

**Resilience, Mental Flexibility, and Cortisol Response to the Montreal  
Imaging Stress Task in Unemployed Men**

by

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## **DEDICATION**

To my parents, Dr Barrie and Beverly Phillips, who have always believed in me and fostered my resilience, and my grandfather, Gail Kingsley, a “True Blue” Michigan fan.

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# **CHAPTER I**

## **BACKGROUND AND SIGNIFICANCE**

### **Introduction**

Nurses care for people experiencing many forms of adversity; a major goal of health restoration and promotion is to foster resilience. Not all individuals exposed to the stressors associated with living with long term environmental, social and/or personal stress experience negative outcomes and show a lack of resilience. Yet, it remains unclear why some individuals are resilient and thrive or rise above such adversity.

### **Specific Problem**

Unemployment constitutes a major life stressor and can impact emotional, cognitive and physiological health (Cohen, et al., 2007). Employment is beneficial from a financial perspective, but it also provides the individual with structure, meaningful activities, social contact and opportunities for recognition and status (Creed & Bartrum, 2008). Unemployment can result in financial strain, social isolation and negatively impact one's sense of personal identity. Those who are unemployed are at risk for a "pile-up" of these stressors, placing them at risk for stress-related physical, cognitive and psychological problems.

Stress is a common experience and a facet of everyday life yet persistent stress and high stress load has a negative effect on both psychological and

physical health. Individual perception of and response to stressful situations varies widely. Individual variation is thought to be influenced by genetic factors, gender, developmental stage, physiological and psychological history. In response to stressful stimuli, neural, neuroendocrine, and neuro-immune mechanisms in the body are activated to produce adaptation or maintain homeostasis within the individual. This coordinated response of the body is referred to as allostasis. When functioning appropriately allostasis allows for the individual to mobilize and respond to a threat or challenge.

In response to chronic threat the activation of multiple interacting mediators to promote adaptation, such as the hypothalamic-pituitary-adrenal (HPA) axis, may malfunction leading to the development of allostatic load/overload (McEwen, 2008). Allostatic load is an individual's accumulation of stress burden over time. It is the "wear and tear on the body and brain resulting from chronic over-activity or inactivity of physiological systems that are normally involved in adaptation to environmental challenge" (McEwen, 1998, p. 37). Allostatic load produces long-term effects on the brain, cardiovascular systems, adipose tissue and muscle, gastrointestinal system, skin, lungs, and immune system. The concept of allostatic load may explain how the body adapts to environmental challenge and the wear and tear that may result from chronic exposure to stressful situations.

The concept of resilience arose from risk research. Resilience has been defined as "the process of, capacity for, or outcome of successful adaptation, despite challenging or threatening circumstances" (Masten, Best, & Garmezy, 1990, p. 426). Resilience is thought to involve the interaction between risk and

protective factors, in which the presence of protective factors (internal or external to the individual) modifies an individual's response to the presence of environmental hazards or risks and results in competent functioning (Staudinger, Marsiske, & Baltes, 1993). It is believed that there is no single means of maintaining competent functioning in the face of adversity but rather multiple pathways to resilience (Bonanno, 2004). Potential pathways to resilience that have been identified include self-enhancement (Bonanno, Rennie, & Deckel, 2005), positive emotions (Fredrickson, Tugade, Waugh, & Larkin, 2003; Tugade & Fredrickson, 2004) and cognitive appraisal (Tugade & Fredrickson, 2004).

One potential pathway to resilience that needs investigation is cognitive/mental flexibility. Cognitive flexibility is a key component of executive control. Executive control is a form of "supervisory" cognitive processing that is required to carry out complex thought and behavior (Goldberg & Bougakov, 2005). Chronic stress is toxic to the brain, and can result in neuron loss in the hippocampus, which plays a critical role in shutting off the stress response, but also in the prefrontal cortex impairing working memory and cognitive flexibility (Cerqueira, Malliet, Almeida, Jay, & Sousa, 2007). This disturbance of working memory and cognitive flexibility may impair one's ability for resilience.

The majority of research on resilience is focused on identifying the key components of resilience and quantifying rates of resilience in specific populations. Additional research is needed to explore other potential pathways to resilience such as cognitive flexibility. There is a noteworthy absence of information regarding cognitive and biological correlates of stress and resilience

that impacts health (Charney, 2004; Curtis & Cicchetti, 2003). Few studies have investigated the potential link between resilience and physiological functioning. Empirical research aimed at characterizing and understanding stress as well as resilience in those experiencing unemployment is lacking.

A sound theoretical foundation is the cornerstone of nursing clinical practice and key to improving health outcomes. While allostatic load may explain the adverse effect chronic stress has on health outcomes, little is known regarding the impact resilience may have on physical health. Results of this study will contribute to the current understanding of allostatic load and resilience. Nursing assessment and interventions need to focus on identification of those at risk for allostatic load, ascertaining their capacity for resilience, and the development of strategies to assist those at risk in managing their stress and increasing resilience.

### **Purpose of Proposed Research**

The goal of this study was to investigate the perceived stress experienced by unemployed men and the impact perceived stress associated with unemployment had on the capacity for resilience. This study explored biological mechanisms through which resilience may operate, i.e.: activation of the hypothalamic-pituitary-adrenal (HPA) axis and/or the autonomic nervous system in response to a controlled psychological challenge (The Montreal Imaging Stress Task). This study will contribute to the resilience literature by ascertaining the impact that frontal lobe functioning, specifically executive control/mental flexibility, has on resilience and how the degree of resilience impacts the body's

physiological and cognitive response to stress. The overall purpose of this study is to examine the relationship between resilience and the physiological response to acute and chronic stress and to examine the relationship between cognitive executive function (frontal lobe function) and resilience in unemployed men.

### **Hypotheses to be Tested**

Hypothesis 1: The degree of resilience will moderate the HPA axis and autonomic nervous system response to a stress challenge, specifically:

Individuals with higher levels of resilience will

- a. exhibit a smaller increase in cortisol in response to the Montreal Imaging Stress Task as compared to individuals with lower levels of resilience.
- b. exhibit a more rapid return to pre-challenge cortisol levels as compared to individuals with low levels of resilience, following the Montreal Imaging Stress Task.

Hypothesis 2: Individuals with greater cognitive mental flexibility will demonstrate higher level of resilience.

## **CHAPTER II**

### **LITERATURE REVIEW**

The concepts of allostatic load and resilience provided the theoretical framework for this research. Unemployment rates and the impact that unemployment may have on the psychological and physical health of the individual will be presented in this chapter. This chapter will focus on a review of the literature related to the concept of stress, with emphasis on allostatic load, and the concept of resilience. The potential relationship between resilience and the development of allostatic load will be discussed. Gaps in the literature will be discussed.

#### **Unemployment**

According to the Bureau of Labor Statistics (2009) the unemployment rate for the state of Michigan, during the time this research project was conducted, began at 11.6% and climbed to 15% prior to completion of the study ([www.bls.gov](http://www.bls.gov)). Michigan's unemployment rate was significantly higher than the national average which began at 7.6% and climbed to 9.4%.

Unemployment constitutes a major life stressor and can impact emotional, cognitive and physiological health (Cohen, et al., 2007). The impact of unemployment on an individual's physical and psychological health has interested researchers for some time and several theories have been proposed

to explain this relationship. One of the most frequently cited theories is Jahoda's latent deprivation model (Ezzy, 1993; Creed & Bartrum, 2008, Janlert & Hammarstrom, 2009). According to Jahoda, employment is not only beneficial from a financial perspective, it also provides the individual with structure, meaningful activities, shared experiences, purpose, social contact and opportunities for recognition and status. The harmful effect of unemployment is not only attributable to loss of financial income, but to the loss of these other latent benefits of employment, which are critical to psychological needs (Creed & Bartrum, 2008). This theory has been criticized that it romanticizes employment, assumes that everyone has a positive work experience and fails to take into account that some people may have an unpleasant employment experience and may perceive unemployment as a relief (Ezzy, 1993).

Many studies have documented the negative impact unemployment has on health. Unemployment has been linked to early death. Morris, Cook, and Shaper (1994) reported that men who experienced loss of employment (due to unemployment or retirement) were twice as likely to die compared to those who were continuously employed. This increased mortality was due to a variety of causes including cancer and cardiovascular disease and remained after controlling for factors such as age, smoking, drinking, and social class. Voss, Nylén, Floderus, Diderichsen, and Terry (2004) found that unemployment in men was associated with an increased risk of suicide and deaths due to undetermined causes, but no link to cardiovascular disease was detected.



Unemployment has also been linked to increased morbidity. Bartley, Sacker, & Clarke (2009), report that unemployment was associated with twice the risk for limiting illness, and that unemployed men were almost 40% less likely to recover from a limiting illness, compared to those employed. Data about the risk for specific types of limiting illness was not reported. A Swedish study by Eliason and Storrie (2009) reported that job loss increased the risk for hospitalization due to alcohol related conditions, motor vehicle accidents and self-harm in men, but did not find a link to increased cardiovascular disease.

Unemployment has also been shown to be linked to immune function and the inflammatory process. Cohen et al. (2007) found that unemployed subjects had significantly lower natural killer cell cytotoxicity (NKCC) when compared to a matched employed sample and that immune function recovered quickly when subjects became employed. Janiki-Deverts, Cohen, Matthews, and Cullen (2008) found that a history of unemployment is associated with future elevations in C-reactive protein. C-reactive protein is a marker for inflammation and is thought to be a precursor of clinical cardiovascular disease.

Unemployment has also been linked to perception of health. Bacikova-Sleskova et al. (2007) and Bambra and Eikemo (2009) both reported that those unemployed reported higher rates of poor health. Ahs and Westerling (2005) reported that poor self-rated health was significantly higher among the unemployed compared to those employed and found that the difference in self-rated health between employed and unemployed was greater in periods of high unemployment rates.

Mental health has also been shown to be impacted by unemployment. Differences in indicators of mental health such as distress, depression, anxiety, psychosomatic symptoms, subjective well-being and self-esteem have been reported. A meta-analysis of 237 cross-sectional and 87 longitudinal studies, (Paul & Moser, 2009) found that the average number of persons with psychological problems among those unemployed was 34% compared to 16% for those employed. This result confirms those of others (Lindstrom, 2005; Brown et al., 2003) who also reported higher risk for mental distress in those unemployed.

A study by Maier et al (2006), examined the impact of unemployment over time on physical work capacity and serum cortisol, also found that those experiencing unemployment reported higher levels of emotional disturbance. Researchers suggested that unemployment deprives one of opportunities for physical activities and increases psychological distress, important factors related to physical fitness, resulting in decreased physical work capacity. A group of unemployed men and women (n=23) were followed for one year after becoming unemployed. Physical work capacity was a measurement of the subject's performance on a bicycle ergometric test. Study results documented that unemployed subjects demonstrated a significant decrease in physical work capacity (16.3%) and a significant increase in cortisol levels (17.0 ug/dl). This decrease in physical work capacity was not found to be influenced by age or gender. Cortisol levels were found to be influenced by age and gender. Older subjects had slightly higher cortisol levels at the beginning of unemployment,

which increased during the first six months of unemployment but then stabilized at the higher level, whereas younger unemployed subjects demonstrated a continuous increase in cortisol levels throughout unemployment. Gender differences revealed that cortisol levels in men significantly increased over the 12 months, but in women, cortisol levels increased significantly in the first 6 months and then decreased thereafter.

The direction through which unemployment and health are related is controversial. The question of whether unemployment results in poor health or being in poor health causes unemployment is a source of debate (Maier et al., 2006). Those who have health problems, that cause them to miss work, are more at risk to lose their job, especially when unemployment rates are high. Empirical evidence supports the negative effect unemployment appears to have on health. Additional research is needed to elucidate this relationship and the potential reasons for this adverse effect.

Chronic stress may be the primary pathway through which unemployment exerts its negative impact on health. The source of chronic stress for those unemployed may be related to both financial strain and the decrease in social capital experienced by those unemployed. The chronic nature of the psychological and social stress experienced by those unemployed may be pathogenic and lead to the health disparities seen. More research is needed to clearly ascertain the variables that influence the relationship between unemployment and health, the degree of influence they produce and the pathways through which they work. A better understanding of pathways that may

influence the relationship between unemployment and health is important to guide the development of policies and programs to reduce health disparities.

### **Stress and Allostatic Load**

The physiological response, initiated after exposure to a stressor(s), occurs as a means to enable the individual to react and either fight or flee from the stressful situation. While the stress response is an adaptive response initiated to ensure survival, repeated exposure to a chronic stressor(s) and repeated activation of the stress response has been linked to the development of stress related illnesses (Juster, McEwen, & Lupien, in press; Logan & Barksdale, 2008; Lovallo, 2004; McEwen & Lasley, 2002).

### **Definition of Stress**

Stress is a multidimensional phenomenon. What is stressful to one individual might not be perceived as stressful to another. Previous life experiences and genetic factors are thought to influence an individual's perception of stress (Korte, Koolhaas, Wingfield, & McEwen, 2005; McEwen, 2007; McEwen & Schmeck, 1994). Stress has been described in terms of an environmental stimulus (stressor), such as a job or relationship. Stress has also been described in terms of the reaction that occurs within an organism (stress response), such as the perception that one's heart is racing or the feeling of butterflies in the stomach. This variation in how stress is described or defined leads to variations in how stress is measured and makes interpretation of the large body of stress literature somewhat challenging. In this research, the definition of stress is what Pearlin (1993) identifies as the general agreement of the core meaning of the

concept of stress, which is “stress refers to a response of the organism to a noxious or threatening condition” (p. 305).

### **Normal Physiological Regulation**

The body maintains normal physiological functioning through the activity of internal reflexes, the autonomic nervous system, and endocrine messengers. Under normal conditions, organs have the ability to regulate their activity through internal reflexes. The autonomic nervous system and endocrine messengers enable the body to meet the demands of rapid changes and to coordinate activity across organ systems. The hypothalamus and brain stem function to coordinate the activities of the autonomic nervous system and the endocrine messengers, and are themselves directed by the input from higher brain centers (Lovallo, 2004).

### **The Stress Response**

Normally, in response to stressful stimuli, neural, neuroendocrine and neuroendocrine-immune mechanisms in the body activate to produce adaptation or maintain homeostasis within the body. The two main components of the stress response are the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis (McEwen, 2006; McEwen & Lasley, 2002; Smith & Vale, 2006). These systems trigger the release of catecholamines (epinephrine and nor epinephrine) and glucocorticoids the principle mediators of the physiological response to stress.

When initially exposed to a threatening or challenging situation the hypothalamus signals the adrenal medulla to release the major stress hormone

adrenaline (epinephrine). This hormone acts to produce the classic fight-or-flight response in the body. The pulse rate increases, increasing blood flow to muscles and organs. Peripheral blood vessels constrict shunting blood to critical areas and lessening the likelihood of bleeding should injury occur. The bronchioles dilate, allowing more oxygen to enter the lung and oxygenate the brain. The brain releases  $\beta$  endorphin, a natural painkiller. To ensure adequate availability of energy, adrenaline triggers the body to release stored glucose and fatty acids.

This initial “fight-flight” response is followed by the activation of the hypothalamic-pituitary-adrenal axis (HPA) and the release of hormones to keep the body functioning during sustained periods of stress. Activation of the hypothalamus triggers the secretion of corticotropin-releasing factor (CRF), which signals the anterior pituitary to secrete  $\beta$  endorphin and adrenocorticotrophin hormone (ACTH). ACTH activates the adrenal cortex to increase production of the glucocorticoid hormone, cortisol, essential for metabolic function.

Cortisol acts to replenish energy stores used during the initial fight-flight response by converting food sources into storage forms such as glycogen or fat. Cortisol increases activity and triggers hunger. During periods of stress cortisol has a double edge effect on the immune system. Initially, a rapid increase in cortisol aids the immune system by triggering the release of white blood cells. Cortisol also changes the texture of white blood cells making them sticky. This increased availability and change in the texture of the white blood cells allows them to better adhere to body tissue and aids the immune system in responding

to a potential injury. But prolonged periods of elevated cortisol suppress the immune system making the individual susceptible to infection (Korte et al., 2005; Lovallo, 2004; McEwen & Lasley, 2002; Pacak & Palkovits, 2001).

The limbic system plays an important role in the stress response through its involvement in the processing of psychological experiences and determination of subsequent behavioral responses (McEwen, 2006, 2007). The limbic system is involved in the interpretation of incoming sensory information and has the ability to direct the actions of the autonomic centers in the hypothalamus and brainstem. The limbic system's primary structures are the hippocampus and the amygdala. Lovallo (2004) identifies the limbic system as the physiological correlate of the psychological process of primary and secondary appraisal. The hippocampus is involved in learning and memory storage and the process of correlating incoming sensory information with previous experiences. The amygdala is necessary for the ability to attach emotions to present experiences and the ability to have emotions direct behavior based on past experiences. Without the functioning of the hippocampus and the amygdala an individual would not be able to identify potential dangers (primary appraisal) nor identify appropriate ways to respond to those dangers (secondary appraisal).

The physiological changes that occur during the stress response can produce damage over time. To prevent damage the body regulates the stress response by means of a physiological negative feedback. Elevated glucocorticoid levels detected by receptor sites in the hippocampus and frontal cortex provide a negative feedback to the HPA axis and act to shut off the HPA stress response,

inhibiting further production of CRH, ACTH and glucocorticoids (McEwen, 2007; Smith & Vale, 2006).

### **Individual Response to Stressful Stimuli**

The brain orchestrates the stress response. Structures within the brain interpret incoming sensory data and direct a behavioral response. An individual's response to stressful stimuli is influenced by characteristics of the stimuli (McEwen & Schmeck, 1994). If the threat associated with the stressful stimuli is unknown the common response is to experience worry, tension and fright, resulting in a state of vigilance/anxiety. If the threat associated with the stressful stimuli is known an individual may experience a thwarted response or a high cost response. When an individual experiences a thwarted response they may experience a sense of helplessness and may exhibit crying, depression, upset or overeating. A high cost response results in aggression and/or self damage and the individual may exhibit behaviors such as drinking, fighting, excessive smoking, and severe anger. An individual's perception of stressful stimuli and the resulting behaviors that may occur in their response to the stressor can influence the physiological response to stress and impact long-term health outcomes.

