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A handwritten signature in black ink, appearing to read 'A. Hagemaster', with a long horizontal flourish extending to the right.

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03/29/2010

The Impact of Spirituality on Cardiovascular Reactivity Among African Americans

Andrew L. Hagemaster

Dissertation proposal submitted to the faculty of the
Department of Medical and Clinical Psychology
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Abstract

In 2005, almost 71 million Americans had at least one form of cardiovascular disease. CVD can be caused by a group of metabolic risk factors including hypertension, abdominal obesity, diabetes, and dyslipidemia. African Americans share a disproportionate amount of stress-related disorders, including stress specifically related to racial and ethnic differences. Stress from racism or discrimination is pervasive and chronic. Racial discrimination may account for health disparities in cardiovascular disease (CVD). This study seeks to examine the role of religiousness / spirituality (R/S) as a buffer to stress. The current exploratory study examined the effects of religiousness and spirituality on stress reactivity following an acute racial stressor among African American men and women. In particular, this study examined whether religiousness/spirituality serves as a buffer to stress in an allostatic model where body mass index categories are compared for changes in stress reactivity. Stress was measured by systolic blood pressure, diastolic blood pressure and salivary cortisol. Results partially supported the study hypotheses. Stress reactivity was generally the lowest for normal weight participants and highest for participants who were obese. In addition, the effect of religiousness and spirituality on stress varied by allostatic load, as indicated by BMI in the current study. There was no support found for overall religiousness or overall spirituality providing a buffer effect for diastolic or cortisol stress reactivity. This study is important because it provides additional details about the relationship between spirituality and health outcomes. This study also provides evidence that allostatic load from overweight or obesity increases stress and decreases the body's effectiveness of responding additional stressors. This research project has added to the body of knowledge regarding convergent and divergent validity of R/S, as measured by the Brief Multidimensional Measure of Religiousness and Spirituality (BMMRS), with several other measures of resilience, hope, well-being, social support, depression, and state anxiety.

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Introduction

The body responds to stress by mobilizing resources to mitigate the effects of stress through regulating blood pressure and cortisol. It occurs naturally in a physiological system designed to maintain balance, yet not all stress is the same. The biological stress reactivity may be different in African Americans than Caucasians, even to the same stress exposure (Arthur, Katkin, & Mezzacappa, 2004; Menon, Arora, Hobel, & Fortunato, 2008; Wilcox, Bopp, Wilson, Fulk, & Hand, 2005). Stress reactivity is important because it may contribute to cardiovascular disease along with many other factors including (hypertension, obesity, and health care behavior).

African Americans share a disproportionate amount of stress-related disorders (CDC, 2008b; DHHS, 2000), including stress specifically related to racial and ethnic differences (Brondolo, Brady, Pencille, Beatty, & Contrada, 2009). Stress from racism or discrimination is pervasive and chronic (Brondolo, Gallo, & Myers, 2008). Racial discrimination may account for health disparities in cardiovascular disease (CVD) (Brondolo, Libby et al., 2008).

Brondolo and colleagues have identified three psychosocial coping methods used by African Americans to buffer the effects of stress including racial identity development, seeking social support, and anger expression or suppression (Brondolo et al., 2009). These psychosocial responses may serve as buffers to protect against stress effects. Individual differences are important in identifying buffers to reduce the effects of stress.

This study seeks to examine the role of religiousness / spirituality (R/S) as a buffer to stress. Religiousness and spirituality are multi-faceted variables related to both physiological and psychological health outcomes (H. G. Koenig, 2001b, 2001c, 2001d; Park, Meyers, & Czar,

1998; Zinnbauer & Pargament, 2005). The church is a central part of African American culture (Brondolo et al., 2009; Chatters, Taylor, Lincoln, & Schroepfer, 2002). The church may provide a culturally accepted venue to help African Americans buffer stress by teaching racial identity development through sermons, youth and adult education programs. These programs may also identify and model accepted responses to stress through seeking social support from a higher power, elders, deacons, pastors, lay ministers, and fellow church members. The church may also foster racial identity development through outreach programs in the local community that help other African Americans in need by being part of something larger than any one individual. Through private and public religious and spiritual interactions African Americans may also learn and model tools to cope with anger and stress from race-related stressors. The church provides a safe place where African Americans can vent frustrations with race-related stressors and feel supported by others as they cope with acute, daily, and chronic stressors. In summary, religiousness and spirituality may serve as a buffer to stress reactivity by encouraging racial identity development, providing social support, and tools to cope with anger from race-related stressors.

General Risk factors for Cardiovascular Disease

In 2005, almost 71 million Americans had at least one form of cardiovascular disease (AIS, 2008). CVD includes diseases of the heart, arteries, and veins. CVD can be caused by a group of metabolic risk factors including hypertension, abdominal obesity, diabetes, and dyslipidemia. These risk factors are collectively referred to as metabolic syndrome (AHA, 2008). Prevalence for the risk factors in metabolic syndrome are higher in African Americans when compared to Caucasians (C. Harris, Ayala, Dai, & Croft, 2005; MMWR, 2005a). Metabolic

syndrome factors account for the first (heart disease), third (cerebrovascular disease), sixth (diabetes), and fourteenth (hypertension) leading cause of death in the United States (Hsiang-Ching, Hoyert, Jiaquin, & Murphy, 2008) and are presented in Table 1. African Americans also have a much higher mortality from CVD compared to Caucasians (Satcher, 2008; Wong, Shapiro, Boscardin, & Ettner, 2002). African Americans are over two and a half times more likely to die from hypertension, over two times as likely to die from diabetes, one and a half times from cerebrovascular diseases, and one and a third times from heart disease (Hsiang-Ching et al., 2008). Some of these specific health disparities account for the higher percentage of preventable deaths of African Americans in the United States. The following sections will discuss stress, hypertension, and obesity as three of the risk factors that contribute to metabolic syndrome.

Stress

Walter Cannon was the first to define the stress response in 1915 (Quick & Spielberger, 1994). Stress was defined as anything that causes an organism to lose homeostasis (Cannon, 1935). Hans Selye defined stress in 1936 as “non-specific response of the body to any demand for change” (AIS, 2008; Selye, 1936). Selye developed the concept of general adaptation syndrome, or G-A-S, to describe how the nervous system responds to stress. The first stage is an alarm reaction, followed by the second stage of resistance, and if the body does not adapt to the stress then the third phase of exhaustion results (Selye & Fortier, 1950). Selye’s work helped scientists understand the physiological process of how the body responds to stress in stages. The theory of homeostasis by Cannon provided a foundation for understanding stress and stress responses, but it did not address chronic stress or why some people responded to the same

stressor in different ways. Sterling and Eyer adapted Cannon's model of homeostasis and addressed cumulative stress in terms of allostasis.

Homeostasis as defined by Bernard (1865) seeks to maintain stability by holding constant the internal milieu. This internal milieu is conceptualized at the organ level and requires negative feedback to correct deviations from homeostasis. Sterling and Eyer discuss how organs that are studied in a dish respond well to homeostasis theories which posit the mind and body are separated, but results are less clear when considered as a whole person keeping their internal milieu in control. An example was provided by the authors regarding an individual student whose blood pressure was recorded over 24 hours, depending on the activity (sleeping, sex, getting ready for school) the blood pressure changed. "Clearly, to achieve stability an organism must occupy each one of these different states and move flexibly between them. At each behavioral transition the blood pressure must be reset to match the new state" (Sterling & Eyer, 1988, p. 633).

Homeostasis and allostasis both address demands to stress, one at an organ level and the other at a whole person level in context to their surroundings. Cannon's research included fight or flight responses to acute stressors of pain, fear, and rage. Selye's research included stressors of a longer duration and mild stressors of frustration. Racism can be experienced either acutely or over a long period of time.

Sterling and Eyer discuss that when an acute stressor is removed from, the blood pressure drops, but when the stressor is chronic and then removed the blood pressure may remain elevated with no drop in blood pressure. From a behavioral perspective, previously neutral stimuli can be paired with an aroused state and eventually reinforce arousal in the absence of the original

stressor. Through adaption chronic arousal can be made permanent, while there is still allostatic regulation, but at a higher setpoint. Evidence to support this comes from the various animal studies that show the stress level does not diminish after a chronic stressor is removed (Sterling & Eyer, 1988; Forsythe, 1969; Henry et al., 1967; Folkow and Rubinstein, 1966). It is possible that racism if experienced as a chronic stressor could lead to higher levels of blood pressure in African Americans regardless of the presence of an acute racial stressor.

There are many benefits of the allostatic model when compared to models of homeostasis. First, allostasis is a more complex form of regulation than homeostasis, because it operates at a brain/body level and not only through local feedback. Second, allostasis can match resources to particular situations. Homeostasis works through specific set-points to trigger an event. If the body worked this way, then one would have an average blood pressure set point. If this were the case, then a persons' blood pressure would be too low when exercising or too high when sleeping. Instead, Allostasis allows the body to match its needs through constant re-evaluation and adjustments of all parameters and set points. Third, allostasis anticipates demands ahead of time. In homeostasis, the trip point must be past before an adjustment. In Allostasis, the mind anticipates the demand. For example, when a person decides they are going to stand up from a seated position, the mind anticipates the change in blood pressure. If the mind did not anticipate the demand, when a person stood up suddenly, they would become dizzy then their body would increase blood pressure. Lastly, allostasis benefits from experience. This cannot happen in a homeostatic regulatory system that works solely through negative feedback at the organ level.

Allostasis can also help explain why spirituality may lead to decreased stress reactivity. In an allostatic model, arousal is described as a catabolic period that allows for physiological, behavioral, and emotional coping to a stressor. When coping has ameliorated the stressor, relaxation must occur. Relaxation is described as an anabolic period that is necessary to restore the body and blood pressure. So there is a balance between periods of arousal and periods of rest.

Sterling and Eyre discuss the religious observance of the Sabbath day as a cultural adaptation for anabolic activity. The Sabbath serves the purpose to reset the body from a week of stressors. "From this point of view one might consider the Sabbath as a cultural adaption to ensure regular periods of physiological, interpersonal, and spiritual anabolism. Its progressive corruption in modern society reflects the continued unrestricted expansion of arousing activities and the loss of a potentially important source of anabolic (restorative) time" (Sterling & Eyer, 1988, pp. 640-641). Allostasis helps support the hypothesis that spirituality and religiousness can serve as buffers to stress and stress reactivity. If there is a time of stress, there needs to be a time of relaxation. Most Judeo-Christian faiths promote the idea of a Sabbath day of rest. Through the religious observances anabolic processes can help balance catabolic periods of stress.

A homeostatic model defines health as a state in which all the physiological parameters have 'normal' values. A value outside of the normal range is said to be 'inappropriate,' and thus a candidate for 'treatment.' An allostatic model defines health as a state of responsiveness. Does the body have the ability to respond to appropriate demands throughout the day? A balance of catabolic and anabolic states is necessary. In Allostasis, any period of demand or arousal which increases catabolic hormones that break down the energy stores to meet the demand, should be followed by a period of rest that stimulates anabolic hormones to restore energy sources in the

body. If blood pressure remains high, then the person loses their ability to regulate effectively when higher demands are present or opportunities to relax are provided. Instead of providing pharmacotherapy to lower blood pressure as found in the homeostatic model, allostatic theory would seek to reduce arousal instead. In Allostasis, health is considered a proper balance between catabolism and anabolism. An allostatic therapy would encourage people to work and rest proportionally and seek to increase predictability, control, and feedback in order to reduce arousal. This therapy is different from a homeostatic therapy that targets a specific mechanism of blood pressure, by considering the whole person mind-body connection and reducing pressure through multiple psychological and social mechanisms instead.

McEwen and Stellar built on Sterling and Eyer's (1988) concept of allostasis or stability through change to describe allostatic loads. Allostasis was defined by McEwen and Stellar (1993) as the process of stabilizing the body through adaptive changes in the neural and neuroendocrine systems. Allostatic change is necessary when a person is seated and then stands up, a demand is created to modify blood pressure in response to the change. When these adaptive systems are over stimulated, or they become dysregulated, allostatic loads and overloads may result (McEwen, 1998). Allostatic load is defined by Stewart (2006) as a cumulative measure of the effects of multiple stressors and the processes of responding to the stressors on the soma (human body).

The body responds to stress through regulation of the Hypothalamus-Pituitary-Adrenal (HPA) axis. Where the hypothalamus perceives a threat or stressor releases two peptides: corticotropin releasing factor (CRF) and vasopressin. CRF alerts the pituitary to release adrenocorticotropin hormone (ACTH), in the circulatory system. ACTH acts on the adrenals,

located on top of the kidneys, and cortisol is secreted into the blood. Cortisol serves to alert the body and initiate the General Adaptation Syndrome (Selye, 1975) response to the stressor. If the stressor is mitigated, then cortisol provides feedback to the hypothalamus and the adrenals to reduce the production of CRF and ACTH. If the stressor is not reduced, then the body continues to produce CRF and ACTH until the stressor is mitigated or the organism is exhausted. If exhaustion occurs, then the body will decompensate which may result in the development of ulcers, CVD, along with mental illnesses including depression.

In summary, stress is one of the primary risks of CVD. Stress can be objectively measured through the HPA axis and sympathetic nervous system (Bjorntorp, 2001). The neuroendocrine system must respond to the changes in the allostatic load in order to achieve a neurohormonal balance. If the loads are not balanced the body and mind become exhausted and negative physical and psychological outcomes ensue. Chronic elevations in cortisol, regulated by the HPA axis, are related to CVD, diabetes, hypertension, and obesity (Bjorntorp, 2001; Kidambi et al., 2007; McEwen, 1998).

Hypertension

Hypertension is a risk factor in the development of CVD (Ishimitsu et al., 2008; O'Loughlin, Renaud, Paradis, & Meshefedjian, 1996). When the HPA axis becomes overstimulated or dysregulated there is an increased risk for developing hypertension. Heightened cardiovascular arousal has been associated with the development of hypertension in several studies (Bjorntorp, 2001; Julius, 1998; Kidambi et al., 2007; Manuck, Kasprowicz, & Muldoon, 1990). Hypertension is defined as having an average blood pressure greater than or equal to 140/90 mmHg or taking current antihypertensive pharmacotherapy (Perloff et al., 1993)

as shown in Table 2. In the United States, 29 percent of the adult population 20 years and older were hypertensive, according to NHANES 2004-2006 data (Cutler et al., 2008). African Americans had a much higher prevalence of hypertension (40 percent) compared to Caucasians (27 percent) (Cutler et al., 2008).

African Americans develop hypertension earlier, have higher average blood pressure, and have more severe hypertension than Caucasians (Cutler et al., 2008). Half of the cardiovascular mortality disparity between African Americans and Caucasians is directly attributable to hypertension (Wong et al., 2002). The health disparity of hypertension morbidity in African Americans accounts for over 8,000 deaths per year (Satcher, 2008). The disparity in the number of deaths related to hypertension in African Americans compared to Caucasians could be related to poorer blood pressure control (Fiscella & Holt, 2008). Several factors may contribute to poorer blood pressure control including access to care, physician management, patient adherence, and physiological differences as proposed by Satcher (2008).

In summary, hypertension is one of the risk factors for developing CVD. Hypertension increases the baseline of the resting heart rate and reduces the ability of the body to adapt to stress or change. Over time, high blood pressure can lead to decreased heart rate variability and decreased flexibility in the arteries, and increased risk for heart failure. Together stress and hypertension increase the likelihood of developing CVD (Lovallo et al., 1991).

Obesity

Obesity is a risk factor for CVD (C. Jung et al., 2008; Nguyen et al., 2008). Obesity is linked with many negative health outcomes, including hypertension, Type-2 diabetes, CVD, stroke, and certain types of cancer (WHO, 2005). Body Mass Index (BMI) and Waist to Hip

Ratio (WHR) have both been linked with left ventricular (LV) dysfunction, diastolic dysfunction, and mortality (Ammar et al., 2008). Obesity, in particular visceral adipose obesity, has been associated with increased risk for hypertension and CVD (Bjorntorp, 1991).

Obesity is most commonly assessed using the Body Mass Index (BMI). BMI relates body weight to body height by calculating the weight of a person in kilograms divided by the square of their height in meters (kg/m^2). In 1998, Overweight and obesity were defined as a BMI greater than or equal to $25 \text{ kg}/\text{m}^2$ and $30 \text{ kg}/\text{m}^2$ respectively. This has been based on empirical work that identified increased health risks associated with overweight and obesity. In 2005, the prevalence of overweight and obesity in the United States has leveled off. Over 26% ($\text{BMI} \geq 30.0 \text{ kg}/\text{m}^2$) of the population were *obese* and over 63% were either overweight ($\text{BMI} \geq 25.0 \text{ kg}/\text{m}^2$) or obese (CDC, 2007a). That is at least a quarter of the population in the United States were obese and almost two out of three people were at least overweight.

In addition to BMI, body fat percentage will also be calculated in this study. Both measures have strengths and weaknesses. Body fat percentage can be a more accurate measure than BMI because it is more specific in identifying body composition. While BMI is a broad, general measure of risk, body fat percentage is more specific to actual fat content thereby providing a more accurate description of body fat. Body fat percentage is a more refined measure than BMI, because it takes into account not only height and weight, but also bioelectric resistance (or skinfold thickness). Body fat percentage is more accurate because it adjusts for gender, allowing women to have a higher fat percentage due to reproductive functions and other differences between genders. BMI does not describe body composition, how much of weight is fat, and how much is muscle and tissue. So BMI does not distinguish fat from muscle.

However, there are strengths to using BMI instead of body fat percentage. BMI is easier and faster to measure because participants are not required to lie down and have wires connected to their hand and ankle to send an electrical impulse through their body. BMI is also used more often than body fat percentage because it can describe health risk for diseases including cardiovascular disease and diabetes. Fat percentage does not have enough research to identify the risk for disease. Researchers have developed initial body fat percentage risk equivalents based on correlations with body mass index scores (Gallagher et al., 2000). In this effort, Gallagher and colleagues evaluated over 1,600 people from diverse ethnic backgrounds (Asian, Caucasian, African American) and examined how body fat percentage was related to disease risk.

BMI may also be a more accurate measure compared to body fat percentage because body electrical impedance is not accurate after exercising or if a person is not properly hydrated. In this study it is unlikely that anyone has exercised before the study given the study takes place in the morning after a night of fasting. BMI can also be more accurate than body fat percentage in an obese sample, because calipers are not as accurate when large skin folds are present and or when there are differences in fat density. Body electrical impedance typically underestimates body fat percentage (Cox-Reijven & Soeters, 2000; Nichols et al., 2006).

Another issue with bioelectrical impedance is that fat free body density values have been validated using Caucasian samples. Race prediction equations are important in determining the composition of the fat free body mass and fat distribution for different ethnic groups (Heyward, 1996). There are some body fat percentage calculations that have been validated with African American samples (Lewy, Danadian, & Arslanian, 1999).

Body fat percentage calculated with bioelectrical impedance has an overall error rate of 13.81 percent for African Americans when compared to under-water displacement measurements (Kirkendall, Grogan, & Bowers, 1991). Body fat percentage when calculated by a skinfold caliper had only a 3.56 percent error rate for African Americans when compared to under-water weighing.

So body fat percentage measures may not be accurate for people who are obese, dehydrated, or who have recently exercised. Even with these limitations body fat percentage provides additional information regarding body composition that is not conveyed with a BMI score. In the current study, both body impedance and skinfold caliper are used to measure body fat percentage. Measurements by a skinfold caliper are only obtained when participants are physically unable to lie down on a mat due to being obese or physically disabled.

Since there are strengths and weaknesses of using either BMI or body fat percentage, both measures will be included in this study to provide a more comprehensive picture of obesity, body composition, and overall health risk.

Obesity is disproportionately present in African Americans. The CDC (2008b) reported the prevalence for obesity as 38.5 percent for African Americans compared to 24 percent for Caucasians. In just over fifteen years the prevalence of obesity in African Americans has almost doubled from 19.3 percent in 1991 to 38.5 percent in 2005 (CDC, 2008a; Mokdad et al., 1999). Health disparities in obesity are most pronounced among African American women. African American women are more likely to be obese than Caucasian women. The CDC reported that 42.2 percent of African American women were obese compared to 23.4 percent of Caucasian women (CDC, 2008a). In a study looking at body composition, 62 percent of obese African

American women had a predominant proportion of abdominal obesity compared to 44 percent in Caucasian women (Klonoff & Landrine, 2000). Statistics for body composition in men have been less divergent with 31 percent of Caucasians versus 23 percent of African American men classified with abdominal obesity (Ford, Giles, & Dietz, 2002). It is clear that there are health disparities between Caucasians and African Americans, but understanding why the disparities exist is not simple. Health disparities are complex and multidimensional (Brondolo, Gallo et al., 2008).

In summary, obesity is a risk factor for CVD. Individuals who are both obese and hypertensive are at greater risk for CVD than someone who is either obese or hypertensive. Obesity places an additional stress on an individual's mental and physical health. People who are obese are at greater risk for hypertension as well. All three risk factors (stress, hypertension, and obesity) contribute to increased risk for CVD for almost 30 percent of the United States population and 40 percent of African Americans. These percentages only take into consideration hypertension prevalence. Obesity increases the risk of CVD for 26.3 percent of United States adults twenty years or older and 36.8 percent for African Americans (CDC, 2007b). When overweight and obesity are combined 63 percent of Americans and 73 percent of African Americans are at increased risk for CVD (CDC, 2007b).

Specific Risk factors for Cardiovascular Disease in African Americans

African Americans experience the highest prevalence of stress related disease compared to any other racial or ethnic group within the United States (Cutler et al., 2008). Stress may contribute to the development of risk factors for metabolic syndrome in African Americans. Prevalence of metabolic syndrome (hypertension, obesity, diabetes, and consequent CVD) is

higher in African Americans as compared to Caucasians and people of Hispanic origin (C. Harris et al., 2005; Marshall, 2005; MMWR, 2005a, 2005b, 2006).

Differences in the regulation of the HPA axis could be the result of physiological and psychological stressors, psychosocial exposures, and socioeconomic status (Belda et al., 2008; Bjorntorp & Rosmond, 2000). If the HPA axis produces excess cortisol and is not properly down regulated through negative feedback, then the excess cortisol can lead to increases in hypertension, central adiposity, and insulin resistance (Purnell et al., 2008). African Americans already have a higher prevalence of hypertension (Cutler et al., 2008), obesity (CDC, 2008b; DHHS, 2000), and insulin resistance (DHHS, 2000). So HPA axis dysregulation could be a potential mediator of health disparities in African Americans (Kidambi et al., 2007).

Stress

A large number of factors interact in complex ways to contribute to health disparities in stress-related disorders in African Americans. Some of these factors include: genetic predisposition, high levels of stress over a lifetime (racial discrimination and socioeconomic position), and other negative environmental experiences. The next sections will address socioeconomic status and racism as specific risk factors for CVD for African Americans.

Socioeconomic Status as a Stressor

Stress is associated with lower socioeconomic status. African Americans experience higher socioeconomic disadvantages including poverty and poor educational opportunities compared to Caucasians (Brondolo, Brady et al., 2008; CDC, 2008c). Lower socioeconomic status contributes to increased allostatic load (McEwen, 1998) which then decreases the effectiveness of how

individuals react to stress and leads to an increased risk for CVD (Steptoe et al., 2002).

Researchers found individuals with lower socioeconomic status required longer recovery times for cardiovascular function in response to a mental stressor (Steptoe et al., 2002).

Low socioeconomic status can cause stress due to overcrowded living conditions, unsafe neighborhoods, limited access to resources including: affordable housing, education, social opportunities, healthy food, and quality healthcare. Gallo and Matthews argue lower SES is a chronic stressor that forces the body to mobilize resources to maintain homeostasis. The Reserve Capacity model (Gallo & Matthews, 2003) hypothesizes that lower SES influences health through negative affect and as presented in Figure 1.

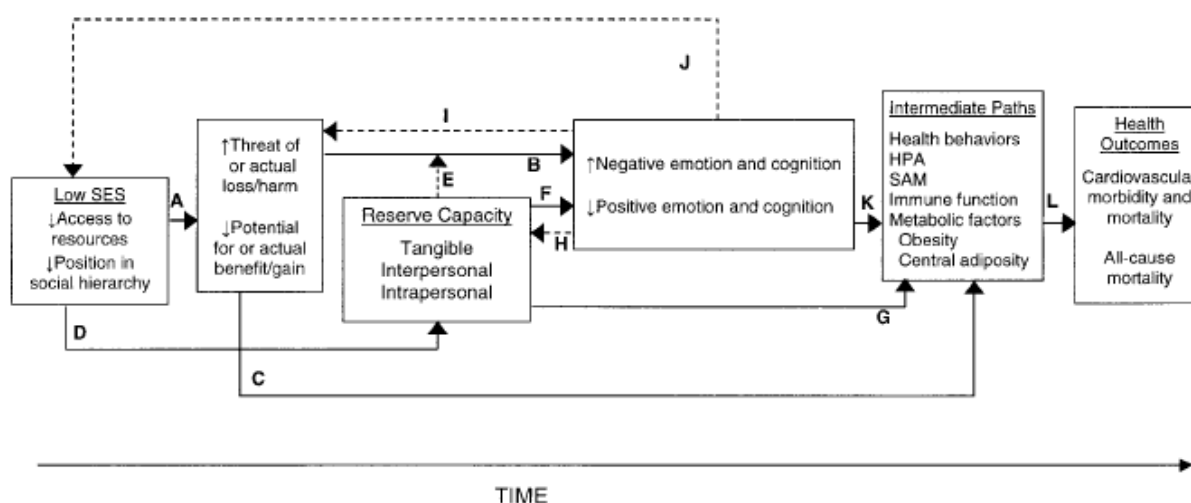


Figure 1. Reserve Capacity Model.¹

¹ Note. (Gallo & Matthews, 2003). SES = socio-economic status, HPA= hypothalamic-pituitary-adrenal axis, SAM= sympathetic adrenal-medullary axis.

In the Reserve Capacity model, lower Low SES reduces access to resources and decreases position in the social hierarchy. This leads to an increased threat of actual loss or harm and decreases potential for benefit or gain. The stress of increased threat and decreased potential for benefit increases negative emotions and cognitions. It also decreases positive emotions and cognitions. This requires a mobilization of resources including tangible, interpersonal, or intrapersonal to address the stress related to lower SES. Low SES acts on intermediate pathways such as negative health behaviors, HPA activation, sympathetic-adrenal-medullary activation, decreased immune function, and metabolic factors including obesity and central adiposity (Gallo & Matthews, 2003). The end result of the Reserve Capacity model is negative health outcomes including increased risk for CVD mortality and morbidity and all-cause mortality.

Racism as a Stressor

Racism is a unique stressor that differentiates African Americans from Caucasians. Racism is defined by Clark and colleagues as “the beliefs, attitudes, institutional arrangements, and acts that tend to denigrate individuals or groups because of phenotypic characteristics or ethnic group affiliation” (Clark, Anderson, Clark, & Williams, 1999, p. 805). Brondolo and colleagues expand Clark and colleagues definition to describe common outcomes of racism as “a special form of social ostracism in which phenotypic or cultural characteristics are used to assign individuals to an outcast status, rendering them targets of social exclusion, harassment, and unfair treatment” (Brondolo et al., 2009, p. 2). Racism is not limited to an expression of prejudice or hatred.

Racism occurs at many levels including individual, institutional, and cultural (Brondolo et al., 2009; Harrell, 2000; Williams & Mohammed, 2009). Racism at the individual level

includes actions to harass, exclude, or deny opportunities. Racism at the institutional level includes unfair hiring practices and lower salaries for similar jobs compared to others. Racism at the cultural level includes stereotypes repeated in the media denigrating someone of a different ethnic or racial background.

Racism is also pervasive and chronic (Brondolo, Rieppi, Kelly, & Gerin, 2003). For some, it is present every day and could overwhelm their body's resources for responding to stress (Brondolo, Brady et al., 2008). The perception of the discrimination or racist exposure and the intentionality of the offense are also important in determining the outcome of racism on stress (Brondolo, Gallo et al., 2008). Racism can also be either external or internal. Externalized racism can be overt or covert acts of discrimination toward others. Internalized racism occurs when people of a discriminated group accept the negative stereotypical views and believes they are inferior to others.

Brondolo and colleagues extended the Reserve Capacity model (Gallo & Matthews, 2003), described earlier, to argue racism influences health through negative affect (Brondolo, Brady et al., 2008). The researchers reported that lifetime perceived racism was associated with daily and trait negative affect (Brondolo, Brady et al., 2008). Perceived racism or discrimination reduces the reserve capacity of the individual to respond to additional stressors. If the target of racism responds actively to a racial assault, then the action can even lead to an increased perceived threat of loss or harm from retaliation. This would result in an increased allostatic load and reduce their reserve capacity to address other stressors. If the target of racism responds by ignoring the assault, then the inaction can lead to rumination about the assault regarding actions that should have been taken during the incident. This inaction would also result in an increased

allostatic load and reduced reserve capacity. Regardless of how a person responds to perceived racism it can increase their risk for negative thoughts and emotions. The same stress pathways are utilized as in the earlier Reserve Capacity model, which leads to negative health outcomes. Brondolo and colleagues argued that racism causes an increase in negative affect, which also changes individual's perceptions of themselves, the world, and the future.

