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Association Between Psychological Trauma From Assault in Childhood and Metabolic Syndrome

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Metabolic syndrome and its component conditions of hypertension, obesity, and insulin resistance are on the increase in United States. Metabolic syndrome substantially increases the risk of cardiovascular disease and type 2 diabetes (T2D). To date, no published study has examined the relationship between psychological traumas from physical and/or sexual assault in childhood and metabolic syndrome or its components. This study, using the psychoneuroimmunology (PNI) model, investigated associations between psychological trauma (physical/sexual abuse) in childhood and metabolic syndrome in adulthood using data from the Midlife in the United States II (MIDUS-II) study. This research was undertaken to investigate whether a history of psychological trauma was associated with an elevated risk for metabolic syndrome. Chi-square test and logistic regression were used to investigate the respective associations. Metabolic syndrome was the dependent variable, assault in childhood was the independent variable, and the relevant covariates included in the logistic regression model were age, gender, cigarette and alcohol consumption, and ethnicity. While there was no significant association between assault in childhood and metabolic syndrome ($p = 0.146$), there were significant associations between metabolic syndrome and age group ($p =< 0.026$). In the adjusted logistic regression model, the only covariate that showed significant association with metabolic syndrome was Age Group 2 (41-55; $p = 0.016$). Also significant was the association between sexual assault in childhood and high blood pressure ($p = 0.041$). The results of this study suggest that clinicians may wish to watch for evidence of abuse, given the potential for future health impacts.

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Dedication

For my wife, Catherine, who embodies love, acceptance, and commitment: Your unwavering support will forever be appreciated. Without you, I could never have done this. Without you, I would never have tried.

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Chapter 1: Introduction to the Study

Background

According to the Centers for Disease Control and Prevention (CDC), over one-third of adults in the United States qualify as having metabolic syndrome; more than two-thirds of adults are now overweight, and a further one-third are obese (CDC, 2009). Direct medical costs, loss of productivity, transportation, and human capital loss are significant, totaling in excess of $147 billion per year in 2008 (Hammond & Levine, 2010). As the percentage of adults with metabolic syndrome and the associated conditions (obesity, hypertension, dyslipidemia, insulin resistance) increases, so too will costs. Intervention and preventative measures are critical to reducing morbidity and mortality of metabolic syndrome.

Psychological trauma from child assault/abuse in the United States is also at epidemic levels. In 2012 alone, over 685,000 children were victims of abuse, and abuse was investigated or suspected for an additional 3.8 million children under the age of 18 years across all 50 states (National Children's Alliance, 2014). Children between birth and 1 year of age suffered the highest rate of victimization, and according to the CDC (2013), the cost of treating child abuse in the United States is in excess of $124 billion annually.

First-line treatments of both metabolic syndrome and psychological trauma involve pharmaceutical medication and/or behavior modification or cognitive behavioral therapy (CBT; Cohen et al., 2009). Currently, upstream interventions and preventative measures are secondary, if even considered. As research into neuroplasticity and the

long-term effects of stress on both hormone balance and inflammatory responses to stress increases, the importance of early prevention will increase. Humans are emotional, psychological, and biological animals; therefore, the treatment of only one aspect of chronic conditions may continue to prove less effective than multifaceted upstream prevention.

This study examined the effects of cumulative stress from psychological trauma experienced during childhood from physical assault and/or sexual assault, and metabolic syndrome defined as insulin resistance, hypertension, and obesity in adults. There are significant positive social change implications for this study. One of the potential positive social implications of this study is that the results could be used to guide interventions that are aimed to reduce the morbidity and mortality of the components of metabolic syndrome identified by the data (insulin resistance, hypertension, and obesity). Another implication of this study is the need for persons to intercede on behalf of child victims of assault and abuse. Aside from improvements to overall physiological and psychological health, a significant decrease in financial costs associated with the treatment of both metabolic syndrome and traumatic stress from child sexual and/or physical assaults may be realized. In this chapter, I discuss the background and symptomology of psychological trauma and metabolic syndrome, present a description of the study, offer the problem description and research questions, and outline the scope of the study and limitations. This chapter ends with a summary of the major points addressed in Chapter 1 and a brief introduction to Chapter 2.

Psychological Trauma

Psychological stress is a part of daily life (Brown et al., 2010), however, *traumatic stress* is that which is not considered a normal aspect of life. Through the psychoneuroimmunology (PNI) model, the emotional effects of traumatic stress on the neurological and physiological systems may be better appreciated. There exist significant resources on physiological and psychological effects of traumatic stress experienced in adulthood, primarily through studies of prisoners of war and soldiers who have faced severe combat situations (Fetzner, McMillan, & Asmundson, 2012) or terrorism (Yehuda, 2002). The possible effects of traumatic stress in childhood on chronic disease outcomes are relatively underinvestigated. While some studies have focused on psychological trauma in childhood and the outcomes of psychological disorders (Roenholt et al, 2012), investigations into psychological trauma and physiological outcomes are less well known.

Akkermann (et al., 2012) discovered a positive association between psychological trauma in childhood and behavioral problems in adolescents. It was found that psychological trauma in childhood was linked to increased susceptibility to serotonin disregulation, which has been associated with eating disorders and unrealistic self-image. Recent studies (Dedert et al., 2010; Lown et al., 2011; Midei et al., 2013) examined the association of stress from psychological trauma and cardiovascular conditions, showing positive indications that even a single event, if traumatic enough to overwhelm the individual's coping, is sufficient to cause long-term physiological effects (Sugaya et al., 2012; Amario et al., 2004).

Psychological trauma in childhood stemming from physical or sexual assault is not confined to Third World nations. Habetha (2012) reported that trauma from child abuse or neglect is a major concern in developed nations of both Europe and North America. The symptoms common to traumatic stress vary from person to person; however, there are agreed-upon indicators. Table 1 lists the accepted symptoms of traumatic stress responses in children and adults.

Table 1

Symptoms of Traumatic Stress

Heightened startle response	Sleep disturbance or nightmares
Loss of interest in normal activities	Prolonged sadness
Outbreaks of anger	Somatic complaints
Recurring memories of the event	Feelings of panic
Anxiety	Inability to concentrate

While the psychological responses to traumatic events are not universal, there are events that would be considered traumatic if experienced by the average child. These are shown in Table 2 (Recognized Causes of Psychological Trauma), drawn from the National Child Traumatic Stress Network (2013) and reflected in Nemeroff et al. (2006). The causes of psychological trauma in children include experiencing sexual abuse, physical abuse, and/or psychological abuse; witnessing domestic violence; suffering extreme neglect; and experiencing war.

It should be mentioned that incidents of psychological trauma stemming from child abuse or assault are considered to be highly underreported (Sege et al., 2011). *Child Maltreatment*, a publication from the Department of Health and Human Services of the United States (DHHS, 2012), indicated that psychological trauma incidence is greatly underestimated. Moreover, a cross-sectional survey of 1,931 women from across socioeconomic classes found that 22% of subjects reported childhood physical or sexual abuse (Nemeroff et al., 2004). A study by Schreier and associates (2005) found that evidence of symptoms of traumatic stress in children following psychological trauma was significant, despite findings that parental acknowledgments were underreported. In a study by Schreier and associates (2005), children between the ages of 7 and 17 and their caregivers were interviewed within 1 day of hospital admission and assessed for traumatic stress symptomology. The results indicated that nearly 70% of children were found to have suffered from traumatic stress at admission to the hospital, and at follow-up 40% continued to suffer 18 months later. The study found that those subjects who reported childhood but not adult abuse suffered significantly higher incidence rates of physical symptoms, in addition to scoring higher on assessments for depression and anxiety and demonstrating nearly 5 times higher prevalence of drug abuse and alcohol abuse (Schreier et al., 2005). These women also reported a significantly higher risk of suicidality.

Metabolic Syndrome

According to the World Health Organization (WHO, 1999), *metabolic syndrome* is a cluster of cardiovascular risk factors. To be recognized as having metabolic

syndrome, an individual must have a diagnosis of insulin resistance identified by one of the following: impaired fasting glucose, impaired glucose tolerance, or type 2 diabetes. In addition to the presence of insulin resistance, the individual must also have two of the following conditions: high blood pressure, high cholesterol, high body mass index (BMI), or elevated urinary albumin excretion rate (WHO, 2014). The precise measures associated with each component of the syndrome that are included in the data are outlined in Table 2.

Table 2

Metabolic Syndrome Component Measures According to the WHO

Metabolic syndrome components	Measures
Insulin resistance	Diagnosis of type 2 diabetes. Impaired fasting glucose (100mg/DL or +). Impaired glucose tolerance.
Obesity	Defined as high BMI (> 30 kg/m2).
Hypertension	Blood pressure (BP) 140/90 mmHg or greater.

Note. Information from *Definition, Diagnosis and Classification of Diabetes Mellitus and Its Complications*, by World Health Organization, 1999, retrieved August 5, 2013, from http://whqlibdoc.who.int/hq/1999/who_ncd_ncs_99.2.pdf

Because the WHO (1999) definition of metabolic syndrome requires the existence of insulin resistance plus both of the associated conditions from the Midlife in the United States II (MIDUS-II) data, any intervention or prevention strategies focused on reducing metabolic syndrome need to be centered on reducing hypertension and obesity. Some

components of metabolic syndrome may be more susceptible to stress from assaults in childhood than others. Also, individual component conditions may reveal greater upstream influence than metabolic syndrome as a condition, presupposing justification for early intervention in cases of child abuse/assault.

Problem Statement

Many of the goals originally set by *Healthy People 2010* included a decrease in the prevalence of the components of metabolic syndrome. Despite this, the components continue to increase; therefore, the incidence and prevalence of metabolic syndrome are increasing (CDC, 2013). The incidence of obesity in the United States has increased from 22% in 1988 to the current level, exceeding 35% (CDC, 2014). According to researchers, obesity is a major component of metabolic syndrome (Haung, 2009; McFarlane, 2010; Simmons et al., 2010). In addition, the age-adjusted incidence of diabetes from 1988 to 1994 was 9.1%; today, it is approaching 12% (CDC, 2013). During the same period, hypertension increased from 25.5% to over 30%. According to Healthy People 2020, type 2 diabetes alone can decrease life expectancy by up to 15 years and increases the risk of complications from heart disease by up to 400%, according to *Healthy People 2020*. With these increases in type 2 diabetes, hypertension, and obesity (metabolic syndrome), there is the significant possibility of increases in health-related complications. Certainly, the need for early intervention is clear. Waiting to address symptoms until after they appear may not prove to be the most effective method of disease intervention as the incidence rate and cost of treatment of the components of metabolic syndrome continue to increase in the United States (CDC, 2009).

Intervention

The fiscal as well as social ramifications of the increased incidence and prevalence of metabolic syndrome call for upstream implementations of interventions that can disrupt the development of the syndrome. If there can be shown psychological manifestations that positively influence the development of metabolic syndrome components, prevention may be possible to a greater or lesser extent. Whereas research has been conducted on associations between traumatic psychological stress in veterans and chronic diseases such as heart disease, significantly less research has been devoted to any connection between psychological stresses from physical and/or sexual assault and the development of components of metabolic syndrome. Although some research has examined the role of child abuse in some aspects of chronic illness, literature concerning associations between traumatic psychological stress from physical and/or sexual assault in childhood and the development of chronic disease, particularly metabolic syndrome, is for the most part absent. In a recent study, Lee, Tsenkova, and Carr (2014) examined variables of child abuse from the MIDUS-II study but did not focus on physical or sexual assaults. Lee and colleagues (2014) examined metabolic syndrome using the National Cholesterol Education Program—Third Adult Treatment Panel (NCEP–ATP III) definition, whereas this study used the WHO (1999) definition. While Lee et al. (2014) found a positive association to metabolic syndrome (as defined by NCEP), this study did not show similar association, despite focusing on traumatic stress from physical and/or sexual assault, which is by nature violent.

Purpose of the Study

This dissertation study is quantitative and retrospective in nature. The intent was to investigate whether or not there is correlation between the dependent variable (metabolic syndrome components) in adulthood and the independent variable (traumatic psychological trauma from assaults in childhood). The covariates were age at time of the assault event(s), current age, ethnicity, and gender. Behavioral covariates were regular smoking of cigarettes, regular use of alcohol, and beliefs about physical fitness. The purposes of this study were as follows: (a) to examine any association between psychological trauma from physical/sexual assault in childhood and metabolic syndrome and (b) to determine whether there is a difference in the association between psychological traumas from sexual abuse compared to psychological trauma from physical abuse and metabolic syndrome.

Research Question(s) and Hypotheses

RQ1: Does a history of psychological trauma from physical/sexual assault in childhood equate to a diagnosis of metabolic syndrome in adulthood?

$H1_0$: There is no association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

$H1_A$: There is an association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

RQ2: Is there a statistical difference in the association between psychological trauma from sexual abuse and the diagnosis of metabolic syndrome in adulthood compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome in adulthood?

$H0_2$: There is no statistical difference in the association between psychological traumas from sexual abuse and the diagnosis of metabolic syndrome components when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

$H1_A$: There is a statistical difference in the association between psychological traumas from sexual abuse and the diagnosis of metabolic syndrome components when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

Theoretical and/or Conceptual Framework for the Study

This study incorporated the psychoneuroimmunology (PNI) model. PNI is the study of the interaction between psychological processes and the biological systems of the body. Based on the mind/body paradigm, this model allowed the examination of the association between traumatic psychological stress from physical/sexual abuse in childhood and the components of metabolic syndrome. According to Lentz (2006), when a person experiences sufficient stress, the physiological systems of the body begin to suffer. This includes cardiovascular, digestive, and immune function. The chronic effects

of trauma, if untreated, can have a debilitating effect on the body's endocrinological and hormone systems as well (Armario, Valles, Dal Zotto, Marquez, & Belda, 2004). For these reasons, this study was based on PNI theory, which is itself based upon the understanding of the physiological effects of chronic stress. While the population of measure was confined to American adults, universal application of symptomology of both traumatic stresses from child assault and metabolic syndrome should extrapolate.