### **Stress and Physical Health**

The adverse effect chronic/excessive stress has on physical health is clearly supported in the literature (Fava & Sonino, 2000; VanItallie, 2002; Wolkowitz, Epel, & Reus, 2001). The stress response has been identified as a pathway to cardiovascular and cerebrovascular disease, resulting in an increased risk for the



development of atherosclerosis, hypertension, heart attacks, and strokes (Andre-Petersson, Engstrom, Hagberg, Janzon, & Steen, 2001; Kario, McEwen, & Pickering, 2003; Kop, 1999; Kranz & McCeney, 2002; Lane, Carroll, & Lip, 2001; Lawler et al., 2003; Mussante et al., 2000). The hormonal changes, specifically elevated cortisol levels, triggered by the HPA axis, in response to stress, are associated with obesity and the development of insulin resistance (Hjemdahl, 2002; Stumvoll, Tataranni, Stefan, Vozarova, & Bogardus, 2003). Stress has also been shown to impact the immune response. Acute stress has been shown to enhance the immune response and can exacerbate some autoimmune disorders. Chronic stress and prolonged periods of elevated cortisol suppresses the immune system and increase susceptibility to infection (McEwen & Dhabhar, 2002; Segerstrom, 2003; Sheridan, 2003). Perhaps most significantly, the high cortisol levels produced by chronic stress is toxic to the brain, and can result in cognitive impairments, psychiatric disturbances and neuron loss, particularly in the hippocampus, which plays a critical role in shutting off the stress response (Heba-Bauer, Morano, & Therrien, 1999; Isgor, Kabbaj, Akil, & Watson, 2004; Lee, Ogle, & Sapolsky, 2002; Sala et al., 2004; and Vyas, Mitra, Rao, & Chattarji, 2002).

### **Allostatic Load**

Historically, the concept of homeostasis has framed our understanding of how the body functions. Homeostasis refers to the body's need to maintain a steady internal state. While there are certain physiological parameters in the body, such as the acid-base balance, which if not maintained within a steady state can result

in dire consequences or even death, many systems in the body have the ability to alter their function in response to changes in the environment (Logan & Barksdale, 2008; McEwen & Lasley, 2002; McEwen & Wingfield, 2010; Schulkin, 2003). The concept of allostasis has been proposed to explain the variation seen in some physiological systems to maintain the overall stability of the organism. Allostasis or the ability to achieve stability through change, is defined by Schulkin, McEwen, and Gold (1994) as “the regulation of many variables over time in maintaining stability to meet changing circumstances “(p. 385).

In response to stressful stimuli, neural, neuroendocrine and neuroendocrine-immune mechanisms in the body activate to produce adaptation or maintain homeostasis within the individual. This coordinated response of these body systems is referred to as allostasis. When functioning appropriately allostasis allows for the individual to mobilize and respond to a threat or challenge. While the concept of allostasis is helpful in understanding the changes that occur in the body in response to stressful stimuli it does not adequately explain the damaging effects seen over time when one is exposed to chronic stress.

McEwen and Stellar (1993) proposed the concept of allostatic load to explain, how over time, environmental factors interacting with genetic predisposition account for the variation in the susceptibility to stress, and the potential for the development of stress-related illnesses. Chronic stress and the subsequent activation of multiple interacting mediators to promote adaptation and changes in behavior that are common in response to stress, such as poor sleep, increase in eating, drinking, or smoking and decrease in physical activity, may result in

damage leading to the development of allostatic load. McEwen (1998) defined allostatic load as “the wear and tear on the body and brain resulting from chronic overactivity or inactivity of physiological systems that are normally involved in adaptation to environmental challenge” (p. 37). McEwen (2008) emphasized the importance of multiple interacting mediators and the eventual “wear and tear” on the body and brain from adapting to the demands of daily life as key components to the concept of allostasis and allostatic load/overload.

Recently the term allostatic overload has been added to the allostasis/allostatic load model (Juster et al., in press; McEwen, 2007, 2008; McEwen & Wingfield, 2010). The difference between allostatic load and allostatic overload is not always clear. Sometimes these terms appear interchangeable (McEwen, 2007, 2008). McEwen (2010) clarifies the difference between allostatic load and overload and identifies allostatic overload as the final stage of progression in allostatic load and the development of a disordered or diseased state. The concepts of allostasis and allostatic load/overload are helpful in explaining the protective and survival value of the acute stress response and how this response if it is allowed to persist too long may result in adverse consequences (Charney, 2004; Gersten, 2008b; Logan & Barksdale, 2008).

### **Types of Allostatic Load**

Four types of allostatic load have been identified. The first type of allostatic load occurs when a person experiences “too much stress” from frequent exposure to novel events. A second type of allostatic load results from the

inability of the body to adapt to repeated exposures of the same stressor and terminate the stress response. Novel events can be perceived as stressful because of the unknown nature of the event, but once the nature of the event becomes known and ways to respond to the stressor are developed further exposure to that event should not activate a stress response. The second type of allostatic load or “failure to habituate” occurs when the stress response continues to be activated in response to an event that has become familiar. The third type of allostatic load results when the body fails to shut off the stress response when the challenge is over. These first three types of allostatic load result in repeated activation of, or prolonged exposure to, the stress response and long-term overexposure to stress mediators, such as adrenaline and cortisol. The fourth type of allostatic load is the failure to mount an adequate response and is associated with an underproduction of stress hormones. Exposure to either overproduction or underproduction of stress hormones has been linked to the development of physiological and/or psychological disorders (Juster et al., in press; McEwen, 2006; McEwen & Lasley, 2003).

### **Measures of Allostatic Load**

Measures of allostatic load include both primary mediators and secondary outcomes. Primary mediators are the chemical messengers that are activated to produce allostasis or adaptation in response to a stressor. Examples of primary mediators include cortisol, epinephrine (adrenaline), nor-epinephrine (nor-adrenaline), and dihydroepiandrosterone-sulfate (DHEA-S), a functional antagonist to the HPA axis. Secondary outcomes represent the cumulative effect

seen in tissues/organs in response to the action of one or more primary mediators. Examples of secondary outcomes include glycosylated hemoglobin (HgbA1C), high-density lipoprotein (HDL), total cholesterol, C-Reactive protein (CRP), blood pressure, pulse, hip-waist ratio, and body mass index (Juster et al., in press.; McEwen & Seeman, 1999). When multiple measures of allostatic load are collected an overall allostatic load score can be calculated by summing the number of parameters in which an individual falls into either the highest risk quartile, or outside the identified normal clinical ranges.

Allostatic load produces long-term effects on the cardiovascular systems, that can lead to cardiovascular disease and atherosclerosis; the brain, which decreases neurogenesis and increases dendritic remodeling in the hippocampus potentially impairing one's ability to adapt to environmental demands; the adipose tissue and muscle leading to the development of obesity and metabolic disease, and the immune system making one more at risk for infection or the development of autoimmune diseases (Korte et al., 2005). The concept of allostasis and allostatic load may explain how the body adapts to environmental challenge and the wear and tear that may result from chronic exposure to stressful situations.

### **Empirical Support**

Allostatic load has been investigated in children, adults and elderly. Research on allostatic load has revealed differences in measures of allostatic load based on gender and age, and a clear association between higher levels of allostatic load and higher levels of morbidity and mortality.

Several studies have investigated the link between cumulative risk (chronic stressors) and the development of allostatic load. The stress of having a child with cancer has been shown to increase allostatic load in women (Glover, Stuber, & Poland, 2006). Studies which have investigated the impact of cumulative life stressors on the development of allostatic load later in life have had mixed results. A weak association between cumulative life stress and allostatic load was found by Gleib, Goldman, Chung, and Weinstein (2007). Difficulties in accurately measuring lifetime exposure to stress and attrition due to mortality was felt to cause an underestimation of the impact of lifetime stress on allostatic load. Gersten (2008a) did not find evidence for an association between stressful life histories and neuroendocrine allostatic load markers (cortisol, DHEA-S, epinephrine and norepinephrine) but did find evidence to support a link between current stress and elevated neuroendocrine allostatic load markers in women. Several studies have documented the link between work stress and the development of allostatic load markers (Li et al., 2007; Schnorpfeil et al., 2003; Sluiter, Frings-Dresen, van der Beek, Meijman, & Heisterkamp, 2000). Sluiter et al. (2000) investigated the effect of job type (mental, physical, or mixed mental and physical) and job characteristics on neuroendocrine reactivity and recovery. Jobs that included both mental and physical demands were associated with significant alteration in both cortisol and adrenaline excretion unrelated to other job characteristics. These results provide evidence of the potential stress associated with double demands on the job (mental and physical) and the development of allostatic load markers in response to that stress. Schnorpfeil et

al. (2003) investigated the association between work characteristics (job demands, decision latitude and social support) and allostatic load. Job demand was the only work characteristic significantly related to allostatic load scores. This effect was found to be age dependent, with an increasing effect of job demands on allostatic load seen in older individuals. These results are confirmed by Li et al. (2007) who found that job stress was linked to 11 parameters of glyco-lipid allostatic load in healthy industrial workers in China. Job stress in this study was a measure of job control and demand with high job stress operationalized as low job control and high job demand. The results of the study found glyco-lipid allostatic load to increase with age and with high job stress. Unfortunately, none of the studies investigating work stress and the development of allostatic load controlled for the potential effect from stressors experienced outside the work environment.

Allostatic load has been linked to self-reported health and sense of coherence. High allostatic load has been associated with poor self reported health (Hanson, von Thiele Schwarz, & Lindfors, 2009; Hu, Wagle, Goldman, Weinstein, & Seeman, 2006; Seplaki, Golman, Weinstein, & Lin, 2006) and weak sense of coherence (Lindfors, Lundberg, & Lundberg, 2006), which Antonovsky identified as essential to long-term health. High allostatic load has also been reported in certain diseased states. Higher allostatic load markers have been documented in chronic fatigue syndrome (Maloney, Boneva, Nater, & Reeves, 2009; Smith, Maloney, Falkenberg, Dimulescu, & Rajeevan, 2009) and in peripheral arterial disease (Nelson, Reiber, Kohler, & Boyko, 2007).

Allostatic load has been investigated in all age groups. Several studies support the association between cumulative risk and the development of allostatic load in children (Evans, 2003; Evans, Kim, Ting, Teshler, & Shannis, 2007; and Johnston-Brooks, Lewis, Evens, & Whalen, 1998). Allostatic load has been extensively studied in the elderly. Several studies investigating allostatic load have utilized data from the MacArthur studies of successful aging. This longitudinal study follows a group of relatively high functioning men and women, ages 70-79 years. These studies report data that support an association between higher allostatic load scores and poorer cognitive and physical functioning, and an increased risk for morbidity and mortality (Gruenewald, Seeman, Karlamangla, & Sarkisian, 2009; Karlamangla, Singer, McEwen, Rowe, & Seeman, 2002; Karlamangla, Singer & Seeman, 2006; Maselko, Kubzansky, Kawachi, Seeman, & Berkman, 2007; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997; Seeman, McEwen, Rowe, & Singer, 2001; Seeman, Crimmins, et al., 2004). Allostatic load has also been studied in elderly Tiawanese, documenting the impact of lifetime stress on the development of allostatic load (Gersten, 2008a; Gleit et al., 2007), and the negative impact of allostatic load on self-rated health, physical mobility, and cognitive ability (Hu et al., 2007; Seplaki et al., 2006).

Racial differences in allostatic load have been documented. Geronimus, Hicken, Keene, and Bound (2006) reported that Blacks have higher allostatic load score than Whites, at all ages, even controlling for the impact of poverty. This impact on allostatic load was felt to be due to the “weathering” effects of



living in a race-conscious society. Low neighborhood socioeconomic status was strongly associated with the development of allostatic load in Black U.S. populations but not with Mexican American and Caucasian populations (Merkin et al., 2009). Differences in allostatic load have also been documented in Mexican Immigrants. Foreign-born Mexicans have lower allostatic load scores compared to U. S.– born Mexican Americans, non-hispanic Whites and non-hispanic Blacks (Kaestner, Pearson, Keene, & Geronimus, 2009; Peek et al., 2010). These results are consistent with the healthy immigrant/unhealthy assimilation effect observed in Mexican immigrants.

Allostatic load has been found to be associated with age, with increasing allostatic load scores observed in older individuals. Allostatic load has been found to increase with age until the 60's and then levels off with stable measures of allostatic load observed in those ages 60's through 90's (Crimmins, Johnston, Hayward, & Seeman, 2003). The impact of age on allostatic load score has been reported by Schnorpfeil et al. (2003) who found that the association between job demands and allostatic load was age dependent, with little or no association seen in younger participants and an increasing association between job demands and allostatic load in older participant (age > 45 years) and by Li et al. (2007) who found glyco-lipid allostatic load to increase with age and with high job stress.

Studies have shown that men tend to have higher allostatic load scores than women. Men and women also differ in their patterns of biological dysregulation. Elevated allostatic load scores in women are associated with dysregulation of

primary mediators such as cortisol and/or catecholamines, whereas elevated allostatic load score in men are reflective of secondary outcomes such as blood pressure, cholesterol and waist/hip ratio (Kinnunen, Kaprio, & Pulkkinen, 2005; Seeman, Singer, Ryff, Love, & Levy-Storm, 2002).

## **Discussion**

The problem of causal inference, or the issue of which came first the chicken or the egg, is evident in much of the empirical support for allostatic load. It is not always clear whether impaired cognitive/physiological functioning causes the presence of allostatic load markers, or if the presence of allostatic load markers leads to the development of impaired cognitive/physiological functioning. One weakness in the empirical evidence supporting allostatic load, related to causal inference, is the failure of many studies in linking stress to the development of allostatic load markers. A major premise in allostatic load is that cumulative risk, or chronic stress exposure, results in wear and tear on the body and the development of allostatic load. Studies that fail to include a measure for stress in the methodology lack a clear link between stress, allostatic load measures and health outcomes resulting in a lack of support for the causal inferences drawn. Another difficulty in causal inference results from the cross-sectional design of many of the studies and the inability to show a progression from exposure to chronic stress, to the development of allostatic load and the development of impairment in cognitive/physiological functioning.

Another potential problem with research on allostatic load is related to the adequacy of the current markers of allostatic load to capture such a complex

phenomenon. Clearly the primary mediators used as markers for allostatic load are evidence of HPA activity and may indicate exposure to a stressor. The secondary outcomes used for markers of allostatic load would seem to represent a progression in the damage from chronic stress. The gender differences noted in the expression of allostatic load markers are confusing and call into question the adequacy of these measures. It is unclear why men display more secondary outcomes as measure of allostatic load but not primary mediators. If secondary outcomes represent the cumulative outcome seen in tissues/organs in response to the action of one or more primary mediators one would expect them both to be present.

There is some question regarding the usefulness of the concept of allostatic load and whether it contributes anything new or will lead to any interventions that will improve health. The concept of allostasis has been criticized and some question its explanatory value, claiming that allostasis offers nothing new and results from a misunderstanding of the concept of homeostasis (Day, 2005; Romero, Dickens, & Cyr, 2009). While Day concedes that McEwen's attempt to map the relationship between "load" and health has merit he questions whether this requires the concepts of allostasis and allostatic load. Day claims that the use of allostasis terminology inadvertently collapses the study of homeostatic responses and stress responses together and may interfere with progress toward investigating pathways of "stress neurocircuitry". Another concern raised regarding allostatic load is the similarity between allostatic load markers and the diagnostic criteria for Metabolic Syndrome X. Many of the primary mediators and

secondary outcomes identified as markers of allostatic load are the same as the symptoms identified for a medical disorder called Metabolic Syndrome, also referred to as Syndrome X. Metabolic Syndrome is a disorder characterized by the presence of multiple obesity-related health risks such as visceral adiposity, insulin resistance, low HDL-c (high density lipoprotein cholesterol) and a pro-inflammatory state and is linked to the development of diabetes, coronary artery disease and cerebrovascular disease (Firdaus, Mathew, & Wright, 2006; Hjendahl, 2002). While allostatic load and Metabolic Syndrome do have several common measures, a study by Seeman et al. (2001) demonstrated that the cumulative impact of allostatic load measures was a better predictor of mortality and decline in physical functioning than either the measures of Metabolic Syndrome or the measure of primary mediator components alone. These results support the concept of allostatic load as measure of cumulative biological burden that produces wear and tear on the body. Further research is needed to investigate the similarities and differences between allostatic load and Metabolic Syndrome and their association with adverse health outcomes.

### **Summary**

Chronic stress and the wear and tear it produces on the body may explain the adverse effect unemployment has on health. Stress is a subjective experience and not all individuals exposed to the stressors associated with unemployment may experience acute/chronic health problems or early death. The concept of resilience may be useful in understanding the inconsistencies seen in the effect unemployment has on health. Does the capacity for resilience alter the stress

response for those experiencing unemployment, preventing the development of allostatic load/overload? The majority of empirical research on resilience has focused on the psychosocial features that are associated with or contribute to the phenomenon of resilience. There is a lack of empirical research aimed at ascertaining the biological mechanisms through which resilience may operate and impact physical health (Charney, 2004; Curtis & Cicchetti, 2003) and recently the need to include neurobiological and molecular genetic measures into investigations of potential pathways to resilience has been recommended (Cicchetti & Curtis, 2007; Rutter, 2007). Research investigating the potential relationship between unemployment, stress, allostatic load, and resilience may contribute to a better understanding of the biological mechanisms through which resilience may operate and may explain some of the inconsistency seen in the effect unemployment has on health within or across age groups.

### **Resilience**

The concept of resilience arose from risk research. In the 1980's, research on vulnerable populations, investigating the impact of protective/risk factors, identified a group of individuals who demonstrated competent functioning despite exposure to adverse circumstances. These individuals who were able to thrive in spite of apparently insurmountable odds, were identified as resilient (Tusaie & Dyer, 2004). Initially it was thought that the ability to be resilient was rare and that resilient individuals were stress resistant and almost super-human in their ability to overcome stressful situations. Resilience is currently accepted as a more common response to stressful situations than previously thought.

Research on loss and trauma substantiate that all individuals experience a significant loss at some point in their life and that they along with many individuals who experience significant trauma continue to demonstrate healthy functioning supporting a resilient trajectory (Bonanno, 2004; Bonanno & Mancini, 2008; Ong, Bergeman, & Boker, 2009). Masten (2001) also identified resilience as more ordinary than originally thought and suggests that resilience occurs as a result of the function of basic human adaptational systems.

### **Definition of Resilience**

Resilience is a multidimensional concept. The concept of resilience is different from recovery. Resilience denotes the ability to maintain competent functioning in the face of adversity whereas recovery suggests a return to normal functioning after a period of disruption. It is believed that there is no single means of maintaining competent functioning in the face of adversity but rather multiple pathways to resilience (Bonanno, 2004). Resilience has been defined in a number of ways. Resilience has been described in terms of an outcome, such as a child raised in poverty who despite the odds stays in school and experiences academic achievement. Resilience has also been described as a quality or trait that an individual possesses that facilitates the ability to overcome adversity. Resilience has also been identified as a process, which acts to modify risk and facilitate adaptation. This variation in how resilience is described or defined leads to variation in how resilience is measured and makes interpretation of the large body of resilience literature somewhat challenging. In this research project, resilience is defined as “the process of, capacity for, or outcome of

successful adaptation, despite challenging or threatening circumstances”  
(Masten, et al., 1990, p. 426).