African Americans cope with racism or discrimination in at least three ways (Brondolo et al., 2009). The first way African Americans cope with racism is through racial identity development. This occurs by increasing their awareness and commitment to their culture. Racism can bring people together as a group through shared experiences. The second way African Americans cope with racism is through seeking social support. Social support can include tangible, cognitive appraisal, or emotional support. The third way African Americans cope with racism is through anger suppression or anger expression. Anger suppression is considered a healthy behavior in acute circumstances where resources are not available to respond to the discriminatory act. Anger expression can be considered a healthy behavior when racism is unintentional and provides an opportunity to communicate with co-workers unacceptable behavior. Women tend to suppress anger more often than men, whereas men tend to express their anger more often than women (Brondolo et al., 2009). The context of the racist exposure can influence which anger coping style is used.

Brondolo and colleagues proposed that racial identity, anger coping, and social support act as potential moderators of the racism-health association (Brondolo, Gallo et al., 2008). They describe these coping mechanisms as buffers against the stress effects of racism. Brondolo (2009) considers a coping response as a buffer to stress when, individuals who are exposed to a

stressor, respond with behaviors, cognitions, or emotions that lessen or reduce the effects of the racist or discriminatory act. If an individual engages the coping response and it reduces the stress response, it is considered a buffer or moderator of stress (Brondolo et al., 2009). Brondolo and colleagues reviewed studies that tested racial identity, social support, and anger coping as buffers of stress from discrimination on health (2009). They found mixed support for each of these coping techniques as buffers of stress.

Stress Reactivity

Stress reactivity is important because it may contribute to CVD along with many other factors including: hypertension, obesity, health care behavior, etc. Acute stress reactivity (e.g., emotional stress and anger) has been associated with acute myocardial infarction and sudden death (Strike & Steptoe, 2005). The HPA axis, altered glucocorticoid peripheral tissue sensitivity, and heightened inflammation have been identified as potential mediators of CVD and stress reactions (Chrousos, 1995). This is important because stress reactivity is different in African Americans when compared to Caucasians (Menon et al., 2008). African Americans had more acute reactivity (e.g., increased heart rate and blood pressure) and slower recovery than Caucasians in a study that included an anger recall test as a stressor (Richman, Bennett, Pek, Siegler, & Williams, 2007).

Stress reactivity may cause or contribute to CVD through a variety of mechanisms including neuroendocrine activation and platelet reactivity (Brondolo et al., 2003; Tartaro, Luecken, & Gunn, 2005). The HPA axis is a major part of the neuroendocrine system that controls the stress response and regulates the body to prepare for a response. When the body is faced with a stressor, the neuroendocrine system activates and deactivates certain processes in

the body. This is to allow the person to address the stressor from a fight or flight perspective and mitigate the stress. Many processes are necessary for fighting or fleeing, such as eyesight, hearing, and blood flow to major muscle groups for running are increased. Those functions not related to fighting or fleeing are down regulated including digestion and the immune system. The immune system increases white blood cell production at low levels of stress, but at higher levels of stress, the immune function decreases. So the length of time and the amount of stress are important when considering the effects of stress on health.

If the HPA axis is dysregulated, then the body may not effectively respond to stress, which could lead to an increased risk for CVD (Jokinen & Nordstrom, 2008). A dysregulated HPA axis could prevent down regulation of cortisol following an exposure to a stressor leading to elevated levels of cortisol for a longer period of time. Elevated levels of CRF have been found in cerebrospinal fluid of patients with anxiety disorders (Bjorntorp, 2001). Corticotropin releasing factor is produced by the hypothalamus in the first part of the HPA process of responding to stress. Another study found people who experienced acute stress exposure (child abuse) often have an HPA axis that is dysregulated and this results in increased CRF activity, stress reactivity, increased immune activation, and reduced hippocampal volume (Heim, Newport, Mletzko, Miller, & Nemeroff, 2008).

Increased platelet reactivity is another hypothesis proposed by Markovitz and Matthews (1991) that could account for increased cardiovascular risk from psychological stress. During a stress response, lipids are released and deposited in the cardiovascular system. Stress causes activation of blood platelets that responds to and activates the clotting cascade (Markovitz & Matthews, 1991). Repeated or prolonged stress responses lead to a buildup of plaque and

eventual thrombosis, heart failure, and possible myocardial infarction. Over time platelet reactivity could contribute to the etiology of hypertension, heart disease and other illnesses (Tartaro et al., 2005). Hypertension leads to exaggerated norepinephrine stress reactivity (Wirtz, Ehler, Bartschi, Redwine, & von Kanel, 2009). Changes in lipid plasma from psychosocial stress are also related to hypertension and norepinephrine stress reactivity. Increased lipid levels can contribute to the formation of plaque and contribute to an increase in risk for CVD.

Stress Reactivity to Racism

Perceived racism may play a role in elevated cardiovascular reactivity in African Americans. Thomas and colleagues conducted a study of 76 Caucasian and 46 African American patients to examine how ethnicity and perceived discrimination effect vascular reactivity to phenylephrine (Thomas, Nelesen, Malcarne, Ziegler, & Dimsdale, 2006). Perceived racial discrimination was associated with increased blood pressure reactivity. The African American patients as a group had increased cardiovascular reactivity compared to the Caucasian patients. These differences among cultures and racial/ethnic group experiences and perceptions of racism could help explain the racial disparities in stress reactivity.

Merritt and colleagues examined perceived racism and cardiovascular reactivity and recovery to a personally relevant stress (Merritt, Bennett, Williams, Edwards, & Sollers, 2006). In the study, two groups of African American men (n=73) responded to active speech tasks- one group was presented with racist stimuli in one a neutral stimuli. The men in the neutral stimulus group, who also scored higher in perceived racism, had increased blood pressure response during the task. Diastolic blood pressure was higher under the neutral stimuli group compared to the racist stimuli group. In another study of 162 African American urban adults, racism was not

associated with increased blood pressure (Peters, 2004). In fact, increased blood pressure was highest for those who scored lower on perceived racism. The researchers attributed this to internalized racism.

In a study with 69 African American men and women without hypertension, 24 hour ambulatory blood pressure readings were recorded and questionnaires on perceived racism and anger expression were completed (Steffen, Hinderliter, Blumenthal, & Sherwood, 2001). Increased perceived racism was related to higher ambulatory blood pressure during waking hours for both systolic and diastolic blood pressure. African Americans who were more likely to inhibit anger as a coping method also had higher sleep diastolic blood pressure and less recovery in diastolic blood pressure after sleeping. Blood pressure was measured in the clinic as well, but was not significantly correlated with perceived racism.

Individual differences in stress reactivity could account for long term risk for hypertension and CVD (Brondolo et al., 2003; Tartaro et al., 2005). Individuals perceive and respond to stress in different ways (Soussignan et al., 2008; Stawski, Sliwinski, Almeida, & Smyth, 2008). Epictetus, a famous philosopher, wrote over 1900 years ago that “It is not what happens to you, but how you react that matters” (Dobbin, 1998). It is not the stress exposure, but the perception of the event that may cause stress. Lazarus and Folkman developed the cognitive appraisal model (Lazarus & Folkman, 1984) to describe how individuals respond differently to stress based on their appraisal of threat, harm, challenge, or loss. Based on the appraisal, the individual selects a problem-focused and emotion-focused coping style to respond to the stressor. The amount and types of resources available to the individual has a direct effect on how they choose to respond to the stressor.

Spirituality and Health Outcomes

Religiousness / spirituality commitment could account for some of the individual variability of risk for hypertension. Spirituality is defined as “a search for the sacred” and religiousness is defined as “a search for significance in ways related to the sacred” (Zinnbauer & Pargament, 2005, p. 36). In this paper, religiousness and spirituality (R/S) will be used as synonymous terms, unless a particular aspect is specified.

Religiousness/spirituality is an understudied variable in health research (P. C. Hill & Pargament, 2003), yet it is still considered a robust variable in predicting both mental and physical health-related outcomes (H. G. Koenig, 2001b, 2001d; Park, Moehl, & Fenster, 2008; Zinnbauer & Pargament, 2005). The church is particularly important to African American culture and a source of support and guidance (Chatters et al., 2002). It is not uncommon for African Americans to seek help for health issues through pastoral services (Bender, 2003). Religious attendance is consistently related to increased mortality (Kark et al., 1996; Oman, Kurata, Strawbridge, & Cohen, 2002; Strawbridge, Shema, Cohen, & Kaplan, 2001). Evidence links religious attendance more strongly to lower mortality than private religious activity (Hummer, Ellison, Rogers, Moulton, & Romero, 2004). In a study by McCullough and colleagues, religious involvement was significantly associated with lower mortality (odds ratio = 1.29, 95% confidence interval: 1.20-1.39) (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000).

Besides living a longer life, R/S has been associated with positive mental and physical health outcomes including less anxiety, less substance abuse, less depression, faster recovery from depressed symptoms, greater well-being, increased optimism, higher social support, and greater marital satisfaction and stability (P. C. Hill & Pargament, 2003; Koenig, 2001a; H. G.

Koenig, 2001d; Koenig, 2004; Oman et al., 2002). In a review of spirituality and mental health, R/S was associated with improved physical health, including less heart disease, lower blood pressure, lower cholesterol, less smoking, and better sleep (H. G. Koenig, 2001c; Koenig, 2004).

Spirituality and Blood Pressure

A variety of studies find R/S is related to lower or reduced blood pressure (Friedlander, Kark, Kaufmann, & Stein, 1985; Graham, Taylor, Hovell, & Siegel, 1983; Levin & Vanderpool, 1989; Teresa E. Seeman, Dubin, & Seeman, 2003; Sloan & Bagiella, 2002). In perhaps the first study on church attendance and blood pressure published in the first issue and year of the *Journal of Behavioral Medicine* in 1978, Graham and colleagues found lower systolic and diastolic blood pressure in frequent church attenders compared to infrequent church attenders (Graham et al., 1978). The Graham study was one of the first studies examining the link between spirituality and blood pressure. The study controlled for age, obesity, cigarette smoking, and socioeconomic status. A limiting factor in this study is that the sample only included Caucasian male heads of households.

Prayer can also be used as a meditation device to lower blood pressure. Reciting prayer and yoga mantras significantly enhanced heart rate variability and baroreflex sensitivity and lowered blood pressure (Bernardi et al., 2001). In a similar study, Benson found prayer was associated with decreased heart rate, arterial blood pressure and respiratory rate (Benson, 1983). In a study involving middle aged and older adults, researchers suggested that spirituality was related to a specific pattern of high cardiac autonomic control and could influence health (Berntson, Norman, Hawkley, & Cacioppo, 2008). In this study, spirituality was associated with enhanced cardiac autonomic regulation (CAR, reflects total autonomic control), but not cardiac

autonomic balance (CAB, parasympathetic to sympathetic balance) in 229 participants who were measured for heart rate variability and pre-ejection period cardiac control.

In a study involving African American men and women, Livingston and colleagues (1991) used Maryland database to examine the relationship between social integration and lower blood pressure in the African American community. They controlled for age, education, body mass index, physical exercise, hypertension medication, and cigarette smoking and found that being affiliated with a church was related to lower blood pressure (Livingston, Levine, & Moore, 1991). In a study of African Americans diagnosed with hypertension, spirituality was related to improved hypertension management and lower blood pressure (Lewis & Ogedegbe, 2008).

In a study comparing African Americans and Caucasians, Steffen and colleagues found a significant relationship between religious coping and ambulatory blood pressure over a 24 hour period in African Americans. This finding was not found in the Caucasian sample in the study. The study included 155 men and women (78 African American / 77 Caucasian). Steffen and colleagues found a lower daily blood pressure load could be a pathway through which R/S might buffer cardiovascular health for African Americans and Caucasians (Steffen et al., 2001).

Spirituality and Stress

Spirituality has also been associated with lower cortisol stress responses (Ironson et al., 2002; Tartaro et al., 2005). In a study with cancer patients undergoing chemotherapy, those with higher scores of spirituality had less cortisol rhythm alteration, a lower frequency of lymphocytopenia, and better health outcomes from chemotherapy (Lissoni et al., 2008). Spirituality was also associated with the diurnal cortisol rhythm in women with stress-related fibromyalgia (Dedert et al., 2004). In their study, spirituality and religiousness were related to

physiological stress, but not perceived stress. In a review that examined neurobiological factors related to stress (e.g., cortisol, dehydroepiandrosterone, corticotropin releasing hormone (CRH), neuropeptide-Y, dopamine), spirituality was found to enhance stress resilience and decrease the likelihood of developing stress-induced depression (Southwick, Vythilingam, & Charney, 2005a). Likewise Tartaro, Luecken, and Gunn explored the effects of blood pressure and stress-related cortisol reactivity in relation to religiousness and spirituality (Tartaro et al., 2005, p. 762). They found the composite score of religiousness and spirituality, overall religiousness, forgiveness, and frequency of prayer was related to lower cortisol stress reactivity. They found the composite score of religiousness and spirituality, overall religiousness, frequency of prayer, and church attendance was related to lower blood pressure in men and higher blood pressure in women. The researchers concluded that religiousness and spirituality served as buffers to neuroendocrine responses.

Spirituality has been associated with lower stress as measured by allostatic load. In the MacArthur Successful Aging Study with a sample of 853 older men and women, spirituality was associated with decreased allostatic load (Maselko, Kubzansky, Kawachi, Seeman, & Berkman, 2007). Allostatic load was a composite measure including systolic and diastolic blood pressure, waist/hip ratio, high-density lipoprotein and total cholesterol, glycosylated hemoglobin, cortisol, serum dihydroepiandrosterone sulfate, norepinephrine, and epinephrine. The study controlled for age, income, education, marital status, and level of physical functioning. Spirituality was associated with the total composite measure of allostatic load, but not any of the individual subscales that form the composite measure.

Spirituality as Buffer to Stress

Religiousness and spirituality could buffer the negative health effects of stress (Delgado, 2007; Tartaro et al., 2005). Two quantitative studies specifically considered spirituality as a buffer to stress. The first study examined the effects of spirituality on quality of life in spousal caregivers of cancer patients (Colgrove, Kim, & Thompson, 2007). Self-reported stress was inversely related to spirituality. In this study, spirituality buffered the effects of stress on health. Spirituality also has been shown to buffer the effects of stress on adjustment in college students (Kim & Seidlitz, 2002). One qualitative study, specifically considering spirituality as a buffer to stress, included African American church members from various Christian denominations (Holt, Lewellyn, & Rathweg, 2005). Spirituality and religiousness were described by participants as being helpful in coping with stress. Also in a review of spirituality and chronic illness (Greenstreet, 2006), spirituality was described as a source of hope in dealing with stress. Spirituality helped individuals find meaning in suffering with a chronic illness.

Specific mechanisms of how and why religiousness and spirituality may buffer stress and lead to positive health outcomes have been proposed, but not thoroughly tested (Ellison & Levin, 1998; Park, 2007a; Teresa E. Seeman et al., 2003; Sloan & Bagiella, 2002; Tartaro et al., 2005; Thoresen & Harris, 2002). Spirituality could buffer effects from a stress exposure by lowering blood pressure through arousal reduction (Davidson et al., 2003) and distraction (Neumann, Waldstein, Sellers, Thayer, & Sorkin, 2004). Spirituality has been thought to protect against stress and CVD because it encourages a healthy lifestyle (Powell, Shahabi, & Thoresen, 2003), provides a source of social support, and psychological resources (Hummer et al., 2004). Other possible mechanisms include improved health behaviors, access to social resources, improved

coping resources, prayer (Ironson et al., 2002; Pargament, 1997), promotion of positive emotions (e.g., forgiveness) (McCullough & Worthington, 1999), taking part in religious rites (Benson, 1983; Bernardi et al., 2001), personal faith (Ellison & Levin, 1998; McCullough et al., 2000; Strawbridge et al., 2001), positive reappraisal (Carrico et al., 2006), and benefit finding (Dedert et al., 2004). R/S could work through physiological mechanisms such as neurohormonal function and cardiovascular function (Teresa E. Seeman et al., 2003). R/S could buffer cardiovascular reactivity through one, some, or all of these behavioral, cognitive, and physiological mechanisms.

Spirituality as Buffer to Stress from Racism

Religiousness and spirituality may buffer stress effects of racism in African Americans. Brondolo and colleagues identified racial identity development, seeking social support, and anger coping (suppression/expression) as common ways African Americans buffer stress effects of racism (Brondolo et al., 2009; Brondolo, Brady et al., 2008; Brondolo, Gallo et al., 2008). The church has remained a unique part of African American culture, which is important in racial identity development. The church also provides social support in every form (tangible, emotional, and appraisal) to its members and people in the surrounding community. Spirituality also allows support and feelings of connectedness from a higher being, which reduces the stress exposure by developing and maintaining feelings of adequacy and importance from a relationship with a higher power and other community members. The church is a place where racism can be discussed and acknowledged in a safe and supportive environment. Religiousness and spirituality also provide coping tools to allow an individual to choose when to express or suppress anger. Finally, religiousness and spirituality may buffer the effects of stress from racism

by providing a multidimensional framework that facilitates previously identified buffers to stress from racism.

Methods

The hypothesis examined in this study was whether spirituality would mitigate stress reactivity among African Americans after viewing a racist film clip. This study extends the work of Tartaro and colleagues (2005) by examining racism as a stressor among African Americans. This study extends the research done by Tartaro and colleagues by examining if R/S provides a buffer response to stress differently in normal, overweight, and obese African American men and women.

The primary model that supported the hypotheses in this study was that spirituality would act as a buffer for neuroendocrine consequences of stress (Tartaro et al., 2005). Religious participation and beliefs were regarded as sources of social support and were hypothesized to act as protective factors against stress (Friedlander et al., 1985; Graham et al., 1978; Levin & Vanderpool, 1989; Walsh, 1998). As opposed to a direct effects hypothesis, which proffers that social support is beneficial during both non-stress and stress events, the buffering hypothesis model proffers the effects of social support are present only during a stressful event (S. Cohen & Wills, 1985; House, Landis, & Umberson, 1988). In this model, coping resources are relied on primarily in high stress conditions and would not influence blood pressure during periods of low stress.

The study attempted to replicate and extend the Tartaro, Luecken, and Gunn (2005) study by including the Brief Multidimensional Measurement of Religiousness/Spirituality (BMMRS),

along with measures of blood pressure and salivary cortisol, in a sample of middle aged African Americans 18-60 years old. Tartaro and colleagues (Tartaro et al., 2005) included a diverse sample (74% Caucasian, 7% African-American, 7% Hispanic, 5% Asian, 7% Other) of 60 undergraduate students (32 females, 28 males) and found participants with higher composite score R/S scores, religiousness, levels of forgiveness, and frequency of prayer had lower cortisol responses. Greater composite scores of R/S, religiousness, frequency of prayer, and attendance at religious services were associated with lower blood pressure in males and elevated blood pressure in females. Tartaro et al. (2005) recommended the inclusion of a different laboratory stressor in future research, since the Stroop test did not alter blood pressure levels. This study extends the research by including a higher intensity stressor (racially charged film). The study is different from the previous study it included only African American men and women in the sample.

The study was incorporated into a larger study that examined the dysregulation of the HPA axis among African Americans. This study attempted to explain why African Americans are at greater risk for various diseases, including hypertension and obesity, than Caucasians. The larger study included measures on health status, perceived stress levels, lifetime experiences, lifestyle, coping skills, and various markers of health and stress in blood and saliva, to include cortisol, insulin, glucose, and genetic markers. The aim of this study was to examine whether religiousness/spirituality mitigates stress reactions. Spirituality was expected to act as a buffer for high blood pressure and cortisol stress reactivity.

Summary

African Americans share an unequal burden of health disparities in the prevalence and mortality risk for hypertension and obesity. It is important to understand and manage hypertension and obesity to reduce health risks and health disparities. One hypothesis is that African Americans have a dysregulated HPA axis system in response to prolonged and repeated acute reactivity to stress. The church is particularly important to African American culture and a source of support and guidance for many African Americans. R/S, an understudied variable in health research, is associated with positive mental and physical health outcomes, including lower systolic, diastolic blood pressure, and cortisol stress response through the HPA axis. R/S could buffer the stress response and help to lower blood pressure or reduce elevations in blood pressure while balancing allostatic loads.

Hypotheses and Rationale

The hypotheses of the investigation were based on the model presented in Figure 2. In addition, religiousness and spirituality was expected to be associated with smaller increases in stress reactivity (Hypotheses 1) after watching a racial video clip. Related to this hypothesis, obesity was expected to be associated with greater stress reactivity (Hypothesis 2) after the video clip. Lastly, religiousness and spirituality were expected to be differentially associated with stress reactivity in normal versus overweight and obese participants. (Hypothesis 3). The list of the hypotheses is also located in Appendix A.

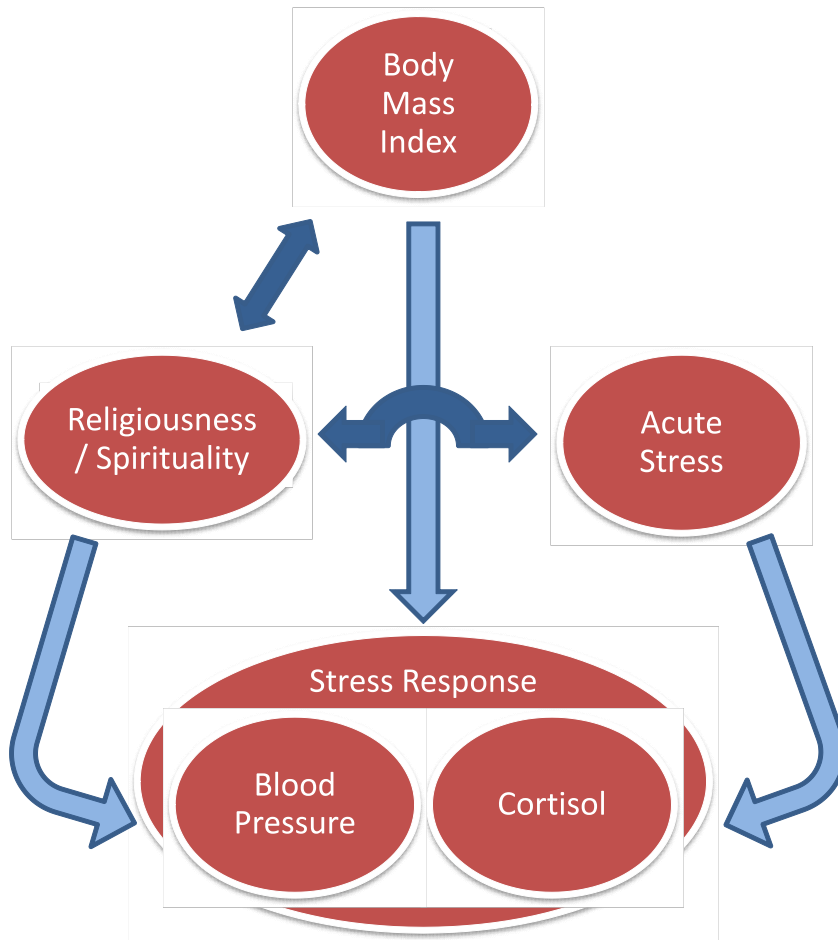


Figure 2. Spirituality Mitigates Stress Response.

Specific Aim 1: Does religiousness and spirituality buffer the stress response after an acute stressor (racially-charged film)? H1: There is a significant inverse linear relationship between religiousness / spirituality and stress reactivity after watching a racial film clip. Higher scores of composite R/S, religiousness, and spirituality were expected to be associated with smaller change in blood pressure and cortisol from pre to post movie. Blood pressure and cortisol change scores were measured by subtracting baseline measures of systolic blood pressure and cortisol from post movie measures. In this study, religiousness and spirituality was measured as a

composite score of the Brief Multidimensional Measure of Religiousness and Spirituality and two intensity subscales rating overall levels of spirituality and religiousness. Religiousness and spirituality were expected to decrease blood pressure and cortisol reactivity through a buffer response (S. Cohen & Wills, 1985). Religiousness/spirituality was expected to buffer blood pressure and cortisol reactivity through arousal reduction (Davidson et al., 2003) and distraction (Neumann et al., 2004).

Specific Aim 2: Is obesity related to increased stress reactivity following an acute stressor? H2: There is a significant linear relation between obesity and stress reactivity after watching a racial film clip. Obesity was expected to be associated with a higher change in blood pressure and cortisol following an acute stressor. The negative health effects of physiological stress from obesity were expected to impair the regulation of blood pressure and the regulation of cortisol through the HPA axis. H3: Religiousness / spirituality is differentially associated with stress reactivity in normal versus overweight and obese participants. In normal weight participants, religiousness/spirituality acts as a buffer to reduce the stress response. In overweight and obese participants, high religiousness and spirituality was not expected to reduce stress response due to increased allostatic load from unhealthy weight. The negative health effects of physiological stress from obesity was expected to impair the regulation of blood pressure and the regulation of cortisol through the HPA axis (Shmueli & Tamir, 2007).

Research Design and Methods

Study Design

The substudy was part of a larger project to examine the health disparities among African Americans under the direction of Dr. Patricia Deuster, the Primary Investigator. The sample included 160 African American men and women between 18 to 60 years old. This study examined whether religiousness/spirituality mitigates stress reactivity in the laboratory. The outcome measures included systolic blood pressure change, diastolic blood pressure change, and cortisol reactivity (H1, H2, H3). Predictor variables in this study included:

Religiousness/spirituality composite score, overall religiousness, and overall spirituality (H1 & H3); BMI and body fat percentage (H2), BMI Categories (H2 & H3). Additional independent variables that were considered as potential covariates in this study included: Age, gender, income, education, marital status, smoking status, and comorbidity status. The continuous variables in the study included: Religiousness/spirituality composite score, overall religiousness, overall spirituality, BMI, waist circumference, cortisol, blood pressure change, cortisol reactivity, and age. The categorical independent variables in the study included: BMI categories, gender, income, education, marital status, smoking status, and comorbidity status.

Participants

Data were used from the first 200 participants in the larger study with a sample size of 600. There were two categories of participants. The first category of participants included 100 African Americans who completed the ongoing study without the Brief Multidimensional Measure of Religiousness and Spirituality (BMMRS) incorporated into the protocol from 4 June 2008 to 24 November of 2008. They were contacted by mail to determine their willingness to complete the

BMMRS for additional compensation of fifteen dollars. It was estimated that 50, or half, of the participants would agree to complete the BMMRS questionnaire. The second category of participants included 100 African Americans who completed the study with the BMMRS from 25 November 2008 to 24 May 2009.

Participants were all African American males and females 18 to 60 years old recruited from the Washington D.C. metropolitan area. Flyers were sent to churches and other potential recruiting organizations to announce the times and dates of the study, and details regarding the study purpose and requirements. In addition, advertisements were placed in local newspapers and online bulletin boards, including Craigslist.

Interested participants called the Human Performance Lab (HPL) at the USUHS. The participants completed a telephone prescreen to determine eligibility. Inclusion criteria included: African-American males and females, 18 to 60 years of age, and ability to read and understand English. Exclusion criteria included: pregnancy, history of heart attack, history of stroke, history of heart failure, and underweight. Volunteers who met the inclusion criteria were scheduled to participate in the study. Participants were asked to fast after 12:00 am the night before arriving at the HPL. The use of snacks and caffeinated beverages were restricted in order to prevent confounding factors in interpreting fasting glucose, cortisol, and blood pressure changes during the testing. Volunteers were tested individually or in groups up to five, at a church (if there was an appropriate place for drawing blood), in a community setting, or in the HPL laboratory at USUHS. The majority of subjects were seen at the Human Performance Lab. Upon arrival at the place of testing (church, library, or laboratory) and prior to being selected as a volunteer, subjects were completely informed as to the nature of the procedures and signed an Informed Consent

Document (ICD). All procedures took place in one day. Most participants started at 8:00am and complete testing around 12:30pm.

