Through 2010. *JAMA Internal Medicine*, *174*(10), 1587. https://doi.org/10.1001/jamainternmed.2014.3422

Ward, B. W., Schiller, J., & Goodman, R. (2014). Multiple Chronic Conditions Among US Adults: A 2012 Update. *Preventing Chronic Disease*, *11*. https://doi.org/10.5888/pcd11.130389

Wawrzyniak, A. J., Rodríguez, A. E., Falcon, A. E., Chakrabarti, A., Parra, A., Park, J., … Metsch, L. R. (2015). The Association of Individual and Systemic Barriers to Optimal Medical Care in People Living with HIV/AIDS (PLWHA) in Miami-Dade County. *Journal of Acquired Immune Deficiency Syndromes (1999)*, *69*(0 1), S63–S72. https://doi.org/10.1097/QAI.0000000000000572

Wilson, R. S. (1983). The Louisville Twin Study: Developmental Synchronies in Behavior. *Child Development*, *54*(2), 298–316. https://doi.org/10.2307/1129693

Wirt, A., & Collins, C. E. (2009). Diet quality - what is it and does it matter? *Public Health Nutrition*, *12*(12), 2473–2492. https://doi.org/http://dx.doi.org.ezp.waldenulibrary.org/10.1017/S1368980009005 31X

Wong, M. D., Sarkisian, C. A., Davis, C., Kinsler, J., & Cunningham, W. E. (2007). The Association Between Life Chaos, Health Care Use, and Health Status Among HIV-Infected Persons. *Journal of General Internal Medicine*, *22*(9), 1286–1291. https://doi.org/http://dx.doi.org.ezp.waldenulibrary.org/10.1007/s11606-007-0265-6

Zimmerman, T. P., Hull, S. G., McNutt, S., Mittl, B., Islam, N., Guenther, P. M., … Subar, A. F. (2009). Challenges in converting an interviewer-administered food probe database to self-administration in the National Cancer Institute Automated Self-administered 24-Hour Recall (ASA24). *Journal of Food Composition and Analysis : An Official Publication of the United Nations University, International Network of Food Data Systems*, *22*(Suppl 1), S48–S51. https://doi.org/10.1016/j.jfca.2009.02.003

Zullig, L. L., Shaw, R. J., Crowley, M. J., Lindquist, J., Grambow, S. C., Peterson, E., … Bosworth, H. B. (2013). Association Between Perceived Life Chaos and Medication Adherence in a Postmyocardial Infarction Population. *Circulation:*

Cardiovascular Quality and Outcomes, *6*(6), 619–625.