### **Components of Resilience**

Resilience is thought to involve the interaction between risk and protective factors, in which the presence of protective factors (internal or external to the individual) modifies an individual’s response to the presence of environmental hazards or risks and results in competent functioning (Staudinger et al., 1993). Most of the empirical research on resilience has focused on the identification of resilience as an outcome and the delineation of common themes observed in resilient individuals. There is a lack of research investigating the mechanisms, or pathways, through which resilience operates. For those experiencing unemployment, does the capacity for resilience affect primary or secondary appraisal, in response to potential stressors, thus decreasing the number of daily stressors perceived and avoiding allostatic load? Or, do resilient individuals experiencing unemployment, while perceiving the stressors associated with unemployment, respond in such a way to these stressors that avoids the development of allostatic load? While much needs to be discovered regarding the mechanisms/pathways through which resilience conveys its protection much is known about the risks and protective factors seen in resilient individuals.

### **Risk Factors**

Risk factors are elements within the individual or within the environment that increase the likelihood for the development of a negative outcome (Garmezy & Masten, 1986). Unemployment exposes an individual to multiple/cumulative risk

factors such as financial strain, social isolation, decreased social capital, increased exposure to unhealthy behaviors such as smoking, alcohol and/or drug use, and can negatively impact one's sense of personal identity. As the number of risk factors an individual is exposed to increase and "pile-up" the likelihood of an unfavorable outcome increases (Garmezy, 1993).

### **Protective Factors**

Protective factors are elements within the individual or within the environment that act to mitigate the effects of risk factors. Three distinct sets of variables including individual, family and environmental attributes operate as protective factors (Garmezy, 1993). Rutter (1987) identified protective factors that may mitigate risks through four main processes. First they may act to reduce the impact of risk by either altering the meaning or danger of the risk or by altering the exposure to risk. According to Rutter an example of this can be seen in cases where prior exposure to stress, in circumstances that facilitated a successful outcome, may have provided an "inoculation" against future stress. Rutter proposes that in these cases the protection results from a "steeling" effect that can be seen in individuals who have successfully navigated previous risk exposure. The second means through which protective factors may operate is the reduction of the negative chain reactions that often follow risk exposure and serves to perpetuate risk. The third way that protective factors may operate is in the establishment and maintenance of self-esteem and self-efficacy. The last mechanism through which Rutter identified protective factors may operate, is through the opening up of opportunities, such as educational or employment.



For a summary of protective factors that have been identified to operate within the individual, the family, and the environment see Table 1 (Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003; Walker, 2001).

Table 1

Protective Factors Across Levels

Protective Factors Across Levels		
Individual Level	Family Level	Community Level
Positive temperament	Family Cohesion	Well-delineated community
Reflectiveness	Marital stability/harmony	Sense of community
Responsive to others	Competent parenting	Community well-being, stability and cohesiveness
Appealing to others	Parental warmth	Supportive friends, neighbors
Emotional regulation	Provides encouragement	Availability of pro-social role models
Communication skills	Provides assistance	Mentoring initiatives
Social skills	Belief in child	Available resources
Pro-social attitude	Noncritical	Employment opportunities
High intelligence	Models competent behavior	Opportunities for involvement in meaningful pro-social community activities
Problem-solving skills	Values child's accomplishments	
Educational aspirations	High but realistic expectations	
Self efficacy	Provides access to knowledge	
Self esteem	Socioeconomic advantages	
Self confident	Connectedness to other competent adults	
Empathy	Involved in child's educational and extracurricular activities	
Hopefulness		
Trust in others		
Sense of humor		
Competence		
Sense of direction/purpose		
Recognizes abilities and accomplishments		
Realistic appraisal		
Faith/religious affiliation		
Ethnic identity		
Flexible		
Perseverant		

## **Key Dimensions of Resilience**

Resilience is not static, but rather a dynamic outcome resulting from the interaction of risk and protective factors that reside both within and outside the individual. Resilient individuals should not be identified as “stress-resistant” and superhuman in their ability to handle stress (Cicchetti & Garmezy, 1993).

Resilience does not convey a form of invulnerability to the individual. Resilient individuals who are able to function competently remain vulnerable to negative outcomes if their situation changes. As circumstances within and outside the individual change so does their corresponding potential for resilience.

There is agreement among researchers that there are multiple domains to the construct of resilience, such as social, academic/work, and relational (Olsson et al., 2003; Tusaie & Dyer, 2004). These domains of resilience are connected to an individual’s developmental level and change as one grows and transitions through various developmental life stages. Resilient functioning in one domain does not guarantee resilient functioning in another domain. Inconsistency across domains suggests that resilience is not an all-or-none phenomenon (Luthar, 1993). This lack of consistency in resilient characteristics across domains was demonstrated in a study of resilience in inner-city adolescents by Luthar, Dorenberger, and Zigler (1993). Study results revealed that high-stressed children who demonstrated behavioral competence at school remained vulnerable to emotional distress. These findings support findings reported by Luthar (1991) that high-risk adolescents who were competent in academic and

social domains had significantly higher ratings of depression and anxiety compared with competent children from low stress background.

### **Measurement Issues**

One of the challenges in evaluating the large body of resilience literature is related to the inconsistency in how resilience is defined which leads to variation in how resilience is measured. In many studies resilience has not been measured directly but instead inferred from specific outcome criteria. There have been self-report instruments developed to quantify resilient factors within the individual but none of these scales have been used extensively or identified as the gold standard in capturing resilience. Tusaie and Dyer (2004) recommend using both qualitative and quantitative measures for resilience along with domain specific outcome measures of resilience to obtain the clearest descriptions and measurements of resilience.

### **Empirical Evidence for Resilience**

Research has generated a significant amount of empirical evidence in support of resilience. A large portion of past research, largely behavioral in focus, has been directed at identification of resilience and the protective mechanisms associated with resilience (Masten, 2007; Masten & Obradovic, 2006). This line of research continues with researchers investigating the resilience of specific groups and factors associated with that resilience. Women with infertility problems were found to have lower resilience score than established norms and the stress of infertility-specific and general distress was found to be negatively associated with resilience (Sexton, Bryd, & von Kluge,

2010). Poverty has long been a focus of research on resilience and the resilience of those living in poverty continues to be investigated, Cavin, Martilla, Burstrom, and Whitehead (2009) documented the resilience of poor households in Britain and identified family and social support, respectful attitudes and behaviors of service providers and opportunities to engage in activity that bolster self-esteem as factors that promoted resilience. Living in a high-risk neighborhood is a known risk factor associated with youth maladjustment, Tiet, Huzinga, and Byrnes (2010) identified bonding to family and teachers, participation in extracurricular activities, less family discord, fewer adverse life events and less involvement with delinquent peers as predictors of resilience in at risk inner city youth.

The capacity for resilience has been documented in various medical conditions. A longitudinal study by White, Driver, and Warren (2010) found no significant change in resilience of patients during inpatient rehabilitation after a spinal cord injury, and identified satisfaction with life, spirituality and less depression symptoms as correlated with resilience. Resilience has been investigated in patients with diabetes with mixed results. Yi, Vitaliano, Smith, Yi, and Weinger (2008) found that those with low or moderate resilience showed a strong association between rising diabetes related distress and worsening HgbA1C across time not seen in those with high resilience and found that those with low resilience reported fewer self-care behaviors when under increasing distress. Resilience was not found to be related to HgbA1C by Yi-Frazier et al. (2010), but low resilience was associated with maladaptive coping which the

researchers suggested impacts one's ability to manage the difficult treatment and lifestyle adjustments required with diabetes.

Research on resilience has supported the premise that resilience is a common response to stressful situations, even in the face of large-scale disasters. Quale and Schanke (2010) identified resilience as the most common recovery trajectory for hospitalized rehabilitation patients coping with severe physical injury with 54% demonstrating a resilient trajectory, 25% a recovery trajectory and 21% a distress trajectory. In this study a resilient trajectory was defined as below the threshold on symptom scales for posttraumatic stress, anxiety, depression and state negative affect and above on state positive affect, with no change at discharge, which reflects Bonanno's (2004) definition of resilience as the ability to maintain healthy symptom-free functioning following stressful life events. Recovery was defined as above the threshold on at least one of the symptom scales but below the threshold by discharge and distress was defined as above the threshold on at least one of the symptom scales with no change at discharge.

Resilience has been investigated in survivors of the Oklahoma City bombing, Tucher et al (2007) found that while survivors displayed emotional resilience, they had significantly greater autonomic reactivity to trauma reminders than control subjects. An examination of the longitudinal trajectories of responses to stress for two different disasters, the 1999 floods in Mexico and the September 11<sup>th</sup> terrorist attacks in New York City, demonstrated resistance or resilience as the two most common trajectories (Norris, Tracy, & Galea, 2009). The other

trajectories identified included recovery, delayed dysfunction and chronic dysfunction. Resistance was defined as none or mild and stable symptoms and resilience was defined as initially moderate or severe symptoms followed by sharp decline. In the Mexico flood 34% of the subjects demonstrated a resistant trajectory and 32% demonstrated a resilient trajectory. In the September 11<sup>th</sup> terrorist attack 53% demonstrated a resistant trajectory and 10% demonstrated a resilient trajectory. The definition of resilience utilized, initial dysfunction followed by adaptation, rather than a lack of symptom, which they defined as resistance, may account for the low number (10%) of resilience following the September 11<sup>th</sup> terrorist attack. A study by Bonanno, Galea, Bucchiarelli and Vlahov (2007), identified that the majority of subjects were resilient and coping well 6 months after the September 11<sup>th</sup> terrorist attack. Resilience was found to be associated with lower levels of depression and less cigarette and marijuana use compared to those identified with mild-moderate trauma or those identified as probable PTSD, but was not associated with alcohol use. Factors associated with greater resilience included older age, social support, no reported prior trauma events and no additional traumatic events since the September 11<sup>th</sup> attack. Females were identified as less likely to be resilient and increasing levels of education did not act as a protective factor but rather appeared to impede adaptation.

Bonanno (2004) identified four possible pathways, through which resilience may operate, including the personality trait of hardiness, the use of self-enhancement, the use of repressive coping, and the employment of positive emotion and laughter. Studies have investigated these and other pathways

through which resilience may operate to modify an individual's response to the presence of environment hazards or risks and results in competent functioning. Self-enhancement has been identified as a pathway to resilience following the September 11<sup>th</sup> terrorist attack (Bonanno et al., 2005). Self-enhancement is defined as "the tendency toward overly positive or unrealistic self-serving bias" (p. 985). While it is believed that self-enhancement may be adaptive and may promote well-being and effective coping, critics identify that the trait may mask serious personal and social problems. Self-enhancement was associated with a resilient outcome, greater positive affect and ratings of better adjustment prior to September 11<sup>th</sup> by friends and relatives. Investigators identified that the potential social cost of self-enhancement may also have been supported by the fact that friends and relatives rated self-enhancer at 18 months as decreasing in social adjustment and as being less honest.

Positive emotions are assumed to convey a beneficial physiological effect by putting the body at ease while negative emotions are thought to activate the autonomic nervous system. Positive emotions may also be beneficial by altering the way people think through the cognitive broadening that accompanies states of positive emotions (Fredrickson et al., 2003). This state of cognitive broadening associated with positive emotions is thought to broaden or expand a person's attention, thinking and behavioral repertoires and according to Fredrickson et al. improve the ways in which they cope during crisis. Fredrickson et al. (2003) investigated positive emotions as a potential pathway through which

resilience operates in college students following the September 11<sup>th</sup> terrorist attack. Resilience was found to be negatively correlated with depression, and positive emotions experienced after the September 11<sup>th</sup> terrorist attack mediated the relationship between pre-crisis levels of resilience and later development of depressive symptoms. Positive emotions were also found to account for the relationship between pre-crisis levels of resilience and post-crisis growth in psychological resources. Tugade and Fredrickson (2004) investigated the impact trait resilience and positive emotions have on threat appraisal and physiological functioning, in response to the potential threat of having to give a speech. Higher levels of trait resilience were associated with higher reports of positive emotions and a lower appraisal of threat. Analysis of the relationship between psychological resilience and the duration of cardiovascular reactivity demonstrated that trait resilience was negatively related to duration of cardiovascular reactivity. Both positive emotions and cognitive appraisal of threat were found to mediate the effect of trait resilience on duration of cardiovascular reactivity supporting positive emotions and threat appraisal as possible pathways through which resilience facilitates adaptation.

Tugade and Fredrickson (2004) also examined the role of cognitive appraisal, specifically threat versus challenge appraisal, in psychological resilience. Threat appraisals were identified as those in which the perception of danger exceeds the perception of one's abilities to deal effectively with the stressor. Challenge appraisals were identified as those in which the perception of danger did not exceed the perception of one's abilities to deal effectively with the stressor.



Once again higher levels of trait resilience were associated with increased measures of positive emotions. When cognitive appraisal was focused as either a threat or a challenge, differences were detected in the association between trait resilience and duration of cardiovascular reactivity. In the threat condition trait resilience was again associated with shorter durations of cardiovascular reactivity and this relationship was mediated by positive emotions. When the appraisal was seen as a challenge, no relationship was found between trait resilience and cardiovascular reactivity. Study results indicate that having low levels of trait resilience may not be detrimental in situations perceived as challenging as opposed to threatening.

Tugade and Fredrickson (2004) examined the effect of finding positive meaning. Subjects were then asked to write a short essay on the most important current problem they were facing. After the essay was completed self-report measures were obtained to indicate the extent participants experienced different emotions in response to the problems they described. Subjects were then asked to rate the degree to which they were able to find positive meaning in the problem they were facing. Data analysis revealed that trait resilience was again positively correlated with positive emotions. The study also found that trait resilience was associated with greater positive meaning finding.

In a study by Cohn, Fredrickson, Brown, Mickels, and Conway (2009), emotions were measure daily for one month and positive emotions were found to predict increases in both resilience and life satisfaction. Changes in resilience were found to mediate the relationship between positive emotions and increased

life satisfaction. Investigating recovering from an anticipated threat, Waugh, Fredrickson and Taylor (2008) found that high trait resilient facilitated more complete affective recovery after viewing a neutral picture that was initially presented as uncertain, indicating that the picture could be either neutral or aversive. These results were confirmed by neurological imaging results in a study by Waugh, Wager, Fredrickson, Noll, and Taylor (2008) who found that when under threat low resilient individuals demonstrated prolonged activation in the anterior insula, an affective region of the brain, to both aversive and neutral pictures while high resilient individuals demonstrated anterior insula activation only in response to aversive pictures.

In the next wave of research on resilience there has been a call to continue to investigate pathways to resilience and the need to include neurobiological measures to ascertain the physiological impact of resilience (Cicchetti & Curtis, 2007). Several studies to date have examined the relationship between resilience and cortisol. Investigating the impact of ego-resiliency, Smeekens, Riksen-Walraven, and van Bakel (2007) found that children with low ego-resiliency had increases in salivary cortisol in response to negative interactions with their parents while children high in ego-resiliency did not. Cicchetti and Curtis (2007) found that low morning cortisol was associated with increased levels of resilience in non-maltreated low-income children, but in maltreated low-income children high levels of resilience was associated with higher morning cortisol. In healthy adults, Simeon et al. (2007) found that resilience was associated with higher urinary cortisol but did not find a relationship between

resilience and cortisol stress reactivity to an applied acute stressor, the Trier Social Stress Test (TSST). These results were confirmed by Mikolajczak, Roy, Luminet, and Timary (2008), who reported that resilient men secreted less cortisol overall but there was no difference between resilient and nonresilient men in increased cortisol secretion (base to peak) or the recovery slopes (peak to return to baseline) followed an applied stressor (TSST).

### **Cognitive/Mental Flexibility**

One potential pathway to resilience that needs further investigation is cognitive flexibility. Masten (2007) identified executive function as one of several “hot spots” in resilience research that warrants further clarification. Cognitive flexibility is a key component of executive control. Executive control is a form of “supervisory” cognitive processing that is required to carry out complex thought and behavior. Executive control involves the use of internal representations to formulate a plan that guides behavior and the ability to switch gears if something unexpected happens, and a different response is needed. This capacity to switch gears is known as cognitive flexibility (Goldberg & Bougakov, 2005). The ability to think flexibly, develop alternative explanations, re-frame negative situations positively and to accept challenging or distressing events has been identified as vital to psychological resilience (Haglund, Nestadt, Cooper, Southwick, & Charney, 2007).

Executive control is thought to be regulated by the frontal lobes. The relationship between frontal lobe functioning and executive control is not clearly understood. Studies show that while most individuals with frontal lobe lesions

show abnormalities on executive function tests, not all do; and some individuals with diffuse lesions and no apparent frontal lobe damage perform poorly on executive function test (Alvarez & Emory, 2006). Both age and intelligence have been linked to cognitive flexibility. In older adults, atrophy of the frontal regions of the brain is more common than in the posterior regions. The importance of the frontal lobes to cognitive flexibility makes it reasonable to suggest that cognitive flexibility may decline with aging. A study by Wecker, Kramer, Hallam, and Delis (2005) found that executive functions, particularly verbal and nonverbal cognitive switching, did decline with age supporting the premise that cognitive flexibility may be affected by aging. Higher levels of intelligence were associated with greater cognitive flexibility in a study by Colzato, van Wouwe, Lavendar, and Hommel (2006). They found that subjects with higher level of intelligence displayed faster reaction times and fewer errors in test of cognitive flexibility.

Chronic stress is toxic to the brain, and can result in neuron loss in the hippocampus, which plays a critical role in shutting off the stress response, but also in the prefrontal cortex impairing working memory and cognitive flexibility (Cerqueira, Malliet, Almeida, Jay, & Sousa, 2007). In the animal model, even brief periods of intense stress have been linked to significant remodeling in the prefrontal cortex and stress induced changes in the prefrontal cortex have been linked to deficits in rodents' working memory and executive functions (Holmes & Wellman, 2009). Bloss, Janssen, McEwen, and Morrison (2010) found that stress induced reductions of prefrontal apical dendritic length and branch number were reversed in younger animals following a 21 day recovery period but not in

middle-aged and older-aged rats. It has been hypothesized that exposure to stress may accelerate cognitive aging and this study provides evidence that aging is accompanied by impairments in neuroplasticity and that the negative impact of stress on the brain may not be reversible.