Ethical Approval

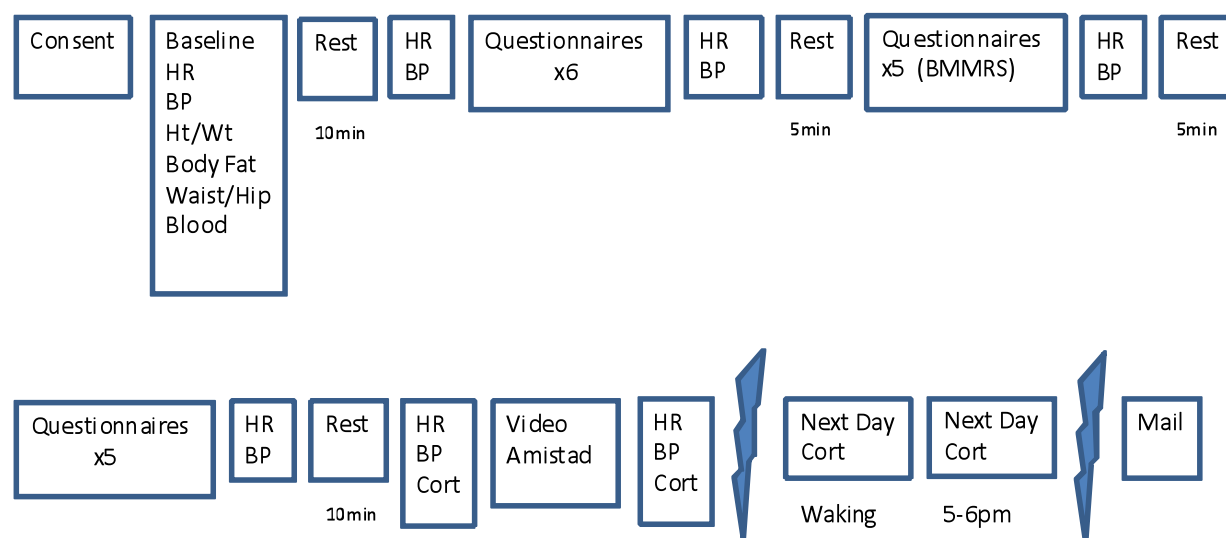
The parent study was approved by the Institutional Review Board under the project title “Health Disparities among African Americans” protocol number G572GD. Dr. Patricia Deuster was the Primary Investigator for the overall study. An amendment was sought for the addition of the BMMRS measure for the proposed study. In addition, approval was sought to contact the previous 100 individuals who already completed the study before the BMMRS was added to the protocol.

Procedure

The procedure for the larger study is discussed followed by a description of procedures for re-contacting the 80 participants who already completed the study before the religiousness/spirituality measure was added to the protocol. The timeline for the ongoing study is depicted in Figure 3. The participant timeline checklist is also presented in Appendix B.

Procedure for Larger Study

African American men and women between the ages of 18 to 60 years were asked to sign the Informed Consent Document (ICD). Cardiovascular measures like blood pressure (BP) and heart rate (HR) were taken in a supine position. Anthropometric data was collected including weight, height, bioelectrical impedance (resistance and reactance), waist, and hip. If participants were unable to lie down on a mat for the bioelectrical impedance measure then a staff member obtained skinfold thickness measures using calipers. The skinfold thickness measures were based

Figure 3. Study Timeline.²

on the American College of Sports Medicine (ACSM) guidelines calculated from three sites and is located in Appendix C. For men, the chest, triceps, and subscapular skinfold were measured. For women, the triceps, suprailiac, and abdominal skinfold were measured. Body mass index, body fat percentage, and waist to hip ratio were calculated from these data. Next, the volunteer provided a 30 mL sample of blood to measure blood glucose. After the blood draw, the participant was allowed to eat a light snack if needed during a ten minute break. During the rest period the volunteer was encouraged to sit still in a reclining chair and rest. Volunteers were not permitted to smoke tobacco or drink caffeinated beverages during the visit. Following the ten minute break, blood pressure and heart rate were recorded.

² Note. HR = heart rate, BP = blood pressure, Ht = height, Wt = weight, BMMRS = Brief Multidimensional Measure of Religiousness and Spirituality, Cort = Cortisol.

The next section of the study included completing psychological questionnaires. Subjects had an option to choose between a paper and electronic format for answering the questionnaires. Questionnaires were divided into three sessions with an optional five minute break between sessions. A complete list of questionnaires is located in Appendix D.

The first set of six questionnaires included: Medical History and Demographics Questionnaire, Paffenbarger Physical Activity Questionnaire, Perceived Stress Scale, Pittsburgh Sleep Quality Index, Beck Depression Inventory, and General Ethnic Discrimination. As participants completed each questionnaire a staff member scanned the questionnaire for completeness. Then, the next questionnaire was provided along with a brief set of instructions. Blood pressure and heart rate was recorded at the end of the first set of questionnaires during a five minute break.

Following the break, a second set of five questionnaires was provided including: Brief Multidimensional Measure of Religiousness and Spirituality, Impact of Event Scale - Revised, Family Communication and Family Satisfaction, Profile of Moods States, and Daily Hassles Scale. The first questionnaire in this set was the Brief Multidimensional Measure of Religiousness and Spirituality. Blood pressure and heart rate were recorded at the end of the second set of questionnaires during a five minute break.

Following the break, a third set of five questionnaires was provided including: Food Frequency Questionnaire, Coping Style Questionnaire, Dispositional Resilience Scale, Multidimensional Health Locus of Control, and the Self Evaluation Form. Blood pressure and heart rate were recorded at the end of the third set of questionnaires during a ten minute break.

During the break, a staff member asked the volunteer questions about their mood and state of alertness when completing the questionnaires.

Following the ten minute break, the pre-movie measurements were taken. Heart rate and blood pressure were recorded followed by saliva collection for cortisol measurements.

Participants were provided a cotton roll to place under their tongue. The roll remained in the volunteer's mouth for five to seven minutes to allow sufficient amounts of saliva to be collected in the cotton roll. The participant then was asked to spit the cotton roll into the plastic tube and secure the lid. Care was taken to avoid touching the roll to prevent contamination of the saliva sample. The salivary sample was then placed in a freezer immediately. Instructions for completing the next two cortisol salivary samples (upon waking the next day and that following evening) were provided to the participant.

Next, participants viewed an eight minute film segment of *Amistad*, a racially charged movie directed by Stephen Spielberg. *Amistad* was a saga of Africans captured by other Africans and taken to Cuba to be sold as slaves in the United States. The movie challenged the concept of freedom and was expected to elicit physiologic responses typical of stress. The segment started at 1:16:08 in the movie and ended at 1:23:50. The segment began with Africans capturing other Africans with nets and they were sold to Spaniard slave traders. The African slaves were then brought onboard a ship and chained together. The remainder of the segment took place onboard the ship. A difficult passage across the ocean was depicted including storms, cramped conditions, food that looked like gruel was poured into the slaves hands as a meal, and they were mistreated by the Spaniard slave traders. During the film clip, a shortage of food caused the Spaniard slave traders to drown the slaves. The slave traders tossed a bag of rocks into the ocean attached to a

chain that connected the slaves. The movie clip showed the slaves being dragged from the bow of the ship onto the deck and then into the water one after the other. The movie clip was stopped when the camera showed the bodies sinking from an underwater perspective.

Blood pressure and heart rate were recorded at the end of the movie segment. A post-movie report was taken from the volunteers about their reactions to the movie. Participants were required to wait a minimum of ten minutes before the post-movie saliva collection. Participants were then provided a summary of their physical results recorded in a pamphlet that described the health risks of obesity and hypertension. Participants were provided with two tubes for additional saliva samples for cortisol: one upon waking before 8:30 am and another in the evening between 5:00 pm and 6:00 pm. Instructions were printed on a card and included with the saliva collection tubes as shown in Appendix E. Participants were asked to rinse their mouth with cold water to remove bacteria from their mouth before placing the cotton role under their tongue. This was to ensure a high quality saliva yield without contamination. Saliva samples were mailed to the investigators in pre-stamped envelopes. Participant saliva samples were stored in a locked freezer and maintained at -70°C . Participants were paid seventy-five dollars for completing the protocol after the HPL received the mailed cortisol samples.

Procedure for Re-contacting Participants

There were one hundred participants who completed the study from April to November 2008 before the BMMRS was integrated into the protocol. They were contacted by mail and asked if they would complete the BMMRS. Additional compensation of fifteen dollars was provided for completing the questionnaire. A list of names and addresses was provided by the principle investigator in order to contact the participants. The participants received a letter of

instruction and a paper copy of the questionnaire along with a pre-paid envelope to send back the completed form.

Measures

1. Demographic Measures. Age, gender, income, education, marital status, smoking status, and comorbidity status were provided by self-report. Age was coded as a continuous variable in number of years. Gender was coded as a categorical variable with two levels (male or female). Income was coded as a categorical variable from one to seven (1 = below \$19,999, 2 = \$20,000-29,999, 3 = \$30,000-49,999, 4 = \$50,000-79,999, 5 = \$80,000-89,999, 6 = \$100,000-150,000, and 7 = above \$150,000). Education was coded as a categorical variable from 1 to 11 (1 = grammar school, 2 = high school or equivalent, 3 = vocational/technical school (2 years), 4 = some college, 5 = bachelor's degree, 6 = some graduate courses, 7 = master's degree, 8 = doctoral degree, 9 = professional degree (MD, JD, etc.), 10 = other, 11 = would rather not say). Marital status was coded as a categorical variable with two levels (married or not married). Smoking status was coded as a categorical variable with two levels (smoker or non-smoker). Comorbidity status was coded as a categorical variable with two levels (present or not present).

2. Anthropometric Measures. Weight and height were measured using a Healthometer balance beam calibrated scale. Body mass index (BMI, $\text{Weight [kg]} / \text{Height Squared [m}^2\text{]})$ was calculated by dividing weight (kg) by height squared (m^2). Overweight and obesity were defined as a BMI greater than or equal to 25 kg/m^2 and 30 kg/m^2 respectively. Body fat percentage was calculated using height (cm), weight (kg), and bioelectric resistance or skinfold thickness. Body mass index and body fat percentage were coded as continuous variables.

3. Blood Pressure. Blood pressure was measured with an arm cuff and sphygmomanometer according to American Heart Association guidelines (Perloff et al., 1993, pp. 2464-2465). All participants were seated quietly for at least five minutes prior to measurement, and were asked beforehand to not ingest caffeine or nicotine for at least thirty minutes prior to measurement (Yanek, Becker, Moy, Gittelsohn, & Koffman, 2001). Systolic and diastolic blood pressure coded as continuous variables.

4. Cortisol. Cortisol was measured by obtaining a salivary sample. Saliva samples were obtained before and ten minutes after the movie and upon waking before 8:30 am and in the evening between 5:00 and 6:00 pm of the following day. Participant saliva samples were stored in a locked freezer and maintained at -70°C . Cortisol was coded as a continuous variable.

5. Self-Report Measures Collected But Not Used In Study. Participants completed a battery of 16 self-report measures in the larger study. Fourteen of the self-report measures that were collected, but not used in the study included: Paffenbarger Physical Activity Questionnaire, Perceived Stress Scale, Pittsburgh Sleep Quality Index, Beck Depression Inventory, General Ethnic Discrimination, Impact of Event Scale – Revised, Family Communication and Family Satisfaction, Profile of Moods States, Daily Hassles Scale, Food Frequency Questionnaire, Coping Style Questionnaire, Dispositional Resilience Scale, Multidimensional Health Locus of Control, and Self Evaluation Form (See also Appendix D).

6. Self-Report Measures Used in Study. Participants completed two self-report measures including: Medical History and Demographics Questionnaire, and the Brief Multidimensional Measure of Religiousness and Spirituality (BMMRS) (Fetzer Institute, 1999). Medical and Demographic data used in this study included: Age, gender, income, education, marital status,

smoking status, and comorbidity status. Participants completed a short form (29 items) of the BMMRS, designed specifically for use in health research as shown in Appendix F. Not every BMMRS scale was incorporated into the proposed study due to the length of the questionnaire. Each subscale of the BMMRS has an additional long form with recommended questions. Key dimensions in this study included daily experiences, forgiveness, private religious practices, coping, commitment, and overall self-ratings of religiousness and spirituality. One strength of the BMMRS was the ability to assess specific domains of religiousness/spirituality. Two items included in the composite score were independently evaluated: overall religiousness, (“To what extent do you consider yourself a religious person?”) and overall spirituality, (“To what extent do you consider yourself a spiritual person?”) The forgiveness subscale included three items, rated from 1 (“always or almost always”) to 4 (“never”) assessing the degree to which participants forgive themselves and others, and feel forgiven by God. The religious coping subscale was composed of five items rated from 1 (“not at all”) to 4 (“a great deal”), including items such as, “To what extent is your religion involved in understanding or dealing with stressful situations in any way?” The composite score of R/S, religiousness index, and spirituality index were all coded as continuous variables.

The Fetzer Institute (Fetzer, 1999) reported internal consistency of the BMMRS subscales in a sample of over 10,000 people in the United States as part of the General Social Survey (GSS) in 1998. The GSS sample was based on data from the United States Census and sampled English speaking adults living in the United States. Cronbach’s alphas were satisfactory for each of the subscales: Public religious activities ($\alpha = 0.82$), private religious activities ($\alpha = 0.72$), congregation benefits ($\alpha = 0.86$), congregation problems ($\alpha = 0.64$), positive religious

coping ($\alpha = 0.81$), negative religious coping ($\alpha = 0.54$), religious intensity ($\alpha = 0.77$), forgiveness ($\alpha = 0.66$), daily spiritual experiences ($\alpha = 0.91$), beliefs and values ($\alpha = 0.64$), subscales. The BMMRS has been cited in over 112 studies since 2000. One of the strengths of the BMMRS is the ability to use different modules to assess particular aspects of religiousness and spirituality.

The study used the same 29 question format used in a previous study by Tartaro and colleagues (2005) that included a study sample of 60 undergraduate students. Cronbach's alphas were satisfactory for each of the subscales: Forgiveness ($\alpha = 0.76$), religious coping ($\alpha = 0.69$), and the composite religious/spirituality score ($\alpha = 0.90$).

Power Analysis

Several power analyses were calculated. The first set of power analyses was based on means and standard deviations of the BMMRS found in the literature (Fetzer, 1999; S. K. Harris et al., 2008; Idler et al., 2003; Johnstone, Franklin, Yoon, Burris, & Shigaki, 2008; Tartaro et al., 2005). Effect sizes from the literature of the covariates used in this study, religious measures, and blood pressure were used to estimate effect sizes for the power analyses (Steffen et al., 2001). The nQuery Advisor version 6.0 software was used to calculate power. It was determined that 186 participants were needed to detect a difference at an effect size of 0.05, 80 percent power, for a multiple linear regression model at a significance level of 0.05 (Cohen, 1988).

The power analysis was reviewed by Dr. Cara Olsen from the biostatistics consulting center at the Uniformed Services University of the Health Sciences. The Tartaro and colleagues (2005) study had a sample size of 60, although the stressor did not result in significant differences of blood pressure or cortisol. Similar studies included racist video clips to measure cardiovascular response in an African American sample. Armstead and colleagues showed anger

provoking racist, non-racist, and neutral video clips to African American college students (Armstead, Lawler, Gorden, Cross, & Gibbons, 1989). The study had a sample size of 27 and found exposure to racist video clips were related to increased blood pressure. In another study, Fang and Myers (2001) showed three video clips including racist, non-racist, and neutral material to African American and Caucasian men. The study had a sample size of 62 (31 African American and 31 Caucasian) and found exposure to hostile or racist video clips were related to significant diastolic blood pressure reactivity in both groups. In another study, Morris-Prather and colleagues showed African American college students two of four video clips including socially stressful scenarios of an unjust arrest for shoplifting and a traffic stop by either African American or Caucasians (Morris-Prather et al., 1996). The study had a sample size of 92 (52 women and 40 men) and found increases of blood pressure to the stressful clips showing discrimination. In all three studies, power and effect size were not reported, but all three clips did find elevations in blood pressure.

Analytic Strategy

Pearson correlation coefficients calculated to examine the associations among demographic variables (i.e., age, gender, income, education, marital status, smoking status, comorbidity status) and outcome variables (i.e., change in blood pressure, cortisol reactivity). Demographic variables that were significantly associated with outcome variables were controlled for in the subsequent regression analyses. The significance level was set at $p = .05$, two-tailed for all analyses in this study.

Regression Analyses

A series of multiple hierarchical regression analyses were conducted to test the hypotheses in this study that examined whether religiousness/spirituality mitigated stress reactivity from a racial video clip in the laboratory. Multivariate regression analyses were conducted. Due to the large number of possible confounders and power limitations, a data reduction technique was employed (Tabachnick & Fidell, 2001). This analysis was conducted in two parts. The first analysis consisted of a linear regression model including all proposed confounders measured (e.g., age, income, education level, marital status, etc). All measures that met the $p < 0.10$ criteria from the first analysis were entered into the final regression model. The dependent variables for both the data reduction regression and the final regression included systolic blood pressure change, diastolic blood pressure change, and cortisol reactivity. Covariates were included as step 1 in the multiple regression. The predictors were entered as step 2. Applicable interaction terms (e.g. religiousness/spirituality x BMI) were entered as the last step. Hierarchical multiple regression analyses were conducted to test the hypotheses in this study as shown in Table 3.

Results

Demographics

The final sample consisted of 160 African American men and women who completed the study and had data for all variables of interest. Of the original sample of 200 African Americans, 27 participants were not administered the Brief Multidimensional Measure of Religiousness and Spirituality (BMMRS) and were dropped from the sample. The reason that these 27 participants did not receive the BMMRS is that the questionnaire was added to the study protocol after the

first 100 participants had completed the study. Efforts were made to re-contact the first 100 participants in the original study to complete the BMMRS questionnaire. Participants were compensated fifteen dollars to complete the questionnaire and were asked to return it by mail. Seventy-three out of 100 participants returned the questionnaire. Of the 173 participants who had BMMRS data, three participants did not complete three or more questions on the BMMRS and were not included in the final sample. Specifically, of the three participants who were excluded because of the incomplete BMMR data, two participants (a transgendered Baptist and a person with no religious or spiritual affiliation) did not complete four items; and one participant (Bahi) did not complete three items. A ten percent rule was applied to missing data for the BMMRS. Those participants missing less than ten percent of questions, or two out of 29 questions or less, on the BMMRS were retained for data analyses. There were three participants that missed two items and seven participants who missed one item. Mean BMMRS score of each participant was used to substitute missing values of questions on the 29 item BMMRS.

Of the 170 remaining participants, ten participants did not have pre and post movie cortisol data. The analysis of cortisol data relies on the amount and quality of the saliva sample. Also, if the saliva sample does not have a tightly secured lid during the freezing process, then the sample could also be unsuitable for cortisol analyses. There were no significant differences in demographic characteristics between the 170 participant and 160 participant samples or the 160 participants and the 10 participants removed from the final sample.

Participant Characteristics

The final sample included 160 African American men and women. The typical participant was 44.7 years old ($SD = 11.24$) with a BMI of 30.3 kg/m^2 ($SD = 8.59$), female, single

or living alone, with an income less than 20 thousand dollars, some undergraduate college or vocational technical training, non-smoker, and no comorbidity (see Table 4). Forty percent of the overall sample made less than 20 thousand dollars per year. The typical participant scored 64 on the BMMRStotal score ($SD = 20.0$), rated themselves as moderately religious ($M = 2.1$, $SD = .92$), and very to moderately spiritual ($M = 1.5$, $SD = .68$). The typical participant had a baseline blood pressure of 133 mmHg ($SD = 16.7$) systolic blood pressure (SBP), 82 mmHg ($SD = 12.3$) diastolic blood pressure (DBP), and 9.5 mcg/dL ($SD = 6.6$) cortisol. Finally, the typical participant experiences a 2.1 mm Hg increase in SBP ($SD = 11.6$) and DBP ($SD = 7.3$) and an increase of .57 mcg/dL ($SD = 4.125$) cortisol following the racial video clip. Table 5 shows the descriptive statistics of the major outcome variables.

Interrelationship of Covariates

The interrelationship of covariates was examined to determine the potential interaction effect of demographic characteristics on the dependent variables in the study. Age was significantly correlated with the other demographic variables in this study. The average age in the study sample ($N = 160$) was 45 years old ($SD = 11.2$). Age was significantly correlated with marital status. In particular, married participants were older ($M = 48$ years old, $SD = 9.2$) than single participants ($M = 44$ years old, $SD = 11.6$), $r_{(159)} = .16$, $p < .05$. Age was also related to comorbidity status. Participants who had comorbid conditions were older ($M = 49$ years old, $SD = 8.0$) compared to non-comorbid participants ($M = 41$ years old, $SD = 12.1$), $r_{(159)} = .35$, $p < .01$. In sum, people who were older were more likely to be married and report comorbid conditions than younger participants.

There were no significant relationships between gender and the other demographic variables in the present study sample. Women comprised 63 percent and men 37 percent of the study sample. Although gender was not significantly related to marital status, there was a trend for women to be more likely married (72 percent) as compared to men (28 percent). Similarly, while there were no significant differences in income between men and women, of the participants who reported earning 80 thousand dollars or more, 80 percent were women and only 20 percent were men. This could be due to potential gender difference in education; 71 percent of people earning a bachelor's degree or higher were women.

There was a significant relation between marital status and income in the present study sample, $r_{(159)} = .28, p < .05$. Eighty percent of the sample reported being single or living alone and 20 percent reported being married or living together with a significant other. Of all the participants reporting earnings less than 20 thousand dollars, 89 percent were single and only 11 percent were married. This was significantly different compared to those who reported earning 80 thousand dollars or more, of which 50 percent of the sample was married and the other 50 percent was single. In sum, participants who were single tended to earn less money and those who were married.

There were significant relationships between income and other demographic variables in this study. 40 percent of participants reported earning less than 20 thousand dollars, 34 percent reported earning between 20 and 49 thousand dollars, 13 percent earning between 50 to 79 thousand dollars, and 13 percent earning 80 thousand dollars or more. Income and education were significantly correlated as expected, $r_{(159)} = -.21, p < .01$. Of the participants who reported having a high school or below education level, 72 percent of them reported earning less than 20

thousand dollars. In contrast, 14 percent of participants with a bachelor's degree or higher reported earning less than 20 thousand dollars. Of those participants with a high school education or below, only four percent reported earning 80 thousand dollars or more. However, of those participants earning more than 80 thousand dollars a year, 31 percent of them had a bachelor's degree or higher. Overall, as a participant reported earning higher degrees of education they also reported earning higher amounts of income. Income was also related to marital status, $r_{(159)} = -.28, p < .01$; participants who reported being married or living with someone had higher income compared to those who were single or living alone. Of the participants who were single, 45 percent reported earning less than 20 thousand dollars, 34 percent reported earning between 20 and 49 thousand dollars, 13 percent reported earning between 50 and 79 thousand dollars, and only eight percent reported earning more than 80 thousand dollars. In contrast, among participants who reported being married or living together, 22 percent reported earning less than twenty thousand dollars, 34 percent reported earning between 20 and 49 thousand dollars, 13 percent reported earning between 50 and 79 thousand dollars, and 31 percent reported earning more than 80 thousand dollars. Income was also related to smoking status. Individuals who reported not smoking regularly were more likely to earn higher income when compared to participants who reported smoking regularly, $r_{(159)} = -.18, p < .05$. 16 percent of non-smokers reported earnings above 80 thousand dollars, while only 8 percent of people who reported smoking regularly reported more than 80 thousand dollars income. Only 33 percent of non-smokers reported earning less than 20 thousand dollars, while 50 percent of people who reported smoking regularly reported earning less than 20 thousand dollars. Overall, participants who

reported smoking regularly were also more likely to earn less income; and people who reported not smoking were more likely to earn a higher income.

There were significant relationships between education and other demographic variables in this study. The sample consisted of an even distribution of educational status: 31 percent of participants reported having a high school education or below, 36 percent having some college or technical school training, and 33 percent earning a bachelor's degree or above. Education and income were significantly related, $r_{(159)} = -.21, p < .01$. Of the participants who reported earning less than 20 thousand dollars, 56 percent reported having a high school education or below, 33 percent having some college, and only 11 percent having a bachelor's degree or above. This is significantly different than those who reported earning over 80 thousand dollars: only 10 percent had a high school education or below, 10 percent with some college experience, and 80 percent earned a bachelor's degree or higher. Overall, as a participant reported earning more income they also reported achieving higher levels of education. Education and smoking status were also significantly correlated, $r_{(159)} = -.39, p < .01$. Of the participants who reported smoking regularly, 42 percent reported having a high school level education or below, 47 percent had some college experience or technical training, and only 11 percent earning a bachelor's degree or higher. These percentages are significantly different when compared with participants who did not regularly smoke. Only 23 percent of non-smokers had a high school education or below, 29 percent had some college experience, and 48 percent had a bachelor's degree or higher. Overall, participants who smoked regularly on average had less education than people who did not smoke regularly.

There were significant relationships between smoking status and other demographic variables in this study. The sample consisted of 59 percent of participants who did not smoke regularly and 41 percent who did smoke regularly. Smoking and income were significantly related, $r_{(159)} = -.18, p < .05$. Of the participants who reported earning 20 thousand dollars or less, 52 percent reported to be current smokers. This is significantly different when compared with participants who reported earning over 80 thousand dollars. Only 25 percent of participants in the highest income category were current smokers. Smoking and education were also significantly related, $r_{(159)} = -.39, p < .01$. Of the participants who reported having a high school education or lower, 56 percent were current smokers and 44 percent identified themselves as a non-smoker. This is different when compared with those with a bachelor's degree or higher. Only 14 percent of participants who also had a bachelor's degree or higher were current smokers and 87 percent were non-smokers. Overall, participants who smoked regularly were on average more likely to have less education and earn less income.

There were significant relationships between comorbidity status and other demographic variables in this study. The sample consisted of 43 percent of participants who reported comorbid conditions and 57 percent without comorbid conditions. Comorbidity status and age were significantly related, $r_{(159)} = .35, p < .01$. Of the younger participants between 18 to 40 years old, 17 percent reported comorbid conditions and 83 percent did not report comorbid conditions. This is significantly different than the older participants. Of the participants 41 to 60 years old, 55 percent reported comorbid conditions and 46 percent did not report comorbid conditions. Overall, older participants were more likely to have comorbid health conditions whereas younger participants were not.

Covariate Selection and Relationship of Covariates to Outcome Measures

The associations among demographic variables, blood pressure, and cortisol were examined by correlation analyses to identify potential covariates. The sample means for the covariates (demographic variables) are provided in Table 6. To control for demographic differences in the analyses, a demographic variable was included in the analyses if it was significantly correlated with an outcome variable. This section reports only significant relations between covariates and outcome measures. See Table 6 for complete findings of the relationship of covariates to outcome measures.

Age was positively correlated with several stress outcome measures in the study. Age was positively correlated with systolic blood pressure, $r_{(159)} = .26, p < .01$. The sample mean systolic blood pressure was 133 mmHg ($SD = 16.7$). Younger participants, aged 18-40 years old, had a mean systolic blood pressure of 127 mmHg ($SD = 15.0$), while older participants, aged 41-60, had a significantly higher mean systolic blood pressure of 136 mmHg ($SD = 16.9$). Age was also correlated with diastolic blood pressure, $r_{(159)} = .25, p < .01$. The sample mean diastolic blood pressure was 82 mmHg ($SD = 12.3$). Younger participants, aged 18-40, had a mean diastolic blood pressure of 78 mmHg ($SD = 12.0$), while older participants, aged 41-60, had a significantly higher mean diastolic blood pressure of 84 mmHg ($SD = 12.0$). Furthermore, age was correlated with blood pressure change in this study, $r_{(159)} = .17, p < .05$. The average sample systolic blood pressure change was 2.1 mmHg ($SD = 11.57$). Younger participants had an average systolic blood pressure change of -0.1 mmHg ($SD = 10.50$), while older participants had a significantly higher change in systolic blood pressure of 3.0 mmHg ($SD = 11.92$). Interestingly, diastolic blood pressure did not decrease after the stress task for neither younger nor older

participants. The diastolic blood pressure change was 1.9 mmHg ($SD = 6.99$) for younger participants and 2.2 mmHg ($SD = 7.42$) for older participants. In contrast to the positive correlation between age and blood pressure, age was negatively correlated with cortisol, $r_{(159)} = -.19, p < .05$. The sample mean cortisol was 9.5 mcg/dL ($SD = 6.60$). Younger participants had a much higher average cortisol level of 12.2 mcg/dL ($SD = 7.65$) compared to older participants who on average had a cortisol average of 8.3 mcg/dL ($SD = 5.75$). In sum, younger participants had significantly lower blood pressure and higher cortisol level compared with older participants.

Income was positively correlated with several stress outcome measures in the study. Income was positively correlated with systolic blood pressure, $r_{(159)} = .19, p < .05$. The sample mean systolic blood pressure was 133 mmHg ($SD = 16.7$). Participants who earned between 20 to 49 thousand dollars had the highest systolic blood pressure at 137 mmHg ($SD = 18.2$), compared to other income categories. This is much different than participants who earned less than 20 thousands who had an average 130 mmHg ($SD = 14.5$). Income was also positively correlated with diastolic blood pressure, $r_{(159)} = .19, p < .05$. The sample mean diastolic blood pressure was 82 mmHg ($SD = 12.3$). Participants who earned between 20 to 49 thousand dollars had the highest diastolic blood pressure at 85 mmHg ($SD = 13.0$), compared to other income categories. This is much different than participants who earned less than 20 thousand dollars who had an average diastolic blood pressure of 81 mmHg ($SD = 12.2$). Overall, lower income participants had higher blood pressure. Income was also correlated with cortisol change after the stress task, $r_{(159)} = .17, p < .01$. In particular, those who earned over 80 thousand dollars had a cortisol change of 2.4 mcg/dL ($SD = 3.77$) compared to -0.5 mcg/dL ($SD = 3.80$) of those who earned under 20 thousand dollars. That is, people with higher income had a stronger cortisol

reaction to the movie compared to participants with lower income. Overall, the sample average cortisol change was .57 mcg/dL ($SD = 4.124$).