Nature of the Study

This study used retrospective data from the MIDUS-II (2004-2006) study, which longitudinally tracked noninstitutionalized, English-speaking adults within the contiguous United States who had listed telephone numbers. Despite epidemiological research in the areas of metabolic syndrome and its components, as well as psychological studies involving child abuse/assault, in terms of agreement on outcomes, particularly when introducing psychological determinants to physiological chronic outcomes, the research has varied. Even the diagnostic criteria for metabolic syndrome are debated.

Concerning metabolic syndrome, the CDC, National Institutes of Health (NIH), and WHO are not in full agreement as to diagnostic parameters. Currently, estimates of the social, financial, and human cost of metabolic syndrome are heavily dependent on the definition used to make the diagnosis. The WHO (1999) has stated that subjects must demonstrate evidence of insulin resistance (type 2 diabetes, insulin resistance), along with at least two of the following four factors: hypertension, hyperlipidemia, obesity, or microalbuminuria. Although other bodies (NCEP/ATP-III) have suggested different measures, the WHO definition may be a better indicator of metabolic syndrome, as

insulin resistance is primary to the diagnosis. Thus, the lack of consensus on a definition makes it difficult to assess the full impact of the syndrome.

While the American Psychological Association (2012) has clearly defined traumatic stress from child assault/abuse, longitudinal studies are sparse. Despite the fact that numerous studies (Austin-Ketch, 2008; Boscarino, 2004; Habetha et al., 2012) have found significant associations between psychological trauma from child abuse/assault and the development of chronic diseases, longitudinal studies examining associations between traumatic stress from child abuse/assault and the components of metabolic syndrome as defined by the WHO (1998) are largely absent.

Assessing a relationship between the components of metabolic syndrome as defined by the WHO (1998) and stress from psychological trauma from sexual and/or physical assault in childhood is difficult. According to some researchers (Pervanidou & Chrousos, 2012), chronic low-level stimulation of the hypothalamus-pituitary-adrenal axis has been shown to increase appetite while slowing digestion, resulting in increased bodyweight mass through glucose imbalance. Other studies (Heim et al., 2009; Kolb & Gibb, 2011;) found that traumatic stress in childhood dramatically increases the risk for psychological disorders, behavioral disorders, cognitive delay, and even dementia.

Epidemiological studies suggest that as many as 25% of females in the United States reported being assaulted during childhood (Midei, Matthews, Chang, & Bromberger, 2013) and that sexual abuse in childhood is a significant issue. Other researchers (Habetha et al., 2012; Hooven et al., 2012; Sugaya et al., 2012; Sripada et al., 2012) have shown strong associations between psychological traumas from sexual or

physical assaults in childhood and compromised psychological/emotional and physiological health in adulthood.

Recently, studies have implicated childhood trauma and neuroendocrine dysfunction involvement in chronic disease and even neurological changes in the brain (Anda et al., 2006). The neuroendocrinological response to stress, either physiological or psychological, includes abnormal sodium and water retention, hyperlipolysis, increased gluconeogenesis, and insulin resistance (Castañeda et al., 2011). Traumatic events such as physical and/or sexual assaults in childhood are sufficient to cause long-term residual stress and lifelong psychological and physiological impairment (Donovan et al., 1996). Despite the significant evidence of negative physiological outcomes from traumatic stress, other researchers have found no association between the components of metabolic syndrome and traumatic psychological stress. When examining expatriated prisoners of war, Linnville, Hoyt, Moore, Segovia, and Hain (2011) could find no association between psychological stress from trauma and the components of metabolic syndrome. This, however, may suggest that adult brains are better equipped to handle psychological trauma than the brains of children. Currently, there seems to be no agreed-upon association between the variables of interest. This study increases the knowledge of the association between a number of variables concerning both psychological trauma and metabolic syndrome.

Definitions

The following terms are defined for this study:

Psychological trauma: A type of damage to the psyche that occurs as the result of a severely stressful event.

Sexual assault in childhood: Sexual assault on a child aged 17 or less.

Physical assault in childhood: Physical assault on a child aged 17 or less.

Metabolic syndrome: The presence of the following conditions:

- *Insulin resistance*: Defined as type 2 diabetes mellitus (DM) or high/elevated blood sugar.
- *High blood pressure*: Defined as blood pressure 140/90 mmHg or greater or the use of medication to treat high blood pressure.
- *Obesity*: Defined as having a body mass index > 30 kg/m2.

Assumptions

The following assumptions provided the research basis for this study: (a) the participants of the original MIDUS study and the follow-up MIDUS-II study understood the survey questions; (b) respondents answered the survey questions honestly; and (c) researchers explained the questions and collected the data accurately.

Scope and Delimitations

This study examined the connection or association between psychological trauma and physiological outcomes. The data are longitudinal and cross-sectional in nature and include a large number of subjects and measure over 2,000 different variables. Several aspects of quality-of-life are addressed in the data and are applicable to the mind-body model used for this study. The MIDUS studies focused on middle-aged or midlife Americans who spoke English and who were not institutionalized. This dissertation study

examined the associations between psychological trauma from physical and/or sexual abuse in childhood and the development of the components of metabolic syndrome, as well as several covariates. As there is general agreement on the diagnostic criteria used by WHO (1998), this study is potentially generalizable.

Limitations

The limitations of this retrospective study included issues of recall, exposure to risk variables, misclassification, and/or misunderstanding of the original survey questions. There is also the possible issue of information bias and recall bias concerning subjects, as well as misclassification or information bias due to the retrospective aspect of the MIDUS and MIDUS-II studies. There may also be a concern of temporal relationship between variables of interest, and exposure and outcome assessments could not be controlled. The recordkeeping of the original MIDUS and MIDUS-II studies was assumed to have been very good, and the large sample size is applicable to rare outcomes and conditions. Because the original MIDUS and the follow up MIDUS-II studies included only noninstitutionalized, English-speaking adults within the contiguous United States, other groups were excluded. Finally, the use of a convenience sample may confer the risk of bias of self-selection. Participants of the original MIDUS study may not have been accurate in answering questions of body weight; a recent report in the *Journal of the British Psychological Association* (Wen & Kowaleski-Jones, 2012) found that both men and women are prone to underestimating true body weight and overestimating true body height. According to the authors, people often lie about height and weight, particularly when completing survey questions (Wen & Kowaleski-Jones, 2012). Because much of

the follow-up in the MIDUS-II survey was completed in face-to-face format, this reality may prove less of an issue for this study. The data were cleansed through delineation, allowing for a subset of the variables required for the analysis, and responses of "did not know" and "refused to answer" were excluded from analysis of the variables. Finally, the limitations of a retrospective study using archival data were somewhat overcome by the large number of subjects, providing a statistically significant number for data analysis drawn from the original cohort.

Significance

Over one-third of adults in the United States have metabolic syndrome, the direct costs of which exceed $147 billion per year (Hammond & Levine, 2010). Upstream focus on intervention and preventative measures is critical to reducing negative social impact and poor health outcomes. Those in the fields of psychology and pediatrics have been cognizant of stress from abuse and assault in childhood for decades, yet there are currently few studies linking this stress to chronic disease outcomes. Along with the reduction of costs associated with treatment of chronic disease and psychological disorders stemming from assault in childhood, the detriments to quality-of-life and difficulties with social relationships must also be considered. This study enhances the current knowledge of the factors associated with the metabolic syndrome epidemic in the United States, as well as the associated conditions of metabolic syndrome as defined by the WHO (1998). This study has the potential to help improve current treatment strategies by expanding the knowledge of potential outcomes of child assault in connection to chronic disease. The information gathered from this study strengthens the current

knowledge regarding factors contributing to the high prevalence of metabolic syndrome in Americans and is critical to policymakers, pediatricians, and public health professionals in regard to the necessity of early interventions into the effects of assaults on children. Finally, this study helps to demonstrate the need for increased funding for intervention programs and calls to attention the need for further research in the area of chronic psychological stress.

Social Change

Medical care costs associated with the treatment of metabolic syndrome and the components of metabolic syndrome as defined by the WHO (1998) are currently unknown. Nichols and Moler (2011) found significantly higher medical care costs associated with the necessary management of hypertension and insulin resistance, components of metabolic syndrome. Metabolic syndrome is widely prevalent as a multifactorial disorder (Gupta & Gupta, 2010), and future medical costs cannot be accurately assessed; still, DeVol and Bedroussian (2007) and others have shown the continuous rise of chronic disease costs in America to be well over $1 trillion annually. Mensah and Brown (2007) assessed the cost of type-2 diabetes at $174 billion per year. The costs of treatment for the components of metabolic syndrome and comorbid chronic diseases are unsustainable; a modified approach to upstream prevention, one that considers the cause-and-effect relationship to chronic disorders, along with the reevaluation of alternative therapies, is desperately needed. The positive social change implications of this effort cannot be underestimated, as the enormous financial costs might be better used to treat other chronic conditions; the reduction in psychological

trauma from assaults in childhood will reap unimaginable benefits. Health science has as its goal the reduction of human suffering. This must by definition include psychological as well as physiological disease. Intervention strategies used in childhood may go far in reducing chronic outcomes in adulthood, thereby reducing the financial burden associated with these outcomes.

Summary

This chapter has provided the main points of the study, with emphasis on careful explanation of the methodology, the variables of interest of this study, and the retrospective data to be used. This study was grounded in mind-body theory with the use of the PNI model, which guided the analyses in order to determine the association between psychological and physiological outcomes, thus promoting a better understanding of the psychological effects of stress on physiology.

While significant research has been done in the field of chronic diseases, significantly less has focused on mental health-related origins of these conditions. A thorough review of the current literature to examine the associations between psychological trauma and the components of metabolic syndrome revealed a lack of focus on this research area. In the review of the literature (Chapter 2), I outline in detail the analysis of both current and historical research into the conditions and variables of interest.

Chapter 2: Literature Review

Introduction

The purpose of this dissertation was to examine associations between traumatic stresses from assault in childhood and the diagnosis of metabolic syndrome in adults. Traumatic stress is generally considered a psychological issue, and metabolic disorder is usually defined as a medical condition. In this dissertation, I suggest that through the mind/body connection, traumatic stress in childhood may be associated with chronic disease outcomes in adulthood, including components of metabolic syndrome. The chronic effects of trauma, if untreated, can have a debilitating effect on the body's endocrinological and hormone systems (Armario, Valles, Dal Zotto, Marquez, & Belda, 2004). In reviewing current literature, I expected an improved understanding of how psychological and biological aspects of the stress response influence health. The theoretical framework of the study was PNI theory and was based on the mind-body paradigm.

In this chapter, I examine the literature on the major variables in question. This includes research into several causes of psychological trauma in childhood, the components of metabolic syndrome, and the complications of prolonged stress on organ systems involved with metabolic processes. This chapter also identifies some of the gaps in the current literature that constrain both social change and healthcare policy.

The methodology used to locate and synthesize relevant recent information included primary, secondary, and tertiary searches using keyword combinations (*metabolic, metabolic syndrome, syndrome X, stress, traumatic stress, hypertension,*

dyslipidemia, high cholesterol, arteriosclerosis, cardiovascular disease, CVD, childhood trauma, psychological trauma, biological stress, stress, digestive issues, dramatic life events, prevalence, eastern medicine, mindfulness, stress management, stress effects, divorce, children, social work, type 2 diabetes, glycogen transport, glucose tolerance, A-1 C, insulin resistance, glucose intolerance, beta cell compensation, free fatty acid, FF a metabolism free fatty acid concentration, hyperglycemia, hypoglycemia, pathogenesis, hypertension, hyperinsulinemia, divorce in childhood, loss of mother in childhood, physical abuse, sexual abuse, neglect, severe neglect, voluntary mutism, stress disorders, stress chemicals, pituitary, hypothalamus, adrenal cortex, neural plasticity, learned helplessness, family violence, obesity, having an "apple shape," eating disorders, bulimia, depression, anxiety, CAD, cardiovascular accident, VLDL, triglyceride, plasma concentration, HDL cholesterol, high blood pressure, coronary artery disease, glucose tolerance test, IGT, IDDM, insulin-dependent diabetes, non-insulin-dependent diabetes, major depression, metabolic syndrome, physical health, anxiety disorder, and *glucose uptake*.

The databases accessed were located within the libraries of Walden University, Cornell University, and Harvard University and used Academic Search Complete, PubMed, ProQuest Central, ScienceDirect, Thoreau, and individual databases including MEDLINE, CINAHL Plus, PsycINFO, PsycARTICLES, and Psychology: SAGE. Articles were also drawn from journals including the *American Journal of Epidemiology*, *Lancet*, *New England Journal of Medicine*, *Annals of Epidemiology*, *Diabetes Care*, *Circulation*, *International Journal of Eating Disorders*, *Social Psychiatry and*

Psychiatric Epidemiology, *Journal of Traumatic Stress*, *Journal of Personality and Social Psychology*, *Journal of Family Violence*, *Obesity Reviews*, *Nature Neuroscience*, *Cognition and Emotion*, *Journal of Psychiatry and Neuroscience*, *Diabetic Medicine*, *Microcirculation*, *Child & Adolescent Psychiatry & Mental Health*, and *Depression and Anxiety*.

In analyzing the clinically diagnosed features of metabolic syndrome, particularly the components, and in the hope of obtaining a universal description, several sources were evaluated for conclusive characterizations of metabolic syndrome. These included the World Health Organization, American Heart Association, American Cancer Society, American Diabetes Association, and Centers for Disease Control and Prevention. All were found to be in general agreement on signs and symptoms of metabolic syndrome. The original literature review produced in excess of 200 articles that were printed in their entirety for review, of which approximately 90 were found applicable for inclusion in this work.

The selected articles were filed electronically for retrieval during the dissertation process. This chapter outlines the literature review and summarizes the investigation of any association between untreated chronic psychological stress in childhood and metabolic syndrome in adulthood.