Acute and chronic stress has also been linked to deficits in cognitive flexibility in humans. Differences in executive function have been reported between subjects with chronic PTSD and matched controls (Kanagaratnam & Asborgren, 2007). They found that after exposure to political violence, subjects with a history of Post Traumatic Stress Disorder (PTSD) demonstrated impairment in mental flexibility, compared to a control group with no diagnosis of PTSD. Three measures of executive function were used in this study, the Tower of London (ToL), the Stroop Color-Word Test (SCWT) and the Wisconsin Card Sorting Test (WCST). The ToL was used as a measure of intentionality, the SCWT was used as a measure of inhibition, and the WCST was used as a measure of executive memory. The SCWT and the WCST are identified as tests that measure mental flexibility. Subjects with PTSD demonstrated impairment on tasks measuring automatic processing and executive memory, but no differences were seen in executive components of intentionality and inhibition. This link between chronic stress and impaired cognitive flexibility has also been detected in children. Fishbein et al. (2009) investigated the effect of personal and community stressors on neurocognitive function in children and found that personal stressors (such as physical and emotional abuse and neglect, school and parental stressors) were associated with neurocognitive functioning and impairment in

executive decision making. Community stressors (such as neighborhood problems and witnessing neighborhood violence) were not significantly associated with neurocognitive function.

The negative impact of short-term stressful event on cognitive flexibility has also been detected in humans. The Tier Social Stress Test (TSST), a public speaking and arithmetic stressor, has been shown to impair performance on measures of cognitive flexibility compared to non-stressful tasks such as reading or counting. These cognitive flexibility deficits improved when propranolol, a beta-adrenergic receptor blocker, was given along with the TSST, suggesting that the impairments in cognitive flexibility were related to the noradrenergic system (Alexander, Hillier, Smith, Tivarus, & Beversdorf, 2007).

Cognitive flexibility and the ability to switch gears when confronted with the unexpected may be helpful in both primary and secondary appraisal. When faced with a potentially stressful situations resilient individuals who demonstrate good cognitive flexibility may reframe the way they approach a problem or see multiple ways to respond and may not perceive something as stress. Executive function and coping has been examined in survivors of childhood leukemia (Campbell et al., 2009). Impairment of neurocognitive functioning is one potential long-term consequence of leukemia treatment. Cambel et al. (2009) found that while working memory and executive function scores were decreased for leukemia survivors compared to matched control, scores still fell within accepted norms with most survivors demonstrating intact executive function abilities. Lower executive function scores were correlated with increased use of

disengagement coping (avoidance, denial and wishful thinking) and behavior problems.

Southwick, Vythilingam, and Charney (2005) identify cognitive flexibility as one of the psychosocial factors associated with stress resilience. They identify positive explanatory style, positive reappraisal and acceptance as examples of the cognitive flexibility associated with stress resilience. Few studies have used measures of executive function to investigate how cognitive flexibility relates to the capacity for resilience. Qouta, El-Sarraj, and Punamaki (2001) investigated mental flexibility as a resiliency factor in children exposed to political violence. Resilience was not measured directly but inferred from psychological adjustment. The triangle-circle test and tree-house test were used to measure mental flexibility. Both tests involve a series of eight cards over which an object transforms into another object (triangle to circle, tree to house). The more rigid one's thought process the longer they maintain or see the original object without responding to the changes in the perceptual content. Data collection occurred initially during a time of political unrest and violent conditions and again, 3 years later, during more peaceful times. Results of this study showed that Palestinian children who had higher levels of mental flexibility were protected from long-term consequences of traumatic event, exhibiting less symptoms of emotional disorder or post-traumatic stress disorder at follow-up. During periods of violence, mental flexibility did not correlate with good psychological adjustment. The intentional, internal manipulation of one's attention and behavior is a set of executive functions identified as effortful control. Effortful control was measured

by Obradovic (2010), using the Simon says task, the peg-tapping task, the Stroop task and the Dimensional Change Card Sort task and was identified as a significant predictor of resilience and adaptive coping in homeless children. While the empirical support for the relationship between mental flexibility and resilience is limited, it clearly confirms the presence of greater mental flexibility in individuals who demonstrate the capacity for resilience.

Recent research on executive function has focused on ways to promote or enhance cognitive flexibility. A dose response relationship between exercise and cognitive flexibility was reported by Masley, Roetzheim, and Gualtieri (2009). They found significant improvement in mental speed, attention and cognitive flexibility in those who participated in moderate (3 days per week) and frequent (5 days per week) aerobic exercise compared to a control group who participated in minimal exercise, with the greatest improvement seen in frequent exercisers. The researchers proposed that the link between exercise and cognitive function might be a result of improved cerebral blood flow and oxygenation, changes in brain chemistry and tissue or due to non-biological mechanisms such as improved well being. The link between exercise and improved cognitive functioning was also reported by Kubesch et al. (2009) with mixed results. They who found that grade school children that participated in a 30-minute physical education program had significantly improved ability to maintain on-task attention in the face of distraction compared to either a control group (who listened to audio books) or an exercise group who participated in 5-minute movement breaks. But the dots task measure of working memory, cognitive flexibility and



inhibition of behavioral tendency did not reveal any differences between the groups.

Mindfulness based cognitive therapy and meditative exercises, in which the participant directs and maintain their attention on a particular present experience without judgment or analysis, have also been linked to enhanced cognitive flexibility. Comparison of a group skilled in mindful meditation to a meditation-naïve control group revealed that meditation and higher levels of mindfulness were associated with improved measures of attention and cognitive flexibility (Moore & Malinowski, 2009). This link between mindfulness and cognitive flexibility was also detected by Heeren, van Broeck, and Philippot (2009), who reported that mindfulness-based therapy improves cognitive flexibility by increasing autobiographical memory specificity and decreasing overgeneral memories

### **Discussion**

The concept of resilience can explain the variation seen in the way individuals respond to stressful situations. There is a lack of consensus regarding how resilience is defined and this has lead to variation in how resilience is operationalized and measured. Differences in the way resilience is defined and correspondingly measured may impact conclusions drawn regarding risk and protective factors and may impact the estimation of rates of resilience identified in similar groups (Luthar, Cicchetti, & Becker, 2000). It is important to clearly specify how resilience is defined, operationalized and measured when reporting study results.

The cross-sectional study design and sample size seen in many of the studies on resilience is a significant limitation. While cross-sectional research studies may be able to demonstrate the prevalence of resilience they are limited in their ability to establish the causal relationships needed to move the resilience literature beyond the current focus of the identification of resilience and/or the protective factors that facilitate resilient outcomes. The small, convenient sample sizes utilized in the studies by Bonanno et al. (2005), Fredrickson et al. (2003), and Tugade and Fredrickson (2004) limit the ability to generalize the results beyond the specific groups investigated (i.e. survivors of a terrorist attack and/or college students) and while they may demonstrate statistically significant results they lack the strength to support overall clinical significance. Further research utilizing larger sample size and diverse populations will help support the clinical significance of the concept of resilience.

Studies on resilience demonstrate a lack of consistency in resilient characteristics across domains and have caused some to question the value of the construct of resilience. While Luthar et al. (2000) identifies that this inconsistency across domains does not invalidate the construct of resilience they identify that it is critical to include this consideration when reporting results. Study results that identify resilience as a means through which at risk children may achieve academic success demonstrate that the capacity for resilience is beneficial, even if that resilience did not prevent a child from experiencing symptoms of anxiety or depression. It is important though to identify that positive adaptation in one domain does not ensure positive adaptation in other domains

so that resilient individuals are not identified as “stress-resistant” or super-human in their ability to handle stress. It is critical to identify that resilient individuals who are able to function competently in one domain may not function competently in all domains and that as circumstances within or outside an individual change so does their corresponding potential for the capacity of resilience.

Future research is needed to establish the clinical significance of resilience to physical health outcomes and the pathways to resilience. Cognitive flexibility and problem solving skills are protective factors that have been identified to operate within resilience individuals. Disturbances of working memory and cognitive flexibility may impair one’s ability for resilience. A clearer understanding of the processes/pathways utilized in achieving a resilient outcome may aid in the development of programs needed to build or maintain resilience in at risk groups.

### **Summary**

The literature clearly supports the negative impact unemployment has on health. While the research provides some clues regarding the variables that may influence how unemployment impacts health, the exact mechanism(s) through which this relationship interacts has not been clearly established. The constructs of limited resilience and high allostatic load, and the interactive nature of these two constructs, provide a conceptual framework that may explain the negative impact of unemployment.

The psychological and social consequences of unemployment expose an individual to multiple/cumulative stressors and as these stressors “pile-up” the likelihood of an unfavorable outcome increases. The two main components of

the stress response are the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, which activate neural, neuroendocrine and neuro-immune mechanisms in the body to produce adaptation. Chronic stress and the repeated activation of the physiological stress response along with changes in behavior that are common in response to stress, such as poor sleep, increase in eating, drinking, or smoking and decrease in physical activity, may result in damage to the brain, cardiovascular systems, adipose tissue and muscle, gastrointestinal system, skin, lungs, and immune system reflecting allostatic load.

Stress is a subjective experience and not all individuals exposed to the stressors associated with unemployment experience acute/chronic health problems or early death. Resilience has been identified as the capacity to overcome adversity and successfully adapt to threatening or challenging situations. The construct of disparate levels of resilience may explain the variation seen in the ability of individuals to manage the stressors inherent to unemployment and remain healthy. Multiple pathways through which resilience may operate have been identified, such as the personality trait of hardiness, the use of self-enhancement, the use of repressive coping, and the employment of positive emotion and laughter. Cognitive flexibility and the ability to switch gears when confronted with the unexpected may be one pathway to resilience. When faced with a potentially stressful situation resilient individuals who demonstrate higher levels of cognitive flexibility can be expected to reframe the way they approach a problem, see multiple ways to respond, and may not perceive something as exceptionally stressful; thus they may be more resilient.

This study explored the impact of resilience on HPA axis and autonomic nervous system response to a stress challenge to provide a potential link between resilience and physiological function. Mental flexibility was examined as a potential pathway to resilience. Results of this study will contribute to the current understanding of allostatic load and resilience.

## **CHAPTER III**

### **DESIGN AND METHODS**

This chapter describes the research design, sample selection, recruitment strategies, and other methodological considerations for the study. The use of the Montreal Imaging Stress Task (MIST) to elicit an acute stress response and the instruments utilized in this study are discussed. The procedure followed for collection, storage and processing of biological measures are clarified. Data analysis techniques are presented.

#### **Research Design**

This study utilized a descriptive correlational repeated measures design. Measures of resilience, mental flexibility, and social support were obtained. Subjects were separated into low, moderate and high resilient groups and repeated measures of salivary cortisol were taken before, during and after the application of the Montreal Imaging Stress Task.

#### **Sample and Setting**

This study was conducted in southwest Michigan. During the time this research study was conducted (2009), Michigan had the highest rate for unemployment in the nation. The unemployment rate for Michigan at the initiation of the study was 11.6% and climbed to 15% prior to completion of the

study compared to the national average, which began at 7.6% and climbed to 9.4% ([www.bls.gov](http://www.bls.gov)).

Selection criteria for study participation are presented in Table 2. Selection criteria were developed to control for possible variation in the chronic stress associated with unemployment and physiologically related variation in cortisol. Because of gender differences and the impact that the female menstrual cycle phase and the use of oral contraceptives have on cortisol, women were excluded from the study (Kudielka, Hellhammer & Wust, 2009).

Table 2

Selection Criteria for Study Participation

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<u>Inclusion criteria</u>	<u>Exclusion criteria</u>
Male	Full time student
Ages 28 to 55 years	Unemployment related to medical leave or disability
Unemployed 3 to 18 months	Current use of steroids
History of full time employment for at least one year prior to current unemployment	Known brain injury or seizure disorder
Able to read and speak English	Current endocrine, kidney, or liver disorder
Any ethnic origin	Established DSM-IV TR Primary Psychiatric Disorder

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## **Recruitment Strategy**

Volunteers were recruited through newspaper advertisement and recruitment posters placed at Michigan Works (a statewide agency that provides employment and training programs), other local employment agencies, local job fairs and public spaces such as grocery stores, churches and libraries. Once the study was underway, subjects were encouraged to refer other unemployed men they knew but were asked to refrain from discussing what occurred in the study with these individuals to ensure an unbiased response. Individuals interested in participating in the study contacted the researcher by phone or email, if they met selection criteria an appointment was scheduled. If an individual did not show up at the scheduled appointment and had given a contact number that individual was re-contacted and allowed to reschedule their appointment. In the case that an individual missed two scheduled appointments no further efforts were made to contact the individual. Seventeen volunteers scheduled appointments and did not come to their scheduled appointments, of these five rescheduled their appointment and participated in the study. One volunteer came to his scheduled appointment but was excluded from participation due to significant hypertension at the baseline reading. The volunteer was encouraged to seek medical attention at the local free medical clinic which was open on the day of his appointment. Directions to the clinic and bus fare were provided.

## **Human Subjects Considerations**

Approval for the study was obtained through the Health Sciences Institutional Review Board of the University of Michigan. Participation in the study was



voluntary. Informed consent detailing the purpose of the study, study requirements, and possible risk and benefits was obtained prior to data collection. Subjects received a copy of the informed consent and were able to withdrawal from participation at any time during the study.

### **Instruments and Measures**

Chronic stress and resilience are the major independent variables and salivary cortisol is the major dependent variable to be measured in this study. A summary of instruments and biological measures is presented in Table 3.

#### **Stress**

The 10-item Perceived Stress Scale (PSS) was used in this study to measure the degree to which situations in the subject's life are identified as stressful (See Appendix C.). Subjects answer questions based on how they have felt over the last month on a 5-point scale ranging from 0, for never, to 4, for very often. The scale includes questions that are negatively phrased (how often have you felt nervous and stressed) and positively phrased (how often have you felt things were going your way), with the positively phrased questions reversed scored. Score range from 0 to 40 with higher scores indicating higher level of perceived stress. The questions are general in nature and are not content specific to any population group. The PSS was developed by Cohen, Kamarck, and Mermelstein (1983), and has been used extensively in research. The 10-item version has been shown to be valid and reliable (Cohen, Kessler, & Gordon, 1997). Recent updated psychometrics for this scale supports a 2 factor loading

for this scale and reports a Cronbach's alpha reliability coefficient for the total scale of .89 (Roberti, Harrington, & Storch, 2006).

### **Resilience**

The Connor-Davidson Resilience Scale (CD-RISC) was used to measure resilience in this study (See Appendix B). This scale has been tested in several groups including community samples, primary care outpatients, psychiatric outpatients and subjects from clinical trials in generalized anxiety disorder and post-traumatic stress disorder. The CD-RISC consists of 25 items rated on a 5-point scale of 0, for not true at all, 1 for rarely true, 2 for sometimes true, 3 for often true and 4 for true nearly all of the time. Possible scores range from 0 to 100 with higher scores reflecting greater resilience. Cronbach's alpha test is reported as .89 and test re-test reliability is reported as .87 (Connor & Davidson, 2003). The CD-RISC has been used to measure resilience in several studies investigating a variety of different population groups such as women experiencing infertility (Sexton et al., 2010), community-dwelling older women (Lamond, et al., 2009), general college students (Benetti & Kambouropoulos, 2006; Campbell-Sills, Cohan, & Stein, 2006), African American college students (Brown, 2008) and patients receiving treatment for PTSD (Davidson et al., 2008; Rothbaum et al., 2008). Support of the CD-RISC as a uni-dimensional resilience measure, independent of positive and negative affect was reported by Burns and Anstey (2010).

## **Social Support**

Social support was assessed in this study to evaluate its effect on resilience and stress. Social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS), developed by Zimet, Dahlem, Zimet, and Farley (1988). This scale is a subjective measure of perceived social support from three sources: family, friends and significant other. The MSPSS consists of 12 items rated on a 7-point scale ranging from very strongly disagree to very strongly agree (See Appendix D.). Cronbach's coefficient alpha, an internal reliability measure, ranges from .81 to .94 for the individual subscales and .84 to .92 for the scale as a whole and test-retest values range from .72 to .85 (Zimet, Powell, Farley, Werkman, & Berkoff, 1990).

## **Executive Control/Mental Flexibility**

Executive control involves the ability to guide behavior by internal representations and the ability to employ flexibility in thought processes and "switch gears" when something unanticipated happens. This cognitive function is critical for making decisions, problem solving, and managing multiple tasks and burdens. In this study the Short Category Test and the Shipley Institute for Living Scale were used to measure executive control/mental flexibility.

### ***Short Category Test***

The Short Category Test (SCT) consists of 5 booklets, each containing 20 stimulus cards. The cards show various geometric shapes, lines, colors and figures. Each booklet is organized around a single principle. Subjects are shown the cards, one at a time and are asked which number, 1-4, the card represents.

The subject is then told if their response was correct or incorrect and proceeds to the next card. In order to answer correctly the subject must be able to discern the principle underlying a given booklet. The SCT assesses an individual's ability to use abstract concept formation to guide problem solving and reflects mental flexibility. The validity of this test is supported by the ability of the test to discriminate between brain-damaged patients and non-brain damaged patients (Wetzel & Boll, 2000). The corrected split half reliability coefficient for this test is reported to be 0.81. The SCT is frequently used as one of a series of tests to evaluate overall brain function. Scoring of the SCT provides a raw error score (number of incorrect answers), a normalized T-score and a percentile rank equivalent for the raw error score. A raw error score above 41, for adults 45 years of age or younger, or above 46 for adults over 45 years of age, indicates neurological impairment (Wetzel & Boll, 2000).

### ***Shipley Institute of Living Scale***

The Shipley Institute of Living Scale consists of a 40-item vocabulary test and a 20-item abstract thinking test. This test measures the discrepancy between vocabulary and abstract concept formation, providing a measure of cognitive function or dysfunction. Scoring of this test provides a conceptual quotient score, an abstract quotient score and a WAIS-R Full Scale IQ score. The Shipley Institute of Living Scale has been used extensively as a quick and accurate measure of general intellectual functioning. The corrected split-half reliability coefficient is .84 for estimated IQs based on the Shipley Total scores and test-

retest reliability ranges from a median of .60 for the vocabulary and to a .78 for the total score (Zachary, 2006).

### **Demographic Characteristics**

A form was developed for this study to collect socio-demographic information, employment history and current unemployment status. Socio-demographic data collected included age, race, education, income and family make-up (marital status, number and age of children). Data collected on unemployment history included length of unemployment, receipt of unemployment benefits and past unemployment episodes.

### **Physiological Stress Response**

The two main components of the stress response are the autonomic nervous system and the HPA axis (McEwen & Dhabhar, 2002). These systems trigger the release of catecholamines (epinephrine and nor epinephrine) and glucocorticoids respectively, the principle mediators of the physiological response to stress.