Education was positively correlated with cortisol, $r_{(159)} = .27, p < .01$. The sample mean for cortisol was 9.5 mcg/dL ($SD = 6.60$). Participants who had some college experience had significantly lower cortisol (8.2 mcg/dL, $SD = 5.66$) than participants who had earned a bachelor's degree or higher (12.0 mcg/dL, $SD = 7.28$). Participants who had a high school education had similar cortisol levels to those participants with some college (8.3 mcg/dL, $SD = 6.22$ and 8.2 mcg/dL, $SD = 5.66$ respectively). That is, people with higher levels of education had higher cortisol.

Smoking status was positively correlated with cortisol, $r_{(159)} = -.18, p < .05$. The sample mean for cortisol was 9.5 mcg/dL ($SD = 6.60$). Participants who did not smoke had higher cortisol than participants who regularly smoked (10.4 mcg/dL, $SD = 7.10$ and 8.1 mcg/dL, $SD = 5.57$ respectively).

The presence of comorbid conditions was determined based on the report of any of the following conditions: heart disease, hypertension, diabetes, or endocrine disorders. Comorbidity was positively correlated with several stress outcome measures in this study. Comorbidity status was associated with systolic blood pressure, $r_{(159)} = .24, p < .01$. The sample mean systolic blood pressure was 133 mmHg ($SD = 16.7$). People with comorbid conditions had significantly higher systolic blood pressure (138 mmHg, $SD = 17.4$) than people without comorbid conditions (130 mmHg, $SD = 15.4$). Comorbidity status was also associated with diastolic blood pressure, $r_{(159)} = .26, p < .01$. The sample mean diastolic blood pressure was 82 mmHg ($SD = 12.3$). Similar to diastolic blood pressure, people with comorbid conditions had significantly higher diastolic

blood pressure (86 mmHg, $SD = 13.1$) than participants without comorbid conditions (79 mmHg, $SD = 11.0$). Overall, those with comorbid cardiovascular or endocrine disorders had significantly higher systolic and diastolic blood pressure than those without comorbid conditions.

The only two participant characteristics that were not significantly correlated to the outcome measures of stress were gender and marital status, as shown in Table 6. Even though gender was not significantly related to the outcome measures, gender difference is likely in stress reactivity and religiousness and was therefore retained in the final analyses. The only outcome variable not significantly correlated with any of the potential covariates was the change of diastolic blood pressure.

Based on the above examination of covariates, age, gender, income, education, smoking, and comorbidity were controlled for in the subsequent regression analyses examining the relation between religiousness and spirituality with stress reactivity. Blood pressure was also significantly correlated with the measures of obesity used in this study. Systolic blood pressure was positively related to both body mass index (BMI), $r_{(159)} = .20, p < .01$, and body fat percentage, $r_{(159)} = .20, p < .01$, as shown in Table 7. Similarly, diastolic blood pressure was also positively related to both BMI, $r_{(159)} = .22, p < .01$, and body fat percentage, $r_{(159)} = .23, p < .01$. Participants with higher blood pressure were more likely to have a higher BMI and higher body fat percentage. It is important to note that cortisol was not related to BMI or body fat percentage in this study.

Religiousness and spirituality were significantly correlated with the outcome measures of stress in this study. The BMMRS total score was positively related to systolic, $r_{(159)} = -.18, p < .05$, and diastolic, $r_{(159)} = -.16, p < .05$, blood pressure as shown in Table 7. Participants who

rated themselves higher in religiousness and spirituality (lower score on the BMMRS) were more likely to have higher blood pressure. In contrast, the BMMRS total score was negatively related to cortisol, $r_{(159)} = .16, p < .05$. Participants who rated themselves higher in religiousness and spirituality (lower score on the BMMRS) were more likely to have lower cortisol. Since both blood pressure and cortisol are stress measures, they are expected to be associated with religiousness and spirituality composite score (the BMMRS total score) in the same direction. However, these results suggest religiousness and spirituality are related to both lower stress when considering blood pressure and higher baseline stress when considering cortisol, further analyses need to be conducted to control for potential confounding covariates. Blood pressure and cortisol change scores were not related to the BMMRS total score, religiousness, or spirituality.

It is also important to know whether the movie video clip was a significant stressor. The racial video clip was validated through a participant interview using a post-movie report. Eighty-nine percent of participants responded that they felt disturbed when watching the movie. Ninety-three percent of participants reported feeling emotionally moved when watching the movie.

Hypothesis 1: Does Religiousness / Spirituality Buffer an Acute Stress Response?

A significant negative linear relationship between religiousness / spirituality and stress response change scores were predicted in Hypothesis 1. Lower scores (lower scores equal greater religiousness and spirituality) of religiousness and spirituality were expected to be associated with a smaller change in blood pressure and cortisol from watching a racially charged video clip; while higher scores of religiousness and spirituality were expected to be associated with a larger change in stress measure scores. Multivariate hierarchical regression analysis was conducted with dependent variables as change scores of stress measures (systolic blood pressure, diastolic

blood pressure, and cortisol), and with independent variables as the BMMRS total scores, religiousness, spirituality, and covariates (age, gender, income, education, smoking status, and comorbidity). Covariates were accounted for before religiousness and spirituality variables were regressed on to stress response change scores. Multivariate results for the hierarchical multiple regression analyses for religiousness and spirituality are provided in Table 8 and univariate results are provided in Table 9. The results partially confirmed the prediction. Multivariate analyses did not support the hypothesis that composite religiousness/spirituality ($F_{(1, 142)} = 2.10$, $p = .10$), overall religiousness ($F_{(1, 142)} = 1.45$, $p = .23$), or overall spirituality ($F_{(1, 142)} = 1.88$, $p = .14$) were related to stress responses following an acute stressor. However, in univariate analyses, lower scores on the composite religiousness/spirituality measure (meaning higher levels of religiousness/spirituality) were associated with an increase in cortisol ($B = -.05$, $SE = .022$, $\beta = -.230$, $p = .03$) as shown in Table 9. Specifically, the more religious or spiritual participants rated themselves (lower scores on the BMMRS), the greater the changes in cortisol were experienced following an acute stressor; while, participants who rated themselves as having low levels of religiosity or spirituality had smaller changes in cortisol following the stressor.

Also in univariate analysis, although not significant, there was a trend for overall religiousness to be associated with increased cortisol stress responses ($B = .76$, $SE = .418$, $\beta = .169$, $p = .07$) as shown in Table 9. The more religious the participants rated themselves (lower scores on the overall religiousness subscale), the smaller the changes in cortisol were experienced following an acute stressor.

Note that income was a significant predictor of stress reactivity ($F_{(1, 142)} = 3.06$, $p = .03$) in the multivariate model. African Americans who made less than 20 thousand dollars had

significantly smaller stress responses (systolic blood pressure change 1.6 mmHg, diastolic blood pressure change 2.7 mmHg, and cortisol change -0.05 mcg/dL) compared to people who made more than 80 thousand dollars (systolic blood pressure change 4.1 mmHg, diastolic blood pressure change 1.7 mmHg, and cortisol change 2.4 mcg/dL) in the study.

Hypothesis 2: Does Obesity Predict Stress Reactivity?

A significant linear relationship between BMI and stress reactivity after watching a racial film clip was predicted in Hypothesis 2. Participants with a normal body mass index category were expected to have smaller stress responses (blood pressure and cortisol) when compared with participants who were overweight or obese according to body mass index. Multivariate hierarchical regression analysis was conducted with dependent variables of stress reactivity measures (changes scores of systolic blood pressure, diastolic blood pressure, and cortisol), and with independent variables of BMI, the BMMRS total scores, religiousness, spirituality, and covariates (age, gender, income, education, smoking status, and comorbidity). Covariates were accounted for before body mass index categorical variables (normal versus overweight = BMI L1L2; normal versus obese = BMI L1L3) were regressed on changes scores for stress. Multivariate results are provided in Table 8 and univariate results are provided in Table 9. The results partially supported the hypothesis. There was no main effect of BMI on stress reactivity in this study. In particular, multivariate results showed that BMI was not associated with greater change in blood pressure and cortisol (normal versus overweight: $F_{(1, 142)} = 0.32, p = .81$; normal versus obese: $F_{(1, 142)} = 0.54, p = .65$ respectively) as shown in Table 8. However, in univariate analyses, there was a significant difference between normal and obese participants in cortisol reactivity ($B = 2.98, SE = 1.382, \beta = .362, p = .03$), such that obese participants had a greater

increase in cortisol than normal participants (see Table 9). There was no difference between normal and overweight participants in cortisol change ($B = 0.90$, $SE = 1.090$, $\beta = .091$, $p = .41$). Also in univariate analysis, there was no statistically significant association between BMI and systolic blood pressure change (normal versus overweight: $B = -2.02$, $SE = 3.082$, $\beta = -.068$, $p = .51$; normal versus obese: $B = -5.32$, $SE = 3.909$, $\beta = -.234$, $p = .18$) and also no association between BMI and diastolic pressure change (normal versus overweight: $B = .51$, $SE = 1.977$, $\beta = .032$, $p = .80$; normal compared to obese: $B = -1.11$, $SE = 2.507$, $\beta = -.082$, $p = .66$).

It is interesting to note that body fat percentage was also significantly related to change in cortisol ($B = .16$, $SE = .073$, $\beta = .322$, $p = .04$) following an acute stressor as shown in Table 9. Body fat percentage variable was constructed as a categorical variable with a mean split of 33.5. Participants with a higher body fat percentage were more likely to have a smaller cortisol response ($M = 0.34$ mcg/dL, $SD = 3.654$) than participants with a lower body fat percentage ($M = 0.82$ mcg/dL, $SD = 4.601$). Note that the change in cortisol for participants with lower body fat percentages was twice the amount than participants with higher body fat percentages. This is opposite of what was expected. Upon further examination, participants with lower body fat percentages had both higher pre-movie cortisol ($M = 9.64$ mcg/dL, $SD = 6.482$ compared to $M = 9.30$ mcg/dL, $SD = 6.739$) and higher post movie cortisol ($M = 10.46$ mcg/dL, $SD = 7.503$ compared to $M = 9.64$ mcg/dL, $SD = 6.708$) higher body fat participants, indicating a potential ceiling effect.

There are several reasons why participants in the overweight BMI category experienced different reactivity responses to the acute stressor. First, the differences in the systolic blood pressure, diastolic blood pressure, and cortisol reactivity could have occurred because of

medication for hypertension. The average blood pressure of all participants in the study was 133/82 mmHg which is in the pre-hypertensive category. The average blood pressure for overweight participants was much lower at 129/78 mmHg. Participants were asked to not take their blood pressure medication the day of the study, but data is not available beyond self-report if the participant's had indeed stopped taking medication. It is also unknown how residual effects of previous doses of medication would have on blood pressure regulation during the test. The steady state of each drug taken to control blood pressure was not assessed in this study. This could help explain the difference between blood pressure and cortisol results for overweight compared to normal and obese participants.

A limitation of this study is that participants who regularly controlled their blood pressure from medication were not identified in this study. It is unknown if there were differences in medication status by group. If blood pressure were controlled artificially through medication, then you would expect to find increased cortisol reactivity as the body adjusts for allostatic load through secondary systems (such as cortisol) if primary systems (blood pressure) do not regulate freely between different states of demand. The average cortisol reactivity of all participants in the study was 0.57 mcg/dL. The average blood pressure change for overweight participants was 1.29 mcg/dL. This difference is explained through the effects of dysregulation of the HPA axis. Dysregulation of the HPA axis is expected to cause primary and secondary physiological systems (blood pressure and cortisol) to act in ways that are not expected. For example, the Action to Control Cardiovascular Risk in Diabetes (ACCORD) study found that efforts to lower blood pressure or lipids through medication did not reduce cardiovascular risks. The researchers found that artificially lowering blood pressure or lipid levels actually increased the risk of major

adverse cardiovascular events or death. When blood pressure or lipid levels were artificially controlled, the body was not able to respond to stress demands which increased health risks by relying on secondary systems of cortisol, insulin, and glucose regulation compensating for the dysregulation of primary systems including blood pressure to maintain allostasis (Cushman & Ginsberg, 2010).

Another possible explanation is that a covariate is influencing the outcome of blood pressure or cortisol reactivity. Comorbidity status, age, income, education, and gender were all controlled in this study. Religiousness and spirituality are complex variables that are multifaceted. Perhaps a different covariate is causing the inconsistent results of stress reactivity in overweight participants. Further analyses can include comorbidity status, age, income, education, and gender as interaction terms within a multivariate analysis of covariance. A limitation of this study is that only BMI categories comparing normal weight to overweight and normal weight to obese were considered in analyses. Another explanation is that overweight participants may not have reached the threshold for dysregulation of the HPA axis. The participant's response to the stressor was not consistent across the overweight BMI category. There was less buffering of stress in the overweight group up to a decrease of 8 mmHg in systolic blood pressure and more reactivity up to an increase of 36 mmHg in systolic blood pressure. This range of reactivity is higher than the normal weight (23 mmHg decrease and 17 mmHg increase) participants.

Hypothesis 3: Is Religiousness / Spirituality Differentially Associated with Stress Reactivity in Normal Versus Overweight or Obese Participants?

The relationship between religiousness/spirituality and stress reactivity was predicted to be moderated by BMI in Hypothesis 3. Among normal weight participants, high religiousness and spirituality was expected to act as a buffer to stress reactivity following an acute stressor. In overweight and obese participants, high religiousness and spirituality was expected to be associated with increases in levels of stress after viewing the film, compared to normal weight participants, due to increased allostatic load from effects of unhealthy weight. Multivariate hierarchical regression analysis was conducted with dependent variables of stress reactivity measures (change scores of systolic blood pressure, diastolic blood pressure, and cortisol), and independent variables of BMI (normal compared to overweight; normal compared to obese), body fat percentage, the BMMRS total scores, religiousness, spirituality, and the interactions of BMI with each of the spirituality and religiousness measures. Covariates (age, gender, income, education, smoking status, and comorbidity) were accounted for before body mass index categorical variables (normal compared to overweight; normal compared to obese) were regressed on measures of stress reactivity in the first step of the regression. Main effects of body mass index, body fat percentage, and religiousness/spirituality variables were entered in step two of the regression. The interactions of BMI with the religiousness/spirituality variables were entered in the third step.

Multivariate results for the hierarchical multiple regression analyses are provided in Table 8 and univariate results are provided in Table 9. The results partially supported the prediction. In multivariate analyses, there were no significant two-way interactions between any

of the religiousness/spirituality variables with the BMI categorical variables (R/S composite and BMI normal vs. overweight: $F_{(3, 136)} = .32, p = .82$, R/S composite and BMI normal vs. obese: $F_{(3, 136)} = 1.45, p = .23$, Religiousness and BMI normal vs. overweight: $F_{(3, 136)} = 2.02, p = .11$, Religiousness and BMI normal vs. obese: $F_{(3, 136)} = 1.71, p = .17$, Spirituality and BMI normal vs. overweight: $F_{(3, 136)} = .98, p = .40$, and Spirituality and BMI normal vs. obese: $F_{(3, 136)} = 1.59, p = .20$ as shown in Table 8.

In univariate analyses, there was a significant interaction of overall religiousness and the BMI variable comparing normal versus overweight status on systolic blood pressure change, $B = 7.11, SE = 3.256, \beta = .57, p = .03$ (see Table 9 and Figure 4). In particular, among participants who were highly religious (i.e., low overall religiousness scores) there was a significant difference in systolic blood pressure changes between normal weight and overweight participants; such that normal weight participants who were highly religious had a decrease in systolic blood pressure following the acute stressor whereas overweight weight participants who were highly religious experienced an increase in systolic blood pressure following the acute stressor. This supports the hypothesis that normal weight participants who are highly religious experience a buffer from stress reactivity following an acute stressor, but overweight participants who are highly religious do not experience the buffering effect. Note that obese participants experienced high stress reactivity regardless of levels of religiousness (see Figure 4). There were no significant differences between normal and obese participants in the relation between systolic blood pressure reactivity and overall religiousness ($B = 4.15, SE = 2.712, \beta = .43, p = .13$) in this study as shown in Table 9.

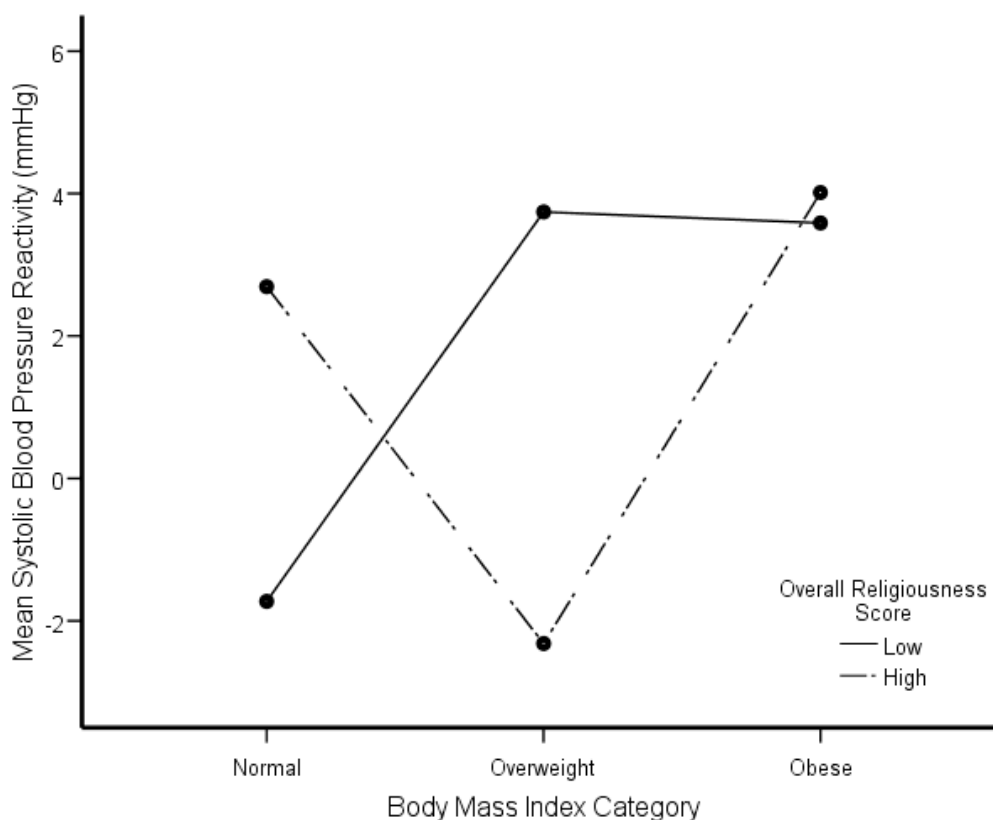


Figure 4. Significant interaction of systolic blood pressure reactivity and body mass index comparing high and low levels of religiousness³

Also in univariate analyses, there were two interactions that were nearing significance based on changes in diastolic blood pressure. The first interaction nearing significance was change in diastolic blood pressure and BMI comparing normal versus obese participants by composite scores of religiousness / spirituality, $B = .16$, $SE = 2.302$, $\beta = .76$, $p = .09$, as shown in Table 9 and Figure 5. In particular, there appeared to be a trend for normal weight participants

³ Note. Low scores on overall religiousness indicate very high religiousness.

who were highly religious and spiritual (i.e., low composite religious / spirituality scores) to have lower diastolic blood pressure reactivity, compared to normal weight participants who reported low levels of religiousness and spirituality. Moreover, among those who were highly religious and spiritual, there appeared to be a trend for obese participants to have higher diastolic blood pressure reactivity than normal weight participants; among those who had low levels of religiousness and spirituality, there appeared to be a trend for normal weight participants to have much higher diastolic blood pressure reactivity than obese participants.

The other interaction that was nearing statistical significance was the interaction between change in diastolic blood pressure and BMI comparing normal weight versus obese participants by levels of overall spirituality, $B = -4.33$, $SE = 2.302$, $\beta = -.50$, $p = .06$, as shown in Table 9 and Figure 6. For normal weight participants, high spirituality was associated with higher diastolic blood pressure change. On the other hand, for overweight and obese participants, high spirituality was associated with a low diastolic blood pressure change. In fact, among those who were highly spiritual, overweight and obese participants had only a slight stress response compared to normal weight participants. Although this interaction was not significant at the alpha level of .05, it was nearing significance and may help to demonstrate that religiousness and spirituality are complex psychological constructs that can have a wide range of effects on stress and stress reactivity in participants with different levels of allostatic load.

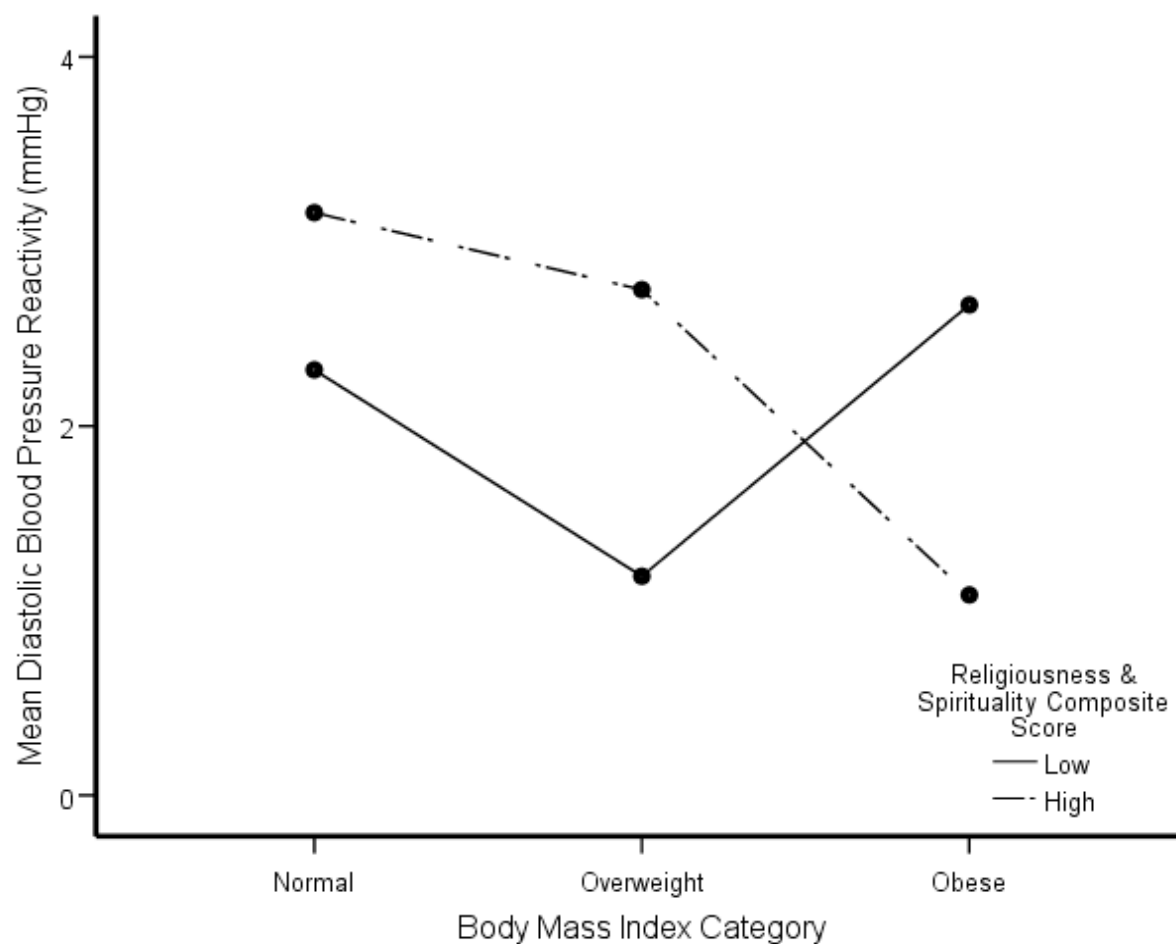


Figure 5. Interaction of BMI category and diastolic blood pressure reactivity by levels of composite religiousness / spirituality ⁴

⁴ Note. Low scores on composite religiousness / spirituality score indicate very high religiousness and spirituality.

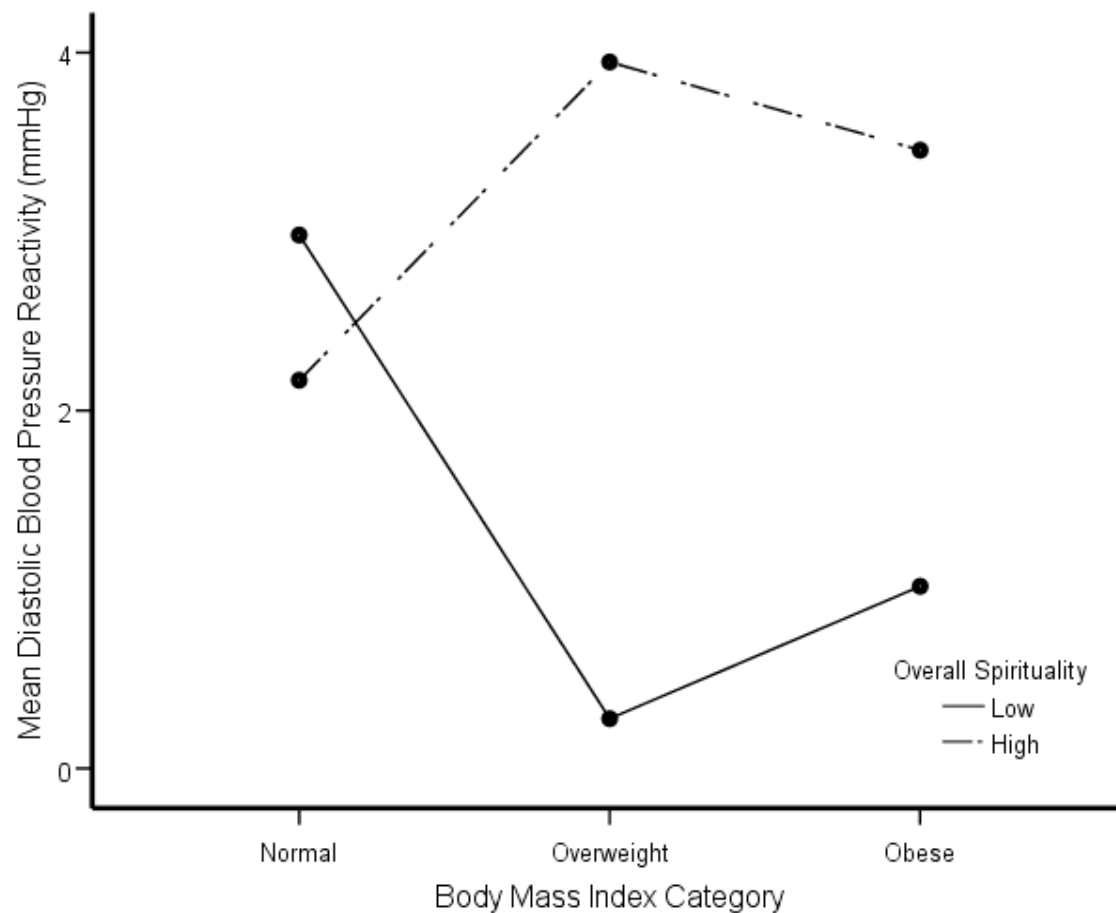


Figure 6. Interaction of diastolic blood pressure reactivity and body mass index by levels of overall spirituality⁵

There were no significant differences in the effects of composite religiousness and spirituality scores comparing normal weight participants to overweight or obese participants on systolic blood pressure reactivity ($B = -.05$, $SE = .169$, $\beta = -.12$, $p = .76$ and $B = -.07$, $SE = .145$,

⁵ Note. Low overall spirituality score indicates very high spirituality.

$\beta = -.21, p = .63$, respectively). There were also no significant differences in the effects of overall spirituality and BMI variables on systolic blood pressure reactivity (normal weight vs. overweight participants: $B = -4.18, SE = 4.912, \beta = -.24, p = .40$, and normal weight vs. obese participants: $B = -2.84, SE = 3.598, \beta = -.21, p = .43$).