Theoretical Foundation

The theoretical foundation for this dissertation was based on the mind-body relationship to health, disease, and disorder. The presumption was that psychological perceptions and physiological impacts of traumatic events could have detrimental effects

on physiological systems. Further, this dissertation suggests an association between this stress and metabolic processes. It is understood that this mind-body connection has produced, at times, conflicting views of health outcomes. The theoretical application of this mind-body construct has been used for centuries and continues to inform the primary treatment modality in many cultures. Hippocrates (460 BC-470 BC) believed that the natural healing force within people is their greatest force for improving their health (On Airs, Waters, and Places, Ch. 19). Hippocrates recognized that humans were much more than physical beings; there were psychological aspects, and both psychological and physiological treatments were needed for health. Both Hippocrates and Galen (129AD-217AD) believed the successful treatment of sickness could occur only with the proper treatment of the mind and the body to heal.

Modern Western biomedicine has been shaped largely by systems of thought that emphasized the separation of mind and body because of the scientific renaissance (Amusco, 1560). Florence Nightingale, in *Notes on Nursing: What It Is, and What It Is Not* (1860), argued that the emotional suffering long held as inevitable with disease was instead separate and different, writing that simple pleasantries like fresh air, warmth, quiet, or even cleanliness can have enormous impacts on the progression to health.

Holistic health practitioners in Japan, Tibet, and China have used traditional medicine, herbs, and meditation to treat disease and disorders for millennia. They believe the body and mind to be intimately connected (Loizzo, Blackhall, & Rapgay, 2009). In order to restore health, both mind and body must be returned to health. This mind-body

connection has at times met with a healthy skepticism by Western practitioners (Loizzo, Blackhall, Rapgay, 2009).

The rationale for the theory of mind-body medicine is based on centuries of concepts on the influence of the mind on the body. For this study, a foundation in mind-body medicine is found in applying treatment to both biological diseases as well as the psychological conditions that result from or are compounded by the disease. In the early 1960s, physician Herbert Benson observed how patients using relaxation and meditation could lower their blood pressure (Esch, Stefano, Fricchione, & Benson, 2002), and psychiatrist George Solomon studied how people with rheumatoid arthritis experienced worsening symptoms when feeling depressed, thus creating the field of psychoneuroimmunology (Lorentz, 2006). Many practitioners of Western medicine (Tsuei, 1978) have come to appreciate the influence of the body on the mind and the mind on the body (Wen-hui et al., 2012). In separating the mind from the body, one cannot treat a disease or condition completely, particularly in the case of traumatic stress resulting from past events. The mind-body paradigm has reemerged in Western medical practices as a methodology to better treat disease.

In 1911, while investigating the process of digestion, W. B. Cannon discovered that when his laboratory animals became stressed, their digestion slowed or stopped (Cannon, 1911). He discovered through experiment that the animals would focus on avoiding stress to the point of ceasing normal digestion. Cannon turned his focus to finding the physiological connection between emotional stress and the body by observing introduced stress reactions caused by pain, hunger, and fear (Cannon, 1915). Fear, real or

imagined, was considered the trigger for often-abrupt changes in physiological functioning (Sugaya, Hasin, Olfson, Lin, Grant, & Blanco (2012).

In 1976, endocrinologist Hans Selye proposed a neurophysiological model for understanding the mind/body connection, suggesting that stress reactions were based in perception and cognition. Seyle showed that perceptions had direct effects on the biological systems of the body through psychological stress response (Selye, 1976). Seyle found that he could evoke a strong stress response by introducing different chemical agents or hormones, and even by introducing extreme heat or cold. Selye recognized similar responses in some of his human patients: Those who suffered from higher rates of diseases, ranging from infections to cancers, reported having experienced psychological trauma (Selye, 1976).

Designed by nature for avoiding threats to the organism (fight/flight), if the stress response system cannot return to prestress levels, both psychological and physiological damage can occur. The system that deals with perceived stressors is complex and involves both neurologic and hormonal organ systems. The hypothalamic-pituitary-adrenal axis (HPA) directs a series of complex responses involving the endocrine, nervous, and even immune systems (Smith & Vale, 2006). While some researchers (Montero, Walther, Perez-Martin, Roche, & Vinet, 2011) have sought association with a genetic predisposition or association to oxidative stress (significant decrease in the effectiveness of antioxidant intracellular defenses), the majority of researchers agree that stress is predominantly environmental.

Some researchers (Porges, 1994), through early psychophysiological research, discovered that the autonomic system is responsible for arousal activation, and that long-term activation of the stress response system often results in negative health issues (Montero, Walther, Perez-Martin, Roche, & Vinet, 2011; Smith & Vale, 2006;).

Chronic long-term activation of the HPA axis from psychological stress can result in negative physiological health outcomes (Marangell et al., 1997; Rice, 2011; Schore, 2002; Smith & Vale, 2006; Selye, 1976). Stress from psychological trauma was a major variable in this dissertation; therefore, the theoretical model needed to incorporate both the emotional/psychological and the biological outcomes related to chronic levels of stress. One theoretical approach that incorporates the mind-body paradigm through understanding the stress response system is psychoneuroimmunology.

Psychoneuroimmunology Theory

Psychoneuroimmunology (PNI) is based upon the theory that stress greatly influences all aspects of health (Azar, 2001). According to the PNI approach, in determining the health of a person, one must take into consideration the mind, body, and spirit, as these aspects of the person are interdependent (Lorentz, 2006). PNI contributes to the broader understanding of medical science, particularly in relation to preventative medicine (Gilbert, 2003). PNI suggests that stress, the psychological state of an animal, is primary to understanding vulnerability to disease, either infectious or chronic (Lorentz, 2006).

By comparing changes and the body's organ systems and tissue function between the normal steady state and stress state, a number of chronic issues have been uncovered.

These include statistically significant risk for heart disease in patients experiencing acute or chronic stress (Jurysta et al., 2010), increased platelet activation (Montero, Walther, Perez-Martin, Roche, & Vinet, 2012), gastrointestinal disorders (Grogan & Murphy, 2011; Kolb & Gibb, 2011; Smith & Vale, 2006), chronic pain (Gibbons, Hickling, & Watts, 2011; Lown, Nayak, Korcha, & Greenfield, 2011), diabetes (Habetha, Bleich, Weidenhammer, & Fegert, 2012), and other metabolic issues (Anda et al., 2006; Ervin, 2009).

Psychological Trauma in Children

Van der Kolk (2005) stated that childhood trauma from abuse is the nation's most critical public health challenge. In 2011, over 680,000 children were confirmed victims of abuse/neglect in the United States (Moyer, 2013). Approximately 1,600 children died due to this abuse. According to Safe Horizon (2013), the number of reports of child endangerment exceeds 3 million in the United States alone; the total number of children involved in these reports exceeds 6 million. The number of cases of children being abused or neglected that go unreported is unknown.

Causes of Psychological Traumatic Stress in Childhood

Traumatic stress in childhood can come from a number of causes, including physical abuse (Sugaya et al., 2012), emotional abuse (Chang, 2012), sexual abuse (Lown et al., 2007), family conflict (Bargai, Ben-Shakhar, & Shalev, 2007), and extreme neglect (Burri et al., 2013). Traumatic stress can also be the result of events such as war (Donovan et al., 1996; McMullen, O'Callaghan, Richards, Eakin, & Rafferty, 2012),

parental loss due to death or extreme illness (Habetha, Bleich, Weidenhammer, & Fegert, 2012), or natural disasters caused by extreme weather (Cohen et al., 2009).

Childhood Traumatic Stress Outcomes

Traumatic stress in childhood dramatically increases risk for the development of psychological disorders, behavioral disorders, cognitive delay, and even dementia (Kolb & Gibb, 2011). Epidemiological studies suggest that as many as 25% of females in the United States report being abused during childhood (Midei, Matthews, Chang, & Bromberger, 2013), indicating that sexual abuse in childhood is a significant issue. Other researchers (Habetha et al., 2012; Hooven et al., 2012; Sripada et al., 2012; Sugaya et al., 2012) have shown strong correlations between psychological trauma in childhood and compromised psychological/emotional health and physiological health in later life.

Anda (et al., 2006) found that abuse in childhood was positively associated with structural changes in the brain, particularly in relation to the function of the stress-responsive neurobiological systems. A number of studies (Brown et al., 2010; Lorentz, 2006; McKeever & Huff, 2003; Rice, 2011; Sripada et al., 2012; Sugaya et al., 2012) have suggested that physiological damage to the body occurs through the over activation of the HPA (Charmandari, Tsigos, & Chrousos, 2005; Pervanidou, 2008; Rice, 2011; Smith & Vale, 2006). Kousha and Tehrani (2013) found that exposure to traumatic events have become common in children and adolescents in both developed and developing nations. Moreover, children and adolescents are more susceptible to psychological stress because they do not have the psychological adaptability or the neurological development necessary to understand situations of trauma. Children who have experienced

psychological trauma are significantly more likely to suffer chronic immune, neurological, and inflammatory diseases including asthma, allergies, and gastrointestinal problems (Sripada et al., 2012; Zlotnick et al., 1999).

Other studies (Epel, 2009) have found correlations among psychological issues, gastrointestinal problems, and cardiometabolic issues; Heim, Ehlert, and Hellhammer (2000) found that the increased rate of chronic disease among adult females was strongly correlated with childhood traumatic experiences. Females in this study who reported having experienced psychological trauma in childhood had significantly higher rates of chronic disease, including fibromyalgia and irritable bowel syndrome. Stojanovich (2010) found that subjects diagnosed with autoimmune disorders often had an element of environmental stress, and Majer, Nater, Lin, Capuron, and Reeves (2010) suggested that traumatic experiences early in childhood could be associated with diminished cognitive function in otherwise healthy adults.

Although a strong positive association was found suggesting chronic HPA activation, there exist other possible causes that may be unrelated to psychological trauma, including genetic glucocorticoid sensitivity or simply having an undersized hippocampus (Majer et al., 2010). Whether genetic or as result of childhood trauma, the brain's ability to regulate stress response is markedly diminished (Vythilingam et al., 2002). One study (Linnville et al., 2011) involving expatriated prisoners of war found no correlation between traumatic stress and components of metabolic syndrome, suggesting that adult brains are better equipped to handle psychological trauma than the brains of children. Other researchers examining the association between psychological illness and

metabolic syndrome components found significant positive correlations (Kahl et al., 2012).

Traumatic Stress Symptomology

Römer (et al., 2008) suggests that the ability of depressed patients to regulate stress directly impacts metabolism through the HPA axis. The activation of the stress response system can occur through both immediate threats to the child or through the memory of the original trauma through intrusions or flashbacks. The intrusions and flashbacks of traumatic memories related to childhood trauma may occur many times each day (Priebe, Kleindienst, Zimmer, Koudela, Ebner-Priemer, & Bohus, 2013).

It is thought that over time, the psychology of the person attempts to normalize this state of chronic stress by adaptation to the trauma and the chronic stress becomes normal (van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005). Both psychological and physiological manifestations of this chronic stress are often experienced as anger, self-destructive behaviors, distorted self-beliefs, disassociation, digestive problems, chronic pain, cardiovascular and cardiopulmonary issues, and risk-taking behavior (van der Kolk et al., 2005). While psychological and biological responses to traumatic stress have been positively correlated to a number of chronic diseases among combat veterans (Babić, Jakovljević, Martinac, Sarić, Topić, & Maslov, 2007), significantly less research has been done to correlate similar responses in children who have experienced traumatic events.

According to Yule (2001) children who have experienced psychological trauma exhibit many of the same symptoms as war veterans. It is accepted by many researchers

(Habetha et al., 2012; Lown et al., 2011) that children can develop long lasting psychological and physiological effects from traumatic stress. Researchers have found positive correlations between psychological and physiological health of children from war-torn areas (McFarlane, 2010).

This positive association between childhood trauma and poor general health outcomes constitutes a significant risk to the development of chronic illness in adulthood (Kassi et al., 2014; Spitzer et al., 2009), and pediatricians are in the unique position to screen for the upstream associations of at least some chronic disease load before cognitive disruption and emotional development are negatively impacted (Loeb et al., 2011). What this means in application is that children who suffer psychological trauma may in fact have an environmentally created predilection for negative physiological health impacts; adding an upstream aspect to health screening for trauma by pediatricians, school nurses, and others, may drastically improve health outcomes in adulthood including psychological and physiological disorders.

Gaps in the Existing Literature

Chronic Disease and Traumatic Stress

A strong correlation between traumatic stress and the development of chronic disease has been well documented in veterans of war (Bremner et al., 1999; Sripada et al., 2012; Zlotnick et al., 1999), and adult victims of sexual abuse (Amario, Valles, Dal Zotto, Marquez, & Belda, 2004; Lilly & Valdez, 2013; Roenholt et al., 2012; Scott-Tilley, Tilton, & Sandel, 2010). A review of the literature revealed psychological trauma in childhood associated with lung cancer (Brown et al., 2010); however, the majority of

research is given toward psychological illness stemming from psychological trauma in childhood (Donovan et al., 1996; Pervanidou, 2008) rather than chronic physiological impacts, including the components of metabolic syndrome. Researchers are examining the connections between psychological traumas and painful conditions such as fibromyalgia (Ablin et al., 2008); Mastalgia (Johnson et al., 2006), transient ischemic attacks (TIA) (Edmondson et al., 2013), heart disease (Edmondson et al., 2013; Bremner, 2009) and correlations to generally poor physiological health in general (Fetzner et al., 2012), research specific to traumatic stress and metabolic syndrome components is largely absent.

According to McFarlane (2010), one challenge to research in the field of traumatic stress study has been that many subjects who were able to cope at the time of the trauma became ill later. While the associations or correlations between psychological trauma and cardiovascular health have been well researched (Austin-Ketch, 2008; Boscarino, 2004; Habetha et al., 2012), with few exceptions, attention concerning chronic disease outcomes in adulthood associated with psychological trauma of children and chronic disease outcomes in adulthood. One study (Heim et al., 2009) examined childhood trauma and chronic fatigue syndrome as associated with neuroendocrine dysfunction using the PNI theory.