### ***Blood Pressure and Pulse.***

Blood pressure and pulse rate were used as a measure of the autonomic nervous system in this study. The Omron HEM-670IT wrist blood pressure monitor with advanced positioning sensor was utilized to monitor blood pressure and pulse. The use of wrist devices to monitor blood pressure provides reliable and accurate results when correct arm position is maintained (Mourad, Gillies, & Carney, 2005).

## ***Cortisol***

Cortisol was used in this study as a measure of HPA axis activity. Cortisol can be measured in the blood (plasma), saliva and urine. Salivary and plasma cortisol measures are highly correlated (King & Hegadoren, 2002). Due to the reliability, and noninvasive nature of sample collection, salivary cortisol was utilized in this study. Passive collection of salivary cortisol was obtained by having subjects spit into a 50cc plastic tube to a level of 5cc. This collection method has been found to ensure adequacy of sample amount and to be acceptable to participants (Strazdins, et al., 2005). Because cortisol levels naturally fluctuate during the day and a diurnal rhythm is seen in this cortisol fluctuation, data collection took place between 1:00pm and 6:00pm. Subjects were asked to refrain from eating, drinking, smoking or sleeping for one hour prior to their scheduled appointment time. Salivary cortisol samples were kept at room temperature during the data collection appointment and then kept frozen at -20°C until assay. According to Aeron Life Cycle Clinical Laboratory ([www.aeron.com](http://www.aeron.com)), normal salivary cortisol for women and men at 8am range between 1.0 - 8.0ng/ml; at 12pm range between 0.4 - 2.5ng/ml; at 4pm range between 0.2 – 1.3ng/ml and at 10pm range between 0.1 - 0.6ng/ml.

The Core Assay Facility at the Department of Psychology, University of Michigan, Ann Arbor processed the salivary cortisol results in this study. All salivary cortisol samples were thawed and refrozen three times to free them from mucopolysaccharides and other residuals. Solid-phase <sup>125</sup>I radioimmunoassays were done to determine salivary cortisol levels. Duplicate runs of the assays

were performed. Inter-assay coefficient of variation was 2.06% for low controls and 8.46% for high controls. Salivary cortisol results are reported in ng/ml.

Table 3

Description of Instruments and Biological Measures

<u>Concept</u>	<u>Measure(s)</u>	<u>Number of items</u>	<u>Type of questions</u>
Stress	Perceived Stress Scale (PSS)	10	Likert
Resilience	Connor-Davidson Resilience Scale (CD-RISC)	25	Likert
Social Support	Multidimensional Scale of Perceived Social Support (MSPSS)	12	Likert
Mental Flexibility	Shipley Institute of Living Scale	60	Fill in, multiple choice
	Short Category Test	100	Short answer
Demographic Characteristics		16	Likert, short answer
Physiological Stress Response	Salivary Cortisol		
	Pulse		
	Blood Pressure		

## **Montreal Imaging Stress Task**

In this study unemployment is considered a chronic source of stress and the Montreal Imaging Stress Task (MIST) was used to elicit an acute stress response. Traditionally the Trier Social Stress Test (TSST) has been advocated as an effective means of eliciting an acute stress response and subsequent activation of the HPA axis. The TSST exposes an individual to a 15-minute period of psychological stress involving 5 minutes of anticipatory stress, 5 minutes of public speaking and 5 minutes of mental arithmetic in front of an audience and often includes the additional threat of being video taped (Williams, Haggerty & Brooks, 2004). This procedure requires a controlled laboratory setting, video equipment and additional personnel and was not feasible for this research project.

The Montreal Imaging Stress Task (MIST), derived from the TSST, was developed as a means to elicit an acute stress response in individuals undergoing brain scans, which precluded the presence of someone in the room at the time the individual was exposed to the stressor (Dedovic et al., 2005). The MIST is a computer program consisting of mental arithmetic challenges along with a social evaluative threat component. The MIST includes 3 conditions, a rest period where the subject is exposed to a blank screen, a control period where the subject is given a series of mental arithmetic tasks to complete and an experimental condition in which subject is again given a series of mental arithmetic tasks to complete but level of difficulty and time are controlled and the subject is provided with negative feedback information regarding their



performance. In the experimental condition the level of difficulty and time constraints are manipulated so answering the question correctly is just beyond the subject's mental capability. The MIST program monitors the subject's responses and during the experimental condition manipulates the difficulty of the task and/or time constraints to enforce a correct response rate between 20% to 45%. This failure rate is maintained to elicit a stress response while avoiding having the subject give up or withdrawal from the task. Between experimental runs of the MIST, the researcher is to apply additional stress by pointing out the difficulty the subject is experiencing and emphasizing the need for them to improve their performance. Several research studies have utilized the MIST and support the effectiveness of this computerized program in eliciting an acute stress response (Dagher, Tannenbaum, Hayashi, Pruessner, & McBride, 2009; Dedovic, Aguiar, & Pruessner, 2009; Dedovic, et al., 2009) Prior to starting data collection the researcher traveled to Montreal to receive training on how to administer the MIST.

### **Data Collection Procedure**

Data collection took place in a private room at Western Michigan University, School of Nursing between 1pm and 6pm. Subjects were asked to refrain from eating, drinking, smoking or sleeping for one hour prior to their scheduled appointment time. Subjects were met in the lobby of the Health and Human Services Building and escorted to the School of Nursing. Informed consent was explained and obtained from subjects prior to data collection. After signing the informed consent, subjects had a 10-minute rest period prior to the first baseline

measure of blood pressure, pulse and salivary cortisol, during which time they could read magazines. At the end of the 10-minute rest period, the first baseline measure of blood pressure, pulse and salivary cortisol was taken. An Omron HEM-670IT wrist blood pressure monitor was placed on the subject's non-dominant wrist, the subject was asked to hold their arm still during the reading, and a measure of blood pressure and pulse was obtained. The subject was then given a 50cc plastic test tube and asked to spit into the test tube and fill it to the 5cc mark. After the first baseline measurement subjects completed the Perceived Stress Scale, the Connor-Davidson Resilience Scale and the subject characteristics questionnaire. The order of these questionnaires was randomized. Upon completion of the questionnaires a second baseline measure of blood pressure, pulse and salivary cortisol was obtained. Following the second baseline measure, subjects completed the Shipley Institute of Living Scale followed by the Short Category Test. Subjects were then trained on the MIST program and given a 5-minute practice time. Subjects then completed a 9-minute run on the MIST in which they cycled thru a 30 second rest condition, a 60 second control condition and a 90 second experimental condition 3 times. After completion of the MIST the first experimental measure of blood pressure, pulse and salivary cortisol was taken and the subject received feedback on their performance. The researcher reminded the subject that the average performance was 80%-90%, which they were not achieving and the importance of improving their performance was stressed. Subjects then completed a second 9-minute run on the MIST, with the same setting as previously described. After

completion of the MIST the second experimental measure of blood pressure, pulse and salivary cortisol was obtained. The subjects then completed the Perceived Stress Scale, the Connor-Davidson Resilience Scale and the Multidimensional Scale of Perceived Social Support. The order of these questionnaires was randomized. Additional experimental measures of blood pressure, pulse and salivary cortisol were taken 15 minutes after completing the MIST and again at 30 minutes after completing the MIST. When subjects had completed all paper and pencil questionnaires, magazines were available for them to read until the study was completed. At the completion of data collection subjects were debriefed on the purpose of the research project, the deception of the MIST program and paid \$40.00 in the form of a gift card to Meijer.

### **Data Analysis**

This section outlines the data analysis issues relevant to this study. Included in this section is a description of sample size determination, handling of missed data and statistical procedures utilized.

#### **Sample size**

Effect size is an important aspect in the determination of power and sample size (Cohen, 1992). Few studies have investigated the impact resilience has on cortisol response or the impact mental flexibility may have on resilience, so it is difficult to specify the magnitude of phenomenon. Assuming a medium effect size with seven independent variables and an  $\alpha = 0.05$ , a sample size of 102 is needed. Because of the exploratory nature of this study and the time and cost involved, an  $n = 80$  was recruited for the study.

### **Missing Data**

Time was available to the researcher to check subject's responses and locate missed data while the subject was available to answer, so there were few missing data points. In the event that data were missing, SPSS was set to exclude cases pairwise, so subjects were excluded only from calculations involving the variable for which they had missing data (Field, 2005).

### **Statistical Procedures**

All data were entered into SPSS (Statistical Package for the Social Sciences) for analysis. Repeated measures ANOVA was used to examine the relationship between resilience, and cortisol, with time (5 measures of salivary cortisol) as the within-subject factor and level of resilience (low, moderate or high) as the between subject factor. This analysis process was repeated to examine the impact of resilience on blood pressure and pulse. Regression analysis was done to examine the relationship between resilience and mental flexibility. Correlations were run to examine the relationships between and among demographic characteristics, stress, social support, resilience, mental flexibility, and physiological response.

## **CHAPTER IV**

### **RESULTS**

This chapter describes the data analysis and results of this repeated measures study investigating stress and resilience in unemployed men. The major aims of this study were to investigate the capacity for resilience in unemployed men and the impact resilience had on the HPA axis response to an acute stressor (MIST). The study also explored the impact mental flexibility has on the capacity for resilience in unemployed men. Analysis was conducted using SPSS (Statistic Package for the Social Sciences). Sample demographics, psychometric properties and results of the instruments utilized, and findings in regards to the research questions are presented.

Strict adherence to the established data collection procedure was maintained throughout data collection. No adverse reactions/responses to participation in the study were noted. The researcher did not begin to enter data into SPSS until data were collected on approximately one-quarter of the subjects. At this time it was noted that three subjects did not answer all responses to a scale, which prevented the calculation of a score for the subject on that scale. From this point forward the researcher reviewed all documentation as it was collected to make sure all questionnaires and scales were completed. In the case of missing data, SPSS was set to exclude cases pairwise, so subjects were excluded only from calculations involving the variable for which they had missing data.

In the repeated measures analysis of resilience’s impact on the cortisol response to an acute stressor (MIST), four subjects were eliminated from the analysis. One subject was excluded who had extremely high cortisol values (more than 8 standard deviations from the mean). Three subjects were excluded because they were reported to have readings identified as low, or having very little hormone and at the end of the standard curve that is starting to flat-line, thus providing less resolution in the reading.

### **Psychometric Properties**

The reliability of the instruments used in the study was tested for this sample. Cronbach’s alpha was used to test internal consistency and determine the extent to which subparts of the instrument measure the same characteristic. Possible coefficient scores range from 0.00 to 1.00, a value between 0.7 to 0.8 is generally accepted to support instrument reliability (Field, 2005). As shown in Table 4, Cronbach alpha scores for all instruments used in the study support the instruments’ internal consistency/reliability for this population.

Table 4

Reliability Analysis for Measures of Stress, Resilience and Social Support

Instrument	n	Alpha
Perceived Stress Scale	80	.86
Connor-Davidson Resilience Scale	79	.91
Multidimensional Scale Perceived Social Support	79	.93

Note. Difference in n are due to missing data

## **Sample Characteristics**

This sample consisted of 80 unemployed men in southwest Michigan during the calendar year of 2009. A summary of sample characteristics is presented in Table 5. Age of subjects ranged from 28 to 55 years. The mean age was 43.6 years with a standard deviation of 7.301. About one-half of the subjects (n=37) were between 40-49 years of age, a little over a quarter of the subjects (n=24) were younger between 28-39 years of age and the remaining subjects (n=19) were older between the ages of 50-55. Age was found to be significantly and positively correlated with education ( $r = .293, p \leq 0.05$ ), length of full-time employment prior to current unemployment ( $r = .402, p \leq .01$ ), and systolic ( $r = .374, p \leq .01$ ) and diastolic ( $r = .371, p \leq .01$ ) blood pressure.

### **Family**

Only one quarter of the subjects reported they were married (n=19), over a quarter reported they had never been married (n=33) and the remaining identified themselves as divorced/separated (n=24). Over one half of the subjects had children (n=49). No data were collected regarding the sex and/or dependency status of these children. The majority of subjects reported having one (n=13) or two (n=18) children, but subjects (n=2) did report having as many as six children. The age of the children ranged between 1 to 35 years of age.

### **Education**

Educational attainment for subjects exceeded national averages. Over one-half of the subjects had some college (n=22) or had graduated from college (n=23). Roughly one-tenth (n=9) of the subjects had not graduated high school.

Higher levels of education were positively correlated with age ( $r = .293, p \leq 0.05$ ); longer lengths of full-time employment prior to current unemployment ( $r = .372, p \leq .01$ ); and higher levels of resilience ( $r = .336, p \leq .01$ ). Higher levels of education were negatively correlated with report of sufficient income to meet monthly expense ( $r = -.358, p \leq .01$ ), levels of perceived stress ( $r = -.395, p \leq .01$ ) and mean pulse rates ( $r = -.288, p \leq .05$ ).

### **Unemployment History**

One-half of the subjects identified that that they had been unemployed between 3 to 6 month ( $n=42$ ) and less than a quarter identified that they had been unemployed more than a year ( $n=16$ ). Over half of the subjects had reported they had experienced unemployment in the past ( $n=48$ ). Length of unemployment and history of previous unemployment were not correlated with unemployment benefits, financial strain, resilience, stress or social support.

### **Employment History**

Most subjects reported a stable work history. Over half of the subjects reported they had worked full time for 5 years or longer ( $n=41$ ). As previously reported, age and education did correlate with work history with older and more educated subjects having longer full-time work histories.



Table 5

## Summary of Sample Characteristics

Characteristics	n	%
Age (in years)		
28-29	3	3.8
30-39	21	26.2
40-49	37	46.3
50-55	19	23.7
Race		
White (Non Hispanic)	44	55.0
Black (Non Hispanic)	26	32.5
Hispanic	5	6.3
Asian	1	1.2
Other	3	3.8
Missing	1	1.2
Marital Status		
Married	19	23.8
Separated	9	11.2
Never Married	33	41.2
Divorced	15	18.8
Missing	4	5.0
Children		
Yes	49	61.3
No	31	38.7
Highest level Education		
Less than high school	9	11.3
High School Graduate	26	32.5
Some College	22	27.5
College Graduate	23	28.7
History Full-time Employment		
1 year	15	18.8
2-5 years	24	30.0
5-7 years	11	13.8
7-10 years	15	18.8
Greater than 10 years	15	18.8

Table 5 (cont'd)

## Summary of Sample Characteristics

Characteristics	n	%
<b>Length Unemployment</b>		
3 months	5	6.3
3-6 months	37	46.3
6-9 months	12	15.0
9-12 months	10	12.5
12-15 months	10	12.5
15-18 months	6	7.5
<b>Prior History Unemployment</b>		
Yes	48	60.0
No	32	40.0
<b>Unemployment Benefits</b>		
Yes	27	33.8
No	53	66.3
<b>Monthly Income Sufficient</b>		
Yes	23	28.7
No	56	70.0
Missing	1	1.3
<b>Change in Stress Level</b>		
Significantly less	3	3.8
Slightly Less	4	5.0
Unchanged	3	3.8
Slightly More	30	37.5
Significantly More	40	50.0

**Financial Strain**

It was evident that unemployment caused many subjects to experience financial strain. Only one-third of the subjects (n=27) reported they received unemployment benefits. Lack of unemployment benefits correlated with an

increased report of not having enough money to meet monthly expenses ( $r = .419, p \leq .01$ ). There was no significant relationship between not receiving unemployment benefits and reported duration of current unemployment, previous history of unemployment, or age. Longer full-time work histories prior to current unemployment increased the likelihood of receiving unemployment benefits, while food service and construction jobs were more likely to report not receiving unemployment benefits. But receiving unemployment benefits did not prevent financial strain. Of the subjects ( $n = 27$ ) who identified receiving unemployment benefit almost half ( $n = 12$ ) reported that they did not have enough money coming in to meet their monthly expenses.

### **Change in Stress Level**

Subjects reported that unemployment significantly changed their stress level. The majority of subjects perceived either a slight ( $n = 30$ ) or significant ( $n = 40$ ) increase in stress. A perceived increase in stress was positively correlated with increased financial strain ( $r = .463, p \leq .01$ ) and higher overall perceived stress ( $r = .549, p \leq .01$ ), with those who reported a slight or significant increase in stress since unemployment experiencing more financial strain and higher scores on the Perceived Stress Scale. Changes in perceived stress were negatively correlated with history of full-time employment prior to current unemployment ( $r = -.290, p \leq .01$ ), resilience ( $r = -.337, p \leq .01$ ) and social support ( $r = -.245, p \leq .05$ ). Those who reported a slight or significant increase in stress since unemployment had a shorter history of full time employment and lower measures of resilience and social support. For a more detailed description of the changes

seen in age and measures of stress, resilience, social support and mental flexibility with different levels of perceived changes in stress see Table 6.

Table 6

Change in Perceived Stress Since Unemployment and Differences in Age and Construct Measures

	<u>Less Stress (n = 7)</u>	<u>No Change (n = 3)</u>	<u>More Stress (n = 70)</u>
Measure	Mean (Std. D)	Mean (Std. D)	Mean (Std. D)
Age	46.00 (5.132)	46.33 (13.32)	43.29 (7.251)
PSS	13.57 (3.359)	12.66 (6.658)	21.10 (5.808)
CD-RISC	81.28 (11.26)	86.00 (3.464)	71.01 (12.87)
MSPSS	66.85 (16.19)	76.33 (10.02)	57.41 (17.63)
Short-RES	25.43 (10.34)	28.33 (3.786)	35.34 (13.45)
Shipley IQ	105 (8.080)	99.00 (13.53)	96.10 (13.14)

Note. Means (Std Dev) of measures are reported. PSS = perceived stress scale; CD-RISC = Connor-Davidson resilience scale; MSPSS = Multidimensional scale perceived social support; Short RES = Short Category Test raw error score.

### Major Constructs

Descriptive statistics for each construct measured are presented in Table 7. Stress, resilience and social support were related to many demographic and employment/unemployment aspects. Perceived stress was positively correlated with perceived changes in stress ( $r = .549$ ,  $p \leq .01$ ) and financial strain ( $r = .455$ ,  $p \leq .01$ ), with those having lower PSS scores reporting a decrease in stress since

becoming unemployed and less financial strain. Perceived stress was negatively correlated with level of education ( $r = -.368, p \leq .01$ ) and history of prior full-time employment ( $r = -.285, p \leq .05$ ). That is, those with higher levels of education and longer previous full time employment histories had lower stress levels.