Summary of Results

Results partially supported the study hypotheses. There was partial support for the first hypothesis that religiousness and spirituality buffer stress reactivity. In this study, higher composite religiousness and spirituality was related to increased cortisol stress responses. Also, there appeared to be a trend towards high overall religiousness being associated with smaller cortisol stress responses after an acute stressor. However, overall spirituality was not related to decreased stress reactivity. There was also partial support for the second hypothesis that obesity predicts stress reactivity with normal weight participants experiencing less cortisol stress reactivity compared to obese participants. However, there were no differences between normal and overweight participants cortisol reactivity. No support was found for systolic or diastolic blood pressure reactivity being related to body mass index. There was partial support found for the third hypothesis that religiousness / spirituality is differentially associated with stress reactivity in normal versus overweight or obese participants. Normal weight participants who rated themselves highly religious had significantly less systolic blood pressure reactivity following an acute stressor, but overweight and obese participants who were highly religious did not experience the same buffering effect. There was no support found for overall religiousness or overall spirituality providing a buffer effect for diastolic or cortisol stress reactivity.

In sum, stress reactivity was generally the lowest for normal weight participants and highest for participants who were obese. There was partial support for the hypotheses that religiousness and spirituality provide a buffer response to stress in normal weight participants. In addition, the hypothesis that the effect of religiousness and spirituality on stress may vary by allostatic load, as indicated by BMI in the current study, was also supported.

Discussion

The current exploratory study examined the effects of religiousness and spirituality on stress reactivity following an acute racial stressor among African American men and women. In particular, this study examined whether religiousness/spirituality serves as a buffer to stress in an allostatic model where body mass index categories are compared for changes in stress reactivity. Stress was measured by systolic blood pressure, diastolic blood pressure and salivary cortisol. A series of hierarchical multivariate multiple regression analyses revealed that religiousness and spirituality may act as a buffer for stress reactivity and is differentially expressed based on an individual's allostatic load.

Religiousness and spirituality were expected to be associated with change in blood pressure and cortisol from watching a racially charged video in the first hypothesis. The results partially confirmed the prediction. Higher levels of religiousness/spirituality were associated with an increase in cortisol. So people who were very religious or spiritual experienced a increase in stress following an acute stressor whereas people who did not claim to be very religious or spiritual had an decrease in stress. People who were very religious/spiritual did not have higher stress before the video clip. This supports the hypothesis that

religiousness/spirituality serves as a buffer to stress. It is unclear if religiousness/spirituality was consciously considered as a buffer during the stressor or if another mechanism was at work to reduce cortisol during the video.

Participants with a normal body mass index category were expected to have smaller stress responses (blood pressure and cortisol) when compared with participants who were overweight or obese according to body mass index in the second hypothesis. The results partially supported the hypothesis. Obese participants had a greater increase in cortisol than normal participants. This also supports the hypothesis that obesity contributes to allostatic load. According to the General Adaptation Syndrome (Selye, 1936), this would increase the likelihood of the sympathetic nervous system reacting following the identification of a stressor because perceived resources would not be available to properly respond to the stressor. So the body would respond by initiating the sympathetic nervous system as a way to apply its resources to the stressor until it is either resolved or the body runs out of resources and becomes exhausted according the General Adaptation Syndrome theory (Selye, 1936).

There was additional evidence to support the idea that religiousness / spirituality serves as a buffer for stress. In the third hypothesis, high religiousness and spirituality were expected to act as a buffer to stress reactivity in normal weight participants following an acute stressor. In overweight and obese participants, high religiousness and spirituality was expected to be associated with increased changes in stress, compared to normal weight participants, due to increased allostatic load from the effects of unhealthy weight. Normal weight participants who were highly religious experienced a decrease in systolic blood pressure following the acute stressor compared to normal weight participants who were low in religiousness and spirituality.

In a sense, they were more relaxed after the stressor than before. Perhaps this was due to increased reflection of their present condition and state of security in their relationship to God or a higher power. Further studies should determine if these results are consistent across other stressors. Overweight participants who were highly religious did not experience a buffering effect from religiousness following the stressor, but experienced a significant increase in stress. A possible explanation for this result within Brondolo's stress buffering model is that overweight and obese participants have dysregulated cortisol response systems due to having a higher allostatic load and are exhibiting a ceiling effect where they do not experience an increase in stress as much since they are experiencing a higher baseline of stress before the acute stressor.

Most people see religiousness and spirituality as one construct, but some view them as two distinct constructs. In the past 20 years, spirituality and religion have become two distinct terms. Spirituality includes James' definition of first-hand religion and now religion is thought of as James' second-hand meaning of religion. Harold G. Koenig, director of the Duke University Center for the study of Religion, Spirituality, and Health, has identified dimensions of spirituality and religion (H. G. Koenig, McCullough, & Larson, 2001). Spirituality is individual, unsystematic, subjective, emotional, inward, and includes freeing expression. Religion is institutional, formal, outward, doctrinal, authoritarian, and inhibits expression. In summary, religion is often viewed as a negative constricting context and spirituality as a positive freeing experience. Considering religion and spirituality as distinct constructs is also supported by the responses of participants in this study. In this sample, most people identified themselves as somewhat spiritual if not very spiritual while people were more hesitant to identify themselves as religious. One outcome of this study may be that religiousness is a better discriminator of health

outcomes since those who identify themselves as religious are more likely to be religious, whereas those who identify themselves as spiritual may not discriminate health outcomes since it is more culturally acceptable to be spiritual without being religious.

Compensation theory is important to understand when interpreting results of this study due to the high percentage of participants who identified themselves as highly spiritual and religious, earning low income, and/or homeless. Compensation theory attempts to describe why “individuals invest more heavily in one domain to make up for what is missing in the other domain” (Staines, 1980). Jung applied compensation theory earlier to how dreams can help compensate for imbalances in life (C. G. Jung, 1934, 1961; Loker, 2007).

In the context of this study, religion and spirituality serves as a compensation for the powerless who are minorities living in a majority culture, earn significantly less than others, who might be homeless and/or HIV positive. Religiousness and spirituality can help buffer stress for African Americans by providing the compensation for imbalances, or disparities, between the majority and the minority culture. Religiousness and spirituality can become a coping tool that helps minimize stress.

In terms of the reserve capacity model (Gallo & Matthews, 2003), religiousness and spirituality helps manage stress through tangible, interpersonal, and intrapersonal means. The reserve capacity, available through religiousness or spirituality, compensates for decreased access to resources or decreased position in social hierarchy and helps to reduce the increased threat of actual loss or harm and reduce the decreased potential for actual benefit/gain. Religiousness and spirituality may relate to compensation theory because African Americans have experienced a harsh imbalance in living conditions compared to Caucasians. From slavery

in the past to racism today, African Americans have endured imbalances that can be seen in health disparities, income, and education. As a result of these imbalances, compensation theory would suggest that African Americans may turn to religiousness and spirituality as a form of compensation. “The church serves a complex role in African American culture as it relates to both spiritual and non-spiritual factors. The church is particularly important to African American culture and is a source of support and guidance (Chatters et al., 2002). The importance of religiousness and spirituality to African Americans may help compensate for imbalances in predictability, challenge, and control of their environment. Predictability, challenge, and control are all aspects of resiliency that are emphasized through the vehicle of religiousness and spirituality. The church can provide assistance with correcting imbalances of distribution and access of resources among community members. So religiousness and spirituality in African Americans can be related to efforts of compensation for imbalances experienced from living as a minority in a majority culture.

Religiousness and spirituality within an African American cultural context help provide buffers to stress as outlined earlier in this dissertation. The African American church continues to assist in the development of an individual’s racial identity development through spiritual teachings and providing role models within their community. The church is also a place where people learn about God and also how to live in the world outside of the church. So the church is important to African American culture by providing both spiritual and secular resources. It is a place to come for refuge from the world and also a place to learn how to become healthier, both spiritually and physically.

The potential of African Americans to compensate for increased stress through religiousness and spirituality impacts the interpretation of these results. The scores for overall spirituality were higher than other national and diverse undergraduate samples as discussed earlier. This increase in overall spirituality can be explained through compensation theory if African Americans compensate for the lack of resources or opportunities available through support and distribution of resources within a religious or spiritual community. In summary, African American culture places a great importance on the role of the church and spirituality. This increased emphasis on religiousness and spirituality may be explained through compensation theory as a way to decrease imbalances experienced as a minority individual living within a majority culture.

How is religiousness/spirituality (R/S) related (or not related) to resilience and other constructs? Religiousness and spirituality provide a structure for making sense of stress and trauma and is related resilience (Southwick, Vythilingam, & Charney, 2005b). Religiousness and spirituality are complex constructs that are multifaceted. Within R/S there are several constructs that could be considered in this comparison. For example, religiousness could be compared to social support as it relates to the behavioral manifestation of a person's inward spiritual state. Spirituality could be compared to resilience, hopefulness, optimism, altruism, and well-being. Also important is to compare R/S to constructs that are not related, for example anxiety, depression, and substance abuse tend to be inversely related to R/S and also resiliency.

Convergent and divergent validity are two ways to measure construct validity. Convergent validity is the degree to which two constructs that are expected to measure similar constructs are related. For example, R/S and well-being measure similar constructs. As a person

scores higher on the General Well-Being Scale (GWBS), they are expected to score higher in R/S. So the GWBS would be useful in measuring convergent validity of the BMMRS.

Discriminant validity is the degree to which two constructs that are expected to measure different constructs are different from each other in expected ways. For example, spirituality is negatively related to depression. As a person scores higher on spirituality measures they also score lower on depression scales. So the Beck Depression Inventory would be useful in measuring discriminant validity of the BMMRS. The rest of this section will discuss specific findings of convergent and discriminate validity of the BMMRS.

Religiousness and spirituality has been discussed as a psychosocial factor associated with resilience (Southwick et al., 2005b). In an article on psychobiological mechanisms of resilience and vulnerability, Charney discusses how resilience “promotes behaviors that facilitate an effective survival reaction... highly effective action while experiencing fear... responses that regulate reward and motivation in the face of an unrewarding environment... maintain low levels of anxiety... and avoiding a sense of hopelessness and interpersonal withdrawal” (Charney, 2004, p. 195). Religiousness and spirituality from a macro level provide hope for a better future if not in the present, but most often in the distant future. The endpoint of most religions or faiths is an ultimate reward of eternal life either through the grace of a redeemer or through a process of good works that outweigh earthly misdeeds. While there is certainly an aspect of motivation for obtaining eternal life in most Judeo-Christian-Islamic faiths, there is also an important aspect of R/S that is focused on surviving the continued pain and stress of daily living and the concerns of living a sanctified life in an earthly existence. The psychobiological mechanisms of resilience that Charney seeks to identify would have significant overlap with R/S. The measurement of

resilience can be identified through neurochemical response patterns to acute stress (Charney, 2004). Decreased cortisol (Goodyer, Park, Netherton, & Herberg, 2001; Morgan et al., 2000), increased dehydroepiandrosterone (DHEA) (Morgan, Doran, Steffian, Hazlett, & Southwick, 2006; Morgan et al., 2000), decreased corticotropin releasing hormone (CRH) (Baker et al., 1999) can be measured to compare resilience to stress. In this way R/S and resilience overlap considerably. Researchers have shown that R/S is also related to the same neurochemical responses attributed to markers of resilience (Park, 2007b). For example, R/S has been related to decreased cortisol (Dedert et al., 2004; Ironson et al., 2002; Maselko et al., 2007; Tartaro et al., 2005) and increased DHEA (Maselko et al., 2007), decreased CRH (citation), increased dopamine (citation), serotonin (citation), and increase in neuropeptide Y (citation). Resilience is not only related to quality of life, but also to survival and length of life. R/S has been shown to be related to increased life expectancy (H. G. Koenig, 2004; Powell et al., 2003) (Zinnbauer & Pargament, 2005) and low levels of suicidality (Donahue & Benson, 1995)

Religiousness and spirituality are also related to well-being. R/S is associated with improved mental well-being, including less anxiety, less substance abuse, less depression, faster recovery from symptoms of depression, increased optimism, higher social support, and greater marital satisfaction and stability (Koenig, 2001a). Religiousness/spirituality is also associated with improved physical well-being, including less heart disease, lower blood pressure, lower cholesterol, less smoking, and better sleep (Koenig, 2004). These positive health outcomes continue to exist even after controlling for social support (P. C. Hill & Pargament, 2003). R/S may be related to health outcomes through its positive effects on health behaviors (Koenig, 2002). If people engage in healthy behaviors, then they are more likely to have increased well-

being than people who engage in unhealthy behaviors such as smoking or drinking. The Index of Well-Being (IWB) is one measure of resiliency used in research (Campbell, Converse, & Rodgers, 1976). In this measure, well-being is defined as “a complex phenomenon representing an individual’s satisfactions and dissatisfactions with his or her life including the gratifying and frustrating emotional experiences representing an individual’s life story” (Campbell, 1981; Campbell et al., 1976; Davis, 2005). No studies have reported convergent validity of well-being with the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS), has been identified as being positively related to well-being as measured by the IWB (Davis, 2005). Well-being was positively related to spirituality ($r = .30, p < .01$) (Davis, 2005). Other studies have also reported spirituality and well-being to be positively related (Kennedy, Abbott, & Rosenberg, 2002; Kennedy, Davis, & Taylor, 1998; Reed, 1987).

Hope and spirituality are closely related. One of the outcomes of spirituality is a sense of hope, renewal, and peace. Hope is the source of motivation to continue living a spiritual existence in spite of present conditions in life that may include suffering and stress. It is through hope that renewal can take place as a person reorients their natural desires and behaviors toward a religious or spiritual direction. This sanctification, or reorienting towards a spiritual existence, leads to ultimate peace not only on earth where stress exists, but also from an eternal perspective. One scientific measure of hope used in research is the Herth Hope Index (HHI) (Herth, 1992). There are only a few studies that report convergent and discriminant validity of the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS) (Reed, 1987), has been identified as being positively related to hope as measured by the HHI (Davis, 2005). Hope was positively related to spirituality ($r = .56, p < .01$) (Davis, 2005). Other studies have also reported

spirituality and hope to be positively related (Fowler, 1997) including an African American sample (Phillips & Sowell, 2000).

Religiousness and spirituality are also related to social support. Spirituality and social support are interconnected in a complex relationship. Spirituality and social support are often confused for the same construct by researchers (Oman & Thoresen, 2005). The link between spirituality and social support has been well documented and both have positive effects on health behaviors (H. G. Koenig, 2002). Spirituality and social support are similar in many ways. Religious support is similar to social support in that both involve increasing self-esteem, providing information, offering companionship, instrumental aid, and act as a stress buffer (S. Cohen & Wills, 1985). Religious support is unique to social support as well (P. C. Hill & Pargament, 2003). Ellison and Levin described the differences using the term “support convoy” (Ellison & Levin, 1998). The support convoy is a group of people who are on the same journey and direction in life. The people in the convoy may change throughout the person’s lifetime, but everyone in the convoy share the same goals, values, and worldview. Religious support is different from social support in that the content of the support is religious in nature. In religious support there is a belief that God is working through others and adds a unique element to social support. There is certainly some overlap between the two constructs, but researchers have shown that religious support is a significant predictor of health outcomes after controlling for general social support effects (VandeCreek, Pargament, Belavich, Cowell, & Friedel, 1999).

Religiousness and spirituality are expected to not be related to depression and pessimism. In theory, R/S measures different constructs and will not be positively correlated. Researchers have compared spirituality and religiousness to depression as a psychosocial factor associated

with lower depression (Southwick et al., 2005b). Koenig conducted a meta-analysis to determine if spirituality was related to health. He found that spirituality was significantly related to lower depression scores and faster recovery from depression in 60 of 93 studies (H. G. Koenig, 2001b).

Religiousness and spirituality has also been shown to be inversely related to anxiety. Giaquinto and colleagues (2007) found spirituality was related to less depression and anxiety in stroke in a study of people who recently experienced a stroke. Anxiety in general is defined by Spielberger as a complex human reaction related to an unknown threat (C. C. Spielberger, 1966). Anxiety is typically measured as either a state or trait variable based on Spielberger's conceptualization of anxiety. State anxiety is defined as a transient, relatively unique emotional reaction that may vary in intensity and fluctuate over time (C. C. Spielberger, 1966). State anxiety can be measured by the State-Trait Anxiety Inventory (STAI) (C. D. Spielberger, Gorush, Lushene, Vagg, & Jacobs, 1983). No studies have reported convergent validity of state-anxiety with the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS), has been identified as being inversely related to state anxiety as measured by the STAI (Davis, 2005). In this study, data from the STAI and BMMRS were collected. In the future, additional articles can be published from this study that address convergent and discriminant validity findings of the BMMRS measure. In this way, this study can add to the body of knowledge regarding how religiousness and spirituality as measured by the BMMRS are related to other constructs.

In summary, R/S has been shown to be related to constructs such as resilience, hope, well-being, and social support. R/S has also been shown to be inversely related to depression and anxiety. There is evidence that R/S and resilience share similar biological pathways to improved

well-being and health, particularly with decreased HPA axis stress responses. This research project will add to the body of knowledge regarding convergent and divergent validity of R/S, as measured by the BMMRS, with several other measures of resilience, hope, well-being, social support, depression, and state anxiety.

This study is important because it provides additional details about the relationship between spirituality and health outcomes. In this study, religiousness and spirituality were consistently related to lower stress reactivity after an acute stressor. In this study the composite measure of religiousness and spirituality was not conceptualized as a single item measure, but were considered complex variables emphasizing daily spiritual experiences, forgiveness, private religious practices, coping, commitment, and overall self-ratings of religiousness and spirituality. This study also extended previous research by including a higher intensity stressor (racially charged film). In previous studies, Tartaro and colleagues (2005) used a Stroop test to serve as a stressor, but it was suggested that a stronger stressor be used in further research. In this study there were significant differences in pre and post cortisol reactivity (See Table 7), but not systolic blood pressure and diastolic blood pressure. This could be due to BMI mediating systolic and diastolic blood pressure. The study also extended previous research by examining the effects of religiousness and spirituality in African American men and women. The results from this study have also added to the understanding of how individuals with a dysregulated HPA axis respond to stress differently than individuals with a lower allostatic load. This study also identified age, income, education, smoking, and comorbidity as covariates with religiousness / spirituality and stress. Also worth noting, was that gender and marital status were not significant predictors of stress reactivity in this study. This study provides an important step forward in

explaining the significant relation between religiousness / spirituality and health outcomes, but more research is needed to understand why participants with no religiousness or spirituality have more stress than individuals who are religious and/or spiritual.

Limitations

There were several limitations in this study. Simply defining spirituality and religiousness is a limitation when individuals are asked to complete a spirituality assessment. By defining spirituality, particularly when a spirituality measure is used in research, it narrowly describes a single aspect of spirituality that may not encompass the larger portion or cross-section of spirituality that is linked to improved health outcomes. This study minimized this limitation by using the Brief Multidimensional Measure of Religiousness and Spirituality which was not a simple one-item measure of church affiliation or church attendance. Even though the BMMRS was developed for use in health research it still does not encompass all the essential aspects of religiousness and spirituality that may influence stress reactivity.

Other limitations in this study include possible measurement error and reliance on self-report data for the assessment of spirituality. The perceived need to appear spiritual or religious may have contributed to inflated scores on the BMMRS. As discussed earlier, very few participants described themselves as not religious, but even fewer identified themselves as not spiritual. The study did incorporate an additional composite score that included a wider range of responses, but this measure was also not significantly related to stress as the simpler single item measure of overall religiousness and overall spirituality.

Also, recruitment of participants from asking previous participants who completed the study to tell their friends about the study may have increased the risk of “snowballing”

(Goodman, 1961). Snowballing occurs when participants who are already enrolled in the study recruit friends they know to join the study. This sampling technique is used to gain access to populations that typically do not participate in research studies. In this case, the recruiting of African American participants at a worship service or a health meeting may have resulted in a different sample composition than if the study relied solely on individuals responding to a newspaper ad or research advertisement.

Although there are few exclusion criteria in this study, there are still limits of generalizability with African Americans from a urban area. The sample for this study suggested that a larger percentage of homeless volunteers enrolled due to monetary reimbursement for taking part in the study. Changes in recruitment for the larger ongoing study were made to correct for this sampling pattern, but are not reflected in the sample for this study. Additional analyses could be made comparing results to the ongoing study to determine any differences in stress responses based on religiousness and spirituality.

In this study participants acted as their own control. There was not an independent control condition. Only African-Americans were recruited for this study. Ideally, a control group of Caucasians and a control group of African Americans that watch a neutral video clip could be used (Armstead et al., 1989; Fang & Myers, 2001; Morris-Prather et al., 1996). This is a limitation because we do not know if the intervention (racist video clip) or another artifact from the protocol causes any observed change. The ongoing larger study is currently collecting individuals to be used as a control sample. Recommendations were made after the collection of this study sample and are not reflected in this study.

Since there is not a control group in this study sample, pre-movie measures were important to obtain before the acute stressor video clip. In the study, four blood pressure measures were taken before the film clip. If blood pressure readings did not change during the baseline period, then changes after the intervention would be attributed to the film and not an artifact of the testing protocol.

Another limitation of this study was the selection of religious and spirituality measures. Although the BMMRS measures used in this study were modeled after a study by Tartaro, Luecken, and Gunn (2005) published in a respected peer-reviewed journal, two of the three measures (overall religiousness and overall spirituality) were single item questions with a range of one to four. Future studies would incorporate the long forms of the Multidimensional measure of religiousness and spirituality instead of using the brief forms or single questions from the BMMRS. Use of the long forms for each subscale of BMMRS could yield a more accurate analysis of the effects of spirituality on blood pressure and cortisol. Other scales that incorporate multiple questions such as the Daily Spiritual Experiences scale (six items) could have been included in this study. Religiousness and spirituality are complex constructs so additional spirituality measures other than the BMMRS could have been incorporated to determine convergent validity of the measures and potentially explain the results by comparing various aspects of the participant's religiousness or spirituality.

Social desirability may have impacted this study. Social desirability was not measured in this study. However, efforts were made to minimize this impact and results suggest the responses are similar to other population samples. Participants were told during the beginning of the protocol that they were not being judged based on their answers to questionnaires and that lab

staff would not read their responses, but only to check for completeness after turning in each questionnaire. Also, participants were informed they would be compensated for their time regardless of their responses as long as the questionnaires were complete. Staff members who were present with participants through the protocol were careful to not provide positive or negative feedback to how people scored on questionnaires. The efforts to inform the participant that his/her responses would be confidential and their name would not be associated with their responses were also designed to prevent social desirability from impacting the study. The scores were similar to Tartaro's study (2005) for the composite religiousness/spirituality 65.7 (19.20) compared to this study of 64.0 (20.00) overall religiousness 2.1 (.91) compared to this study 2.1 (.91) and overall spirituality 2.6 (.93) compared to this study 1.5 (.71). In the present study, people presented themselves slightly more spiritual than Tartaro's study. Also the BMMRS was used in the General Social Survey of 1988 (Fetzer, 1999) also included the overall religiousness and spirituality measure with means of 2.7 (1.03) and 2.7 (1.06). After comparing the overall religiousness, overall spirituality, and composite religiousness/spirituality of the current study with other samples, social desirability does not appear to have influenced the scores. The only exception would be the slightly higher response to the overall spirituality score. If social desirability was an issue in this study then the responses would artificially be higher than expected. There is an effect in this study. If social desirability was controlled, then the effect would be expected to be stronger in this study.

It is also possible that the video of racial tension used in this study was not strong enough to cause a change in stress. Although the video was validated through a standardized post movie interview, including a stronger stressor could benefit the study by including more relevant racial

stressors that include a familiar context. Tartaro also found that using the Stroop test was not sufficient in causing a change in stress as measured by blood pressure and cortisol. Perhaps a stronger or even more salient racial video clip is needed, instead of using racial video clips emphasizing colonial slavery from the movie *Amistad*. Future studies should incorporate stronger and more salient racial stressors from movies like *Crash* or *Gran Torino*.

Cortisol and blood pressure rarely were in agreement in this study. There are several reasons this may have occurred. The differences could be from measurement error of the outcome variables. To prevent measurement error, a standardized method of taking blood pressure was used involving an automatic blood pressure machine placed at or about heart level with the patient. The salivary cortisol samples were placed in a freezer immediately after collection to prevent measurement error as well. Additional samples of cortisol were obtained from participants who mailed their additional samples. Due to differences in time it took the post office to deliver the samples to the lab, the additional samples were not considered in this study due to potential measurement error. It is also possible that salivary cortisol is not the most effective measure of stress at baseline. Another way to measure cortisol is through blood samples, but it is an invasive process of drawing blood and thought to be enough of a stressor that it could become a confounding variable. Obtaining samples of blood also include a higher safety risk than obtaining salivary samples. Future studies could incorporate a central blood line at time of blood draw to allow collection of blood cortisol without increasing stress from multiple needle pricks.

Perhaps it is not allostatic load that increases the effects of an acute stressor or in other words it is not religiousness / spirituality that serves as a buffer to stress, but rather allostatic load

decreases variability in how the body responds to stress. Much like heart rate variability is a sign of health, perhaps stress response works in an allostatic paradigm where the body experiences stability through change. If the body can change to meet its demands then it is considered healthy. When a person has an increased allostatic load their body does not mobilize its resources to address the stressor as quickly or effectively. So a person with high allostatic load may not have as high a stress response than a person with a lower allostatic load. A person with a lower allostatic load may have a spike in blood pressure or cortisol, but they would return to baseline faster than a person who had a higher level of accumulative stress. Future studies could incorporate stress recovery, or return to baseline, as a variable for allostatic health in addition to stress reactivity.

Another limitation of this study could be the conceptualization that religiousness and spirituality is linearly related to stress. The results indicate that religiousness and spirituality may not be linearly related to stress. Religiousness and spirituality may be curvilinear in that people who report the highest levels of religiousness and spirituality also could have increased stress from additional time and obligations spent at church or a religious place of worship. In the middle of the spectrum, people who are moderately religious or spiritual appear to have the lowest levels of stress. It is possible that religiousness does buffer stress in people who are religious compared to people who are not at all religious, but too much religiousness could increase stress. This finding is similar to Tartaro's (2005) study that found the presence of religiousness and spirituality was more important than the magnitude of religiousness or spirituality in buffering effects of physiological arousal to stress. Another possible conceptualization of the relationship of religiousness and allostatic load is that people who

describe themselves as very religious could also be experiencing more stress therefore they turn to religion as a social support more than people who are moderately or somewhat religious. In this study, people who were not religious or spiritual exhibited high levels of stress. Surprisingly, their stress is similar to people who view themselves as very religious and/or spiritual. This study provides evidence that it is the presence of religiousness or spirituality that is more important for buffering stress than the extremes of having too much or the absence of religiousness and spirituality.

Clinical Implications

In people at risk for hypertension, it is useful to identify potential coping tools to minimize negative health effects on blood pressure and cortisol reactivity from racial stressors. It is believed that race disparities strongly interact to create an overwhelming allostatic load to which spirituality could provide a buffer response in lowering blood pressure and cortisol stress reactivity. If religiousness and spirituality buffers stress reactivity to a racial/discriminatory stress exposure, then spirituality and religious beliefs of the patient could be incorporated into programs designed to cope with stress, reduce negative health outcomes from race disparities for African Americans. Behavioral health providers could be encouraged to incorporate questions pertaining to the patient's spirituality and religious beliefs into medical appointments or therapy sessions to determine potential coping mechanisms for preventing or treating stress related disorders.

Summary

The findings from this study are important because they provide additional details about the relationship between spirituality and health outcomes. The outcomes from this study provide

additional evidence that religiousness and spirituality can provide a buffering effect for stress. However the results were not consistent across different measures of stress including systolic blood pressure, diastolic blood pressure, and salivary cortisol. The results also were not consistent across measures of overall religiousness, overall spirituality, and a composite score of religiousness and spirituality. As expected, the results varied across different levels of body mass index categories.

In general, normal weight participants had lower stress reactivity than overweight and obese participants. This study also provides evidence that allostatic load from overweight or obesity increases stress and decreases the body's effectiveness of responding additional stressors. Conceptually it is not known whether people who are stressed are more likely to seek comfort from spirituality and religion or if people who are spiritual or religious have less allostatic load. Acute stress responses may not be as important as the time it takes to return to baseline stress levels. Further studies on stress recovery to baseline levels of stress are needed to further understand how religiousness and spirituality buffer stress.

Tables

Table 1

Percentage of Total Deaths and Age-Adjusted Death Rates Related to Metabolic Syndrome in the United States for 2005

<u>Rank</u>	<u>Cause of death*</u>	<u>Number**</u>	<u>Percent of total deaths</u>	<u>Age-adjusted death rate</u>		
				2005 crude death rate	Ratio African American to Caucasian	
1	Diseases of heart	652,091	26.6	220.0	211.1	1.3
3	Cerebrovascular diseases	143,579	5.9	48.4	46.6	1.5
4	Chronic lower respiratory diseases	130,933	5.3	44.2	43.2	0.7
6	Diabetes mellitus	75,119	3.1	25.3	24.6	2.1
13	Essential (primary) hypertension and hypertensive renal disease	24,902	1.0	8.4	8.0	2.6

Note. From “Deaths: Final data for 2005” by K. Hsiang-Ching, D. L. Hoyert, X. Jiaquin, & S. L. Murphy, 2008, National Vital Statistics Report, 56 (11), p.121. *Cause of death based on the International

Classification of Diseases, Tenth Revision, 1992. **Death rates on an annual basis per 100,000 population: age-adjusted rates per 100,000 U.S. standard population. The asterisks preceding the cause-of-death codes indicate that they are not part of the International Classification of Diseases, Tenth Revision (ICD-10).