https://doi.org/10.1161/CIRCOUTCOMES.113.000435

Appendix A: Assumptions of Heteroscedasticity

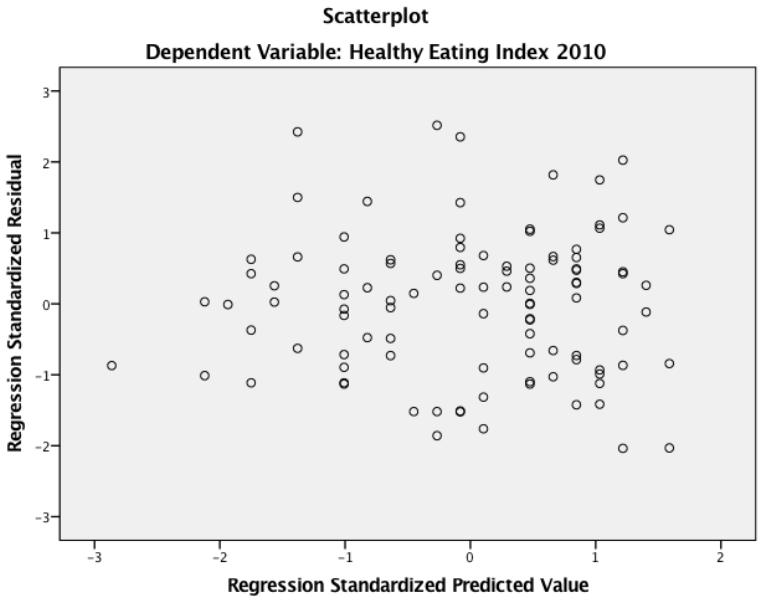

Figure 4. Assumption of heteroscedasticity for life chaos in RQ1

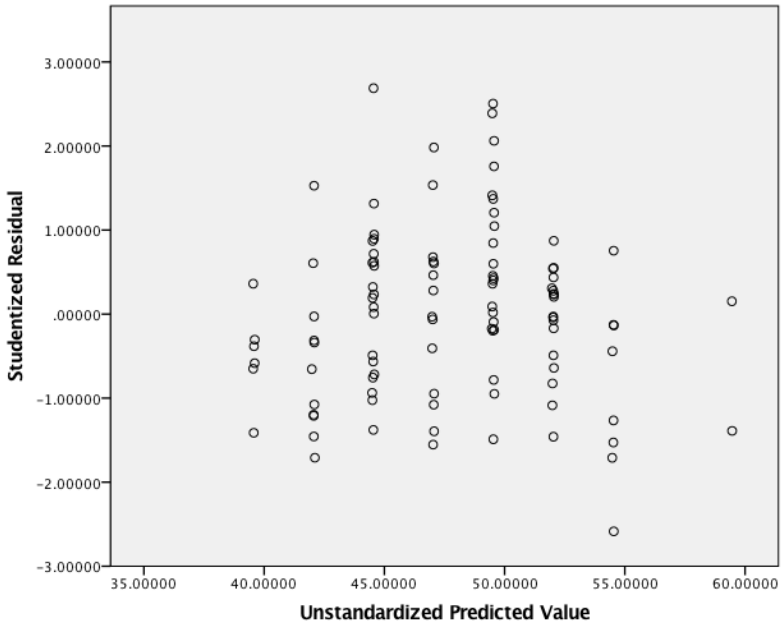

Figure 5. Assumption of heteroscedasticity for RQ2.

Appendix B: Assumptions of Normality of Residuals

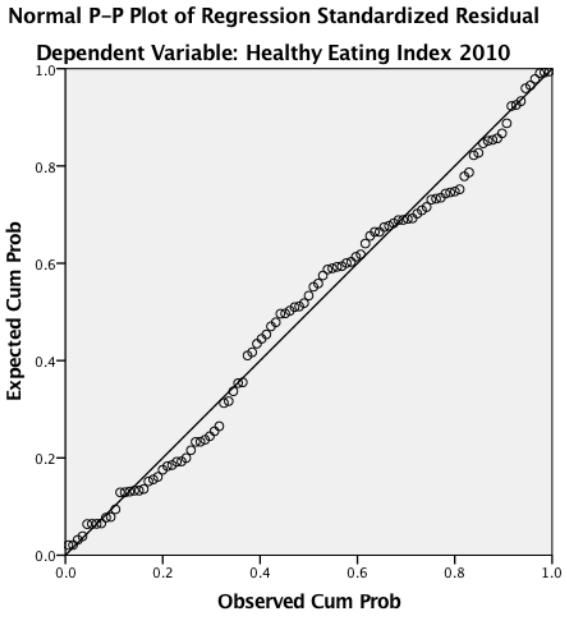

Figure 6. Assumptions of normality of residuals for life chaos in RQ1.

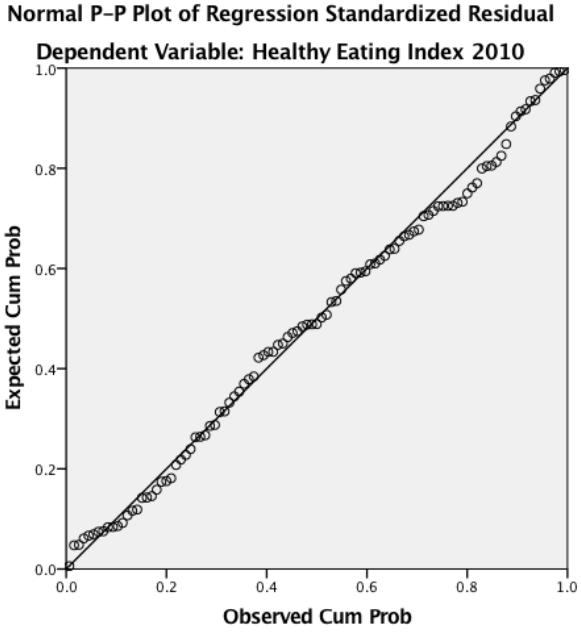

Figure 7. Assumptions of normality of residuals in RQ2