More recent studies have begun to examine the role of psychological stress from childhood with midlife chronic diseases, including those metabolic syndrome components identified by the World Health Organization (2012). A recent study published after the beginning of this literature review by Lee, Tsenkova, and Carr (2014)

found that maladaptive stress responses stemming from psychological trauma from abuse and neglect in childhood abuse increases the risk for metabolic syndrome for both genders in adulthood. The authors also suggest that cumulative abuse increases the risk of the development of metabolic syndrome and that sexual abuse is predictor for women only. Primary action for chronic activation of stress is HPA axis activation; gender differences in age-related changes in HPA axis reactivity (Seeman, Singer, Wilkinson, & McEwen, 2001) may account for differences in the study by Lee, Tsenkova, and Carr (2014). According to Seeman, Singer, Wilkinson, & McEwen (2001) differences in age-related structural changes in HPA reactivity may account for differences in free cortisol measures. Concerning the complication of structural age-related changes in HPA reactivity, differences in gender and differences in type or form of child abuse, further elucidation seems necessary.

Researchers (O'Rahilly, 1999; Simmons et al., 2010) suggest that psychological stress may in fact be a strong precursor to some components of metabolic syndrome (Fetzner et al., 2012; Haung, 2009). Hypertension is of particular interest in relation to both cardiovascular disease as well as metabolic syndrome (Kramer et al., 2009; O'Rahilly, 1999; Simmons et al., 2010). In this regard, preventative measures to guard against psychological stress should prove both financially, physically, and socially constructive. Of significance is the lack of primary care interventions designed to prevent child now maltreatment among children (Moyer (2013). Any study seeking to reduce the incidence of the components of metabolic syndrome should also address traumatic psychological stress as a precursor of hypertension or other associated conditions.

History and Etiology of Metabolic Syndrome

Metabolic syndrome was first recognized as a chronic condition in the 1920's when Dr. Jean Vague recognized an association between gout, hypertension, obesity, and hyperglycemia in his middle-age patients was correlated with obesity (Batsis, Nieto-Martinez, & Lopez-Jiminez, 2007). Until recently, a widely accepted definition of metabolic syndrome was lacking from health science research. The National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), and American Diabetes Association (ADA) agree on the associated conditions that indicate the diagnosis of metabolic syndrome (WHO, 1998; CDC, 2009; NIH, 2012). Any person exhibiting three or more of the preconditions is considered as adequate diagnosis of metabolic syndrome. These associated conditions include abdominal obesity, having a high triglyceride level or taking medication to reduce triglycerides, having a low HDL level or taking medication to increase HDL, hypertension or taking medication to treat hypertension, and having a high fasting blood sugar level, (NIH, 2012). Each of the components of metabolic syndrome are a significant health problem individually; three or more of the components are indicative of the syndrome, and prevalence of metabolic syndrome has been shown to be a significant risk factor for cardiovascular diseases (Scuteri, Najjjar, Morrell, & Lakata, 2005).

Prevalence of Metabolic Syndrome

In the United States, approximately 34% of adults met the criteria for metabolic syndrome (Ervin, 2009). Adults aged 40 to 59 years were found to have been approximately three times as likely as younger adults to meet the criteria (three or more

components) for metabolic syndrome (Rice, 2011). According to Ford, Giles, and Dietz (2002) the prevalence of the metabolic syndrome was 23.7% in the first years of the new century; using 2000 census data, nearly 47 million US residents reported having a diagnosis of metabolic syndrome. More recent studies have correlated obesity, hyperinsulinemia, hypertension, and dyslipidemia to metabolic syndrome (Batsis, Nieto-Martinez, & Lopez-Jiminez, 2007; Bedi et al., 2007).

Prevalence of Metabolic Syndrome Components

According to the WHO (1998), metabolic syndrome is diagnosed when the presence of insulin resistance (defined as type 2 diabetes mellitus (DM) or impaired fasting glucose (IFG) (> 100 mg/dl) or impaired glucose tolerance) plus two of the following: abdominal obesity (waist-to-hip ratio > 0.9 in men or > 0.85 in women, or body mass index (BMI) > 30 kg/m2, dyslipidemia (Triglycerides 150 mg/dl or greater, and/or HDL< 40 mg/dl in men and < 50 mg/dl in women), hypertension (blood pressure (BP) 140/90 mmHg or greater, microalbuminuria (urinary albumin secretion rate 20 μ g/min or greater, or albumin-to-creatinine ratio 30 mg/g or greater). The MIDUS-II Data includes three of these conditions: insulin resistances, hypertension, and BMI, which will be calculated using available data on height and weight.

Insulin Resistance/Type 2 Diabetes

Insulin resistance is defined by the World Health Organization (1999) as having a plasma glucose concentration >=7 mmol/L (or 126 mg/dL) or >=11.1mmol/L (or 200mg/dL) 2 hours after a 75g glucose drink, or having a diagnosis of type-II diabetes.

Nathan (et al., 2007) found that impaired fasting glucose level and impaired glucose tolerance led to the onset of type-two diabetes in 70% of cases under age 60 (US population). Further, the researchers found an increase of over 60% in type-II diabetes incidence between 1990 and 2001. Glucose insensitivity is a significant risk factor in both type-II diabetes and metabolic syndrome, and both are significant risk factors for cardiovascular disease (Vogel, 2005).

Obesity—Defined as BMI

For this study, obesity will be defined using BMI or body mass index. BMI is based upon weight-for-height to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his or her height in meters (kg/m2). According to the WHO (1998), a BMI greater than or equal to 30 constitutes obesity. Currently in the United States, over one third of adults are obese (American Heart Association, 2011; National Institutes of Health, 2012).

High Blood Pressure or Hypertension

Hypertension as a metabolic syndrome component is defined as the systolic measurement of 130 mm Hg or more or diastolic measurement of 85 mm Hg or more (WHO, 1998). According to the CDC (2012), nearly one third of American adults have hypertension and the estimated annual expenditures in the United States alone for the treatment of hypertension exceeds $47 billion. Wang and Ayala (2013) found that both proportion of hospitalizations associated with hypertension and the costs of such hospitalizations have tripled over the past three decades. Hypertension alone is a significant risk factor for cardiovascular disease (Wang & Vasan, 2005).

Neuroendocrine Involvement in Traumatic Stress

Stimulation of the Hypothalamic–pituitary–adrenal axis is shown to increase appetite while slowing digestion, leading to increased body weight through glucose imbalance (Pervanidou & Chrousos, 2012). Recent studies have implicated childhood trauma and neuroendocrine dysfunction involvement in chronic disease states (Heim et al., 2009). The neuroendocrinological response to stress, either physiological or psychological, includes abnormal sodium and water retention, hyperlipolysis, increased gluconeogenesis (glucose production), and impaired glucose clearance or insulin resistance (Castañeda et al., 2011). Whether traumatic stress is a residual aspect from physical abuse, non-adaptive family life, or through single incident exposure (combat, sexual abuse, severe physical abuse), both traumatic stress and long-term residual stress are both adequate to cause long-lasting psychological and physiological impairment (Donovan et al., 1996).

As the rate of adults diagnosed with metabolic syndrome are increasing dramatically, greater attention is being directed to treatment (Pervanidou & Chrousos, 2012; Pervanidou, 2008; Reims et al., 2005). A redirection of intervention based in prevention, and an upstream focus may allow a greater impact on reducing allostatic load, defined as psychological stress on physiology (Fetzner et al., 2012; McFarlane, 2010), thus experiencing a reduction in eventual healthcare spending and in improved quality of life. A better understanding of the epidemiology of metabolic syndrome, childhood psychological trauma, and increased wear on the body's organ systems or allostatic load is needed to better understand the disease progression.

Metabolic Syndrome as a Socioeconomic Issue

Medical care costs associated with metabolic syndrome are currently unknown. Nichols and Moler (2011) studied over 57,000 non-diabetic adults, aged 30 or over with metabolic syndrome components in 2003/2004, with follow up after five years. After adjustment, hypertension, obesity, low high-density lipoprotein, and high triglycerides were found to be significantly associated with higher treatment costs annually. However, impaired glucose tolerance was not found to be a significant factor in the increase of healthcare spending (Nichols & Moler, 2011). What is beyond dispute is the higher medical care costs associated with the components of metabolic syndrome, the necessary management of hypertension, dyslipidemia, and the association to type-two diabetes and chronic heart disease. According to Nichols and Moler (2011), the number of metabolic syndrome components and overall annual cost of treatment per patient range from approximately $4,300 to approximately $5,700. Using this additional cost of treatment, the 57,000 adults in Nichols and Moler's (2011) study alone would cost nearly $500 million.

Because metabolic syndrome is widely prevalent as a multifactorial disorder (Gupta & Gupta, 2010), significantly higher medical care costs are associated with metabolic syndrome components. Future medical cost cannot be known, yet based on the current cumulative costs of the metabolic syndrome components, and associated chronic diseases such as type 2 diabetes and chronic heart disease, estimated current costs in the United States alone are enormous.

While most chronic diseases are preventable or manageable, DeVol and Bedroussian (2007) and others, have shown the continuous rise of chronic disease costs in America. In 2003 alone, the cost of treatment of chronic disease exceeded $1.3 trillion; Heart disease and stroke account for approximately $432 billion per year (Mensah & Brown, 2007) and diabetes costs $174 billion/year (ADA, 2007). The cost of treatment for the components of metabolic syndrome and comorbidity chronic diseases are unsustainable; a modified approach to upstream prevention, one that considers the cause-and-effect relationship to chronic disorders, along with the reevaluation of alternative therapies is desperately needed.

Conclusions

In conclusion, the incidence rate of metabolic syndrome as well as the components of metabolic syndrome is increasing in the United States (CDC, 2012). Further, the cost of treatment of these chronic conditions is increasing significantly (Boudreau et al., 2009). While the incidence of diabetes and cardiovascular disease account for a percentage of the chronic disease health care costs, elevated costs are associated with the components of metabolic syndrome (Nichols & Moler, 2011). As the cost of treatment continues to increase, further research is needed to understand the underlying morbidity that is driving these increases in incidence. In addition, further research is necessary to better predict and identify those persons susceptible to the components of metabolic syndrome and to identify screening methodology and treatment to reduce cost and increase prevention efforts.

Research indicates a strong correlation between psychological trauma and negative health outcomes in veterans of war and women who experienced sexual and domestic violence (Moyer, 2013), and between psychological trauma in childhood and mental health issues, including cognitive delay, depression, and anxiety (Burri et al., 2013; Sugaya et al., 2012). It is reasonable to expect similar health outcomes from psychological trauma in childhood in regards to negative health outcomes in adulthood, particularly those aspects of chronic disease that are influenced by stress including the components of metabolic syndrome. The findings indicate that health care professionals may benefit their patients by assessing childhood trauma from abuse in the treatment of obesity and components of metabolic syndrome, and further, by assessing childhood trauma in pediatrics.

Currently, literature is predominant with studies debating the association between stress from psychological trauma and chronic diseases in adults, with little attention to psychological trauma in childhood. Veterans of wars and even adult survivors of domestic abuse are represented in the literature; however, the case for childhood victims of abuse, maltreatment, or conflict remains underrepresented. This study, as outlined in the following chapter (chapter 3-methodology), utilizes data from National Survey of Midlife Development in the United States (MIDUS II), and is longitudinal study representative of the health history of a national sample of Americans. MIDUS-II data provides assessment of many psychological factors including traits, affect, as well as many components of metabolic syndrome while allowing the ability to control for gender, ethnicity, and family history of disease.

As determined by the scarcity of research, and as evidenced in the existing literature concerning associative measures between the variables of interest, the research topic was explored through statistical analysis of a retrospective data set (MIDUS-II). The study design allowed for an exploratory approach to examining the possible associations among the variables previously mentioned.

Chapter 3: Research Methodology

Introduction

This study offered the opportunity to examine whether psychological trauma, defined as physical or sexual assault in childhood, is associated with the presence of metabolic syndrome in adults age 35-74 using diagnostic criteria developed by the World Health Organization (1998). As the incidence of metabolic syndrome and its components rises, the social and financial costs to society also increase. The study focused on middle-aged Americans from the contiguous United States and used self-identified and self-reported surveys to examine health and life satisfaction. This chapter contains a description of the study design, data collection, analysis and instrumentation, and issues surrounding protection of human subjects and ethical considerations. The following sections are included in this chapter:

1. Description of MIDUS-II 2004-2006;
2. Data Collection;
3. Study Design;
4. Variables;
5. Data Analysis.

Research Design and Rationale

This research study used a nonexperimental, correlational design involving longitudinal and cross-sectional secondary data obtained from the Interuniversity Consortium for Political and Social Research (ICPSR). Nonexperimental examination can be used to analyze existing data, analyze variables, and measure statistical

associations among variables; thus, it was appropriate for use in this study. The study was quantitative in nature, based upon secondary analysis of archival data by way of a retrospective study. In medical and public health research, retrospective studies offer several advantages over concurrent case-control studies.

By using retrospective data, risk ratio or odds ratio allows for an assessment of relative risk in examining the association between variables of interest. Outcomes have already occurred in the past, and therefore the establishment of risk or association of exposure to a particular factor can be measured based on the data. Additionally, caution must be exercised using retrospective data, as errors due to confounding or bias may not be easily controlled. Breslow (2002) suggested that issues of confounding and bias are more common in prospective studies than in retrospective studies.

The benefits of a retrospective cohort study over a prospective study include smaller scale, less time to complete, and better use for the analysis of multiple results. Retrospective studies can also address unique conditions that would necessitate a much larger cohort group in prospective studies (Waller, 2004). Conditions or diseases have already been identified in retrospective data; therefore, this type of study is especially applicable in addressing conditions of low incidence. Retrospective studies have the benefits of statistical analysis; however correctly assessing the temporal relationship may be difficult. Retrospective studies that have very large sample sizes may allow unique outcomes to be assessed.

Variables of Interest

Dependent variable. In this study, the dependent variable was metabolic syndrome as defined by the World Health Organization (1998). The MIDUS-II study did not collect a single variable that identified a person as having metabolic syndrome; therefore, a combination of variables was used to code a categorical variable for the syndrome. The WHO definition drawn from the literature requires the presence of insulin resistance (defined as type 2 diabetes or elevated blood sugar) and a combination of at least two other metabolic risk factors (WHO, 1998). For this study, elevated BP (defined as blood pressure ≥ 140/90 mmHg or the use of medication to treat blood pressure) and elevated BMI (defined as BMI > 30 kg/m2) were used (WHO, 1998). According to the World Health Organization (1998), the presence of these associated conditions constitutes a clinical diagnosis of metabolic syndrome.