Table 2

Classification of Blood Pressure for Adults Aged 18 years and Older

BP Classification	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
Normal	< 120	< 80
Prehypertension	120 – 139	80 – 89
Stage 1 Hypertension	140 – 159	90- 99
Stage 2 Hypertension	≥ 160	≥ 100

Note. BP = blood pressure, mm = millimeters, Hg = mercury.

Table 3

Summary Table of Regression Analyses

Hypothesis	Predictor Variable(s)	Criterion Variables
1	Religiousness / Spirituality Composite	Systolic Blood Pressure Change Diastolic Blood Pressure Change & Cortisol
2	Body Mass Index Category & Body Fat Percentage	Systolic Blood Pressure Diastolic Blood Pressure & Cortisol
3	Body Mass Index Category & Religiousness / Spirituality	Systolic Blood Pressure Change Diastolic Blood Pressure Change & Cortisol

Table 4

Sample Demographic Characteristics of Age, Body Composition, Gender, Marital Status, Income, Education Level, Smoking Status, and Comorbidity (N = 160)

Measure		M	SD
Age (years)		44.7	11.24
BMI (kg/m ²)		30.3	8.59
Body Fat Percentage		33.5	8.52
Characteristic	Level	%	
Gender	Female	63	
	Male	37	
Marital Status	Single / Living Alone	80	
	Married / Living Together	20	
Income	< \$20K	40	
	\$20-49K	34	
	\$50-79K	13	
	> \$80K	13	
Education	High School & Below	31	
	Some College	36	
	Bachelors & Above	33	
Smoking	Current Smoker	41	

	Non Smoker	59
Comorbidity	Comorbid	43
	Not Comorbid	57
BMI Category	Normal	33
	Overweight	20
	Obese	47

Note. BMI= Body Mass Index (kg/m^2), Comorbidity is based on presence of heart disease, hypertension, diabetes, or endocrine disorder, BMI category normal equivalent to 0 to 24.9 (kg/m^2), BMI category overweight equivalent to 25 to 29.9 (kg/m^2), BMI category obese equivalent to 30 and greater (kg/m^2).

Table 5

*Means, Standard Deviations for Religiousness, Spirituality, Blood Pressure, and Cortisol**(N = 160)*

<u>Measure</u>	<u>M</u>	<u>SD</u>
BMMRS Total	64.0	20.00
Religiousness Overall	2.1	0.92
Spirituality Overall	1.5	0.68
Systolic Blood Pressure Baseline	133.0	16.70
Diastolic Blood Pressure Baseline	82.0	12.30
Systolic Blood Pressure Change	2.1	11.57
Diastolic Blood Pressure Change	2.1	7.27
Cortisol Baseline	9.5	6.60
Cortisol Change	0.6	4.12

Note. BMMRS = Brief Multidimensional Measure of Religiousness and Spirituality. Baseline blood pressure calculated as a mean score from all available time points before the video clip.

Table 6

Inter-correlations for Demographic Variables, Blood Pressure Change, and Cortisol Change (Point by Serial) (N = 160)

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SBP Change	--	.36**	.03	.17*	.13	.03	.10	-.15	.07	-.08	.04	.01	.05
2. DBP Change		--	.03	.05	-.00	-.06	-.01	-.07	-.02	.03	.05	.04	.01
3. Cortisol Change			--	-.02	-.06	.05	.02	-.02	.17*	.04	.07	-.07	-.05
4. Age				--	.09	.15*	-.03	-.07	-.07	.02	-.12	.13	.35**
5. Sex					--	-.09	.10	.01	-.13	-.04	-.12	.10	-.01
6. Marital Status						--	.00	-.01	.28**	.05	.05	.03	.07
7. Income L1L2							--	-.28**	-.27**	.17*	.03	.04	-.07
8. Income L1L3								--	-.15	.05	.13	-.18*	-.08
9. Income L1L4									--	-.21**	.38**	-.13	.05
10. Education L1L2										--	-.52**	.19*	.00
11. Education L1L3											--	-.39**	-.01
12. Smoking												--	-.06
13. Comorbidity													

Note. Pearson coefficient used for continuous variables. Point by Serial coefficient used for dichotomized-by-continuous variables.

SBP = Systolic Blood Pressure (mm Hg). DBP = Diastolic Blood Pressure (mm Hg). IncomeL1L2 = Comparing to 20-49K Under 20K. IncomeL1L3= Comparing 50-79K to Under 20K. IncomeL1L4= Comparing Above 80K to Under 20K. Education L1L2= Comparing Some College to High School and Below. Education L1L3= Comparing Bachelors and Above to High School and Below. Comorbidity is based on presence of heart disease, hypertension, diabetes, or endocrine disorder. $*p < .05$, $**p < .01$.

Table 7

Inter-correlations for Blood Pressure, Cortisol, Body Composition, Religiousness, and Spirituality (Pearson's R) (N = 160)

Measure	1	2	3	4	5	6	7	8	9	10	11
1. SBP	--	.84**	-.08	-.01	-.03	-.04	.20**	.20**	-.18*	.01	-.13
2. DBP		--	-.02	.09	-.08	-.04	.22**	.23**	-.16*	-.08	-.13
3. Cortisol			--	.12	-.04	-.19*	-.07	-.07	.16*	.16*	.08
4. SBP Change				--	.36**	.03	.13	.08	.04	.03	-.01
5. DBP Change					--	.03	-.04	-.09	-.03	-.01	.08
6. Cortisol Change						--	.05	.00	-.10	.07	.03
7. BMI							--	.86**	-.07	.20	.37
8. Body Fat								--	-.07	-.13	-.15
9. BMMRS Total									--	.47**	.52**
10. Religiousness										--	.33**
11. Spirituality											--

Note. BMI = Body Mass Index (kg/m^2). BMMRS = Brief Multidimensional Measure of Religiousness and Spirituality. SBP = Systolic Blood Pressure (mm Hg). DBP = Diastolic Blood Pressure (mm Hg). $*p < .05$, $**p < .01$.

Table 8

Results of the Hierarchical Multiple Regression Analysis of Religiousness, Spirituality, and Body Composition on Change in Blood Pressure and Cortisol, Controlling for Age, Sex, Income, Education, Smoking Status, and Comorbidity (N = 160).

Step	Variable	F	p
1	Constant	.66	.58
	Age	1.41	.34
	Sex	.82	.49
	Income L1L2	1.40	.25
	Income L1L3	.85	.47
	Income L1L4	2.42	.07
	Education L1L2	1.27	.29
	Education L1L3	1.28	.29
	Smoking Status	.43	.73
	Comorbidity	.26	.86
2	Constant	.71	.55
	Age	1.34	.26
	Sex	.75	.52
	Income L1L2	1.75	.16
	Income L1L3	.81	.49
	Income L1L4	3.06	.03

	Education L1L2	1.65	.18
	Education L1L3	1.94	.13
	Smoking Status	.40	.75
	Comorbidity	.14	.93
	Body Fat	1.90	.13
	BMI L1L2	.48	.70
	BMI L1L3	2.24	.09
	BMMRS Total	2.10	.10
	Religiousness	1.45	.23
	Spirituality	1.88	.14
3	Constant	.34	.80
	Age	1.17	.32
	Sex	.71	.55
	Income L1L2	1.34	.27
	Income L1L3	.68	.56
	Income L1L4	3.32	.02
	Education L1L2	1.46	.23
	Education L1L3	2.13	.10
	Smoking Status	.39	.76
	Comorbidity	.07	.98
	Body Fat	1.91	.13
	BMI L1L2	.32	.81

BMI L1L3	.54	.65
BMMRS Total	2.24	.09
Religiousness	.65	.59
Spirituality	2.40	.07
BMMRS Total*BMI L1L2	.32	.82
BMMRS Total*BMI L1L3	1.45	.23
Religiousness*BMI L1L2	2.02	.11
Religiousness*BMI L1L3	1.71	.17
Spirituality*BMI L1L2	.98	.40
Spirituality*BMI L1L3	1.59	.20

Note. IncomeL1L2 = Comparing Under 20K to 20-49K, IncomeL1L3= Comparing Under 20K to 50-79K, IncomeL1L4= Comparing Under 20K to Above 80K, Education L1L2= Comparing High School and Below to Some College, Education L1L3= Comparing High School and Below to Bachelors and Above, Comorbidity is based on presence of heart disease, hypertension, diabetes, or endocrine disorder, BMI = Body Mass Index (kg/m²), BMI L1L2 = Comparing Normal to Overweight, BMI L1L3 = Comparing Normal to Obese, BMMRS = Brief Multidimensional Measure of Religiousness and Spirituality, *p < .05, **p < .01.

Table 9

Results of the Hierarchical Multiple Regression Analysis of Religiousness, Spirituality, and Body Composition on Change in Blood Pressure and Cortisol, Controlling for Age, Sex, Income, Education, Smoking Status, and Comorbidity (N = 160).

Step	Variable	SBP Change			DBP Change			Cortisol Change		
		B	β	<i>p</i>	B	β	<i>p</i>	B	β	<i>p</i>
1	Constant			.00			.00			.00
	Age	.18	.17	.04	.04	.05	.54	.01	.04	.67
	Sex	-2.80	-.12	.15	-.22	-.02	.86	.33	.04	.64
	Income L1L2	-2.25	-.09	.33	1.74	.11	.24	-.60	-.07	.47
	Income L1L3	3.62	.11	.25	2.93	.14	.15	-.15	-.01	.90
	Income L1L4	-2.96	-.09	.38	2.41	.11	.27	-2.44	-.20	.05
	Education L1L2	1.37	.06	.56	-2.11	-.14	.17	-.68	-.08	.43
	Education L1L3	-.33	-.01	.91	-3.37	-.22	.06	.00	.00	1.00
	Smoking Status	.41	.02	.84	-.88	-.06	.51	.58	.07	.44
	Comorbidity	.33	.01	.87	.29	.02	.82	.61	.07	.39
	Model R ²			.03			.03			.01
2	Constant			.75			.47			.28
	Age	.19	.18	.046	.05	.08	.40	-.01	-.01	.97
	Sex	-3.05	-.13	.17	.00	.00	1.00	-.01	.00	1.00
	Income L1L2	-1.85	-.08	.45	2.14	.14	.18	-1.07	-.12	.22

	Income L1L3	2.78	.08	.39	3.21	.15	.13	-.02	-.01	.99
	Income L1L4	-3.73	-.11	.29	2.64	.12	.24	-2.79	-.22	.03
	Education L1L2	1.50	.06	.54	-2.61	-.17	.10	-.57	-.07	.51
	Education L1L3	.28	.01	.92	-4.18	-.27	.03	-.02	-.01	.98
	Smoking Status	.33	.01	.88	-.92	-.06	.49	.52	.06	.48
	Comorbidity	1.07	.05	.62	.31	.02	.82	.34	.04	.66
	Body Fat	-.12	-.09	.56	.14	-.17	.29	.16	.32	.04
	BMI L1L2	-2.02	-.07	.51	.51	.03	.80	.90	.09	.41
	BMI L1L3	-5.32	-.23	.18	-1.11	-.08	.66	2.98	.36	.03
	BMMRS Total	.03	.04	.69	-.04	-.11	.32	-.06	-.23	.03
	Religiousness	.66	.05	.58	-.46	-.06	.54	.76	.17	.07
	Spirituality	-.59	-.03	.73	1.57	.15	.14	.94	.16	.11
	Model R ²			.78			.09			.13
	Model ΔR ²			.75			.06			.12
3	Constant			.97			.53			.46
	Age	.18	.18	.06	.05	.07	.44	-.01	-.01	.90
	Sex	-3.12	-.13	.16	-.26	-.02	.85	-.13	-.02	.86
	Income L1L2	-1.53	-.06	.54	1.79	.12	.27	-1.08	-.13	.22
	Income L1L3	1.58	.05	.64	3.10	.14	.16	-.15	-.01	.90
	Income L1L4	-4.60	-.13	.20	2.39	.11	.30	-2.98	-.24	.02
	Education L1L2	2.05	.09	.41	-2.17	-.14	.17	-.56	-.07	.52
	Education L1L3	.79	.03	.79	-4.27	-.28	.03	-.07	-.01	.95

Smoking Status	.64	.03	.76	-.70	-.05	.60	.58	.07	.44
Comorbidity	.79	.03	.72	.27	.02	.85	.23	.03	.77
Body Fat	-.15	-.11	.49	-.12	-.14	.38	.16	.33	.03
BMI L1L2	-7.53	-.26	.43	.13	.01	.98	-1.61	-.16	.63
BMI L1L3	-6.08	-.26	.45	-5.29	-.36	.31	-2.20	-.25	.48
BMMRS Total	.10	.16	.67	-.190	-.52	.16	-.06	-.28	.05
Religiousness	-7.25	-.58	.29	-1.92	-.24	.31	-1.17	-.26	.56
Spirituality	4.70	.28	.62	8.35	.78	.02	.88	.15	.15
BMMRS*BMI L1L2	-.05	-.12	.76	.08	.28	.47	.01	.06	.87
BMMRS*BMI L1L3	-.07	-.21	.63	.16	.76	.09	-.01	-.03	.94
Religious*BMI L1L2	7.11	.57	.03	1.55	.20	.46	1.40	.32	.22
Religious*BMI L1L3	4.15	.43	.13	.26	.04	.88	1.58	.46	.10
Spiritual*BMI L1L2	-4.18	-.24	.40	-5.28	-.47	.10	-.69	-.11	.69
Spiritual*BMI L1L3	-2.84	-.21	.43	-4.33	-.50	.06	1.37	.28	.28
Model R ²			.64			.02			.04
Model ΔR^2			-.14			-.07			-.09

Note. IncomeL1L2 = Comparing Under 20K to 20-49K, IncomeL1L3= Comparing Under 20K to 50-79K, IncomeL1L4= Comparing Under 20K to Above 80K, Education L1L2= Comparing High School and Below to Some College, Education L1L3= Comparing High School and Below to Bachelors and Above, Comorbidity is based on presence of heart disease, hypertension, diabetes, or endocrine disorder, BMI = Body Mass Index (kg/m²), BMI L1L2 = Comparing Normal to Overweight, BMI L1L3 = Comparing Normal to Obese, BMMRS = Brief

Multidimensional Measure of Religiousness and Spirituality, $*p < .05$, $**p < .01$.

Appendices

Appendix A: Hypotheses

H1: There will be a significant inverse linear relationship between religiousness / spirituality and stress reactivity after watching a racial video clip.

H2: There will be a significant linear relationship between obesity and stress reactivity after watching a racial video clip.

H3: Religiousness / spirituality are expected to be differentially associated with stress reactivity in normal versus overweight and obese participants.

Appendix B: Participant Timeline

G572GF - Reasons for Health Disparities among AA Timeline

SUBJECT ID _____ DATE _____ TIME _____ STUDY 1

Day of Test	_____	Turn on all equipment
	_____	Set up blood drawing equipment
Time _____	_____	Consent Subject
	_____	Initial Blood Pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
	_____	Body weight of subject (BW) _____ kg
	_____	Height of subject _____ cm
	_____	BIA Resistance: _____ Reactance: _____
	_____	WHR Measurement; Waist: _____ Hip: _____
	_____	Ratio: _____
Time _____	_____	Blood Draw (30 mL)
	_____	_____ mg/dl Blood Glucose
Timer: 5 minutes	_____	Inform subject it is now okay to eat a snack if hungry.
Time _____	_____	Subject rests for 10 min.
Time _____	_____	Record HR _____
	_____	Blood Pressure (supine) (Pre Questionnaires)
	_____	Systolic BP
	_____	Diastolic BP
Time _____	_____	Questionnaires
	_____	Medical History Questionnaire AND Demographic Profile
	_____	Paffenbarger Physical Activity Questionnaire (PPAQ)
	_____	Perceived Stress Scale
	_____	Pittsburgh Sleep Quality Index (PSQI)
	_____	Beck Depression Inventory (BDI)
	_____	General Ethnic Discrimination (GED)
Time _____	_____	Record HR _____
	_____	Blood Pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
	_____	(~5MIN BREAK)
	_____	Brief Multidimensional Measure of Religiousness and Spirituality (BMMRS)

	_____	Impact of Event Scale_ Revised
	_____	Family Communication & Family Satisfaction (FACES IV)
	_____	Profile of Moods States
	_____	Daily Hassles Scale (DHS)
Time_____	_____	Record HR _____
	_____	Blood Pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
	_____	(~5 MIN BREAK)
	_____	Food Frequency Questionnaire
	_____	Coping Style Questionnaire
	_____	Dispositional Resilience Scale (Cognitive Hardiness)
	_____	Multidimensional Health Locus of Control
	_____	Self Evaluation Form (STAI: Y1 & Y2)
Time_____	_____	Record HR _____
	_____	Post Questionnaire blood pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
Time_____	_____	Subject rests for 10 min.
	_____	Ask subject post questionnaire questions
Time_____	_____	Record HR _____
	_____	Pre Movie blood pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
Time_____	_____	Pre Movie Saliva Sample
Time_____	_____	Watch Movie Clip
Time_____	_____	Record HR _____
	_____	Post blood pressure (supine)
	_____	Systolic BP
	_____	Diastolic BP
	_____	Ask subject post movie questions
Time_____ (+10min)	_____	Post Movie Saliva Sample
	_____	Saliva Pack given to participant with directions and mailer pack (2 tubes)
	_____	Provide summary of physical results

Appendix C: Generalized Skinfold Equations

Three-Site Formula

Men (chest, triceps, subscapular)

Body density = $1.1125025 - 0.0013125 (\text{sum of three skinfolds}) + 0.0000055 (\text{sum of three skinfolds})^2 - 0.000244 (\text{age})$.

Women (triceps, suprailiac, abdominal)

Body density = $1.089733 - 0.0009245 (\text{sum of three skinfolds}) + 0.0000025 (\text{sum of three skinfolds})^2 - 0.0000979 (\text{age})$

American College of Sports Medicine (ACSM) Guidelines (Jackson & Pollock, 1985).

Appendix D: List of Questionnaires

First set of questionnaires

Medical History and Demographics Questionnaire

Paffenbarger Physical Activity Questionnaire

Perceived Stress Scale

Pittsburgh Sleep Quality Index

Beck Depression Inventory

General Ethnic Discrimination

Second set of questionnaires

Brief Multidimensional Measure of Religiousness and Spirituality

Impact of Event Scale – Revised

Family Communication and Family Satisfaction

Profile of Moods States

Daily Hassles Scale

Third set of questionnaires

Food Frequency Questionnaire

Coping Style Questionnaire

Dispositional Resilience Scale

Multidimensional Health Locus of Control

Self Evaluation Form

Appendix E: Instructions for Saliva Collection and Return of Samples

Instructions

Day 1- AFTER TESTING

1. Collect saliva sample as soon as you wake up in the morning.
2. Remove cotton roll from tube and place it under your tongue for 3 to 5 minutes, or until it is saturated.
3. Return cotton roll to tube, cap tightly, and place tube in zip lock bag with absorbent pad.
4. Freeze sample.

In the Late Afternoon / Evening

1. Collect saliva sample between 5 and 6 pm.
2. Remove cotton roll from tube and place it under your tongue for 3 to 5 minutes, or until it is saturated.
3. Return cotton roll to tube, cap tightly, and place tube in zip lock bag with absorbent pad.
4. Freeze sample.

Day 2

1. Place the zip lock bag of the two tubes with cotton in the provided pre-paid envelope and mail it back to the Human Performance Laboratory at Uniformed Services University.

Appendix F: Brief Multidimensional Measure of Religiousness and Spirituality (Fetzer, 1999).

BMMRS

Subject ID: 	Date: / /
The following questions deal with possible spiritual experiences. To what extent can you say you experience the following:	

	Many Times A Day	Every Day	Most Days	Some Days	Once In A While	Never Or Almost Never
01. I feel God's presence.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
02. I find strength and comfort in my religion.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
03. I feel deep inner peace or harmony.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
04. I desire to be closer to or in union with God.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
05. I feel God's love for me, directly or through others.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
06. I am spiritually touched by the beauty of creation.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

	Strongly Agree	Agree	Disagree	Strongly Disagree
07. I believe in a God who watches over me.	☐ 1	☐ 2	☐ 3	☐ 4
08. I feel a deep sense of responsibility for reducing pain and suffering in the world.	☐ 1	☐ 2	☐ 3	☐ 4
09. I try hard to carry my religious beliefs over into all my other dealings in life.	☐ 1	☐ 2	☐ 3	☐ 4

Think about how you try to understand and deal with major problems in your life. To what extent is each of the following involved in the way you cope?

	A Great Deal	Quite A Bit	Somewhat	Not At All
10. I think about how my life is part of a larger spiritual force.	☐ 1	☐ 2	☐ 3	☐ 4
11. I work together with God as partners.	☐ 1	☐ 2	☐ 3	☐ 4
12. I look to God for strength, support, and guidance.	☐ 1	☐ 2	☐ 3	☐ 4
13. I feel God is punishing me for my sins or lack of spirituality.	☐ 1	☐ 2	☐ 3	☐ 4
14. I wonder whether God has abandoned me.	☐ 1	☐ 2	☐ 3	☐ 4
15. I try to make sense of the situation and decide what to do without relying on God.	☐ 1	☐ 2	☐ 3	☐ 4
16. To what extent is your religion involved in understanding or dealing with stressful situations in any way?	☐ 1	☐ 2	☐ 3	☐ 4
17. I try to carry my religious beliefs over into all my other dealings in life.	☐ 1	☐ 2	☐ 3	☐ 4

BMMRS - 1 -

Appendix F: (cont)

BMMRS	More Than Once A Day	Once A Day	A Few Times A Week	Once A Week	A Few Times A Month	Once A Month	Less Than One A Month	Never
18. How often do you pray privately in places other than at church or synagogue?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8
19. Within your religious or spiritual tradition, how often do you meditate?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8
20. How often do you watch or listen to religious programs on TV or radio?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8
21. How often do you read the Bible or other religious literature?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8
22. How often are prayers or grace said before or after meals in your home?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8

Because of my religious or spiritual beliefs:

	Always Or Almost Always	Often	Never	Seldom
23. I have forgiven myself for things I have done wrong.	☐ 1	☐ 2	☐ 3	☐ 4
24. I have forgiven those who hurt me.	☐ 1	☐ 2	☐ 3	☐ 4
25. I know that God forgives me.	☐ 1	☐ 2	☐ 3	☐ 4

	More Than Once A Week	Every Week Or More Often	Once Or Twice A Month	Every Month Or So	Once Or Twice A Year	Never
26. How often do you go to religious services?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
27. Besides religious services, how often do you take part in other activities at a place of worship?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

	Very	Moderately	Slightly	Not At All
28. To what extent do you consider yourself a religious person.	☐ 1	☐ 2	☐ 3	☐ 4
29. To what extent do you consider yourself a spiritual person.	☐ 1	☐ 2	☐ 3	☐ 4

30. What is your current religious preference? _____

BMMRS- 2 -

Appendix G: Allostasis and Allostatic Load

Homeostasis as defined by Bernard (1865) seeks to maintain stability by holding constant the internal milieu. This internal milieu is conceptualized at the organ level and requires negative feedback to correct deviations from homeostasis. Sterling and Eyer discuss how organs that are studied in a dish respond well to homeostasis theories which posit the mind and body are separated, but results are less clear when considered as a whole person keeping their internal milieu in control. An example was provided by the authors regarding an individual student whose blood pressure was recorded over 24 hours, depending on the activity (sleeping, sex, getting ready for school) the blood pressure changed. “Clearly, to achieve stability an organism must occupy each one of these different states and move flexibly between them. At each behavioral transition the blood pressure must be reset to match the new state” (Sterling & Eyer, 1988, p. 633).

Homeostasis and allostasis both address demands to stress, one at an organ level and the other at a whole person level in context to their surroundings. Cannon’s research included fight or flight responses to acute stressors of pain, fear, and rage. Selye’s research included stressors of a longer duration and mild stressors of frustration. Racism can be experienced either acutely or over a long period of time.

Sterling and Eyer discuss that when an acute stressor is removed from, the blood pressure drops, but when the stressor is chronic and then removed the blood pressure may remain elevated with no drop in blood pressure. From a behavioral perspective, previously neutral stimuli can be paired with an aroused state and eventually reinforce arousal in the absence of the original stressor. Through adaption chronic arousal can be made permanent, while there is still allostatic

regulation, but at a higher setpoint. Evidence to support this comes from the various animal studies that show the stress level does not diminish after a chronic stressor is removed (Sterling & Eyer, 1988; Forsythe, 1969; Henry et al., 1967; Folkow and Rubinstein, 1966). It is possible that racism if experienced as a chronic stressor could lead to higher levels of blood pressure in African Americans regardless of the presence of an acute racial stressor.

There are many benefits of the allostatic model when compared to models of homeostasis. First, allostasis is a more complex form of regulation than homeostasis, because it operates at a brain/body level and not only through local feedback. Second, allostasis can match resources to particular situations. Homeostasis works through specific set-points to trigger an event. If the body worked this way, then one would have an average blood pressure set point. If this were the case, then a person's blood pressure would be too low when exercising or too high when sleeping. Instead, Allostasis allows the body to match its needs through constant re-evaluation and adjustments of all parameters and set points. Third, allostasis anticipates demands ahead of time. In homeostasis, the trip point must be past before an adjustment. In Allostasis, the mind anticipates the demand. For example, when a person decides they are going to stand up from a seated position, the mind anticipates the change in blood pressure. If the mind did not anticipate the demand, when a person stood up suddenly, they would become dizzy then their body would increase blood pressure. Lastly, allostasis benefits from experience. This cannot happen in a homeostatic regulatory system that works solely through negative feedback at the organ level.

Allostasis can also help explain why spirituality may lead to decreased stress reactivity. In an allostatic model, arousal is described as a catabolic period that allows for physiological,

behavioral, and emotional coping to a stressor. When coping has ameliorated the stressor, relaxation must occur. Relaxation is described as an anabolic period that is necessary to restore the body and blood pressure. So there is a balance between periods of arousal and periods of rest.

Sterling and Eyre discuss the religious observance of the Sabbath day as a cultural adaptation for anabolic activity. The Sabbath serves the purpose to reset the body from a week of stressors. "From this point of view one might consider the Sabbath as a cultural adaption to ensure regular periods of physiological, interpersonal, and spiritual anabolism. Its progressive corruption in modern society reflects the continued unrestricted expansion of arousing activities and the loss of a potentially important source of anabolic (restorative) time" (Sterling & Eyer, 1988, pp. 640-641). Allostasis helps support the hypothesis that spirituality and religiousness can serve as buffers to stress and stress reactivity. If there is a time of stress, there needs to be a time of relaxation. Most Judeo-Christian faiths promote the idea of a Sabbath day of rest. Through the religious observances anabolic processes can help balance catabolic periods of stress.

A homeostatic model defines health as a state in which all the physiological parameters have 'normal' values. A value outside of the normal range is said to be 'inappropriate', and thus a candidate for 'treatment'. In an allostatic model health is defined as the ability to respond to demands throughout the day. A balance of catabolic and anabolic states is necessary. In Allostasis, any period of demand or arousal which increases catabolic hormones that break down the energy stores to meet the demand, should be followed by a period of rest that stimulates anabolic hormones to restore energy sources in the body. If blood pressure remains high then the person loses their ability to regulate effectively when higher demands are present or opportunities to relax are provided. Instead of providing pharmacotherapy to lower blood

pressure as found in the homeostatic model, allostatic theory would seek to reduce arousal instead. In Allostasis, health is considered a proper balance between catabolism and anabolism. An allostatic therapy would encourage people to work and rest proportionally and seek to increase predictability, control, and feedback in order to reduce arousal. This therapy is different from a homeostatic therapy that targets a specific mechanism of blood pressure, by considering the whole person mind-body connection and reducing pressure through multiple psychological and social mechanisms instead.

Allostatic load and resilience are related concepts and each concept fits well within a behavioral health perspective. They are both similar because they are related to similar measures of health. The definition of resilience from the American Psychological Association (2004) is “an interactive product of beliefs, attitudes, approaches, behaviors, and perhaps physiology that help people fare better during adversity and recover more quickly following it.” Allostasis has been defined by McEwen as “stability through change” (McEwen, 1997). Both definitions are similar in that resilience includes responding to adversity (stress) well and then recovering quickly and the other includes the idea of being able to react to situations that require different stress demands easily. So allostatic load and resilience fit well within the definitions of each term.