Table 7

Descriptive Statistics for Instruments and Subscales

Measure/Subscale	Valid n	Min.	Max.	Mean	Std. Dev.
Perceived Stress Scale	80	5	32	20.12	6.18
Connor-Davidson Resilience Scale	79	43	99	72.49	13.05
Multidimensional Scale of Perceived Social Support	79	13	84	58.96	17.69
Shipley Institute of Living Scale Estimated IQ	79	64	120	97.05	12.94
Short Category Test					
Raw Error Score	80	4	63	34.21	13.26
T-Score	80	23	77	55.36	11.31

Note. Differences in valid n are due to missing data

Perceived stress was not found to be significantly related to age, race, marital status, length of unemployment, history of previous unemployment, or receipt of unemployment benefits. Resilience was positively correlated with educational level ( $r = .333, p \leq .01$ ). While racial differences were noted, with Blacks and

Hispanics reporting slightly higher levels of resilience, race was not significantly correlated with resilience. Resilience was not significantly correlated to age, marital status, employment history, length of unemployment or financial strain. Social Support was positively correlated with educational level ( $r = .263, p \leq .01$ ), with subjects with more education reporting higher levels of social support; and negatively correlated with marital status ( $r = -.251, p \leq .05$ ), with married subjects reporting higher levels of social support; and race ( $r = -.258, p \leq .05$ ), with Hispanics and Caucasians reporting higher levels of social support. Social support was not significantly related to age, employment/unemployment aspects, or financial strain.

### **Relationships Between Major Constructs**

In order to determine the relationships among stress, resilience, social support, mental flexibility, and physiological response, correlations among 9 variables were explored, as shown in Table 8. Resilience was moderately and positively related to social support ( $r = .569, p \leq .01$ ), with greater social support associated with increased resilience. A weak positive correlation was detected between social support and higher Shipley IQ measures ( $r = .275, p \leq .01$ ). Increased stress was weakly but positively associated with an increase in the number of errors on the Short Category Test ( $r = .253, p \leq .05$ ). Several significant inverse relationships were detected. Increased perceived stress was strongly correlated with lower levels of resilience ( $r = -.661, p \leq .01$ ) and moderately correlated with lower levels of social support ( $r = -.458, p \leq .01$ ). Higher Short Category Test raw error scores were weakly associated with less

resilience ( $r = -.219, p \leq .05$ ) and moderately correlated with lower Shipley IQ scores ( $r = -.473, p \leq .01$ ).

Table 8

Summary of Intercorrelations for Scores on the PSS, CD-RISC, MSPSS, Shipley IQ, Short RES, Cortisol, Pulse and Blood Pressure

Variable	1	2	3	4	5	6	7	8	9
1. PSS	1								
2. CD-RISC	-.661**	1							
3. MSPSS	-.458**	.569**	1						
4. Shipley IQ	-.134	.156	.275**	1					
5. Short RES	.253*	-.219*	-.106	-.473**	1				
6. Mean BC	.064	-.046	-.120	-.065	-.018	1			
7. Mean BP	.086	-.047	-.023	-.163	.137	-.136	1		
8. Mean BSBP	.149	-.059	.039	.045	.064	-.079	-.152	1	
9. Mean BDBP	.168	-.060	-.011	-.017	.048	-.013	.039	.833**	1

Note. PSS = perceived stress scale; CD-RISC = Connor-Davidson resilience scale; MSPSS = Multidimensional scale perceived social support; Short RES = Short Category Test raw error score; Mean BC = mean baseline cortisol; Mean BP = mean baseline pulse; Mean BSBP = mean baseline systolic blood pressure; Mean BDBP = mean baseline diastolic blood pressure; \* $p \leq 0.05$ ; \*\* $p \leq 0.01$ .

### Resilience

Resilience was a major construct in this study. The mean resilience score for unemployed men was 72.49 (Std D 13.05), which is lower than the Conner and Davidson's (2003) reported mean of 80.4 (Std D 12.8) for a general population.

To better understand the impact differing degrees of resilience may have on the physiological response to the applied stress, MIST, the researcher categorized subjects as exhibiting low, moderate or high resilience based on their CD-RISC resilience score. As shown in Table 9, the lowest third resilience scores were categorized as low; the middle third scores were categorized as moderate resilience and the highest third scores were categorized as high resilience. While resilience was not correlated with financial strain, resilience category (high, moderate or low) was weakly correlated with financial strain ( $r = -.255, p \leq .05$ ). High resilient men were less likely to report that their monthly income was insufficient to meet their monthly expenses.

Table 9

Descriptive Statistics for Low, Moderate and High Resilience Categories

Category	Minimum	Maximum	Mean	Std. Dev.
Low (n=26)	43	67	57.9615	7.3293
Moderate (n=26)	68	76	71.9573	2.7926
High (n=27)	79	99	87.0000	4.7149



## Hypotheses Testing

### Resilience and Cognitive Flexibility

An unexpected finding of this research was the difficulty many unemployed men demonstrated with mental flexibility. Short Category Test raw error scores above 41, for adults 45 years of age or younger, or above 46 for adults over 45 years of age, indicates neurological impairment (Wetzel & Boll, 2000). Data analysis revealed that over one quarter of the subjects ( $n=23$ ) in this study had SCT raw error scores that suggested neurological impairment.

To determine whether individuals with greater cognitive mental flexibility demonstrate higher levels of resilience ( $H_0: 2$ ), regression analysis was conducted to examine the relationship between mental flexibility (measured by the Shipley IQ, and the Short Category Test (SCT) raw error score and T-score) and resilience. Ranges for these tests are reported in Table 7. Correlation analysis demonstrates a weak but significant negative relationship between resilience and SCT raw error score ( $r = -.219, p \leq .05$ ). As shown in Table 8, as resilience increases raw error score decreases. Because of the known relationship between resilience, stress and social support reported in the literature, the perceived social support measure, the perceived stress measure and length of unemployment were included in the regression model as covariates. When the SCT raw error score alone was entered with the above described covariates the effect of the SCT raw error score was not significant, and the regression model explained 55% of the variability of resilience. One

potential reason for this lack of significance may be that the SCT raw error score alone does not account for the expected changes seen in performance with aging. Gontkovsky & Souheaver (2002) encouraged caution when using SCT t-score results to differentiate between normal brain function and the presence of brain dysfunction. Their study showed that SCT raw error scores demonstrated valid differentiation between normal functioning subjects and subjects with neurological dysfunction, but suggested the cut-off provided by Wetzel and Boll may require downward adjustment to increase the sensitivity of this measure to accurately predict neurological dysfunction. Because of this a decision was made to include both the SCT raw error score and t-score together along with the covariates into the regression model. The Durbin-Watson score of 2.393 supports the assumption of independent errors is met. The decision to include both the SCT raw error score and the SCT t-score was made to better detect a relationship between resilience and mental flexibility. Including both the SCT raw score and t-score may increase the risk of multicollinearity due to the strong correlation between these two predictors. The variance inflation factor (VIF) for the SCT raw error score is 6.285 and for the SCT t-score is 6.369, which is under the identified value of 10, at which one is to worry about multicollinearity. But the tolerance statistics of .159 for the SCT raw error score and .157 for the SCT t-score and the average VIF score for all predictors of 2.9985 may indicate that multicollinearity may be biasing the regression model. The presence of multicollinearity limits the size of the R and makes it difficult to determine the importance of an individual predictor (Field, 2005).

The identified predictors explain 59% of the variability of resilience. Perceived stress, length of unemployment, social support and the Short Category test raw error score and T score, as shown in Table 10, are significant predictors of resilience. The Shipley IQ was not significantly related to resilience. The Shipley Institute for Living Scale has both verbal and abstract thinking components. Post-hoc analysis was done to investigate whether the abstract portion of the Shipley captured mental flexibility better and was related to resilience. There was no significant correlation detected between the Shipley abstraction raw score and resilience ( $r = .166$ ,  $p = ns$ ) or stress ( $r = -.090$ ,  $p = ns$ ). Hypotheses number three was supported with caution. Mental flexibility was measured using both the Shipley Institute of Living Scale and the Short Category test. While the Shipley IQ was not significantly related to resilience, the Short Category Test was significantly related to resilience. As resilience increased the raw error score of the Short Category Test decreased and the T-score increased indicating greater mental flexibility.

Table 10

Multiple Regression Analyses Predicting Resilience From Perceived Stress, Length of Unemployment, Social Support and Mental Flexibility

	B	Std. Error B	$\beta$
Constant	57.389	13.835	
PSS	-1.067	.187	-.505***
Length Unemployment	1.553	.707	.170*
MSPSS	.210	.067	.284**
Shiplely IQ	.032	.093	.032
Short RES	-.512	.187	-.521**
Short T Score	.610	.225	.517**

Note. Dependent variable = Connor-Davidson resilience score; PSS = perceived stress scale; MSPSS = Multidimensional scale perceived social support; Short RES = Short Category Test raw error score;  $R^2 = .594$ ; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

### Resilience and Cortisol Response

In response to an acute stressor one would expect to see a significant rise in salivary cortisol followed by a return to baseline levels after termination of the stressor event. As shown in Table 11, for this population of unemployed males, mean salivary cortisol were unexpectedly highest at baseline, regardless of level of resilience, and did not increase in response to the MIST.

Table 11

## Mean Salivary Cortisol Response to the MIST by Resilience Category

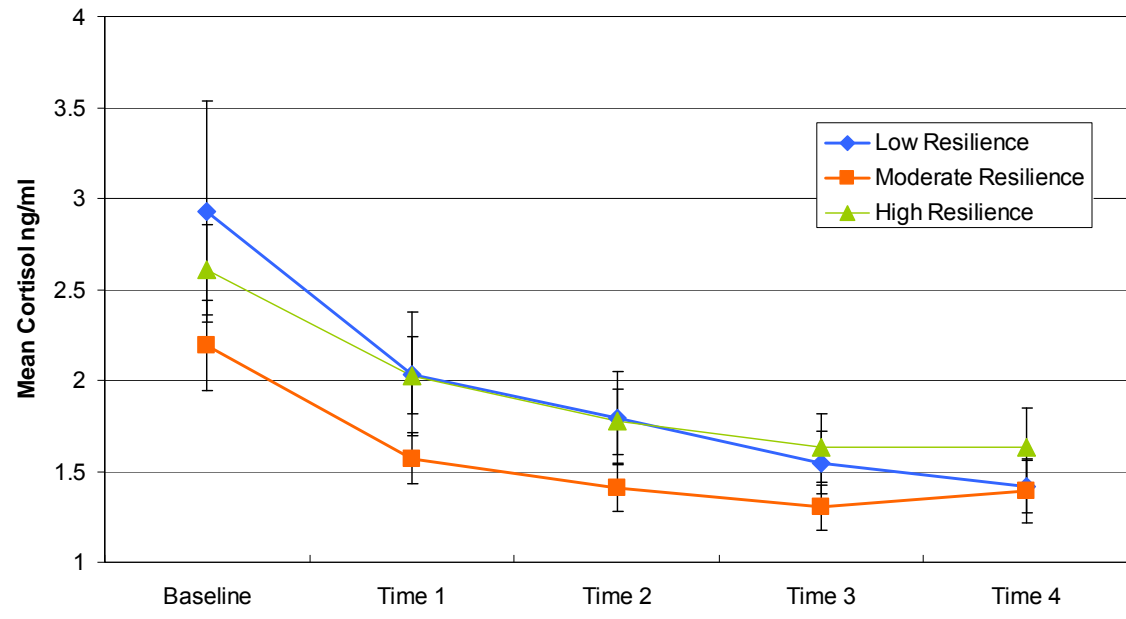
Category*Time	Mean	Std. Deviation
Low Resilience (n=25)		
Baseline	2.9250	3.03618
Experimental Time 1	2.0360	1.71909
Experimental Time 2	1.7944	1.28447
Experimental Time 3	1.5468	0.86483
Experimental Time 4	1.4160	0.70917
Moderate Resilience (n=26)		
Baseline	2.1902	1.25343
Experimental Time 1	1.5719	0.73006
Experimental Time 2	1.4112	0.68540
Experimental Time 3	1.3004	0.63728
Experimental Time 4	1.3931	0.88880
High Resilience (n=25)		
Baseline	2.6066	1.23616
Experimental Time 1	2.0272	1.06987
Experimental Time 2	1.7740	0.89761
Experimental Time 3	1.6284	0.94311
Experimental Time 4	1.6316	1.10010

Note. Baseline salivary cortisol is the average of the two baseline samples taken. Salivary cortisol reported in ng/ml.

All baseline measures were obtained in the afternoon, between 12 and 4pm, normal salivary cortisol for women and men at 12pm range between 0.4 - 2.5ng/ml and at 4pm range between 0.2 – 1.3ng/ml ([www.aeron.com](http://www.aeron.com)), so baseline measures for those with high and lower resilience are higher than the accepted norm and those with moderate resilience are at the high end of normal.

Mean baseline measures of cortisol were highest for subjects with low levels of resilience, as seen in Figure 4.1, but ANOVA conducted on mean baseline cortisol by resilience category showed no significant difference at baseline ( $F = .852, p = ns$ ).

Figure 4.1. Absence of Mean Salivary Cortisol Response to the MIST by Resilience Category



Note. Mean salivary cortisol reported in ng/ml. Application of Montreal Imaging Stress Task occurred before Time 1 measurement and again before Time 2 measurement.

To determine whether the degree of resilience moderated the HPA axis response to a stress challenge (( $H_0: 1$ ) repeated measures ANOVA was conducted on mean cortisol with time (5 measures of salivary cortisol) as the

within-subject factor. Even in repeated measures design, when analyzing data the need to have homogeneity of variance between conditions remains. Mauchly's test of sphericity tests the hypothesis of equal variance of the differences between treatment levels. Violating sphericity results in a loss of power and the possibility of missing genuine effects (Field, 2005). Data analysis revealed that Mauchly's test of sphericity violated the assumption of sphericity, so degrees of freedom were corrected using Greenhouse-Geisser correction. Data analysis showed the significant effect of time on cortisol ( $F = 25.023$ ,  $p < .001$ ), but as shown in Figure 4.1, this time effect was not the expected curve of cortisol increasing from baseline measures in response to the MIST and decreasing after the termination of the MIST, but rather gradual decrease in cortisol from baseline to experimental T4 measure. Repeated measures ANOVA conducted on mean cortisol with level of resilience (low, moderate or high) as the between subject factor showed no significant effect of resilience on cortisol ( $F = 1.021$ ,  $p = ns$ ). Covariates were tested for their effect; age, Shipley IQ, and perceived stress were not found to be significantly related to cortisol.

The ability to determine whether individuals with higher levels of resilience exhibited a smaller increase in cortisol in response to the MIST compared to individuals with lower levels of resilience and exhibit a more rapid return to pre-challenge cortisol levels than individuals with low levels of resilience ( $H_0: 1$ ) was not possible. The lack of a cortisol response to the applied laboratory stressor, the MIST, prevented the ability to test hypotheses two. There was no increase in cortisol detected after application of the MIST and hence there was no measure

of return to pre-challenge cortisol levels. Hypothesis number one, as related to HPA axis response, was rejected.

### **Resilience, Blood Pressure and Pulse**

Blood pressure and pulse rate were used as a measure of autonomic nervous system activity in this study. It was expected, in response to the applied laboratory stressor, the Montreal Imaging Stress Task (MIST), that blood pressure and pulse rate would increase and return to normal after termination of the stressor. Analysis of blood pressure and pulse rate results again did not show the expected change in response to the applied laboratory stressor. Subjects' highest mean pulse rate was again noted at baseline, regardless of resilience category, as shown in Table 12. Blood pressure did slightly increase after application of the MIST but did not recover after termination of the stressor, as shown in Table 13.

Repeated measures ANOVA was conducted on mean pulse rate with time (5 measures of pulse rate) as the within-subject factor. Mauchly's test of sphericity violated the assumption of sphericity, so degrees of freedom were corrected using Greenhouse-Geisser estimates sphericity. Data analysis showed significant effect of time on pulse rate ( $F = 41.084$ ,  $p = < .001$ ), but again this time effect was not the expected curve of pulse increasing from baseline measures in response to the MIST and decreasing after the termination of the MIST but rather gradual decrease in pulse from baseline to experimental T4 measure. Repeated measures ANOVA conducted on mean pulse rate with level of resilience (low,



moderate or high) as the between subject factor showed no significant effect of resilience on pulse rate ( $F = 1.198$ ,  $p = ns$ ).

Table 12

Mean Pulse Rate Response to the MIST by Resilience Category

Category*Time	Mean	Std. Deviation
Low Resilience (n=24)		
Baseline	80.10	11.829
Experimental Time 1	75.63	12.057
Experimental Time 2	75.67	11.228
Experimental Time 3	73.25	11.456
Experimental Time 4	72.21	12.036
Moderate Resilience (n=27)		
Baseline	80.70	12.296
Experimental Time 1	74.22	10.871
Experimental Time 2	74.26	11.367
Experimental Time 3	72.33	10.202
Experimental Time 4	71.81	9.377
High Resilience (n=27)		
Baseline	76.00	10.247
Experimental Time 1	70.89	9.740
Experimental Time 2	71.56	9.188
Experimental Time 3	70.30	9.750
Experimental Time 4	68.11	8.577

Note. Baseline pulse rate is the average of the two baseline readings taken.

Repeated measures ANOVA was conducted on mean systolic blood pressure (SBp) with time (5 measures of SBp) as the within-subject factor. Mauchly's test of sphericity supported the assumption of sphericity. Data analysis showed the significant effect of time on systolic Bp ( $F = 6.845$ ,  $p < .001$ ), but this time effect

was not the expected increase in response to the MIST followed by a return to normal, but rather a gradual rise of not more than 7mm. Repeated measures ANOVA conducted on mean SBp with level of resilience (low, moderate or high) as the between subject factor showed no significant effect of resilience on SBp ( $F = 1.500, p = ns$ ).