Independent variables. The independent variables of this study were cumulative psychological traumas, defined as having a history of sexual assault in childhood and/or physical assault that occurred during childhood. The variables specified in the data set were limited to a history of physical assault and/or sexual assault. A history of either physical or sexual assault in childhood placed respondents in the group for psychological trauma.

According to the National Institute of Mental Health (NIMH, 2014), events of sexual or physical assault can result in psychological trauma, particularly if the event or events occurred in childhood. Further, Srivastava (2011) suggested that traumatic stress occurs in children and adolescents through exposure to as few as one event of assault if

that event was unexpected, was uncontrollable, and caused harm to the child or a significant attachment figure.

Covariates. The covariates in this study included gender, current age, the use of alcohol, daily smoking of cigarettes, beliefs concerning physical fitness, and ethnicity. Because the MIDUS and MIDUS-II studies targeted middle-aged Americans, current age was known to be 35–75+ years. Because this study was concerned with traumatic psychological stress from physical/sexual assaults in childhood, the assault(s) needed to have taken place at age 17 or under for inclusion in this group.

Methodology

Description of MIDUS-II 2004-2006

MIDUS-II 2004-2006, the National Survey of Midlife Development in the United States, was a collaborative, interdisciplinary investigation of sociological and physiological patterns, predictors, and outcomes of midlife development in the United States. The MIDUS-II study is retained and disseminated by the National Archives of Computerized Data on Aging (NACDA) within the ICPSR. The National Institute on Aging (NIA), located within the National Institute of Health (NIH), in turn supports the NACDA. The MIDUS-II was a follow-up to the National Survey of Midlife Development in the United States, 1995-1996, which sought to investigate the roles of behavioral, psychological, and socioeconomic factors in explaining attributes of age-related health disparities in a national sample of Americans. Investigators sought a follow-up of MIDUS respondents.

The MIDUS-II surveys were composed of five projects. The first followed up on the psychosocial, sociodemographic, and health variables originally assessed in the MIDUS study. The second examined the daily diary study included in the MIDUS study, and the third assessed cognitive abilities, along with longitudinal follow-up for the cognitive subsample. The fourth project examined comprehensive biomarker assessments on a subsample of the MIDUS respondents. The fifth project involved neuroscience assessments on a subsample of the respondents in the biomarker study (ICPSR, 2012)

The original MIDUS sample of 7,189 noninstitutionalized, English-speaking adults aged 25 to 74 was followed after 10 years with the MIDUS-II survey (University of Wisconsin, 2011). The MIDUS-II study successfully included 4,963 of the original participants. In addition to a phone interview and extensive self-administered questionnaire, questions in selected areas were added, including cognitive function, coping and life outlook, and history of stressful life events. The fourth project, which sought comprehensive assessment of cardiovascular, neuroendocrine, immune function, and neurological biomarkers, included roughly 1,500 subjects from regions in the United States. The analytical sample used was drawn from the biomarker substudy of the MIDUS-II study.

Population

MIDUS-II was a longitudinal follow-up to the original MIDUS study (1995-1996), composed of a core sample, a metropolitan over-sample, twins, and siblings, conducted in 2004-2006. This national survey of Americans aged 25 to 74 (MIDUS) examined the role of behavioral, emotional, and social factors in an effort to understand

age-related variations in both physical and emotional health, including conceptualized ideas such as well-being, emotional stress, and cognitive functioning (Ryff et al., 2012). Of interest for researchers were the possible association between behavioral and psychosocial factors and consequential physical and mental health outcomes (Ryff et al., 2012).

By the time of the MIDUS-II study, these same respondents were aged 35 to 86 (ICPSR, 2013), and data collection repeated baseline assessments in the form of phone interviews and extensive self-administered questionnaires. Additional questions in the MIDUS-II study addressed such information as cognitive functioning, optimism and coping (well-being), and stressful life events (ICPSR, 2012). In order to provide the greatest application, an African American sample was recruited and also participated in a personal interview and completed similar questionnaires. A telephone follow-up survey was administered to respondents who failed to complete a self-administered questionnaire (Brooks et al., 2014). Complete data had been obtained from approximately 5,900 individuals comprising nearly 2,300 variables (Ryff et al., 2012).

Sampling Procedure for MIDUS-II

The MIDUS-II survey was conducted using a multistage sampling design. Stage 1 included an equal probability sample of telephone numbers; predesigned households were selected in a random replicates, and contact persons were informed that participation would entail the completion of a telephone interview along with two mailed questionnaires. Information was collected from contact persons concerning configuration of household in order to determine applicability to eligibility criteria. Once this had been

acquired, a list was generated of all English-speaking households in the age range 25 to 74, from which random respondents were selected.

Oversampling to adjust the class distribution of the data set, particularly the ratio between the represented classes and categories of older respondents and males, was carried out by probability varying as a function of the age and gender of all the randomly selected persons. Some subjects in the MIDUS-II study completed more than one of the five additional projects; the daily dietary assessment from Project 2 involved daily phone assessments encompassing several days. The assessments of cognitive function for the third project were obtained by further phone interviews, and all participants in the first project were asked to consider participation in the third project (cognitive assessment).

Sampling Frame

The sampling frame for the MIDUS-II study included tracts from the Census in which African Americans comprised at least 40% of the population (ICPSR, 2012). The Census blocks were stratified according to income; approximately 50% had a median household income ≥ $40,000 (ICPSR, 2012). Data collection in the original study included audio computer-assisted self-interviews, computer-assisted personal interviews, computer-assisted telephone interviews, and mailed questionnaires (ICPSR, 2012). ICPSR housing of the MIDUS and MIDUS-II data includes a confidentiality allergy review, and any identifying variables are altered when necessary to limit risk of disclosure. ICPSR routinely manufactures data files formatted for use with statistical software formats including SPSS and SAS. ICPSR makes available codebooks in PDF format. Additionally, ICPSR performed the following steps for the MIDUS-II collection:

consistency checks, the creation of variable labels and value labels, the creation of online analysis, recoding and calculation of derived variables, and checks for undocumented or out-of-range codes (ICPSR, 2012).

Inclusion and Exclusion Criteria

The MIDUS-II study participants were all middle-aged adults; therefore, younger adults (less than 35 years), teens, and children were excluded from the MIDUS and MIDUS-II data collection process. As a result, these participants were also excluded from this study. Participants who self-identified as having suffered from sexual and/or physical assaults in childhood (independent variable) and as having the required WHO (1998) components of metabolic syndrome (dependent variable) were compared to those participants who had metabolic syndrome (dependent variable) without having experienced physical/sexual assault.

Power analysis. In order to ascertain any association among the variables, it was necessary to use a power calculator in order to ensure an adequate sample size. According to Gpower*3 (Erdfelder, Faul, & Buchner, 1996), an effect (statistical significance) size of 0.3, α of 0.05 (Power = 95%) would require a sample size of $\geq$ 220 cases in order to accommodate chi-square test. The codebook for this data set lists all the variables needed for the calculation, and of the 7,000 cases in the original MIDUS study, 4,963 were successfully contacted to participate in MIDUS II (ICPSR, 2012); the population sample from this number for analysis (n = 339) was shown to be adequate.

Use of Archival Data

Obtaining Data

Acquisition of data requires membership in the ICPSR. There are currently over 700 colleges, universities, government agencies, and other institutions among the membership of ICPSR. Members of these institutions, including faculty, staff, and students, have full and direct access to the data archive, as well as all ICPSR services (ICPSR, 2014). Walden University's faculty, staff, and students have member access to ICPSR data. Once the IRB approved this research, MIDUS-II data in SPSS format were obtained.

Operationalization of the Variables

The variables of interest are outlined in Table 3 (Operationalization of the Variables). Using the codebook from ICPSR (2014), the variables of interest were selected and defined; the levels of measurement used for the data are listed in Table 3. The table includes the control variables, independent variables, and dependent variables.

Table 3

Operationalization of the Variables

Variable	Conceptual definition	Operational definition	Level of measurement
Covariate variables			
Gender	Identified as male or female	Gender of respondent at the time of survey: From B1PRSEX. Male = 1, Female = 2.	Categorical
Beliefs about fitness	Respondent's belief concerning the need for physical fitness to lead a good life	Believe fitness necessary for good life from:B1SE2J. 1 = Yes, 2 = No	Categorical
Current age	What is the respondent's current age	Age determined by subtracting DOB_Final from b1ipidate: From B1PAGE_M2. Refused = 998, INAPP = 999.	Scale (interval/ratio)
Regular alcohol consumption	Did/does respondent regularly consume alcohol?	Now smoke cigarettes regularly. From B1PA39. Refused = 998, INAPP = 999.	Categorical
Cigarette smoker	Did/does respondent smoke cigarettes?	Ever smoked cigarettes regularly. From B1PA38A. Refused = 998, INAPP = 999.	Categorical
Ethnicity	Respondent's ethnicity	Ethnic group; taken from B1PF7A; White = 1, 2 = Black, 3 = NAAIEA.	Categorical
Independent variables—Psychological trauma			
Ever sexually assaulted	Respondents identified as having been sexually assaulted	Ever sexually assaulted at time of survey: From B1SE11T. Yes = 1, No = 2, Don't know = 7, Refused = 8, Inapp = 9.	Categorical
Respondent's age sexually assaulted	At what age(s) did sexual assault(s) happen?	Age of responded at time of sexual assault(s): From B1SE11T1. Refused = 998.	Scale (interval/ratio)
Ever physically assaulted	Respondent identified as having been physically assaulted	Ever physically assaulted at time of survey: From B1SE11S. Yes = 1, No = 2, Don't know = 7, Refused = 8, Inapp = 9.	Categorical
Respondent age physically assaulted	At what age(s) did physical assault(s) happen?	Age of respondent at time of physical assault(s): From B1SE11S1. Refused = 998.	Scale (interval/ratio)
Dependent variable—Metabolic syndrome (components)			
High blood pressure diagnosed	Has a doctor ever told you that you have or had high blood pressure?	High blood pressure diagnosed. From B1PA24. Yes = 1, No = 2, Suspects = 3, 7 = Don't know, 8 = Refused, Inapp = 9.	Categorical
Diabetes/high blood sugar treatment	In the past 12 months, have you experienced or been treated for diabetes or high blood sugar	Treatment for diabetes or high blood sugar. From B1SA11X. Yes = 1, No = 2, Refused = 8, Inapp = 9.	Categorical
Obesity as BMI	What is your height? What is your weight?	BMI calculated from: B1SBMI: A1SBMI [B1SWSTHI]: heights greater than 84 inches were set to 84 inches; waist measurements below 20 were set to 20; over 75 were set to 75.	Scale

Data Analysis Plan

The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 21 (IBM, 2012). In order to ascertain associations between the variables and covariates, a series of chi-square tests were used. While the chi-square test indicated some statistical significance between variables, the relationship between those variables may not be causal. When statistically significant association was determined, additional tests were used to confirm.

The Pearson's Contingency Coefficient was used to approximate the relative association between the variables of interest, and Cohen's Kappa was used to examine measures of association beyond chance. While a negative value is feasible, range between zero and one was expected. Table 4-Data Analysis Plan explains the tests and the reasoning for each measure described above. It also includes the rationale for each test. Although chi-square test might be sufficient to assign raw association, the study will also include logistic regression was performed to adjust for the effects of relevant covariates.

Table 4

Data Analysis Plan Using SPSS

Test	Reasoning
Spearman rank order correlation	Measure strength of association between identified variable
Cramer's V coefficient	Comparing multiple χ^2 test statistics
Pearson's contingency coefficient	Approximate rows of association between variables
Logistic regression	Adjust for possible interactions among the covariates

Research Questions and Hypotheses

RQ1: Does a history of psychological trauma from physical/sexual assault in childhood equate to a diagnosis of metabolic syndrome in adulthood?

$H1_0$: There is no association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

$H1_A$: There is an association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

RQ2: Is there a statistical difference in the association between psychological trauma from sexual abuse and the diagnosis of metabolic syndrome in adulthood compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome in adulthood?

$H0_2$: There is no statistical difference between psychological traumas from sexual abuse when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

$H1_A$: There is a statistical difference between psychological traumas from sexual abuse when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

Statistical Analyses by Research Question

The research question and statistical tests conducted are outlined in table 5-statistical analysis by research question. In testing for associations, a number of tests were applied to the data, and the research questions helped direct those tasks. Therefore, each research question will be addressed through the application of a statistical analysis used in the software (SPSS, 2012). Because one research question will compare differences between psychological traumas from sexual abuse compared do psychological, from physical abuse, statistical analyses will include two tests for correlation: Phi and Pearson, both of which are found in the statistical tests with in SPSS (2012).

Table 5

Statistical Analyses by Research Question

Research questions	Variables	Methods
1. Does a history of psychological trauma from physical/sexual assault in childhood equate to a diagnosis of metabolic syndrome in adulthood?	Psychological trauma (physical assault in childhood + sexual assault in childhood) Metabolic syndrome (insulin resistance + hypertension + obesity)	Chi-square contingency table analysis Cramer's V correlation Spearman correlation analysis Fisher's exact test Logistic regression to examine interactions among variables
2. Is there a statistical difference in the association between psychological trauma from sexual abuse and the diagnosis of metabolic syndrome in adulthood compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome in adulthood?	Psychological trauma—Physical (physical assault in childhood) Psychological trauma—Sexual (sexual assault in childhood) Metabolic syndrome (insulin resistance + hypertension + obesity)	Chi-square contingency table analysis Cramer's V correlation Spearman correlation analysis Fisher's exact test Logistic regression to examine interactions among variables

Threats to Validity

Internal validity refers to the ability to investigate the approximate reality about a causal relationship. A major concern of internal validity to questions of association is zero generalizability. Unlike construct validity, questions of association do not predict but rather investigate, issues of internal validity include alternative cause. Concerns of retrospective studies include loss to follow up, loss differential, potential bias of outcome assessment, bias of self-identification, and alternative explanations of observed association or phenomena (Creswell, 2008). Because the data from MIDUS-II is cross-sectional, it was not reasonable to determine the contributory order between such psychological trauma of sexual and/or physical assaults in childhood and the development of the components of metabolic syndrome.