A person who is resilient is going to have the ability to change between states depending on the requirements placed on their body. A person that is resilient they will keep a lower allostatic load compared to someone who is not resilient because they will be able to balance catabolic and anabolic states, in other words have a balance between times of stress and times of rest. Selye’s General Adaptation Syndrome (GAS) can also be used to discuss how allostatic

load and resilience are related. In GAS there are three stages. Selye developed the concept of GAS, to describe how the nervous system responds to stress. The first stage is an alarm reaction, followed by the second stage of resistance, and if the body does not adapt to the stress then the third phase of exhaustion results (Selye & Fortier, 1950). Selye's work helped scientists understand the physiological process of how the body responds to stress in stages. A person who is resilient would become aroused during alarm reaction, resist the stressor, and then recover by replenishing the resources used to resist the previous stressor. If a person has a high allostatic load, then they would also become aroused during alarm reaction, but they would respond differently than someone who is resilient. They would resist the stressor, but either run out of resources and enter the exhaustion phase or fail to replenish resources to meet the next demand. A person who is healthy within an allostatic model would become aroused; resist the stressor through catabolic processes of making energy available for critical thinking or energy for physiological activity. The healthy person would then replenish resources through anabolic periods of rest after the stress demand has been met.

Appendix H: Predicting Reactivity to Stress From Allostatic Load Criteria

It may be possible to predict reactivity to stress by considering the criteria for allostatic load as possible tags. Allostatic load has been previously measured by levels of corticosterone (Smith and Myburgh, 2004; Tannenbaum et. al, 2002; Thompson et. al, 2004; van der Meer et. al, 2004; Zorilla et. al, 2001), DHEA (Hogue and Bremmer, 2005), IL-6 (Kopp et. al, 2004), adrenocorticotrophic hormone (Barr et. al, 2004), serotonin (Barr et. al, 2004), and insulin resistance (Stumvall et al., 2003). An interesting potential marker for allostatic load is glucose metabolism (Zambrano et al., 2005; Barker et al., 1993; need other references here) could also be a predictor of allostatic load. Based on allostatic theory that a healthy body is one that can adapt to change in demands, if the body cannot respond to glucose metabolism then it is a sign that is unable to adapt through primary responses of the body. Secondary systems would then be utilized to adjust for the failure of insulin in the body. This process of utilizing secondary systems to help the body adjust leads to increased damage to the body over time and increases the risk for CVD (McEwen, 1998).

Beyond physiological markers, there are behavioral markers that have been found to be correlated with allostatic load. Low SES and exposure to violence were also indicators of higher allostatic load (Evans, 2003). Diets high in salt intake have also been shown to contribute to allostatic load (van Berge-Landry and James, 2004). Other markers for allostatic load include social stressors including racism (Carlson & Chamberlain, 2004). Spirituality related variables have also been found to be predictors of allostatic load. Lawler and colleagues (2003) found students who practiced forgiveness after interpersonal conflict had lower allostatic load and returned to baseline faster than those students who did not practice forgiveness.

Appendix I: Explanations for Hypoactivity of HPA Axis Following a Stressor

The smaller than expected differences from pre to post stressor can be attributed to the video of *Amistad* not being enough of a stressor to cause an increase in blood pressure or cortisol above their current allostatic load. This is similar to what Tartaro and colleagues found with using the Stroop test as a stressor. The test was not strong enough to invoke a significant change in blood pressure or cortisol from pre to post stressor (Tartaro, 2005). Perhaps African Americans who watched the racial film clip from *Amistad* did not contextualize the stimuli as either threatening, uncontrollable, or unpredictable which could explain why their cortisol levels did not raise significantly as would be expected from an acute stressor.

Another possibility is the film clip was stressful, but the participants removed themselves mentally from the film by perceiving it as a past event or something not related to their life. This could be done in order to avoid or cope with emotional, cognitive, and behavioral responses to the movie. This would be supportive from anecdotal evidence from comments made by participants during the administration of the post movie questionnaire. One participant mentioned he had removed himself emotionally from the film clip because it was about slaves. Another participant mentioned he was glad we did not show a film clip from the movie *Crash*, because that would have “hit closer to home and be more realistic” of racism present today. In summary, the choice of the 19th century periodic film clip may not be considered a stressor to African Americans living in the 21st century.

Perhaps the video was more stressful to older than younger participants. While completing the post-movie questionnaire, some older participants described the movie as a horrible reminder of racism and where we have come from as a nation. Some mentioned that

they were thankful that we now have a black president. Other younger participants mentioned this choice of film clip was not stressful because it involved a time long ago that they could not relate to in their current living condition. More research is needed on selecting an effective racial video clip. Future studies could include a between groups factor of racial video clip. One group could watch the existing clip from *Amistad* and another could watch a similar length film clip from *Crash*.

The length of the film clip may not have been appropriate to evoke a significant stress response. The film clip was eight minutes long. Perhaps a shorter film clip would intensify the experience and not become familiar with the movie and characters. On the other hand, a longer film clip may be required to fully immerse subjects into the life and experiences of racism portrayed in the movie. More research is needed to identify an appropriate length of movie clip to serve as a stressor. Future studies could use multiple lengths of clips from the same movie to determine the appropriate length.

Other reasons for not seeing an increase in blood pressure or cortisol levels include the timing of the movie clip and measuring blood pressure or collecting cortisol. In this study, blood pressure was taken immediately following the film clip. Perhaps ambulatory monitoring of blood pressure throughout the eight minute video clip would result in more accurate measures of blood pressure reactivity to a racial video stressor. Future studies could also use constant blood pressure monitoring throughout the clinic visit. Cortisol was taken at 10 minutes after the film clip was completed. This was done to allow time for cortisol to circulate throughout the body following the stressor. Perhaps ten minutes is not long enough or is not soon enough. Future studies could take multiple measures of cortisol before the clip, immediately following, five

minutes after, ten minutes after, and fifteen minutes after to determine the best time for collecting the blood pressure and cortisol measure. Plasma cortisol could also be obtained during the lab visit and measured more frequently by using a catheter and conducting blood draws at pre-movie, post-movie, five minutes, ten minutes, and fifteen minutes following the video clip. More research is needed to determine when cortisol or blood pressure should be monitored during the study.

Generalizing the increased response from the HPA axis following an acute stressor to a broader pattern of responding to stress has not been challenged in research (Decker, 2006). Decker found that African rural men from Botswana had significantly lower salivary cortisol, lower cortisol diurnal variation, and increased depressive affect compared to men in urban environments (Decker, 2006). “Low-cortisol may be a widespread indicator of “stress” or allostatic load among some non-Western, or underdeveloped populations, and among segments of industrial populations” (Decker, 2006). People with PTSD also often have chronically lower levels of free cortisol (Gold and Chrousos, 2002; Hart et al., 1996; Mason et al., 2001; Yehuda et al., 2000).

There is no research to date that suggests a person would experience a drop in blood pressure or drop in cortisol from pre to post stressor. Participants with hypocortisol are expected to have a muted or blunted response to a stressor (Sterling, 2006) but yet they are still expected to have some elevation of blood pressure or cortisol. If participants have higher allostatic loads then they are expected to have less fluctuation of stress, because they may already have a higher baseline of accumulative stress and their system may not be as reactive or have a higher range of response than someone with lower levels of allostatic load.

Appendix J: Body Fat Percentage

Body Mass Index and body fat percentage are two ways to describe health risk related to body composition. Both measures have strengths and weaknesses. Body fat percentage can be a more accurate measure than BMI because it is more specific in identifying body composition. While BMI is a broad, general measure of risk, body fat percentage is more specific to actual fat content thereby providing a more accurate description of body fat. Body fat percentage is a more refined measure than BMI, because it takes into account not only height and weight, but also bioelectric resistance (or skinfold thickness). Body fat percentage is more accurate because it adjusts for gender, allowing women to have a higher fat percentage due to reproductive functions and other differences between genders. BMI does not describe body composition, how much of weight is fat, and how much is muscle and tissue. So BMI does not distinguish fat from muscle.

However, there are strengths to using BMI instead of body fat percentage. BMI is easier and faster to measure because participants are not required to lie down and have wires connected to their hand and ankle to send an electrical impulse through their body. BMI is also used more often than body fat percentage because it can describe health risk for diseases including cardiovascular disease and diabetes. Fat percentage does not have enough research to identify the risk for disease. Researchers have developed initial body fat percentage risk equivalents based on correlations with body mass index scores (Gallagher et al., 2000). In this effort, Gallagher and colleagues evaluated over 1,600 people from diverse ethnic backgrounds (Asian, Caucasian, African American) and examined how body fat percentage was related to disease risk.

BMI may also be a more accurate measure compared to body fat percentage because body electrical impedance is not accurate after exercising or if a person is not properly hydrated.

In this study it is unlikely that anyone has exercised before the study given the study takes place in the morning after a night of fasting. BMI can also be more accurate than body fat percentage in an obese sample, because calipers are not as accurate when large skin folds are present and or when there are differences in fat density. Body electrical impedance typically underestimates body fat percentage (Cox-Reijven & Soeters, 2000; Nichols et al., 2006).

Another issue with bioelectrical impedance is that fat free body density values have been validated using Caucasian samples. Race prediction equations are important in determining the composition of the fat free body mass and fat distribution for different ethnic groups (Heyward, 1996). There are body fat percentage calculations that have been validated with African Americans (Lewy et al., 1999).

Body fat percentage measures may not be accurate for people who are obese, dehydrated, or who have recently exercised. Body fat percentage calculated with bioelectrical impedance has an overall error rate of 13.81 percent for African Americans when compared to under-water displacement measurements (Kirkendall et al., 1991). In the same study, body fat percentage when calculated by a skinfold caliper had only a 3.56 percent error rate for African Americans when compared to under-water weighing. Even with these limitations, body fat percentage provides additional information regarding body composition that is not conveyed with a BMI score. In the current study, both body impedance and skinfold caliper are used to measure body fat percentage. Measurements by a skinfold caliper are only obtained when participants are physically unable to lie down on a mat due to being obese or physically disabled.

There are strengths and weaknesses with using either BMI or body fat percentage as a single measure of health risk from body fat. Both measures are included in this study. Including

both measures in the study will provide a comprehensive picture of obesity, body composition, and overall health risk.

Appendix K: Strategies for Dealing with Variance of Sample Diversity

Diversity within a sample can be a strength and limitation in a study. Diversity is often beneficial to a study because it allows the results to be generalized to a larger audience. However, diversity also introduces additional sources of variance. The most effective way to control variance is during the design phase of the study. Kerlinger (1986) conceptualized experimental design as variance control. A properly designed research study will maximize experimental variance while minimizing measurement error and controlling extraneous variance.

Variance is important in research. An Analysis of Variance (ANOVA) is a ratio of variability between groups divided by the variability within groups. It is important in experimental design to minimize the within group variance and maximize the between group variance to determine if the null hypothesis is true or false. One way to minimize the within group variance is to control other background variables. In this study, seven covariates (age, gender, income, education, marital status, smoking status, and comorbidity) are used to measure and control the variance in the sample.

There are two prevailing conceptual frameworks in selecting covariates within experimental design. The first method is to control for everything possible. The other method is to control select variables that are significantly related to the dependent variable.

In this study, the Tabachnick and Fidell (2001) method is used to select covariates that are meaningful to the model and control extraneous variance. It is a hybrid of the two methods for selecting covariates, because it includes many covariates in the beginning and after a process of correlating variables to the outcome measures, it reduces covariates that do not explain

variance in the model. This is done to control diversity of the model while not simply controlling everything that is not related to the variables of interest.

The sample for the current study is diverse. Diversity is good because it allows for the results to be generalized to a larger audience. However, diversity also introduces additional sources of variance. For this study, the diversity will not affect sample analysis as much because each person serves as their own control group from pre to post film clip. I spoke with Dr. Deuster and discussed concerns about not having a true control group. Dr. Deuster decided to add a Caucasian control group ($n = 100$) to the study protocol. This is important because the distinct control group will help reduce extraneous variance not associated with being African American.

Another way to reduce variance in this study is to minimize instrumental error. This is done by following strict guidelines on how the study is conducted and under the same conditions each time as much as possible. For instance, everyone starts the testing at 0800 in the morning. Cortisol samples are taken the same time for each person (pre, post, Day+1 before 0830, Day+1 between 1730-1830). Also the questionnaires are handed out in the same order with breaks in between sets of questionnaires occurring at the same interval. One way to control variance is to make sure each lab assistant understands the protocol and follows it the same way. Periodically, meetings are held to address any differences that have been observed by anyone in the lab. Randomization is another way to control diversity between both groups in the study. In this study, each person serves as their own control, so the diversity is not a source of variance in this design.

Matching subjects based on an extraneous variable (age, gender, income, etc) is still another way to control variance in data analysis. In this study each person serves as their own control so the diversity is not a source of variance in this design.

Blocking is another way to control diversity during data analysis. This can be done after the data is collected. The sample could be blocked by first 93 participants and last 93 participants in order to test for any localized error variance between the groups. If the final study sample includes participants who were tested in the lab and at church sites, then location could become a blocking factor.

Another way to control diversity is to increase the reliability of the BMMRS, BP readings, and cortisol testing. The reliability and validity of the BMMRS has been tested (see #8 dissertation due out) and was found to be both reliable and valid for this population. Ways to improve the reliability of the BP measurements include using the same arm for each BP measurement, same machine, while seated, and without legs crossed. Cortisol sampling requires freezing of the sample immediately following the collection. Instructions are provided to each participant. This remains a source of variance depending on whether the participant follows the guidance and to what degree they collect the sample for five minutes under their tongue, rinse their mouth out before collecting the saliva, time of day, and time in the postage system. Since there is a certain degree of uncontrolled variance with the latter two collection times for cortisol, I chose to only use the cortisol obtained in the laboratory setting for pre and post movie sample.

In a regression, it is important that the outcome measures are orthogonal or not inter-related. The problem of multi-collinearity is often caused by including too many regressors in a

regression model. Multi-collinearity is a concern in the current study. SBP and DBP are expected to be co-linear. Religiousness and spirituality are also expected to be co-linear.

If there is collinearity in the predictor variables or criterion variables, then there is a risk of artificially inflating the variance explained (R^2) of the model. Variation Inflation Factor (VIF) can be used to detect multi-collinearity $[1/(1-R^2)]$. VIF is only found in SAS not SPSS. Centering the predictor variables (also called orthogonalization, ridge regression analysis) will help reduce the effects of collinearity. To center the variable you subtract the mean from the raw score of the predictor. Other ways of controlling the variance of multicollinear variables include dropping one of the collinear variables and obtain more data.

In summary, diversity of the sample is generally helpful and allows greater generalizability of the results. It is important to maximize the between group variance and minimize within group variance and measurement error. Controlling certain covariates is one step in the process to control extraneous variance in the current study design. Two problems with controlling every known covariate is a risk of over-fitting the model and multicollinearity of the predictors and outcome variables. Multi-collinearity can lead to an increased risk of inflating the variance explained in the model. Efforts to select appropriate covariates using a process by Tabachnick and Fidell will help reduce the number of predictors in the model. Centering the predictor variables is another way to “orthogonalize” the vectors in the model to reduce the effects of multi-collinearity. Multicollinearity does not change the predictive power or reliability of a regression analysis, but it does limit the ability to explain or interpret the results (O'Brien, 2007; Schroeder, 1990).

Appendix L: Data Reduction Technique (also included in data analyses section)

Multivariate regression analyses were conducted. Due to the large number of possible confounders and power limitations, a data reduction technique was employed (Tabachnick & Fidell, 2001). This analysis was conducted in two parts. The first analysis consisted of a linear regression model including all proposed confounders measured (e.g., age, income, education level, marital status, etc). All measures that met the $p < 0.10$ criteria from the first analysis were entered into the final regression model. The dependent variables for both the data reduction regression and the final regression included systolic blood pressure, diastolic blood pressure, and cortisol. (Dr. Feuerstein recommended that I contact Liz Calvio and use her write-up as a template for describing the procedure.)

Appendix M: Reliability and Validity of BMMRS

How were the questions structured for each sub-measure of the BMMRS?

The BMMRS was designed to evaluate the relationship between religiousness/spirituality and health. The BMMRS is self-administered 38 question survey that includes all of the short forms of the subscales. The BMMRS has several versions based on how researchers combine the subscales. Some have selected only the questions from specific subscales they are interested. Others have reworded references to ‘God’ as a ‘higher power’ to be more inclusive of other faiths. The 29 question version of the BMMRS that I used is the same as Tartaro and colleagues (Tartaro et al., 2005) used in their research on R/S as a buffer to stress reactivity. This version left out two subscales (religious/spiritual history, and religious support) from the original BMMRS since the questions applied only to people who actively attended church or had a denominational affiliation. There was also a concern of adding additional questions to a larger study that already included 16 questionnaires.

Key dimensions in this measure include daily spiritual experiences, values/beliefs, forgiveness, private religious practices, religious and spiritual coping, commitment, organizational religiousness, and overall self-ratings of religiousness and spirituality. Each of the dimensions were identified as being theoretically or empirically related to health outcomes (Fetzer, 1999).

The daily spiritual experiences scale (DSES) is the most widely used subscale in the BMMRS as a standalone measure. The DSES includes six items, rated from 1 (“many times a day”) to 6 (“never or almost never”) assessing the participant’s understanding of the transcendent (God, the divine) in daily life and the perception of interaction with the transcendent in life.

Individual items include “I feel God’s presence” and “I find strength in my religion or spirituality.” The testable relevance to health is the exposure to psychophysical states religious/spiritual experiences. This subscale was designed to measure daily spiritual experiences and not extraordinary spiritual experiences, including near-death and out-of-body experiences. Focus groups were used to define transcendent in order to apply to most faith groups where God would not suffice. Theological, spiritual, and religious literature from Buber, van Kaam, Merton, Hahn, Underhill, and DeWit were used to develop the measure (Fetzer, 1999). Existing spiritual experience measures were used to help develop the DSES. The scale has a high internal consistency rating from .95 to .91 with different samples (Fetzer Institute). Construct validity was determined by comparing mean scores with different known-groups as discussed below (S. K. Harris et al., 2008; Underwood & Teresi, 2002). A factor analysis supported a unidimensional set for the Daily Spiritual Experiences scale (Underwood & Teresi, 2002).

The commitment subscale used in this study includes one item, rated from 1 (“Strongly agree”) to 4 (“Strongly disagree”) assessing the value the individual places on religion itself. The item is stated “I try hard to carry my religious beliefs over into all my other dealings in life.” The testable relevance to health of this subscale is that well-being is enhanced through concern for others (Fetzer, 1999). The BMMRS commitment scale has three items, the two additional items not included in this study involve non-Likert scale questions pertaining to amount of monetary contribution to a place of worship and another question regarding the number of hours spent at church related services. These two questions were not included in the present study because they do not contribute to the overall composite score due to a string variable response for the items.

They other reason the two questions were not included is they require a person to be affiliated with a church or religious meeting place in order to answer positively on the item.

The values/beliefs subscale includes two items, rated 1 (“strongly agree”) to 5 (“strongly disagree” and rated 1 (“none”) to 3 (“a great deal”) assessing the degree to which a person’s values and beliefs affect how they view their relationship to God and the world. This subscale is not about the presence or absence of values, but rather the extent that the participant’s behavior is shaped by their faith or religion. Beliefs are measured in the BMMRS as a cognitive aspect of religiousness. Beliefs are assessed by the degree to which the individual hold orthodox views for their particular religious affiliation. Individual items include “I believe in a God who watches over me” and “I feel a deep sense of responsibility for reducing pain and suffering in the world.” The testable relevance to health is that opportunities for social comparison promote personal well-being and reduce stress through provision of hope (Fetzer, 1999). The item related to values found in the BMMRS originated from the Intrinsic/Extrinsic Revised Scale (Gorsuch & McPherson, 1989) which is described as the single most used single item measure in religious research (Allport & Ross, 1967; Fetzer, 1999) and can be used as a single item scale. There is limited research that supports the use of this measure directly with health outcomes, other than to promote healthy behaviors. The question regarding belief also has strong face validity, but does not have psychometric work to validate the scale. The belief question has been used in prior research that linked patients to improved survivability, general well-being, lower risk of mortality in patients with poor health (Fetzer, 1999).

The forgiveness subscale includes three items, rated from 1 (“always or almost always”) to 4 (“never”) assessing the degree to which participants forgive themselves and others, and feel

forgiven by God. Individual items include “I have forgiven myself for things I have done wrong” and “I know that God forgives me.” The testable relevance to health is that forgiveness should reduce stress following the resolution of conflict (Fetzer, 1999).

The spiritual and religious coping subscale includes seven items (three positive and three negative questions) rated from 1 (“not at all”) to 4 (“a great deal”), assessing the extent to which an individual uses spirituality or religion to cope with stressful life events. Individual items include “To what extent is your religion involved in understanding or dealing with stressful situations in any way?” The testable relevance to health is that spiritual and religious coping buffers the negative impact of stressful life events (Fetzer, 1999). This subscale was developed from a recent religious and spiritual measure for religious coping RCOPE. A factor analysis of the RCOPE found the items loaded on two dimensions positive and negative religious/spiritual coping (Pargament, 1997). The first three items on this subscale had .60 or greater factor loadings on positive coping. The second three items on this subscale had .53 or greater factor loadings on negative coping. The last item on this subscale is an overall religious/coping item. The RCOPE has shown good internal consistency (as described later), discriminant, criterion-related validity, and incremental validity in different known-groups (Fetzer, 1999).

The private religious practice subscale includes five items, rated from 1 (“more than once a day”) to 8 (“never”). This subscale assesses the extent to which an individual engages in religious behavior including prayer, meditation, and reading religious material that is informal and outside of an organized religious activity. Individual items include “How often do you pray privately in places other than church or synagogue?” and “How often do you read the Bible or other religious literature?” The testable relevance to health of the private religious practices

subscale is the ability to compare the exposure to psychophysical religious/spiritual states (Fetzer, 1999). The items in this scale were modified from existing measures of private religious practices. Three of the five items in this subscale were also found in the National Survey (NSBA), but was modified to a Likert scale rather than a dichotomous question.

The organizational religiousness subscale includes two items, rated from 1 (“more than once a week”) to 6 (“never”) assessing the degree to which an individual attends religious services or other public activities at a place of worship. Items include “How often do you go to religious services?” and “Besides religious services, how often do you take part in other activities at a place of worship?” The testable relevance to health of the organizational religious subscale is the exposure to psychophysical religious/spiritual states, conformity to risk reducing behaviors, and exposure to social networks and sources of support (Fetzer, 1999).

The BMMRS also includes two religious and spiritual intensity items, rated from 1 (“very”) to 4 (“not at all”). Items include “to what extent do you consider yourself a religious person” and “to what extent do you consider yourself a spiritual person.” The testable relevance to health of the intensity questions is they serve as an indicator of feelings of self-worth (Fetzer, 1999).

Is the BMMRS validated with African Americans?

The BMMRS has been validated with African Americans in national surveys and in other research efforts. The BMMRS were designed to represent a variety of common US religious traditions and cultures. Most of the national studies that have used the BMMRS have a large percentage of African Americans represented in the sample from the 1998 General Social Survey (GSS), National Survey of Black Americans (NSBA), and Study of Women Across the Nation

(SWAN). The largest subscale of the BMMRS, Daily Spiritual Experiences (11 items) is often used as a stand-alone spirituality measure, and was reliable and valid in an African American sample ages 34-85 (Loustalot, Wyatt, Boss, & McDyess, 2006). A majority of the items from the private religious practices subscale were also used in the NSBA study. African American women scored higher than Caucasian women in the 1998 national GSS survey ($t = 8.44$, $p < .01$, $n=791$). In a different study, African American women who completed the long form of the DSES scored higher than Caucasian women in the SWAN study ($t = 6.82$, $p < .01$, $n=233$) (Underwood & Teresi, 2002).

Is it validated with low-income population?

There is no data to support the validation of the BMMRS with low-income population. Although, the BMMRS was validated in a study with a lower income group of which only 29% of the sample earned over \$50,000 (Johnstone et al., 2008). The BMMRS measure was validated in this group. Other national studies have not mentioned differences in scores based on income although income data was collected (Fetzer, 1999; Idler et al., 2003).

On what scientific basis was the BMMRS chosen for this study?

The BMMRS was chosen for this study because it is a multidimensional spirituality/religiousness measure designed to investigate the relationship between spirituality and health. The measure was created by a working group at the National Institute on Aging comprised of health and religious scholars and researchers. This was considered a positive strength of the measure, since a group of experts in the field designed it, rather than a single researcher. In particular, there were several notable spirituality and health researchers on the working group, including Pargament (past president of APA Division 36 Psychology of

Religion), Idler, Musick, Ellison, Powell, Underwood, Williams, and George who all have contributed to scholarly research of spirituality and health.

Another reason the BMMRS was selected for this study is because it can be tailored to individual research projects. This can be done by including or excluding specific subscales. Another way to tailor the BMMRS is to use available short or long forms for each of the subscales. In this study, only the short forms were used. Follow-on studies may include the long forms of specific subscales to answer more in-depth questions about how a particular dimension of spirituality or religiousness. For example, a future project might extend the work of this study by examining how forgiveness, using the long form, is related to cardiovascular reactivity to a racial stressor.

BMMRS reliability- Reliability of the BMMRS can be assessed by measuring internal consistency and response stability. For example, internal consistency would include evaluating response consistency to questions that measure the same construct. Response stability would include comparing test-retest consistency over time.

Internal Consistency Reliability- The Fetzer Institute (Fetzer, 1999) reported internal consistency of the BMMRS subscales in a sample of over 10,000 people in the United States as part of the General Social Survey (GSS) in 1998. The GSS sample was based on data from the United States Census and sampled English speaking adults living in the United States. Cronbach's alphas were satisfactory for each of the subscales: Organizational religiousness ($\alpha = 0.82$), private religious activities ($\alpha = 0.72$), positive religious coping ($\alpha = 0.81$), negative religious coping ($\alpha = 0.54$), forgiveness ($\alpha = 0.66$), daily spiritual experiences ($\alpha = 0.91$), values and beliefs ($\alpha = 0.64$) subscales. Other researchers have reported similar ranges of Cronbach's

alpha of .71 to .91 for the subscales (Kendler et al., 2003; Pargament, Koenig, & Perez, 2000; Underwood & Teresi, 2002; Yoon & O., 2004). One of the strengths of the BMMRS is the ability to use different modules to assess particular aspects of religiousness and spirituality. The proposed study will use the same 29 question BMMRS format used in a previous study by Tartaro and colleagues (2005) that evaluated the buffering response of spirituality after a stress response in a sample of 60 ethnically diverse undergraduate students. Cronbach's alphas were satisfactory for each of the subscales in the Tartaro study: Forgiveness ($\alpha = 0.76$), religious coping ($\alpha = 0.69$), and the composite religious/spirituality score ($\alpha = 0.90$). A preliminary analysis of the current study with a sample size of 75 reported satisfactory Chronbach's alpha for each subscale: BMMRS composite ($\alpha = 0.93$), daily spiritual experiences ($\alpha = 0.91$), private religious practices ($\alpha = 0.80$), and religious coping ($\alpha = 0.80$).

Test-retest Consistency- Harris and colleagues (2008) reported test-retest consistency of the BMMRS subscales in a racially diverse sample of 93 adolescents. The BMMRS showed moderate to high stability after one week for domains, subscales, and individual items: Daily spiritual experiences scale (ICC = 0.93, CI .90, .96), belief (ICC = 0.57, CI .43, .71), forgiveness (ICC = 0.81, CI .72, .87), private religious practices (ICC = 0.87, CI .81, .91), religious/spiritual coping (ICC = 0.80, CI .71, .86), religious support (ICC = 0.95, CI .91, .97), religious/spiritual history (ICC = 0.86, CI .80, .91), commitment (ICC = 0.73, CI .62, .81), organizational religiousness (ICC = 0.90, CI .85, .93), religious preference (ICC = 0.93, CI .87, 1.00), meaning (ICC = 0.67, CI .54, .77), and overall self-ranking (ICC = 0.78, CI .69, .85) see also Table 4. All but two domains (meaning and belief) had an ICC > .70 (Harris et al., 2008). The largest subscales

also had the highest ICC (.93 daily spiritual experiences, .80 religious/spiritual coping, and .95 religious support).

Interrater reliability- Interrater reliability is not relevant to the BMMRS since it is designed to be self administered.

BMMRS validity

Discriminant validity- The BMMRS is unlike any other multidimensional religious and spiritual measure. There are no known measures that could serve as a standard to measure related phenomenon with the BMMRS. Discriminant validity has been used to measure the subscales with other known measures during the development of the BMMRS (Fetzer, 1999; Idler et al., 2003). Also each BMMRS subscale has been measured against the other subscales to reduce overlap in content to ensure the subscales are related, but sufficiently different and not highly correlated in order to improve the “discriminatory power of the measure”(Idler et al., 2003, p. 352). Each subscale has its own behavioral and cognitive emphasis (Idler et al., 2003).

Convergent validity- The BMMRS subscales and individual questions were compared to other similar scales and items used in the National Institute on Aging (NIA) / Fetzer Indices and Items survey to determine convergent validity (Idler et al., 2003) (See Table 5). Also several of the subscales were derived from other measures used in research today. For example, questions from the RCOPE was used in the religious and spiritual coping subscale. The subscale was tested for convergent validity and found to be highly correlated with the RCOPE (Idler et al., 2003).