Table 13

Mean Systolic and Diastolic Blood Pressure Response to the MIST by Resilience Category

Category*Time	<u>Systolic Blood Pressure</u>		<u>Diastolic Blood Pressure</u>	
	Mean	Std. Dev.	Mean	Std. Dev.
Low Resilience (n=24)				
Baseline	121.15	14.522	79.37	10.711
Experimental Time 1	123.54	15.729	80.29	11.965
Experimental Time 2	125.08	15.679	82.50	10.052
Experimental Time 3	125.00	15.891	80.13	12.814
Experimental Time 4	128.63	14.711	82.79	9.203
Moderate Resilience (n=27)				
Baseline	117.20	14.785	76.59	11.449
Experimental Time 1	119.63	12.413	79.70	10.982
Experimental Time 2	118.48	16.322	79.15	11.124
Experimental Time 3	119.70	17.404	77.41	11.590
Experimental Time 4	120.81	12.683	79.74	8.847
High Resilience (n=27)				
Baseline	123.07	14.553	80.29	11.009
Experimental Time 1	124.37	16.577	80.48	12.106
Experimental Time 2	126.52	15.368	83.11	12.974
Experimental Time 3	124.93	15.840	83.30	12.353
Experimental Time 4	127.41	15.108	81.63	10.199

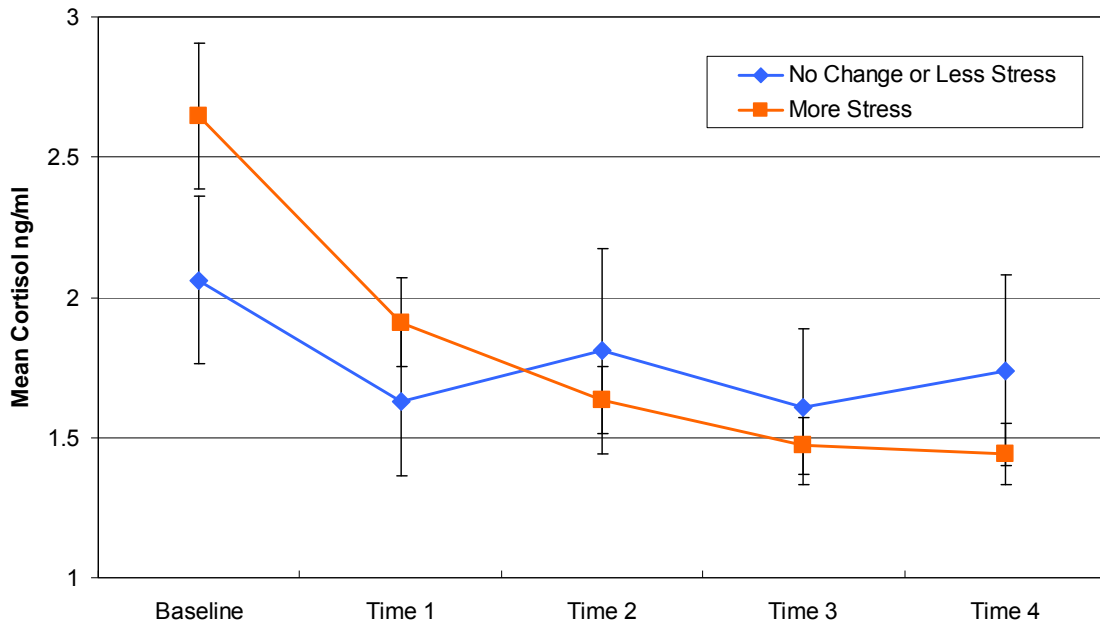
Note. Baseline measures are the average of the two baseline readings taken.

Repeated measures ANOVA was conducted on mean diastolic blood pressure (DBp) with time (5 measures of DBp) as the within-subject factor. Mauchly's test of sphericity violated the assumption of sphericity, so degrees of freedom were corrected using Greenhouse-Geisser estimates sphericity. Data analysis showed the significant effect of time on DBp ( $F= 3.878, p = .006$ ), but this time effect was not the expected increase in response to the MIST followed by a return to normal, but rather a gradual rise of not more than 4mm. Repeated measures ANOVA conducted on mean diastolic blood pressure with level of resilience (low, moderate or high) as the between subject factor showed no significant effect of resilience on DBp ( $F = .735, p = ns$ ). Hypothesis number one, as related to autonomic nervous system response, was rejected.

The lack of HPA axis response in this study was unexpected and the cause is not clear. While subjects were not asked to rate how stressful they found the MIST, most subjects did verbalize that they found the MIST difficult. When the researcher interacted with subjects between the runs of the MIST, to apply additional stress by pointing out the difficulty the subject is experiencing and emphasizing the need for them to improve their performance, most subjects identified the difficulty of the task. Some subjects showed frustration and anger, and many said that they hadn't done math like this since they were in school and couldn't possible do the math under the imposed time constraints. In this study the majority of subjects reported that unemployment had increased their stress. The high level of chronic stress experienced by these unemployed men may have impacted HPA axis response to the MIST seen in this study. Post-hoc

analysis shown in Figure 4.2, demonstrated that there was a significant difference at baseline in mean cortisol results for subjects who reported no change or less stress (n=10) compared to subjects who reported higher levels of stress (n=70), with those reporting more stress having higher mean baseline cortisol results. While a significant difference in mean baseline cortisol was found, neither group (no change or less stress/more stress) demonstrated the expected cortisol reactivity to the MIST. Overall it appears that subjects who reported no change or less stress demonstrated even less cortisol response.

Figure 4.2. Absence of Mean Salivary Cortisol Response to the MIST by Change in Perceived Stress



Note. Mean salivary cortisol reported in ng/ml. Application of Montreal Imaging Stress Task occurred before Time 1 measurement and again before Time 2 measurement.

In conclusion this study revealed that the majority of unemployed men, in this study, reported an increase in their stress level since becoming unemployed. Perceived stress was negatively correlated with resilience and mental flexibility, as evidenced by increased Short Category Test raw error scores. Unemployed men who performed better on the Short Category test did display higher levels of resilience. The capacity for resilience did not impact the HPA axis response to an applied stressor (MIST). The overall lack of the expected response to the MIST leads one to question the effectiveness of this tool to elicit an acute stress response in this population.

## **CHAPTER V**

### **DISCUSSION**

This study explored the relationship between mental flexibility and resilience and how the capacity for resilience may impact the body's physiological response to an applied stressor. While this study did not support a protective relationship between resilience and the physiological response to the MIST, this study provides evidence that unemployed men with greater mental flexibility had higher levels of resilience, and that perceived stress and financial strain were significantly correlated with impaired mental flexibility. This chapter will discuss the stress associated with unemployment and the resilience of unemployed men. Next the findings regarding the impact of cognitive/mental flexibility on the capacity for resilience and how resilience related to the physiological response to an applied laboratory stressor will be discussed. Implications for nursing practice will be presented. The strengths and limitations of the study and suggestions regarding future research will be presented.

#### **Unemployment and Stress**

A major premise of this study is that unemployment can result in financial strain, social isolation and negatively impact one's sense of personal identity, placing one at risk for a "pile-up" of stressors. During the time this research was conducted unemployment was at the highest rate seen in over two decades and was almost a daily topic on the evening news. The majority of subjects in this

study reported that unemployment increased their stress, but unemployment aspects such as length of unemployment, prior history of unemployment and receipt of unemployment benefits were not found to be correlated with stress levels. It is not clear why unemployment aspects were not related to stress. The fact that prior experience with unemployment did not relate to current levels of resilience seems to run counter to the potential “steeling effect” that Rutter (2006) identified as the strengthened resistance to stress conveyed from prior experience with that stress or adversity. What was correlated with reported stress was perceived financial burden. Subjects who identified that their monthly income was not sufficient to meet their monthly expenses demonstrated significantly higher levels of perceived stress. Receiving unemployment benefits being married and having an employed spouse decreased the financial burden of unemployment and made it more likely that subjects reported they had a monthly income that enabled them to meet their monthly expenses. Yet, the majority of subjects reported that they did not receive unemployment benefits and did not have sufficient income to meet their monthly expenses. State unemployment programs provide up to 26 weeks of unemployment benefits based on an individual’s earnings when they were employed. According to the United States Department of Labor, federally funded Emergency Unemployment Compensation (EUC) programs were started in July of 2008 to assist those who had exhausted state unemployment benefits and an Extended Benefits program began in January 2009 to assist those who had exhausted EUC benefits ([www.ows.doleta.gov/unemploy](http://www.ows.doleta.gov/unemploy)). The majority of subjects reported that they had

been unemployed one year or less, which correlates with the almost 60% jump in the unemployment rate seen in Michigan the year prior to the start of this research study. It is not clear why so few subjects were receiving unemployment benefits. Not everyone is eligible to receive unemployment benefits. An individual can be disqualified from receiving unemployment benefits for quitting their job voluntarily without good cause attributable to the employer, voluntary retirement, and being fired for misconduct connected to work, intoxication while at work, absence related to conviction and imprisonment, assault and battery connected with work, theft or willful destruction of property connected with work, illegal use of or possession of drugs on the employer's premises, refusing to submit to a drug test or testing positive for illegal drugs on a drug test or involvement in a labor dispute. Once receiving unemployment benefits, benefits can be terminated for failure to report for a job interview, failure to apply for suitable work, failure to accept an offer of suitable work or failure to notify a temporary help firm within seven days that a work assignment has ended (State of Michigan Department of Energy, Labor & Economic Growth Unemployment Insurance Agency, 2009). It is also possible that unemployment benefits may not have been applied for if someone was currently receiving income via a severance package from their last job. Unemployment was self-reported and proof of employment history was not required beyond a verbal description. It is possible that subjects were unemployed longer than they had reported. Regardless of the reasons for not receiving unemployment benefits, lack of unemployment benefits placed one at risk for financial strain. Financial strain



itself was not directly correlated with resilience but it was moderately correlated with increased stress and increased stress was strongly correlated with decreased levels of resilience. Money is critical to basic survival and necessary to procure adequate food, shelter and healthcare. The perceived stress and financial strain experienced by unemployed men in this study clearly impacted their capacity for resilience.

### **Resilience**

Unemployed men, in this study, demonstrated significantly lower resilience scores than the published norms for a general population (Connor & Davidson, 2003). The mean resilience for those categorized as low or moderate fell below published norms, while the mean resilience for those identified as high resilience, was higher than published norms. Unemployed men who had high levels of resilience were better educated and had more social support. Education and social support are known protective factors that mitigate risk factors and facilitate resilience. High resilient unemployed men reported less perceived stress and financial strain. Whether unemployed men with high resilience actually experienced less stress and/or financial strain or whether the capacity for resilience influenced their perception of stress/financial strain and their ability to respond is unclear. While the capacity for resilience was limited for many, those with high resilience did evidence greater cognitive flexibility, supporting cognitive flexibility as a potential pathway to resilience

## **Resilience and Cognitive Flexibility**

An unexpected finding of this research was the difficulty many unemployed men demonstrated with cognitive flexibility performance, with one-quarter of the men with results at the level of neurological impairment. The exact cause of this impaired cognitive flexibility is not clear. While it is feasible to accept that there are inflexible people in the world, this large a number of men with clinically significant difficulties in cognitive flexibility were unexpected. It is possible that with unemployment and the resulting increased demands these men may have had to attend to, such as financial matters and job searching, that attention fatigue could have contributed to their decreased mental flexibility. Another possible explanation may be the high level of perceived stress reported by subjects. Subjects reported that unemployment had significantly changed their stress level, with the majority reporting an increase in their stress since becoming unemployed. This impact of perceived stress on cognitive flexibility coincides with Kanagartnam and Asbjornsen (2007), findings of impairment in mental flexibility in subjects with a history of Post Traumatic Stress Disorder (PTSD). Unemployed men in this study were not screened for symptoms of PTSD and the researcher detected no obvious signs of PTSD, but it is possible that the increased level of stress experienced by some of these unemployed men impaired their cognitive flexibility and decreased their capacity for resilience.

The stress response begins with the brain, as the brain is responsible for how we interpret events and determines how we respond but at the same time chronic stress has known damaging effects on the brain causing neuron loss in

both the hippocampus and prefrontal cortex potentially impairing both the physiological stress response and associated behavioral responses and cognitive functioning. The changes in neural plasticity that occur in response to chronic stress play a critical role in shutting off the stress response, but also impair working memory and cognitive/mental flexibility. This study found that cognitive flexibility, as measured by the Short Category Test (SCT) was significantly related to the capacity for resilience. Subjects with higher levels of resilience were able to process the feedback given by the researcher regarding their answers to the SCT, re-frame the way they saw an object on following cards and arrive at the correct understanding of the response pattern for a given booklet sooner, with less overall errors. It makes sense that cognitive flexibility is related to resilience and some researchers have suggested a link between cognitive flexibility and resilience (Haglund et al., 2007; Masten, 2007), but limited empirical evidence has been reported regarding the associations between resilience and cognitive flexibility. There are several means through which the capacity for cognitive flexibility may influence resilience. Cognitive flexibility and the ability to switch gears when confronted with the unexpected may be helpful in both primary and secondary appraisal. When faced with a potentially stressful situation resilient individuals who demonstrate greater cognitive flexibility may reframe the way they approach a problem or see multiple ways to respond and may not perceive something as stress or as stressful as the individual with less cognitive flexibility. When responding to a perceived threat, greater cognitive flexibility may facilitate the ability to switch to one or more alternative solutions if

an initial response is not effective. The findings of this study concur with the reported association between cognitive flexibility and resilience in children exposed to political violence found by Qouta et al. (2001) and the findings by Obradovic (2010) that “effortful control” contributed to the resilience and adaptive coping of homeless children.

Surprisingly, no significant relationship was found between resilience and the Shipley abstract thinking and IQ measure. It is unclear, based on the evidence in support of the link between cognitive flexibility and resilience, why the abstract thinking portion of the Shipley Institute of Living scale was not related to resilience. One possible explanation is that the Shipley Institute of Living Scale is a paper and pencil test, during which the individual is not provided any information regarding their performance, and may not be an adequate measure of the capacity for cognitive switching. Shipley IQ scores were correlated with the Short Category Raw Error Scores, with higher IQ scores seen in those who experienced fewer errors on the Short Category Test. These results concur with Colzato, et al. (2006) finding that higher levels of intelligence were associated with greater cognitive flexibility. The relationship between intelligence and resilience is mixed. Academic performance, which is influenced by intelligence, is often used a measure of resilience, particularly in studies of children. Tiet et al. (2010) used academic achievement along with measures of self-esteem, psychosocial functioning, gang involvement, delinquency, and drug use to classify resilience in their study of predictor of resilience among inner city youth. But Collishaw et al. (2007) did not find a link between intelligence and resilience

to adult psychopathology following childhood abuse and Bonanno et al. (2007) found that those with higher levels of education demonstrated less resilience to the September 11<sup>th</sup> terrorist attack in New York City.

### **Resilience and Cortisol Reactivity**

In response to an acute stressor one would expect to see a significant rise in salivary cortisol followed by a return to baseline levels after termination of the stressor event. In response to short-term laboratory psychological stress tasks, healthy adult males demonstrate a significantly larger increase in salivary cortisol compared to females. Following a laboratory stressor, increases in mean salivary cortisol range from 200 - 400% from baseline in men, compared to 50 – 150% in women (Kudielka et al., 2009). The overall lack of response to the Montreal Imaging Stress Task was unexpected and severely hindered the ability to adequately assess the impact resilience may have on HPA axis response in this sample. No significant relationship between resilience and HPA axis response, blood pressure or pulse rate was detected. The perceived stress experience by unemployed men clearly impacted their capacity for mental flexibility and thus resilience, but any potential physiological impact was not supported. Mean baseline cortisol levels, while higher than expected for the time of day, most likely reflected a white-coat phenomenon, as cortisol level fell steadily throughout study participation and did not differ significantly among resilient categories. These findings differed from the recent study by Mikolajczak et al. (2008) who found high resilient subjects had less salivary cortisol response overall but no significant response difference to an acute stressor (TSST) in

regards to increased salivary cortisol production (baseline to peak) or recovery. Simeon et al. (2007) also reported that resilience was weakly correlated with urinary cortisol and was not related to plasma cortisol, a dexamethasone suppression test, or plasma cortisol reactivity to an acute stressor (TSST). Inclusion of an employed match control group may have facilitated the ability to differentiate whether the elevated baseline cortisol levels detected reflected a potential white-coat phenomenon versus a response to chronic stress exposure.

Traditionally the Trier Social Stress Test (TSST) has been advocated as an effective means of eliciting an acute stress response and subsequent activation of the HPA axis. The effectiveness of the TSST to elicit an HPA axis stress response in empirical research is well documented (Mikolajczak et al., 2008; Uhart, Chong, Oswald, Lin, & Wand, 2006; Gaab, Rohleder, Nater, & Ehlert, 2005; Roelofs, Elzinga, & Rotteveel, 2005; Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004). Unfortunately the recommended procedure for the TSST requires a controlled laboratory setting, video equipment and additional personnel and was not feasible for this research project.

The MIST is a relatively new tool developed to elicit an acute stress response (Dedovic et al., 2005; Dagher et al., 2009; Dedovic et al., 2009). The researcher did travel to Montreal for training on how to administer the MIST; a few procedural adjustments were made, after discussion with the developers of the MIST, to allow for the use of this tool. A team approach is also recommended with the use of the MIST. One person is responsible for the majority of study activities such as determining eligibility for participation, scheduling

appointments, obtaining informed consent and administration of any instruments/data collection. The second person's only responsibility is to administer the MIST. This allows the person who is administering the MIST to be quite stern with the subject when giving negative feedback regarding their performance and need to improve. To control for the lack of a team approach, a protocol was developed and adhered to, to limit social interactions with subjects. The researcher wore a lab coat and glasses and presented a down to business, neutral approach with subjects, limited time spent in the room with subjects and kept discussions limited only to study related activities. Even with adherence to the study protocol it is unlikely that the researcher was as effective in reprimanding the subjects' performance, as a team approach would have enabled. This may have negatively impacted the subject's perceived social evaluative threat, identified as a key component of the MIST, potentially reducing the effectiveness of the MIST to elicit an acute stress response. Most of the empirical research utilizing the MIST has involved a younger, often student, population. It is possible that the age of this sample, most of which were years out from having to perform on a math test, coupled with the high level of stress these unemployed men reported, facilitated these unemployed men to chose to proverbially "not sweat the small stuff" interfering with the ability of the MIST to elicit an acute stress response. Participants were not asked to rate how stressful they found the MIST but many did verbalize that they found the MIST difficult or impossible to do under the time constraint given. While about 20% of subjects did demonstrate an acute stress response, it remains unclear why the MIST did

not elicit a stress response in the majority of these unemployed men. It is possible that the lack of response to the MIST may reflect an insufficient dose of the stressor but it may also be related to the chronic stress these unemployed men experienced.

Many studies that investigate HPA axis response are conducted with healthy subjects, under normal conditions. Kudielka et al. (2009) identified that altered HPA axis response to an acute stress, both hyper- and hyporesponsivity, have been reported in individuals who are chronically stressed or exhausted. One possible explanation for this altered HPA axis response is allostatic load. McEwen identified one type of allostatic load as the failure to mount an adequate response and an underproduction of stress hormones. A study Bellingrath, Weigl & Kudielka (2008) found that teachers with higher levels of chronic stress, burnout and vital exhaustion responded to a dexamethasone suppression test (DST) with heightened cortisol suppression indicating an altered HPA axis negative feedback sensitivity.

Overall most subjects in this study did not demonstrate the expected cortisol reactivity to the MIST and post-hoc analysis demonstrated no significant difference in mean cortisol results for subjects who reported no change or less stress compared to subjects who reported higher levels of stress so it is unlikely that chronic stress/burn out is helpful in explaining the study results.