Ambiguous temporal precedence relationship is always a concern to validity. This can best avoided by clarifying events chronologically; this was accomplished by using psychological trauma from physical and/or sexual assault in childhood and the development of metabolic syndrome in adulthood, thereby avoiding chronological error. Confounding error is a significant threat to internal validity, as the causal inferences concerning the dependent variable may be attributed to the existence of an outside, mitigating, or tertiary variable (Creswell, 2008). In such findings, spurious relationships cannot be ruled out, and rival hypotheses must be considered.

Selection bias was a concern, as the subjects of the original MIDUS study were recruited via phone banks, and within the contiguous United States. Those citizens who did not have telephones in the home, or who resided in Alaska or Hawaii were naturally

excluded from this study. Maturation was also a concern to internal validity, as subjects may change or have the benefit of hindsight or new information that would change or effect their viewpoints or comprehensions of some of the survey questions between the measures of the MIDUS and the MIDUS-II. Over time, subjects may change the way they responded in the surveys to particular questions related to the variables. This was mitigated through the use of the MIDUS-II study rather then attempting to use both MIDUS studies.

Instrumentality might have been a concern to validity as the testing procedure used to gather the data, the construction of the survey questions, the formulation of the survey questions used for the interviews, the gender of those conducting the interviews, and even the surroundings where the interviews took place can all impact some responses. This bias was mitigated to some degree by the willingness of those subjects who were contacted to participate in the second study who had also willingly participated in the first study.

Differential attrition error can also occur if inferences are made using subjects that have participated in both studies and assigning a universal treatment to include those subjects contacted for the second study who refuse participation. Finally, experimenter bias can occur when the researchers gathering the information, or writing the instruments, either intentionally or inadvertently affects the outcome. Because this study sought to examine variables that originally paired on either the original or the follow-up study, the experimenters could not have been aware of the variables to the examined for association. Extrapolation is prime to the application of study results to the wider population.

Ethical Consideration of Participants

Institutional Permissions

The Interuniversity Consortium for Political and Social Research (ICPSR). According to information obtained from ICPSR and the codebook for the data (ICPSR 4652) all aspects of the MIDUS-II study, including questionnaires, follow-up telephone surveys, and statistical methods follow preset ethical guidelines. Those guidelines, created and monitored by the Institute for Social Research at Michigan State University (ISR) state that procedures used by the University of Michigan are designed to ensure confidentiality of the research subjects, from data collection to public dissemination. Data managed by ICPSR are screened for both confidentiality and privacy. Because the proposed study will use archival data that has been deidentified, as such, this researcher cannot gain access to confidential aspects of the data of any kind.

The Institutional Review Board (IRB) at Walden University

The Institutional Review Board at Walden University is responsible for ensuring that all Walden University research studies are in compliance with Walden University's ethical standards, as well as current United States Federal Regulations. IRB approval is required before the collection or analysis of any data. After acceptance of the proposal, a full IRB application outlining each of the ethical considerations was submitted (addendum 1).

ICPSR rigorously protects their participants through the securing and distributing of sensitive data. All information concerning names, places, and other confidential information has been removed. All participation was voluntary and all data archived for

the MIDUS and MIDUS-II studies has been deidentified. This researcher does not know of any personal information connected to the data, and the research questions were analyzed by retrospective analysis of the archival data. Moreover, data was analyzed utilizing statistical techniques, tables and graphs, without suggestion or information of a confidential nature. Access to the data set for this study will be limited to the researcher, chairperson, and methodology expert upon acceptance of the IRB process. No other discussion or dissemination will occur. The data will be kept for a minimum of five years from acceptance of the dissertation. The final issue to consider is physical security. Any computer or hard drive on a network is highly vulnerable to theft and/or malicious damage or modification. For this reason, an external hard drive will be used and password-protected. This external hard drive utilizes a 2-M USB connection, making it difficult to connect to any computer aside from the researcher's Sun Systems/Apple Computer, which is password-protected with an encryption algorithm and is protected by voice recognition and kept in a locked home office. As it is advisable to encrypt any data stored on even well protected devices, TrueCrypt (2011) will be used to encrypt the data. TrueCrypt uses 11 different algorithms to secure files in a password-protected volume, file, partition, or drive, by requiring complex passwords and erasing telltale signs of the encryption process, including mouse movements and keystrokes.

Summary

This chapter described the research method, a retrospective study of middle-aged American adults who suffered from metabolic syndrome and compared with middle-aged American adults. A sample (n=339) was drawn from this cohort for anaylsis. Archival

data originally collected by the MIDUS-II study was analyzed to determine associations between psychological trauma from assault(s) in childhood and the development of metabolic syndrome.

Spearman rank order correlation was used to measure the strength of the association between the variables, Pearson's contingency coefficient in order to approximate rows of associations between those variables, Cramer's V coefficient to compare the multiple chi-square test statistics, and chi-square to determine the moderating effects of gender all the other variables. Chapter 4 present the results of the all data analyzed from the MIDUS-II study in order to assess associations between traumatic psychological stresses from physical and/or sexual assault in childhood, and the presence of metabolic syndrome.

Chapter 4: Results

Introduction

This study was undertaken to evaluate the relationship of physical and/or sexual assault in childhood and a diagnosis of metabolic syndrome, defined as the presence of insulin resistance, hypertension, and obesity in adults. This study focused on middle-aged Americans and included self-identified and self-reported data to examine health and life satisfaction. In this chapter, I discuss baseline descriptive and demographic characteristics of the cohort, describe the analytical sample in relation to the total cohort, address the data acquisition process, and provide the results of statistical analyses conducted to explore each of the research questions. The results of the statistical analyses are provided in tables and figures and are summarized in relation to each hypothesis.

Research Questions and Hypotheses

The following research questions and hypotheses were used for the analyses in this study:

Original Research Questions

RQ1: Does a history of psychological trauma from physical/sexual assault in childhood relate to a diagnosis of metabolic syndrome in adulthood?

$H1_0$: There is no association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

$H1_A$: There is an association between a history of psychological trauma from physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adulthood.

RQ2: Is there a statistical difference in the association between psychological trauma from sexual abuse and the diagnosis of metabolic syndrome in adulthood compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome in adulthood?

Using Pearson's chi-square analysis, the following hypotheses were tested:

$H0_2$: There is no statistical difference between psychological trauma from sexual abuse when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

$H1_A$: There is a statistical difference between psychological traumas from sexual abuse when compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome components.

Post Hoc Questions

RQ3: If no significant association ($p > 0.05$) is found between physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adults, is there a significant association between physical/sexual assault in childhood and a diagnosis of any of the components of metabolic syndrome in adults?

The components of metabolic syndrome in adults are: (a) diabetes/high blood sugar, (b) high blood pressure, and (c) obesity. Diet was not addressed in the data, nor was physical fitness identified; however, personal beliefs concerning the importance of physical fitness for a healthy life were addressed, and these data were included in the analysis.

RQ4: Is there a statistically significant association between any of the covariates examined and any of the components of metabolic syndrome?

Description of the Study Population

The data for this study were drawn from the follow up the Midlife in the United States (MIDUS) study conducted in 1995-1996. The follow up to the original study, MIDUS-II, was conducted from 2004 to 2009 and was drawn from the original participant group. The MIDUS-II data provided an abundance of raw data concerning a number of psychological as well as physiological variables while controlling for possible covariates such as age, gender, and detrimental behaviors (e.g., cigarette and alcohol use). The results of the study indicated no statistically significant association between physical and/or sexual assault in childhood and the diagnosis of metabolic syndrome.

This study used a nonexperimental, correlational design to analyze inferential statistics for a middle-aged noninstitutionalized cohort of Americans in the contiguous 48 states who had phone service in their home. Because of the methodology employed in this study (i.e., landline telephone contact), multiple ethnicities as well as a wide range of socioeconomic groups were included in both the original MIDUS study and the follow up MIDUS-II study. There is concern that some of the original cohort may not have had

home phones and instead relied on cellular services, thus making it difficult to locate these respondents for the MIDUS-II follow up.

Data Access and Acquisition

Permission to access and analyze data was contingent upon approvals by the Walden University IRB and the ICPSR. As mentioned in Chapter 3, these approvals were obtained; the approval materials are contained in Appendix B. Data for all original MIDUS-II study variables listed in Chapter 3, Table 3 were taken from the MIDUS-II study and downloaded as a single SPSS file. It is important to note that this second MIDUS study involved a large number of participants from the original MIDUS study.

This study used a sample from the MIDUS-II cohort (n = 4,963). The participants were aged 28-84, lived within the contiguous United States, and had listed home phone numbers. The participant population was distinctly represented by ethnicity; however, age was reasonably well presented as a cross-section of middle-aged adults within American populations. Gender was also nearly equally represented. Filtering of the data revealed a sample of 339 (n = 339). Using a G*power calculator revealed a minimum sample size (n = 220), thereby confirming that the minimum size was exceeded. The following frequency tables illustrate the occurrence of the variables, variable components, and covariates in the study.

Frequency Tables

Table 6 outlines the dependent variable (metabolic syndrome) as well as reporting on the frequency of metabolic syndrome components. While only 4.4% of respondents met the requirements for metabolic syndrome, 7.7% reported high blood pressure, and

36.6% of respondents reported diabetes/high blood sugar. Obesity was calculated using height/weight data and was found to have been represented in 33% of respondents, in line with the CDC's (2014) estimate of 34%. Concerning the independent variables of physical or sexual assault in childhood, 9.4% of respondents in the sample reported having experienced physical assault in childhood, and nearly 70% of respondents in the sample reported having experienced sexual assault in childhood.

Table 6

Frequency of Dependent and Independent Variables

		MetSyn		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	15	4.4	4.4	4.4
No	324	95.6	95.6	100.0
Total	339	100.0	100.0	
		High blood pressure		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	124	36.6	36.6	36.6
No	213	62.8	62.8	99.4
Suspects	2	0.6	0.6	
Total	339	100.0	100.0	
		Diabetes/high blood sugar		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	26	7.7	7.7	7.7
No	313	92.3	92.3	100.0
Total	339	100.0	100.0	
		Obese		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	112	33.0	33.0	33.0
No	227	67.0	67.0	100.0
Total	339	100.0	100.0	
		Physical assault in childhood		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	32	9.4	34.0	34.0
No	62	18.3	66.0	100.0
Total	339	100.0		
		Sexual assault in childhood		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	237	69.9	69.9	69.9
No	102	30.1	30.1	100.0
Total	339	100.0	100.0	
		Combined assault in childhood		
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	97	28.6	28.6	28.6
No	242	71.4	71.4	100.0
Total	339	100.0	100.0	

Table 7 depicts the covariates, indicating that 24.8% of the respondents reported believing that physical fitness was important for a good life, 23.3% of respondents reported smoking cigarettes regularly, and 45.1% reported at least some alcohol intake. Ethnicity was identified early in the thesis as a possible covariate, and of the 339 respondents in the sample, 92.3% were White. Black respondents comprised 1.5% and Native Americans, Aleutian Islanders, Eskimos, and Asians (NAAIEA) comprised the remaining 2.4% of the sample. Finally, age group was divided into four categories: 25 to 40 (15%), 41 to 55 (53.1%), 56 to 70 (27.7%), and 71 to 90 (4.1%). The predominant number of White respondents in the sample suggests that ethnicity may not be significant in this study.

Table 7

Frequency of Covariates

Physical fitness important for good life				
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	84	24.8	24.8	24.8
No	255	75.2	75.2	100.0
Total	339	100.0	100.0	

Now smoke cigarettes regularly				
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	79	23.3	43.2	43.2
No	227	67.0	67.0	100.0
Total	183	54.0	100.0	

Alcohol				
Valid	Frequency	Percent	Valid percent	Cumulative
Yes	153	45.1	83.2	83.2
No	31	9.1	16.8	100.0
Total	339	100.0	100.0	

Ethnicity				
Valid	Frequency	Percent	Valid Percent	Cumulative
White	313	92.3	96.0	96.0
Black	5	1.5	1.5	97.5
NAAIEA	8	2.4	2.5	100.0
Total	339	100.0		

Age group				
Valid	Frequency	Percent	Valid percent	Cumulative
25-40	51	15.0	15.0	15.0
41-55	180	53.1	53.1	68.1
56-70	94	27.7	27.7	95.9
71-90	14	4.1	4.1	100.0
Total	339	100.0		

Note. For ease of data analysis, Native Americans/Aleutian Islanders/Eskimo/Asians collectively grouped (NAAIEA).

Chi-Square Analysis

Pearson's chi-square was used to address associations between the components of metabolic syndrome (type 2 diabetes/high blood glucose or insulin resistance, high blood pressure, and obesity as BMI = 30 kg/m² or greater). Assessment of the individual components of metabolic syndrome, as well as the condition as a single (dependent) variable, was used to investigate significance. For each research question, chi-square analyses were performed, resulting in the following *p*-values. Table 8 demonstrates the *p*-values of the crosstabulation of variables indicating that age group was found to be a statistically significant predictor of metabolic syndrome (*p*-value = 0.026).

Table 8

Crosstabulation of Metabolic Syndrome

	Metabolic syndrome			
Gender	Yes	No		Total
Male	2	46		48
Female	13	278		291
Total			*p*-value = 0.641	339

	Metabolic syndrome			
Ethnicity	Yes	No		Total
White	14	299		313
Black	1	4		5
NAAIEA	0	8		8
Total			*p*-value = 0.212	339

	Metabolic syndrome			
Age group	Yes	No		Total
25-40	1	50		51
41-55	5	175		180
56-70	8	86		94
71-90	1	13		14
Total	15	324	*p*-value = 0.026	339

	Metabolic syndrome			
Child sexual assault	Yes	No		
Yes	13	224		237
No	2	100		102
Total	15	324	*p*-value = 0.247	339

	Metabolic syndrome			
Child physical assault	Yes	No		
Yes	5	79		84
No	10	245		255
Total	15	324	*p*-value = 0.044	339

	Metabolic syndrome			
Combined sexual/ physical assault	Yes	No		
Yes	2	95		97
No	13	229		242
	15	324	*p*-value = 0.146	339

	Metabolic syndrome			
Physical fitness/life	Yes	No		
Yes	5	79		84
No	10	245		255
Total	15	324	*p*-value = 0.54	339

Table 9 outlines the crosstabulation of obesity within covariates, demonstrating no statistically significant associations.