Known-group differences- One way of assessing BMMRS validity is to compare the BMMRS scores with different known-groups that would be expected to score differently. For example, known-groups validity testing of the BMMRS compared responses across groups that

were expected to be different (in this case religiously affiliated versus no religious affiliation/atheist). This is a form of divergent validity where the measure is expected to yield different results based on characteristics of each sample. Harris and colleagues reported significant differences of every BMMRS domain, subscale, and individual item between those who reported a religious affiliation compared to those who reported no religious affiliation: Daily spiritual experiences scale ($F = 18.08, p < .001$), belief ($X^2 = 23.03, p < .001$), forgiveness ($X^2 = 8.64, p < .05$), private religious practices ($X^2 = 18.39, p < .001$), religious/spiritual coping ($F = 10.03, p < .01$), religious support ($F = 5.24, p < .01$), commitment ($F = 22.64, p < .001$), organizational religiousness ($F = 16.38, p < .001$), meaning ($F = 4.67, p < .01$), overall self-ranking religiousness ($F = 24.43, p < .001$), and overall self-ranking spiritual ($F = 5.16, p < .01$). Similar results have been reported in the 1998 national GSS sample that compared those with a religious affiliation to those without a religious affiliation ($F = 126.60, p < .01, n=1445$) on the BMMRS (Underwood & Teresi, 2002). In summary, the BMMRS is a valid instrument in differentiating people who report some level of religiousness or spirituality from others who report no affiliation of religiousness or spirituality.

Other groups have been compared using BMMRS scores. Women in the 1998 GSS national study scored higher ($t = 6.26, p < .01, n=1445$) than men on all subscales of the BMMRS (David, Smith, & Marsden, 2001; Underwood & Teresi, 2002). This is in line with previous reported findings that women tend to be more spiritual than men.

Comparing BMMRS with other measures- A second method of assessing BMMRS validity is to compare the BMMRS with other psychosocial or health measures. Scores on the BMMRS have been correlated with other psychosocial and health related measures including the

Beck Depression Inventory (BDI-II) (Beck, Steer, & Brown, 1996), Cohen Perceived Stress Scale (PSS) (S. Cohen, Karmarck, & Mermelstein, 1983), State-Trait Anxiety Inventory (STAI) (C. D. Spielberger et al., 1983), the Center for Epidemiologic Studies-Depression scale (CES-D) (Radloff, 1977), Scheirer's Optimism Scale (Scheirer, Carver, & Bridges, 1994), Berkman's scale of Perceived Social Support (T. E. Seeman & Berkman, 1988), the Positive And Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988) and the Quality of Life (SF-36) (McHorney, Ware, Lu, & Sherbourne, 1994). In the current study, participants complete the BDI-II and PSS along with the BMMRS. In summary, scores on the Daily Spiritual Experiences subscale of the BMMRS have shown to be correlated with scores from psychosocial and other health measures such that higher scores on the BMMRS (indicating higher reported levels of religiousness or spirituality) are correlated with less depressive symptoms, less anxiety, less hostility, better quality of life, more optimism, more positive affect, and more perceived social support (See Appendix S, T, & Q).

Scores on the BMMRS have shown to be correlated with scores from the BDI-II (Harris et al., 2008). So that as people scored higher on religious subscales they had lower BDI scores indicating less depression. The subscales and items that were correlated include the forgiveness subscale (Spearman's $\rho = -0.181$, $p = .002$, $n = 286$), negative items from the religious/spiritual coping (Spearman's $\rho = 0.295$, $p < .001$, $n = 289$), religious support item for negative interaction (Spearman's $\rho = 0.167$, $p = .035$, $n = 159$), religious support item for anticipated support (Spearman's $\rho = -0.196$, $p = .013$, $n = 159$), and commitment (Spearman's $\rho = -0.119$, $p = .043$, $n = 289$) (See Appendix Q).

Appendix N: African Americans and the Military

Over 35 percent of active duty military identify themselves as an ethnic minority (L. Hill, Williams, & Rattley, 2005; Hoge, 2006). African Americans make up 24 percent of the active duty recruitment each year. African Americans have a greater risk of developing cardiovascular diseases earlier in life and are more likely to die from cardiovascular disease than Caucasians. The military is also recruiting people who are older to join the military who may be at a higher risk for cardiovascular disease than younger recruits.

In 2007, hypertension accounted for only 1% of all total medical encounters of all US service members. The healthcare burden attributed to essential hypertension in the US armed forces resulted in the 28th leading reported cause of a 76,682 medical encounters, and also affecting the 28th highest number of individuals at 40,366, which resulted in the 53rd leading cause of hospital bed days with 929 bed days reported (MSMR, Absolute and relative morbidity burdens attributable to various illnesses and injuries, U.S. Armed Forces, 2007, vol15, number 3, April 2008, p18). Stress reactivity is related to hypertension, obesity, and diabetes.

The military is experiencing a dramatic increase in obesity. Seventy thousand military service members were diagnosed as overweight in 2008 compared to only twenty-five thousand in 2002 (MSMR, Diagnoses of overweight/obesity, active component, U.S. Armed Forces, 1998-2008, vol16, number 1, January 2009, p2). In 2005, 61 percent of men and 39 percent of women on active duty were overweight (≥ 25 BMI)(Bray, R.M., Hourani, L.L., Rae, K.L., et al., 2005 Department of Defense Survey of Health Related Behaviors among Active Duty Military Personnel. 2006 Dec. Research Triangle Park, NC: Research Triangle Institute.) In a different study based on a review of all the medical records in the military health surveillance network, 12

percent of active duty service members were obese (> 30 BMI) in 2008 compared to only five percent in 1998 (MSMR, Diagnoses of overweight/obesity, active component, U.S. Armed Forces, 1998-2008, vol16, number 1, January 2009, p2). In other words, there has been a two and a half times increase in the diagnosis of overweight or obese in US service members. Increases in reported stress and number of deployments may account for this increase of overweight and obese given the sharp increase after the Global War on Terror began in 2002 to present day (MSMR, Diagnoses of overweight/obesity, active component, U.S. Armed Forces, 1998-2008, vol16, number 1, January 2009, p2).

Diabetes is also important from a military perspective. From 1997 to 2007, there were 8,781 cases of diabetes mellitus reported in US service members with an incidence rate of 62.8 per 100,000 person-years (MSMR, Diabetes Mellitus, Active Component, U.S. Armed Forces, 1997-2007, vol16, number 2, February 2009, p8). Over this eleven year period, the incidence rate for diabetes mellitus in the military has been stable, even though the general US population has increased sharply (MSMR, Diabetes Mellitus, Active Component, U.S. Armed Forces, 1997-2007, vol16, number 2, February 2009, p8). One reason for the lower incidence rate may be that diabetes is a disqualifying condition for entry into US military service (Department of Defense Directive 6130.4. Subject: Medical standards for appointment, enlistment, or induction in the Armed Forces, dated 18 Jan 2005. Washington, DC.). Over time, the diabetes in the general population will reduce the available number of recruits for active duty service.

The US military is experiencing trends toward increasing numbers of overweight personnel that mirror the general population. Because of the obesity and diabetes trends in the general population, recruiting new service members is expected to be extremely difficult due to

limited numbers of persons able to meet weight and health standards established for entry and continued service. This is particularly true for minority populations. Thus, it is likely the military will be directly affected in terms of recruitment, retention and military readiness because personnel who are overweight or develop diabetes could be referred for discharge or retirement (Paris, Bedno, Krauss, Keep, & Rubertone, 2001).

If R/S is related to improved health outcomes regarding hypertension, then behavioral health providers should be encouraged to work with their unit/post chaplain or to encourage providers to view chaplains as a resource for improving service member's physical and psychological health in patients by reducing the risk for chronic health conditions such as coronary heart disease (CHD), hypertension, and obesity.

Appendix O: Resilience and Related Constructs

How is religiousness/spirituality (R/S) related (or not related) to resilience and other constructs? Religiousness and spirituality provide a structure for making sense of stress and trauma and is related to resilience (Southwick et al., 2005b). Religiousness and spirituality are complex constructs that are multifaceted. Within R/S there are several constructs that could be considered in this comparison. For example, religiousness could be compared to social support as it relates to the behavioral manifestation of a person's inward spiritual state. Spirituality could be compared to resilience, hopefulness, optimism, altruism, and well-being. Also important is to compare R/S to constructs that are not related, for example anxiety, depression, and substance abuse tend to be inversely related to R/S and also resiliency.

Convergent and divergent validity are two ways to measure construct validity. Convergent validity is the degree to which two constructs that are expected to measure similar constructs are related. For example, R/S and well-being measure similar constructs. As a person scores higher on the General Well-Being Scale (GWBS), they are expected to score higher in R/S (Fetzer, 1999). So the GWBS would be useful in measuring convergent validity of the BMMRS. Discriminant validity is the degree to which two constructs that are expected to measure different constructs are different from each other in expected ways. For example, spirituality is negatively related to depression. As a person scores higher on spirituality measures they also score lower on depression scales (Southwick et al., 2005a). So the Beck Depression Inventory would be useful in measuring discriminant validity of the BMMRS. The rest of this section will discuss specific findings of convergent and discriminate validity of the BMMRS.

R/S has been discussed as a psychosocial factor associated with resilience (Southwick et al., 2005b). In an article on psychobiological mechanisms of resilience and vulnerability, Charney discusses how resilience “promotes behaviors that facilitate an effective survival reaction... highly effective action while experiencing fear... responses that regulate reward and motivation in the face of an unrewarding environment... maintain low levels of anxiety... and avoiding a sense of hopelessness and interpersonal withdrawal” (Charney, 2004, p. 195). Religiousness and spirituality from a macro level provide hope for a better future if not in the present, but most often in the distant future. The endpoint of most religions or faiths is an ultimate reward of eternal life either through the grace of a redeemer or through a process of good works that outweigh earthly misdeeds. While there is certainly an aspect of motivation for obtaining eternal life in most Judeo-Christian-Islamic faiths, there is also an important aspect of R/S that is focused on surviving the continued pain and stress of daily living and the concerns of living a sanctified life in an earthly existence. The psychobiological mechanisms of resilience that Charney seeks to identify would have significant overlap with R/S. The measurement of resilience can be identified through neurochemical response patterns to acute stress (Charney, 2004). Decreased cortisol (Goodyer et al., 2001; Morgan et al., 2000), increased dehydroepiandrosterone (DHEA) (Morgan et al., 2006; Morgan et al., 2000), decreased corticotropin releasing hormone (CRH) (Baker et al., 1999) can be measured to compare resilience to stress. In this way R/S and resilience overlap considerably. Researchers have shown that R/S is also related to the same neurochemical responses attributed to markers of resilience (Park, 2007b). For example, R/S has been related to decreased cortisol (Dedert et al., 2004; Ironson et al., 2002; Maselko et al., 2007; Tartaro et al., 2005) and increased DHEA (Maselko et

al., 2007), decreased CRH (Park, 2007a), increased dopamine (Park, 2007a), serotonin (Park, 2007a), and increase in neuropeptide Y (Park, 2007a). Resilience is not only related to quality of life, but also to survival and length of life. R/S has been shown to be related to increased life expectancy (H. G. Koenig, 2004; Powell et al., 2003) (Zinnbauer & Pargament, 2005) and low levels of suicidality (Donahue & Benson, 1995)

R/S is also related to well-being. R/S is associated with improved mental well-being, including less anxiety, less substance abuse, less depression, faster recovery from symptoms of depression, increased optimism, higher social support, and greater marital satisfaction and stability (Koenig, 2001a). Religiousness/spirituality is also associated with improved physical well-being, including less heart disease, lower blood pressure, lower cholesterol, less smoking, and better sleep (Koenig, 2004). These positive health outcomes continue to exist even after controlling for social support (P. C. Hill & Pargament, 2003). R/S may be related to health outcomes through its positive effects on health behaviors (Koenig, 2002). If people engage in healthy behaviors, then they are more likely to have increased well-being than people who engage in unhealthy behaviors such as smoking or drinking. The Index of Well-Being (IWB) is one measure of resiliency used in research (Campbell et al., 1976). In this measure, well-being is defined as “a complex phenomenon representing an individual’s satisfactions and dissatisfactions with his or her life including the gratifying and frustrating emotional experiences representing an individual’s life story” (Campbell, 1981; Campbell et al., 1976; Davis, 2005). No studies have reported convergent validity of well-being with the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS), has been identified as being positively related to well-being as measured by the IWB (Davis, 2005). Well-being was positively related to spirituality ($r = .30$, p

< .01) (Davis, 2005). Other studies have also reported spirituality and well-being to be positively related (Kennedy et al., 2002; Kennedy et al., 1998; Reed, 1987).

Hope and spirituality are closely related. One of the outcomes of spirituality is a sense of hope, renewal, and peace. Hope is the source of motivation to continue living a spiritual existence in spite of present conditions in life that may include suffering and stress. It is through hope that renewal can take place as a person reorients their natural desires and behaviors toward a religious or spiritual direction. This sanctification, or reorienting towards a spiritual existence, leads to ultimate peace not only on earth where stress exists, but also from an eternal perspective. One scientific measure of hope used in research is the Herth Hope Index (HHI) (Herth, 1992). There are only a few studies that report convergent and discriminant validity of the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS) (Reed, 1987), has been identified as being positively related to hope as measured by the HHI (Davis, 2005). Hope was positively related to spirituality ($r = .56, p < .01$) (Davis, 2005). Other studies have also reported spirituality and hope to be positively related (Fowler, 1997) including an African American sample (Phillips & Sowell, 2000).

R/S is also related to social support. Spirituality and social support are interconnected in a complex relationship. Spirituality and social support are often confused for the same construct by researchers (Oman & Thoresen, 2005). The link between spirituality and social support has been well documented and both have positive effects on health behaviors (H. G. Koenig, 2002). Spirituality and social support are similar in many ways. Religious support is similar to social support in that both involve increasing self-esteem, providing information, offering companionship, instrumental aid, and act as a stress buffer (S. Cohen & Wills, 1985). Religious

support is unique to social support as well (P. C. Hill & Pargament, 2003). Ellison and Levin described the differences using the term “support convoy” (Ellison & Levin, 1998). The support convoy is a group of people who are on the same journey and direction in life. The people in the convoy may change throughout the person’s lifetime, but everyone in the convoy share the same goals, values, and worldview. Religious support is different from social support in that the content of the support is religious in nature. In religious support there is a belief that God is working through others and adds a unique element to social support. There is certainly some overlap between the two constructs, but researchers have shown that religious support is a significant predictor of health outcomes after controlling for general social support effects (VandeCreek et al., 1999).

R/S is expected to not be related to depression and pessimism. In theory, R/S measures different constructs and will not be positively correlated. Researchers have compared spirituality and religiousness to depression as a psychosocial factor associated with lower depression (Southwick et al., 2005b). Koenig conducted a meta-analysis to determine if spirituality was related to health. He found that spirituality was significantly related to lower depression scores and faster recovery from depression in 60 of 93 studies (H. G. Koenig, 2001b).

R/S has also been shown to be inversely related to anxiety. Giaquinto and colleagues (2007) found spirituality was related to less depression and anxiety in stroke in a study of people who recently experienced a stroke. Anxiety in general is defined by Spielberger as a complex human reaction related to an unknown threat (C. C. Spielberger, 1966). Anxiety is typically measured as either a state or trait variable based on Spielberger’s conceptualization of anxiety. State anxiety is defined as a transient, relatively unique emotional reaction that may vary in

intensity and fluctuate over time (C. C. Spielberger, 1966). State anxiety can be measured by the State-Trait Anxiety Inventory (STAI) (C. D. Spielberger et al., 1983). No studies have reported convergent validity of state-anxiety with the BMMRS. Another spirituality measure, the Spiritual Perspective Scale (SPS), has been identified as being inversely related to state anxiety as measured by the STAI (Davis, 2005). In this study, data from the STAI and BMMRS were collected. In the future, additional articles can be published from this study that address convergent and discriminant validity findings of the BMMRS measure. In this way, this study can add to the body of knowledge regarding how religiousness and spirituality as measured by the BMMRS are related to other constructs.

In summary, R/S has been shown to be related to constructs such as resilience, hope, well-being, and social support. R/S has also been shown to be inversely related to depression and anxiety. There is evidence that R/S and resilience share similar biological pathways to improved well-being and health, particularly with decreased HPA axis stress responses. This research project has added to the body of knowledge regarding convergent and divergent validity of R/S, as measured by the BMMRS, with several other measures of resilience, hope, well-being, social support, depression, and state anxiety.

Appendix P: Outcome variables by BMI Category

Blood Pressure and Cortisol Outcome Variables by Body Mass Index Category

Outcome Variable	Body Mass Index Category		
	Normal	Overweight	Obese
Number of Participants	53	32	75
Percentage of Sample	33	20	47
SBP	130	129	137
DBP	80	78	85
Cortisol	10.00	9.33	9.09
SBP Change	-0.14	2.04	3.71
DBP Change	2.69	1.77	1.81
Cortisol Change	0.76	1.29	0.13

Note. N = 160. BMI= Body Mass Index (kg/m^2), BMI category normal equivalent to 0 to 24.9 (kg/m^2), BMI category overweight equivalent to 25 to 29.9 (kg/m^2), BMI category obese equivalent to 30 and greater (kg/m^2), SBP = systolic blood pressure, DBP = diastolic blood pressure.

Appendix Q: BMMRS Summary Statistics and Reliability Coefficients

Harris' Summary Statistics and Reliability Coefficients (Chronbach's Alpha and Intraclass Correlation Coefficient [ICC] or Cohen's Kappa) for Each Brief Multidimensional Measure of Religiousness / Spirituality (BMMRS) Domain (Total N = 305)

BMMRS domain	N	# of Items	Score range	Mean	SD	Alpha	Retest ^e ICC (95%CI)
Daily Spiritual Experience Scale	284	15	15–87	50.06	17.68	.93	.93 (.90, .96)
Belief	302	1	1–4	3.42	0.81	–	.57 (.43, .71) ^f
Forgiveness	295	3	3–12	9.14	2.12	.68	.81 (.72, .87)
Forgiven self	302	1	1–4	2.99	0.88	.56 ^d	.71 (.60, .80)
Forgiven others	301	1	1–4	2.75	0.94	.73 ^d	.63 (.49, .74)
Know that God forgives me	299	1	1–4	3.41	0.89	.46 ^d	.67 (.55, .77)
Private Religious Practices	298	5	5–35	15.19	7.23	.76	.87 (.81, .91)
Religious/Spiritual Coping (Brief RCOPE)	294	11	11–39	24.43	5.69	.71	.80 (.71, .86)
Positive items	296	5	5–20	12.64	4.37	.88	.86 (.80, .91)
Negative items	295	5	5–20	9.29	2.85	.54	.58 (.42, .70)
God is punishing me	295	1	1–4	2.06	1.05	.55 ^d	.58 (.43, .70)
Wonder whether God has abandoned me	301	1	1–4	1.51	0.80	.45 ^d	.46 (.28, .60)
Make sense... without relying on God	302	1	1–4	2.21	1.07	.54 ^d	.29 (.09, .46)
Question whether God exists	295	1	1–4	1.84	0.99	.45 ^d	.55 (.39, .68)
Express anger at God	296	1	1–4	1.57	1.34	.39 ^d	.60 (.45, .72)
Overall Coping item	299	1	1–4	2.55	1.02	–	.63 (.49, .74)
Religious Support ^a	162	12	12–48	30.29	8.98	.92	.95 (.91, .97)
Anticipated Support	161	3	3–12	9.45	2.85	.91	.89 (.83, .93)
Emotional Support from Others	161	3	3–12	8.17	2.99	.90	.90 (.85, .94)
Emotional Support Given to Others	160	3	3–12	7.79	2.86	.88	.87 (.80, .92)
Negative Interaction	159	3	3–12	4.85	1.87	.71	.70 (.56, .81)
Religious/Spiritual History	295	3	0–3	0.95	0.92	.45	.86 (.80, .91)
Life-changing experience ^b	300	1	0–1	31.33	26.19–36.96	–	.67 (.49, .85) ^f
Age of occurrence	98	1	4–18	12.41	3.11	–	.87 (.68, .95)

Significant gain in faith ^b	297	1	0–1	37.71	32.23–43.52	–	.78 (.64, .93) ^f
Age of occurrence	108	1	4–18	12.57	2.96	–	.73 (.43, .89)
Significant loss in faith ^b	297	1	0–1	25.25	20.49–30.66	–	.78 (.63, .94) ^f
Age of occurrence	70	1	6–18	13.46	2.48	–	.95 (.85, .98)
Commitment	240	2	1–7	3.55	1.76	.59	.73 (.62, .81)
Try hard to carry over religious beliefs into all other dealings with life	299	1	1–4	2.55	0.97	–	.44 (.29, .58) ^f
Weekly hours (categorized) spent on activities for religious/spiritual reasons ^c	242	1	0–3	1	0–2	–	.64 (.52, .77) ^f
Organizational Religiousness	296	2	2–12	5.53	2.97	.73	.90 (.85, .93)
Religious service attendance	299	1	1–6	3.16	1.70	–	.86 (.80, .91)
Frequency of other activities at place of worship	298	1	1–6	2.40	1.65	–	.80 (.72, .87)
Religious Preference	264	1	–	–	–	–	.93 (.87, 1.00) ^f
Meaning	286	2	2–8	5.12	1.61	.72	.67 (.54, .77)
Overall Self-Ranking	300	2	2–8	4.45	1.52	.75	.78 (.69, .85)
Religious	301	1	1–4	2.79	0.83	–	.75 (.65, .83)
Spiritual	300	1	1–4	2.77	0.88	–	.79 (.70, .86)

^a Among youth who reported attending religious services $\geq$ once/month ($n = 164$)

^b For these dichotomous variables, we present the proportions answering “yes” and their 95% confidence intervals

^c Due to a highly skewed distribution of responses, the median and interquartile range are presented

^d Alpha if item deleted

^e Retest sample $n = 93$

^f Cohen’s kappa statistics are presented instead of ICC due to dichotomous or non-ordinal response formats

(S. K. Harris et al., 2008)

Appendix R: BMMRS Background Reliability Data

Idler’s Zero Order Correlations Between National Institute on Aging (NIA) / Fetzer Items and Indices and Key General Social Survey (GSS) Items

<i>NIA/Fetzer Indices and Items</i>	<i>v1</i>	<i>v2</i>	<i>v3</i>	<i>v4</i>	<i>v5</i>	<i>v6</i>	<i>v7</i>	<i>v8</i>	<i>v9</i>	<i>v10</i>	<i>v11</i>	<i>v12</i>	<i>v13</i>	<i>v14</i>	<i>v15</i>	<i>v16</i>	<i>v17</i>
v1: Life-changing experience	—																
v2: Public practices	.32	—															
v3: Private practices	.47	.62	—														
v4: Congregation benefits	.21	.34	.31	—													
v5: Congregation problems	-.12	-.12	-.16	-.04	—												
v6: Positive religious coping	.41	.54	.67	.30	-.10	—											
v7: Negative religious coping	.06	-.05	-.00	-.12	-.15	.05	—										
v8: Beliefs	.38	.49	.57	.33	-.11	.67	.03	—									
v9: Money given to congregation	.12	.27	.21	.12	-.04	.15	-.04	.15	—								
v10: Giving-to-income ratio	.25	.56	.48	.23	-.15	.37	-.03	.33	.53	—							
v11: Forgiveness	.22	.35	.42	.23	.00	.48	-.09	.46	.10	.24	—						
v12: Daily spiritual experience	.41	.58	.70	.39	-.13	.76	-.00	.67	.15	.40	.52	—					
v13: Religious intensity	.42	.57	.65	.34	-.13	.69	-.02	.64	.17	.37	.44	.72	—				
Related GSS variables																	
v14: In-home activity amount ^a	.26	.37	.48	.18	-.09	.36	-.00	.29	.10	.32	.22	.39	.36	—			
v15: Outside home activity amount ^b	.21	.44	.36	.20	-.09	.30	-.03	.24	.16	.42	.21	.31	.30	.50	—		
v16: Born again ^c	.52	.37	.49	.25	-.14	.43	.06	.40	.11	.31	.29	.43	.42	.26	.22	—	
v17: Strength of affiliation ^d	.31	.61	.55	.26	-.11	.51	-.06	.49	.20	.44	.35	.54	.59	.33	.30	.35	—

NOTE: Coefficients in bold are significant at $p < .01$.

a. “In the past month, about how many hours have you spent doing religious activities in your home (such as time spent praying, meditating, reading religious books, listening to religious broadcasts, etc.)?”

b. “In the past month, about how many hours have you spent doing religious services activities outside your home (such as attending religious services, prayer groups, Bible studies, fellowship meetings, church leadership meetings, etc.)?”

c. “Would you say you have been ‘born again’ or have had a ‘born again’ experience—that is, a turning point in your life when you committed yourself to Christ?”

d. “Would you call yourself a strong (PREFERENCE NAMED ABOVE) or not a very strong (PREFERENCE NAMED ABOVE)?”

(Idler et al., 2003)

Appendix S: BMRRS Validity Data from Previous Research

Harris' Comparisons of BMMRS Subscale Means Across Religious Preference Groups

BMMRS domain	Religious Preference			Test statistic
	None/Atheist (<i>n</i> = 30)	Don't Know/ Confused (<i>n</i> = 23)	Named a religion (<i>n</i> = 211)	
Overall Self-Ranking	3.2 (2.7–3.7)	4.0 (3.5–4.5)	4.7 (4.5–4.9)	<i>F</i> = 15.88***
Religious	1.4 (1.1–1.7)	1.9 (1.6–2.2)	2.4 (2.3–2.5)	<i>F</i> = 24.43***
Spiritual	1.8 (1.5–2.1)	2.1 (1.7–2.5)	2.3 (2.2–2.4)	<i>F</i> = 5.16**

^a Due to highly skewed distributions, medians, interquartile ranges, and the results of Kruskal-Wallis *H* test comparing groups are presented

^b Percentages, their 95% confidence intervals, and the results of χ^2 tests of association, are presented for these variables

* *p* < 0.05, ** *p* ≤ 0.01, *** *p* ≤ 0.001

(C. Harris et al., 2005)

Appendix T: BMMRS Validity Data from Previous Research

Underwood & Teresi's Correlations Between The Daily Spiritual Experience Scale and Psychosocial and Other Health-Related Factors

<i>Factor</i>	<i>Correlation</i>
Quality of Life (SF-36)	.240**
Sleep Problems	-.060
Physical Ailments	-.110
Alcohol Consumption	-.200**
Anxiety	-.394**
Center for Epidemiological Studies–Depression	-.220**
Speilberger Anger–Coping Scale	-.303**
Cohen Perceived Stress	-.197**
Cook Medley Hostility	-.157*
Scheirer Optimism	.352**
Berkman Perceived Social Support	.183**

Note. The Daily Spiritual Experience Scale was scored in the positive direction for these analyses. The following scales were scored such that a high score reflects more positive outcomes: Quality of Life, Optimism, Social Support. SWAN = Study of Women Across the Nation; SF = Short Form.

* $p < .51$, two tailed. ** $p < .01$, two tailed.

(Underwood & Teresi, 2002)

Appendix Q: Validity Data Comparing BMMRS and BDI

Harris' Correlations Between Each BMMRS Subscale and BDI-II Scores

Domain	Spearman's rho	p-value (two-tailed)	Analysis N
Daily Spiritual Experience Scale	−0.019	—	278
Beliefs	−0.045	—	289
Forgiveness	−0.181	.002	286
Forgiven self	−0.178	.002	291
Forgiven others	−0.098	—	289
Know that God forgives me	−0.123	.037	289
Private Religious Practices	−0.037	—	290
Religious/Spiritual Coping			
Positive items	−0.009	—	289
Negative items	0.295	<.001	289
God is punishing me	0.157	.008	288
Wonder whether God has abandoned	0.370	<.001	290
Make sense without relying on God	0.065	—	291
Question whether God exists	0.161	.006	289
Express anger at God	0.211	<.001	288
Overall Coping item	0.011	—	289
Religious Support ^a			
Emotional Support from Others	−0.100	—	159
Emotional Support Given to Others	−0.093	—	159
Negative Interaction	0.167	.035	159
Anticipated Support	−0.196	.013	159
Religious/Spiritual History			
Life-changing experience	−0.014	—	290
Significant gain in faith	0.020	—	288
Significant loss in faith	0.172	.003	288
Commitment			
Try hard to carry over religious beliefs into all other dealings with life	−0.119	.043	289
Weekly hours spent on church or other activities for religious/spiritual reasons§	−0.073	—	235
Organizational Religiousness	−0.013	—	286
Meaning	−0.001	—	278
Overall Self-Ranking	−0.104	—	291
Religious	−0.093	—	291
Spiritual	−0.109	—	291

^a Among youth who reported participating in religious services at least monthly

(S. K. Harris et al., 2008).

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