### **Strengths**

This is the first study to report low levels of mental flexibility and decreased resilience in unemployed men. Study results support the validity of the Connor-



Davidson Resilience Scale to measure resilience in this population. While resilience has been shown to be a common response to stressful situations (Bonanno et al, 2007; Norris et al., 2009; Quale & Schanke, 2010) and is associated with successful adaptation/functioning (Cavin et al., 2009; Tiet et al., 2010; White et al, 2010; Yi et al., 2008; Yi-Frazier et al., 2010), sometimes stressful experiences can overwhelm an individuals' capacity for resilience (Sexton et al., 2010). This study documents the high-perceived stress and the decreased capacity for resilience in unemployed men. Cognitive flexibility has been shown to be correlated with resilience (Obradovic, 2010; Quota et al., 2001). This study confirms a link between cognitive flexibility and resilience in unemployed men. Unemployed men with high resilience demonstrated a greater capacity for cognitive flexibility.

Limited empirical evidence is available to explain the stress reactivity in those experiencing chronic stress or burn out. It is not clear whether the cortisol reactivity seen in this study is a result of an altered HPA axis response to an acute stressor in a chronically stressed population versus an unexpected lack of response to the MIST to illicit an acute stress response. A study design that included a matched control group may have been helpful in distinguishing the effectiveness of the MIST with the population. These study results indicate that further empirical research is needed to explore the effectiveness of the MIST to elicit an acute stress response across differing population and to clarify the altered HPA axis response in chronically stressed populations.

## Limitations

Few studies have investigated the impact resilience has on cortisol response or the impact mental flexibility may have on resilience, so it is difficult to specify the magnitude of the phenomenon. A larger sample size may improve the ability to detect a difference in mental flexibility and HPA axis response in low, moderate and high resilient populations.

Participation in this study was voluntary, and those unemployed men who chose not to participate may have had significant differences in resilience, stress, mental flexibility and HPA axis response. Unemployment and employment history was self reported and no documentation was required to verify that subjects met eligibility requirements. The large number of subjects in this study (68%) who reported they did not receive unemployment benefits may call into question the accuracy of unemployment/employment history provided. Eligibility criteria regarding unemployment/employment history were developed to capture unemployment as a source of chronic stress ( $\geq 3$  months) while avoiding unemployment as normal state ( $\leq 18$  months). Requiring documentation of unemployment/employment history may improve the ability to understand the impact of employment/unemployment aspects on perceived stress and resilience. While the majority of subjects reported that unemployment increased their stress, it is also possible that the time frame of unemployment investigated (3 -18 months after job loss) was not adequate in capturing unemployment as a source of chronic stress or allowed for too much variability between subjects. This time frame may have allowed some to become acclimated to their situation.

Restricting the time frame (1 – 3 months after job loss) or at the time when unemployment benefits have been exhausted may be more effective in capturing unemployment as a source of chronic stress.

This study utilized the Montreal Imaging Stress Task (MIST) to elicit an acute stress response. This is a relatively new tool and has limited empirical support. The lack of a research team approach may have negatively impacted the subject's perceived social evaluative threat, identified as a key component of the MIST, potentially reducing the effectiveness of the MIST to elicit an acute stress response. This makes it difficult to tease out whether the lack of HPA axis response in this study was due to chronic stress/burn out or the inadequacy of how the MIST was administered to elicit an acute stress response.

This study utilized a descriptive correlational, repeated measures design. An experimental design, which included a control group, may have provided greater insight into the effectiveness of the MIST to elicit an acute stress response and differences in HPA axis response. Future research including multiple measures of cortisol such as serum, urine and salivary may be more effective in detecting differences between resilient groups

This study utilized the Shipley Institute of Living and the Short Category Test to measure mental flexibility. The Shipley was not found to be related to resilience. There is some concern that including both the SCT raw error score and t-score may increase the risk of multicollinearity due to the strong correlation between these two predictors. This may have made it difficult to accurately determine the importance of mental flexibility (as measured by the SCT) to

resilience. Future research including other measures of mental flexibility such as the Wisconsin Card Sort, the Stroop Color-Word Test and the Tower of London should improve the ability to explain the relationship between the differing aspects of mental flexibility, such as intentionality, inhibition, and executive memory, and resilience.

### **Nursing Practice**

Nurses care for people experiencing many forms of adversity; a major goal of health restoration and promotion is to foster resilience. The majority of empirical evidence for resilience supports the beneficial effect of resilience to mental health, but there are few studies that investigate the effect resilience has on physiological health. If the capacity for resilience does not convey any protection to physiological health then resilient individuals under stress may be coping well psychologically but may still be at risk for the negative effect of stress on physiological health, or allostatic load. A clearer understanding of the relationship between resilience and physiological health is needed so that nurses are better able to meet the health needs of those facing adversity. This study documents the high level of perceived stress in unemployed men and a low capacity for resilience. A major goal for clinical practice should be the identification of those at risk for chronic stress and the development of allostatic load.

Actions focused on ways to improve cognitive flexibility may lead to improved resilience in unemployed men. Stress reduction may be one means of improving cognitive flexibility in unemployed men. Reviewing current life stressors and

coping strategies may alert nurses to those at risk. Awareness of state and local assistance programs (such as Michigan Works, Michigan State Emergency Relief Programs, Michigan low-income home energy assistance programs, food stamps, local food banks and free health clinics) and referring those at risk may help reduce stress. Focusing on established ways to improve cognitive flexibility, such as aerobic exercise, mindfulness based cognitive therapy, flexible-thinking exercises, and meditative practices may also improve resilience in unemployed men. Financial strain may present as a barrier to exercise if one has lost a gym membership. Encouraging walking, either outdoors or at the mall, for 30 minutes to 1 hour daily is an inexpensive effective means of aerobic exercise. Not all nurses may be aware of mindfulness based cognitive therapy or meditative practices. Awareness of local holistic resources and providing information on meditation or local meditation resources may improve resilience. While this study provides evidence of a link between cognitive flexibility and resilience more research is needed that investigates ways to build cognitive flexibility and resilience in the presence of chronic stress and how the capacity for resilience may impact allostasis and the development of allostatic load.

Interventions to foster resilience to stress and decrease allostatic load often include simple and obvious actions that assist at risk individuals to change unhealthy behaviors or lifestyles (such as encouraging clients to avoid smoking, decrease alcohol consumption and engage in moderate physical activity), improve the quality and ensure adequate amounts of sleep, maintain a healthy diet, develop and maintain good social support and self esteem. If indicators of

allostatic load are present, such as elevated cholesterol, high blood pressure, pharmacological agents may be needed. Known pathways to resilience include positive emotion and mental flexibility. Encouraging a positive outlook on life and assisting clients to re-frame the way they view and respond to stressful situations may foster resilience. There is a lack of empirical literature regarding effective actions/ programs to build resilience. The READY program (REsilience and Activity for every Day) developed by Burton, Paken, & Brown, (2010) targets five protective factors associated with resilience including positive emotion, cognitive flexibility, social support, life meaning and active coping assists individuals to build resilience. Completion of this 13-week program was shown to improve measures of mastery, positive emotion, personal growth, mindfulness, acceptance, stress reduction, self-acceptance, valued living, autonomy and total cholesterol.

### **Future Research**

This study provides evidence of increased perceived stress, low resilience, impaired mental flexibility and a lack of cortisol reactivity to an acute laboratory stressor in unemployed men. The cause of this lack of cortisol reactivity is unclear. Additional research utilizing the Montreal Imaging Stress Task, with differing population groups, will provide support for the validity of this program to elicit a stress response. Previous research on cortisol reactivity in individuals with high levels of chronic stress is inconsistent. Additional research investigating cortisol reactivity to an acute stressor in chronically stressed subjects is needed to help clarify stress reactivity in this population. Do

individuals under chronic stressor show a hyporesponsivity to an acute stressor indicating evidence of allostatic load?

### **Conclusions**

In summary, this study provides evidence for the lack of HPA axis response to an acute laboratory stressor (MIST) in unemployed men. The hypothesized moderating effect of resilience on HPA axis response to an acute stressor was not supported. In general subjects with lower measures of resilience did present with higher mean baseline measures of salivary cortisol but there was an overall lack of HPA axis response to the MIST present in most subjects, regardless of level of resilience. The hypothesized relationship between mental flexibility and resilience was supported. Individuals with greater cognitive mental flexibility, as measured by the Short Category Test, did demonstrate higher level of resilience.

## **APPENDICES**



**APPENDIX A**  
**INFORMED CONSENT**  
**AGREEMENT TO BE IN A RESEARCH STUDY**

Resilience and Cortisol Response to the Montreal Imaging Stress Task

**INTRODUCTION**

You are being asked to volunteer for a research study. You must read and sign this form before you agree to take part in this study. This form will give you more information about this study. Please ask as many questions as you need to before you decide if you want to be in the study. You should not sign this form if you have any questions that have not been answered.

***PURPOSE OF THE STUDY***

This study is being done to investigate the stressors experienced by unemployed men and their capacity for resilience. Resilience is the capacity for successful adaptation despite challenging or threatening circumstances. This study will examine how the capacity for resilience impacts the physiological response to a mental challenge.

**HOW LONG THE STUDY WILL LAST**

Your participation in this study will take approximately 2 to 2 and 1/2 hours.

***WHAT WILL HAPPEN DURING THE STUDY***

During participation in the study you will take a challenge test on a computer. This computerized challenge test involves answering math questions and will consist of two, nine-minute test runs with a two-minute rest period between the two test runs. Measurements of salivary cortisol, blood pressure and pulse rate will be taken before the computerized challenge test, during the test and after the test to monitor your body's response the computerized challenge test. Cortisol is a hormone in the body that increases during stressful situations. In this study cortisol will be measured in your saliva. You will be asked to spit into a large tube to collect your saliva. Blood pressure and pulse will be measured through a monitor placed on your wrist. The first measurement of the salivary cortisol,

blood pressure and pulse rate will be taken after you have read and signed the informed consent form. After this first measurement is taken you will provide answers to questionnaires that provide information on perceived stress, resilience and how you process information. Upon completion of these questionnaires another measurement of salivary cortisol, blood pressure and pulse rate will be taken and the computerized challenge test will be given. Measurement of salivary cortisol, blood pressure and pulse rate will be taken between the two runs of the computerized challenge test and at the completion of the test. Following the computerized challenge you will provide answers to several questionnaires that provide information on demographic data, social support, and perceived stress. While you are completing these questions, to monitor how your body recovers from the computerized challenge test additional measurements of salivary cortisol, blood pressure and pulse rate will be taken 15 minutes and 30 minutes after the computerized challenge test is completed. If you complete the questionnaires before the last scheduled measurement of salivary cortisol, blood pressure and pulse rate, you will be provided with magazines to read until the last scheduled measurement is taken.

## **1.2. POSSIBLE RISKS OF PARTICIPATION**

*Participation in this study poses minimal risks to you. All tests and measures are noninvasive.*

## **POSSIBLE BENEFITS OF THE STUDY**

There is a lack of clear understanding regarding how the capacity for resilience impacts the physiological response to a mental challenge. Although you may not receive direct benefit from your participation, others may ultimately benefit from the knowledge obtained in this study.

## **PAYMENT FOR BEING IN THE STUDY**

You will receive a \$40.00 gift card for being in the study. You will receive this gift card only if you complete the entire study.

## **CONFIDENTIALITY OF RECORDS/DATA**

You will not be identified in any reports on this study. Records will be kept confidential to the extent provided by federal, state, and local law. However the Institutional Review Board or university officials responsible for monitoring this study may inspect these records.

**CONTACT INFORMATION**

Principle Investigator Elizabeth L. Phillips RN, MSN  
Doctoral Student University of Michigan  
Phone number (269) 343-1705

Faculty Advisor Dr Barbara Therrien  
Associate Professor  
Phone number (734) 647-0179

**IRB CONTACT INFORMATION**

Should you have any questions regarding your rights as a research participant please contact the Institutional Review Board, 540 E. Liberty Street, Suite 202, Ann Arbor, MI 48104-2210, (734) 936-0933, email: [irbhsbs@umich.edu](mailto:irbhsbs@umich.edu).

**VOLUNTARY NATURE OF PARTICIPATION**

Your participation in this project is voluntary. Even after you sign the informed consent, you may decide to leave the study at any time.

**DOCUMENTATION OF CONSENT**

One copy of this document will be kept together with the research records of this study. Also, you will be given a copy to keep.

**CONSENT OF THE SUBJECT**

I have read the information given above. Elizabeth Phillips has offered to answer any questions I may have concerning the study. I hereby consent to participate in the study.

ADULT SUBJECT OF RESEARCH

\_\_\_\_\_  
**Printed Name** **Consenting signature**

DATE: \_\_\_\_\_

## APPENDIX B

### Connor-Davidson Resilience Scale

Dear Elizabeth:

Pursuant to your request, for a copy of the CD-RISC (scale) developed by Drs. Connor and Davidson, we are attaching the Use Agreement, which specifies the terms under which you may use the scale, and the User's Profile. Please note that

- 1) permission cannot be given to use the scale on the Internet or in any other electronic form--permission is granted for use as a hard (print) copy only; and
- 2) permission cannot be given to reproduce the scale in publications resulting from research with the scale or in dissertations.

If you agree to the terms set out in the Agreement, please sign it, fill out the Profile, and return both documents, in their entirety (both pages of the Agreement), to me at [david011@mc.duke.edu](mailto:david011@mc.duke.edu). Upon receipt of the documents, we will e-mail a copy of the CD-RISC to you. We attempt to handle responses to CD-RISC e-mails within a week to ten days. If you do not receive a prompt response, please feel free to follow up.

We have several approved translations of the scale. If you need a translation, please let us know. If we do not have it, we will send requirements for translating.

If you have any questions, I can be reached at the phone number below. Thank you.

Best wishes,  
Jonathan Davidson

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## APPENDIX C

### Perceived Stress Scale -10 Item

Instructions: the questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

1. In the last month, how often have you been upset because of something that happened unexpectedly?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

2. In the last month, how often have you felt that you were unable to control the important things in your life?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

3. In the last month, how often have you felt nervous and “stressed”?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

4. In the last month, how often have you felt confident about your ability to handle your personal problems?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

5. In the last month, how often have you felt things were going your way?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

6. In the last month, how often have you found that you could not cope with all the things that you had to do?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

7. In the last month, how often have you been able to control irritations in your life?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

8. In the last month, how often have you felt that you were on top of things?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

9. In the last month, how often have you been angered because of things that were outside your control?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

\_\_\_0=never \_\_\_1=almost never \_\_\_2=sometimes \_\_\_3=fairly often \_\_\_4=very often

## APPENDIX D

### Multidimensional Scale of Perceived Social Support

Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

Circle the "1" if you **Very Strongly Disagree**

Circle the "2" if you **Strongly Disagree**

Circle the "3" if you **Mildly Disagree**

Circle the "4" if you are **Neutral**

Circle the "5" if you **Mildly Agree**

Circle the "6" if you **Strongly Agree**

Circle the "7" if you **Very Strongly Agree**

- |                                                                         |   |   |   |   |   |   |   |
|-------------------------------------------------------------------------|---|---|---|---|---|---|---|
| 1. There is a special person who is around when I am in need.           | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. There is a special person with whom I can share my joys and sorrows. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. My family really tries to help me.                                   | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. I get the emotional help and support I need from my family.          | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. I have a special person who is a real source of comfort to me.       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. My friends really try to help me.                                    | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. I can count on my friends when things go wrong.                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. I can talk about my problems with my family.                         | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

9. I have friends with whom I can share my joys and sorrows. 1 2 3 4 5 6 7
10. There is a special person in my life who cares about my feelings. 1 2 3 4 5 6 7
11. My family is willing to help me make decisions. 1 2 3 4 5 6 7
12. I can talk about my problems with my friends. 1 2 3 4 5 6 7



## APPENDIX E

### Demographic Data

1. What is your current age? \_\_\_\_\_.
  
2. What is your highest level of education?
  - Less than high school diploma
  - High school graduate, no college
  - Less than a bachelor's degree
  - College graduate
  
3. In what type of employment were you last employed?
  - Food services
  - Construction
  - Manufacturing
  - Sales
  - Teaching
  - Clerical
  - Computer Services
  - Health Services
  - Transportation
  - Management
  - Professional
  - Other                      Please Specify \_\_\_\_\_
  
4. Prior to becoming unemployed, how long had you been employed full-time?
  - 1year
  - 2-5 years
  - 5-7years
  - 7-10years
  - Greater than 10 years
  
5. How long have you been unemployed?
  - 3 months
  - 3 - 6 months
  - 6 - 9 months
  - 9 months – 12 months
  - 12 months – 15 months
  - 15 months – 18 months

6. Are you currently receiving unemployment benefits?
- Yes
  - No
7. Have you been unemployed prior to this episode?
- Yes
  - No
8. Are you married?
- Yes
  - No (If not married skip to question #11)
9. How long have you been married? \_\_\_\_\_.
10. Is your wife currently employed?
- Yes
  - No
11. Do you have enough money coming in each month, through either unemployment benefits, or if you are married, your wife's income, to meet your monthly expenses?
- Yes
  - No
12. Do you have children?
- Yes
  - No (If no children skip to question #14)
13. How many children do you have and what are their ages?
- One → Age \_\_\_\_\_.
  - Two → Ages \_\_\_\_\_.
  - Three → Ages \_\_\_\_\_.
  - Four → Ages \_\_\_\_\_.
  - More than four → Ages \_\_\_\_\_.

14. Prior to becoming unemployed what was your family annual income?

- Less than \$20,000/year
- \$20,000 --- \$24,999/year
- \$25,000 --- \$29,999/year
- \$30,000 --- \$34,999/year
- \$35,000 --- \$39,999/year
- \$40,000 --- \$44,999/year
- \$45,000 --- \$49,999/year
- \$50,000 --- \$54,999/year
- \$55,000 --- \$59,999/year
- \$60,000 --- \$64,999/year
- \$65,000 --- \$69,999/year
- \$70,000 --- \$75,000/year
- Greater than \$75,000/year

15. What is your family's current annual income?

- Less than \$20,000/year
- \$20,000 --- \$24,999/year
- \$25,000 --- \$29,999/year
- \$30,000 --- \$34,999/year
- \$35,000 --- \$39,999/year
- \$40,000 --- \$44,999/year
- \$45,000 --- \$49,999/year
- \$50,000 --- \$54,999/year
- \$55,000 --- \$59,999/year
- \$60,000 --- \$64,999/year
- \$65,000 --- \$69,999/year
- \$70,000 --- \$75,000/year
- Greater than \$75,000/year

16. Since you became unemployed do you feel the level of stress in your life has changed?

- I have significantly less stress since becoming unemployed
- I have slightly less stress since becoming unemployed
- My stress level has not changed since becoming unemployed
- I have slightly more stress since becoming unemployed
- I have significantly more stress since becoming unemployed

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