Table 9

Crosstabulation of Obese

	Obese			
Gender	Yes	No		Total
Male	15	33		48
Female	97	194		291
Total	112	227	*p*-value = 0.776	339

	Obese			
Age group	Yes	No		Total
25-40	17	34		51
41-55	58	122		180
56-70	34	60		94
71-90	3	11		14
Total	112	227	*p*-value = 0.723	339

	Obese			
Child sexual assault	Yes	No		Total
Yes	82	155		237
No	30	72		102
Total	112	227	*p*-value = 0.352	339

	Obese			
Combined sexual/physical child assault	Yes	No		Total
Yes	28	69		97
No	84	158		242
Total	112	227	*p*-value = 0.301	339

	Obese			
Physical fitness/good	Yes	No		Total
Yes	23	61		84
No	89	166		255
Total	112	227	*p*-value = 0.204	339

Table 10 demonstrates the only statistically significant association in the crosstabulation of diabetes/high blood sugar and gender, indicating a *p*-value of 0.035.

Table 10

Crosstabulation of Diabetes/High Blood Sugar

	Diabetes/high blood sugar			
Gender	Yes	No		Total
Male	4	44		48
Female	22	269		291
Total	26	313	*p*-value = 0.035	339

	Diabetes/high blood sugar			
Ethnicity	Yes	No		Total
White	21	292		313
Black	1	4		5
NAAIEA	0	8		8
Totals	22	304	*p*-value = 0.373	326

	Diabetes/high blood sugar			
Age group	Yes	No		Total
25-40	2	49		51
41-55	11	169		180
56-70	12	82		94
71-90	1	13		14
Total	26	313	*p*-value = 0.166	339

	Diabetes/high blood sugar			
Child sexual assault	Yes	No		Total
Yes	21	216		237
No	5	97		102
Total	26	313	*p*-value = 0.209	339

	Diabetes/high blood sugar			
Combined sexual/physical child assault	Yes	No		Total
Yes	5	92		97
No	21	221		242
Total	26	313	*p*-value = 0.271	339

	Diabetes/high blood sugar			
Physical fitness important for good life	Yes	No		Total
Yes	10	74		84
No	16	239		255
Total	26	313	*p*-value=0.093	339

Finally, Table 11 illustrates the cross tabulation of high blood pressure and child sexual assault found a *p*-value (0.041) indicating significance. In summary, the cross tabulation from the previous tables indicate significance seems to lay in the associations between diabetes/high blood sugar and gender; and between child sexual assault and high blood pressure.

Table 11

Crosstabulation of High Blood Pressure

	High blood pressure			
Child sexual assault	Yes	No		Total
Yes	95	142		237
No	29	73		102
Total	124	215	*p*-value = 0.041	339

Once chi-square analysis had been completed, logistic regression was performed to adjust for the effects of relevant covariates such as age, gender, regular cigarette use, and alcohol intake. Alcohol intake was categorized as Alcohol(1): No occasions of having 5+ drinks in the past month, and Alcohol(2): Having 5+ drinks on at least 1 occasion in the past month.

Logistic Regression

After the assault variable is added into the logistic regression model the only significant variable was age group =2 (41-55) compared to age group =4 (71-90), which significantly predicted the risk of metabolic syndrome. For logistic regression placing ethnicity in the model resulted in a high *p*-value (0.998) indicating a constant (y-intercept) not different from zero. This model goes through the origin (at zero). Marginal

significance (p=<0.05 /≤0.07) indicates that ethnicity does not change the significance of the other variables. Concerning gender, male seems to be susceptible to metabolic syndrome regardless of ethnicity; concerning age group, only age group(2) was found to be marginally significant, which suggests attention as demonstrated in Table 12.

Table 12

Logistic Regression Model Including Ethnicity

Variables	B	S.E	Wald	*df*	Sig.
RegularCigarette	0.457	0.569	0.645	1	0.422
RespGender(1)	-0/998	0.453	4.857	1	0.028
PhysicalFitnessCrit(1)	0.867	0.553	2.462	1	0.177
Agegroup			5.565	3	0.135
AgeGroup(1)	1.508	1.116	1.825	1	0.177
AgeGroup(2)	1.184	0.631	3.521	1	0.061
AgeGroup(3)	0.118	0.482	0.059	1	0.807
RegAlcoholConsum			2.845	2	0.241
RegAlcoholConsum(1)	-1.127	1.049	1.153	1	0.283
RegAlcoholConsum(2)	-1.814	1.141	2.528	1	0.112
Ethnicity			0.098	2	0.952
Ethnicity(1)	-17.112	9284.474	0.000	1	0.999
Ethnicity(2)	-17.443	9284.474	0.000	1	0.999
Constant	21.760	9284.474	0.000	1	0.998

Note. Variables entered on Step 1: RegularCigarette, RespGender, PhysiclFitnessCrit, AgeGroup, RegularAlcoholConsum, Ethnicity.

Removing ethnicity from the regression model produces an extremely low p-value (<0.0001) indicating a constant (y – intercept) that is significantly different from zero. This model does not go through the origin, as depicted in Table 13.

Table 13

Logistic Regression Model Excluding Ethnicity

Variables	B	S.E	Wald	*df*	Sig.
RegularCigarette	0.458	0.568	0.729	1	0.393
RespGender(1)	-1.017	0.452	5.601	1	0.024
PhysicalFitnessCrit(1)	0.907	0.551	2.707	1	0.100
Agegroup			5.561	3	0.135
AgeGroup(1)	1.533	1.112	1.899	1	0.168
AgeGroup(2)	1.184	0.631	3.521	1	0.061
AgeGroup(3)	0.123	0.480	0.066	1	0.798
RegAlcoholConsum			3.021	2	0.221
RegAlcoholConsum(1)	-1.177	1.048	1.263	1	0.261
RegAlcoholConsum(2)	-1.873	1.139	2.704	1	0.100
Constant	4.715	1.203	0.000	1	0.000

Note. Variables entered on Step 1: RegularCigarette, RespGender, PhysiclFitnessCrit, AgeGroup, RegularAlcoholConsum.

Results of Research Question 1 Statistical Analysis

RQ1 was as follows: Does a history of psychological trauma from physical/sexual assault in childhood equate to a diagnosis of metabolic syndrome in adulthood? Statistical analysis relating to Research Question 1 addressed whether or not there was an association between either sexual or physical assault in childhood and a diagnosis of metabolic syndrome. The total number of respondents from the sample meeting the criteria for a diagnosis of metabolic syndrome was 15 (4.4%); the total number of respondents reporting sexual assault during childhood was 237 or 69.9% of the sample); Respondents in the sample reporting physical assault during childhood were 32 (9.4%). Statistical analysis of the association between sexual assault in childhood and metabolic syndrome revealed a Pearson Chi-Square value =2.095, df = 1, *p*-value=0.148

demonstrating no significant association between sexual assault in childhood and metabolic syndrome for this sample. Since the Pearson's Chi-square had one cell (25%) with an expected count less than 5, a Fisher's Exact Test was used in addition, showing a *p*-value of 0.247, indicating no association. Statistical analysis of the association between physical assault in childhood and metabolic syndrome revealed a Pearson Chi-Square value =4.967, df = 1, p-value=0.044 demonstrating association, however, since the Pearson's Chi-square had one cell (25%) with an expected count less than 5, a Fisher's Exact Test was used in addition, showing a *p*-value of 0.247, indicating no significant association.

Results of Research Question 2 Statistical Analyses

RQ2 was as follows: Is there a statistical difference in the association between psychological trauma from sexual abuse and the diagnosis of metabolic syndrome in adulthood compared to psychological trauma from physical abuse in childhood and the diagnosis of metabolic syndrome in adulthood? The analysis relating to Research Question 2 addressed the difference of association of sexual assault in childhood and a diagnosis of metabolic syndrome in adults when compared to the association of physical assault in childhood and the diagnosis of metabolic syndrome. Statistical analysis was performed examining the association between physical assault in childhood and metabolic syndrome. A Fisher's exact tests revealed a *p*-value=0.247, indicating no association between physical assault in childhood and a diagnosis of metabolic syndrome. Statistical analysis of the association between sexual assault in childhood and metabolic syndrome revealed a *p*-value=0.247, suggesting no significant association between

physical assault in childhood and a diagnosis of metabolic syndrome, since the chi-square had two cells (50%) with expected counts less than 5, the chi-square analysis is suspect and therefore unreliable.

Results of Research Question 3 & 4 Post Hoc Statistical Analyses

RQ3 was as follows: If no significant association ($p > 0.05$) is found between physical/sexual assault in childhood and a diagnosis of metabolic syndrome in adults, is there significant association between physical/sexual assault in childhood and a diagnosis of any of the components of metabolic syndrome in adults? Crosstabulation indicated no association between diabetes/high blood sugar and age group, or diabetes/high blood sugar and child sexual assault; combined sex/physical assault in childhood and diabetes/high blood sugar also revealed no association. There was significant association between high blood pressure and sexual assault in childhood, suggesting the need for further study. Obesity was not found to be associated with gender, age group, or a history of either physical or sexual assault in childhood.

RQ4 was as follows: Is there a statistically significant association between any of the covariates and metabolic syndrome or it's components? Statistical analysis demonstrated association between being Male and having a diagnosis of Diabetes/High Blood Sugar (p-value = <0.035). No association was demonstrated between physical fitness and any of the components of metabolic syndrome; no association could be found between gender and metabolic syndrome, or between ethnicity and metabolic syndrome, and no association was found between obesity and any covariate. There was however

significant Association ($p = 0.041$) between high blood pressure and sexual assault in childhood.

Gender was examined in association to sexual assault in childhood, revealing a Pearson's Chi-Square value of 0.287, df=1, *p*-0.001 indicating a statistically significant association between gender and sexual assault in childhood for this sample; analysis concerning the association between physical assault in childhood and gender resulted in a Pearson's Chi-Square value of 0.177, df=1, *p*-0.674 suggesting no association.

Summary of Analyses

For this sample, statistical analysis indicated an association between gender and diabetes/high blood sugar, indicating men in this sample were at an elevated risk. Association between age and diabetes/high blood sugar revealed no significant association for this cohort sample. Sexual assault in childhood was significant for high blood pressure, however physical assault in childhood was not found to have been significant for this sample.

Statistical analysis of obesity based on BMI revealed that gender was not a significant predictor of obesity, nor was age or ethnicity. Statistical analysis demonstrated that neither age nor ethnicity was found to be significant predictors of high blood pressure, at least within this sample. Further statistical analysis demonstrated no significant association between gender and metabolic syndrome in this sample, and found no significant association between age and metabolic syndrome.

Data reporting the regular smoking of cigarettes was analyzed for possible associations with metabolic syndrome. While only 23.3% of respondents reported

smoking regularly, analysis revealed no statistically significant association between regular use of cigarettes and metabolic syndrome for this sample ($p = 0.194$). Regular alcohol consumption was also tested for significance in association to metabolic syndrome. Over 45% of sample respondents reported not having any alcohol intake, and statistical analysis indicated there was no significant association between alcohol intake and metabolic syndrome among the respondents of this sample. Finally, the question of perceived importance of physical fitness was addressed. While just 25% of the sample reported they believed that physical fitness was important, statistical analysis found no significant association between a belief in the importance of physical fitness and a diagnosis of metabolic syndrome.

Descriptive statistics revealed that sexual assault in childhood was significantly associated with gender, as 70% of females from the sample reported assault in childhood. Analysis of physical assault in childhood was not found to have been associated with gender for this sample. Further analysis demonstrated no significant association between diabetes/high blood sugar and any type of assault in childhood, although there was a significant association between sexual assault in childhood and high blood pressure.

Chapter 5 will discuss the interpretations of these findings and establish a conclusion of these results. Chapter 5 will also include discussions about the study's limitations. Lastly, the implications for social change and recommendations for further research consideration will be discussed.

Chapter 5: Discussion

Summary

The purpose of this research study was to identify associations between metabolic syndrome and physical/sexual assault in childhood among the cohort of middle-aged Americans. The components of metabolic syndrome, particularly obesity, contribute to other chronic conditions including cardiovascular disease, posing a significant threat to public health (CDC, 2012). Little research has been conducted specifically on the long-term effects of physical or sexual assault in childhood in relation to health outcomes longitudinally. This retrospective cohort study was undertaken to assess association between physical and/or sexual assault in childhood and the components of metabolic syndrome as defined by the World Health Organization (1998). This study revealed that using the WHO (1998) definition produced no significant association between assault in childhood and metabolic syndrome; however, significant associations were found between some components of metabolic syndrome and both age and ethnicity, and some behavioral covariates.

Conceptual Framework

The theoretical framework of this study was based on a construct that has received growing recognition in social sciences: psychoneuroimmunology (PNI). Proponents of PNI recognize that many factors are associated with chronic conditions and that the interactions of systems can significantly affect autonomic systems such as blood pressure, heart rate, digestion, and even immune function. Psychological trauma, if left untreated, may have debilitating effects on endocrine and hormone systems. In order to

improve general health, early interventions be needed to assess issues with psychological and stress-related factors.

The following discussion presents the research findings outlined in Chapter 4.

Comparison to Previously Published Studies

The purpose of this study was to examine the association between psychological trauma from physical/sexual assault in childhood and metabolic syndrome. Four research questions were created, along with the hypotheses to explore this topic. The results of this study indicated that no associations exist between psychological trauma from physical or sexual assault in childhood and metabolic syndrome as defined by the World Health Organization (1998). This contradicts the results of a study by Lee, Tsenkova, and Carr (2014), who used different criteria for metabolic syndrome presented by the National Cholesterol Education Program—Adult Treatment Panel III (NCEP-ATP III). These researchers found a significant association between stress from child abuse and metabolic syndrome. The NCEP-ATP III criterion is based on guidelines for health cholesterol management (National Institutes of Health, 2001) and is formulated from blood cholesterol levels.

In this study, while no association was discovered between physical or sexual assault in childhood and metabolic syndrome, among the metabolic syndrome components examined (diabetes/high blood sugar, high blood pressure, obesity) and inherent covariates (age, gender, ethnicity) or behavioral covariates (regular cigarette smoking, alcohol use, perceptions of physical fitness), the interaction of metabolic syndrome components and covariates was acknowledged. Significant associations were

found particularly in sexual assault in childhood and high blood pressure (p-value = 0.041) and between gender and diabetes/high blood sugar (p-value = 0.035). Other interactions appeared to be significant; however, upon additional statistical testing, they were found to have not been significant. One slight association, p-value > 0.05/p-value =< 0.07, was detected between gender and metabolic syndrome (p-value = 0.0641). Gender was not associated with high blood pressure or obesity. Ethnicity was not found to be significant in any of the statistical tests, and the behavioral covariates, including regular smoking of cigarettes, alcohol intake, and beliefs about physical fitness being important for a good life, were not found to be significantly associated with any of the metabolic syndrome components, or with physical or sexual assault in childhood.

Many of the findings of this study were inconsistent with previous studies, particularly in the areas of psychological stress from trauma (Hildebrandt, Yehuda, & Olff, 2012; Lee, Tsenkova, & Carr, 2014; Midei, Matthews, Chang, & Bromberger, 2013). While the outcomes of this study did not reflect associations between psychological trauma and the components of metabolic syndrome as in some previous studies, the idea that stress from psychological trauma in childhood may be associated with chronic disease outcomes seems widely accepted, and at least in association between sexual assault in childhood and high blood pressure seems to have been demonstrated. Lee, Tsenkova, and Carr (2014) used the childhood trauma questionnaire by Bernstein and Fink (1998) to examine the MIDUS-II cohorts in the domains of abuse including emotional abuse, physical abuse, and sexual abuse. The study by Lee, Tsenkova, and Carr (2014) used a much larger set of parameters to define abuse in comparison to this

dissertation, which focused on physical and/or sexual assault in childhood. Physical and sexual abuse is considered severe abuse, and the previous study found significant association between emotional abuse and physical abuse; however, these authors suggested the small number of respondents reporting physical or sexual abuse as raising concerns as to the accuracy of reporting (Lee et al., 2014, p. 124). Concerning the outcomes of both studies, reporting of sexual assault/abuse was significantly higher among women; both studies found no gender difference in physical abuse. The findings of this dissertation study do lend support to previous examinations that found associations between obesity and ethnicity (Caprio et al., 2008); however, the definitive relationship is not known. Suggestions from studies include associations based on economics, diet, and sedentary behavior; however, this study found no association among variables of behavioral covariates and ethnicity, suggesting that causal agents would require further investigation.

In this study, it was shown that a slight association existed between gender and metabolic syndrome and that more robust associations existed between metabolic syndrome and age group as well as between gender and diabetes/high blood sugar, with male being a significant predictor of diabetes/high blood sugar. Although 43% of the sample respondents regularly smoked cigarettes, no association was found among any of the variables or covariates. While an absence of regular alcohol use was reported by 41% of sample respondents, statistical analysis demonstrated no significant association between this covariate and any of the components of metabolic syndrome. Perceptions around the importance of physical fitness for maintaining good health were addressed,

and while just 24% of the sample respondents believed that physical fitness was important, analysis indicated that this covariate was not associated with a metabolic syndrome among this group.

Analysis of assault in childhood showed that gender was a significant predictor of the type of assault: Females comprised nearly 81% of respondents reporting sexual assault in childhood, whereas physical assault in childhood was fairly equally divided among males and females. Although statistical analysis demonstrated no significant association between diabetes/high blood sugar and a history of assault in childhood, there was a significant association found among other components and among covariates.

Interpretations of the Findings

The findings from this research suggest that physical and/or sexual assault, including child assault, is a real concern in the United States. Fully 85% of sample respondents reported having been sexually assaulted at some point of their lives; 29.5% of respondents reported being physically assaulted at some point in their lives. The study demonstrated that females are far more likely to be sexually assaulted than males, and that while assault in childhood was not associated with metabolic syndrome or metabolic syndrome components, a number of chronic outcomes, particularly diabetes/high blood sugar, were associated with gender, and metabolic syndrome was associated with age group.

Although there were significant findings in relation to project health outcomes for age group and gender, other associations were absent. Perhaps research that better assesses psychological stress and trauma will reveal more robust results. Future research

is needed using assessments more focused on psychological stress and trauma in relation to health outcomes.

Theoretical Foundation

The psychoneuroimmunology (PNI) model is a multimodal, body/mind foundational construct that combines psychological, neurological, and immunological processes as interrelated and critical to maintaining homeostasis or total body health (Armario, Valles, Dal Zotto, Marquez, & Belda, 2004). For the PNI model, obesity, hypertension, and even diabetes can be prevented in many persons by eating a healthy diet, by avoiding proinflammatory foods, by mitigating all-cause psychological stress, and by following an exercise regime. PNI suggests that hormones (cortisol, epinephrine, and insulin) are essential to stress reaction and metabolism in the short term but are associated with detrimental effects on the physiological systems if not returned to homeostatic levels. It is also considered that diet and exercise modulate the effects of these hormones and that sympathetic activity, oxidative stress, and cytokine production places stress the physiological systems, particularly those involved in digestion and metabolism. In the United States today, many people's diets consist of unhealthy foods merely because they do not have access to more healthy alternatives. According to PNI, the avoidance of inflammatory processes through a diet rich in omega-3 and omega-6 fatty acids and natural antioxidants is critical (Kiecolt-Glaser, Glaser, & Christian, 2014). The researchers in a recent study found that many Americans' intake levels of omega-3 to omega-6 fatty acids are significantly lower than those of other populations, which may help explain the rates of obesity, hypertension, and dyslipidemia found in U.S.

populations (Nording, Yang, Georgi, Karbowski, German, Weiss, Hogg, Trygg, Hammock, & Zivkovic, 2013). Many studies within the past decade have suggested a direct sympathetic link between traumatic stress and chronic disease (Alonzo, 2000; Rhudy, Davis, Williams, McCabe, Bartley, Byrd, & Pruiksma, 2010). Although cardiovascular disease has been the primary focus of these studies (Charmandari, Tsigos, & Chrousos, 2005; Devol & Bedroussian, 2007; Edmondson, Gambao, Cohen, Anderson, Kutner, Kronish, Mills, & Mutner, 2013), other systems may be involved, particularly immune and endocrine; thus, a history of stress may be associated with a host of negative health outcomes (Epel, 2009; Fetzner, McMillan, & Asmundson, 2012; Gibbons, Hickling, & Watts, 2011).

Limitations

This research used deidentified secondary data from a cross-sectional and longitudinal study of middle-aged Americans. The original study relied upon self-reported survey questions for data collection. Guarded or biased answers are always possible with such studies, particularly in relation to behavioral habits that may be seen as unacceptable such as regular smoking of cigarettes or alcohol intake, due to perceptions garnered from health organizations (National Institutes of Health, 2007). According to the World Health Organization (2003), victims of sexual and/or physical assault in childhood often do not report the event or events, or they suppress them. Also, if the parent is the perpetrator of the assault, the child may psychologically suppress the event. According to *Child Maltreatment in the UK* (2000), reasons often given for not reporting assaults include not wanting family or friends to know, being afraid to go to the

police, being scared, not thinking that one will be believed, being threatened by the assailant, or wanting to put the event behind oneself.

The World Health Organization (1998) diagnostic criteria for metabolic syndrome, while closely mirroring those of Reaven (1978), may not be the best diagnostic criteria available. The WHO's criteria require insulin resistance as identified by type 2 diabetes, impaired fasting glucose, or impaired glucose tolerance, plus any two of the following: high blood pressure or treatment for high blood pressure (≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg), cholesterol imbalance (plasma triglycerides ≥ 150 mg/dL; HDL cholesterol < 35 mg/dL in men or < 39 mg/dL in women), obesity, and/or urinary albumin excretion (rate ≥ 20 mcg/min or albumin/creatinine ratio ≥ 30 mg/g). The number of respondents from this sample, however, does suggest that the diagnosis of diabetes/high blood sugar is significantly different than expected, nor was hypertension. Obesity among the sample respondents very closely matched estimates by the Centers for Disease Control and Prevention for the United States (2012); verifying obesity rate in the United States at 30%. The findings from this study indicated that the percentage of respondents from this sample of the MIDUS-II who met the criteria for obesity was 33%, somewhat higher than CDC reports.

Recommendations for Further Analysis or Study

Although I could find no significant association between sexual or physical assault in childhood and metabolic syndrome as defined by the WHO (1998) in this study, further investigation into negative health outcomes and physical and sexual assault in childhood should be pursued. There was significant association between ethnicity and

the components of metabolic syndrome among this cohort, and significant association between the components of metabolic syndrome and regular cigarette smoking. Finally, as significant associations were found between a belief in the importance of physical fitness and a diagnosis of obesity among this cohort, further examination of this phenomenon may help to decrease obesity rates and/or lend to exercise programs to combat obesity. While these associations were secondary to the primary research question, they signify the necessity for further investigation. The ICPSR has compiled an enormous wealth of data concerning health outcomes. These data can be analyzed to better understand any associations between behaviors and health outcomes, particularly those that are epidemic in the United States, including hypertension and obesity. As hypertension and obesity remain at epidemic levels in the United States, further research investigating these associations should be conducted. While this study included middle-aged Americans from the contiguous United States, generalization and extrapolation should be possible with other developed nations. The caveat with such research is the requirement of a longitudinal design/cross-sectional design using large data sets that may not be readily available to researchers. Studies that focused more on psychological stress and health outcomes, for example the American Psychological Association's Stress in America (2010) and The Whitehall Study (Marmot, Stansfeld, Patel, North, Head, White, Brunner, Feeney, Marmot, & Smith, 2011) may establish different or more robust associations between this study's diagnostic components and stress from assault in childhood.

Implications for Positive Social Change

Although the original thesis concerning the association between physical/sexual assault in childhood and metabolic syndrome was not demonstrated, significant findings related both age and gender with components of metabolic syndrome. Also of critical importance was the association between sexual assault in childhood and high blood pressure. These results, although limited, may prove important in assisting physicians, school leaders, parents, and public health officials in understanding the importance of preventing violence in society and the home. Although this study failed to associate metabolic syndrome with physical/sexual assault in childhood, other diagnostic criteria might result in very different outcomes, particularly with data sets that better address larger component measures. Regardless, associations were discovered between age group and metabolic syndrome, between gender and diabetes/high blood sugar, and between sexual assault in childhood and high blood pressure.

Public health workers, school psychologists, teachers, and other researchers who have an interest in childhood mental health, behavioral health, and preventative medicine may realize this study's implications for social change. This study has the potential to improve screening of childhood victims of violence and to draw attention to sexual assault among girls. In addition, as obesity continues to be a significant risk factor among American populations, this study may prove significant in better understanding obesity's important association to sexual/physical assault in childhood and stress.

Conclusions

While the results of this study failed to establish a statistically significant

association between assault in childhood and metabolic syndrome in adults, significant associations were shown between some components of metabolic syndrome and age as well as gender. Slight association was found between gender and metabolic syndrome, significant association was found between gender and diabetes/ high blood sugar, and age group was found to be significantly associated with age group for this sample.

The results of RQ2 for the difference between metabolic syndrome and the type of assault in childhood revealed association only in the high blood pressure component. However, there was a significant association between type of assault in childhood and gender. Child abuse, including physical and sexual assault involving children go largely unreported in the United States. Behaviorally, the regular smoking of cigarettes was not found to be associated with any of the components of metabolic syndrome, nor was alcohol intake.

The findings of the RQ3 found significant association only between high blood pressure and sexual assault in childhood. Of importance beyond the data analysis was the high rate of obesity among this sample. As obesity is epidemic in the United States, and associated to a number of health issues including cardiovascular disease, hypertension, and depression (CDC, 2010); the costs of treating these conditions continue to place enormous strain on the American healthcare system, both physiological and psychological. One study (RTI International, 2009) found that obesity cost in the US alone totaled $147 billion annually, and that medical expenditures directly attributed to the obesity epidemic have doubled in less than 10 years. Over three-quarters of people with type-2 diabetes are obese or overweight (CDC, 2012), and while type-2 diabetes

may be manageable for many, obesity complicates diabetes treatment, and decreases the effectiveness of drugs (CDC, 2009). People who are obese also have a marked increase in cardiovascular disease, including congestive heart failure according to the CDC (2009). Further, obese persons are more likely to fall victim to a sudden cardiac death, angina, and arrhythmias that those with a healthy BMI, due to the negative effects on blood lipid levels. These negative lipid levels increased triglycerides levels and decrease high-density lipoproteins, further exacerbating chronic complications (American Heart Association, 2014). Obesity is also strongly associated with hypertension, which also greatly increases risk of heart attack, stroke, and renal failure (CDC, 2009). As a component of metabolic syndrome or as a separate condition, obesity in the United States is epidemic, and studies illustrate that ethnicity may play a significant role; prevalence of childhood obesity among Mexican and Indigenous Americans as well as African Americans exceeds that of other ethnicities (Caprio, Daniels, Drewnowski, Kaufman, Palinkas, Rosenbloom, & Schwimmer, 2008).

Finally, obesity negatively impacts endocrine and metabolic functions, and metabolic syndrome is one of the fastest increasing obesity related health concerns in United States and other developed nations (CDC, 2009). The findings of this study suggest that some components of metabolic syndrome are epidemic among this population suggesting possible avenues of prevention and/or reduction in rates of hypertension and obesity. When combined with high blood pressure, obesity can be a lethal combination.

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Appendix A: Certification

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **W Sumner Davis** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 07/23/2014

Certification Number: 1508223