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Religiosity, Spirituality, and the Metabolic Syndrome Among U.S. Hispanics/Latinos in the Sociocultural Ancillary Study of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL)

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Religiosity, Spirituality, and the Metabolic Syndrome Among U.S. Hispanics/Latinos in the Sociocultural Ancillary Study of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). (May 2013)

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Hispanics/Latinos in the U.S. experience a disproportionate amount of socioeconomic adversities and culturally specific stressors. In addition, they have higher rates of obesity and diabetes than other ethnic groups and may have higher rates of the metabolic syndrome. Religiosity and Spirituality (R/S) are integral parts of Hispanic culture, and have been shown to be protective of various health outcomes such as all-cause mortality and CVD in the general population. Health outcomes and possible protective factors such as R/S have not been well studied in Hispanics. The proposed study examined the relationship between multiple dimensions of R/S and the metabolic syndrome and its individual components in Hispanics aged 45 years and older. Structural equation modeling was used to examine pathways from multiple dimensions of spiritual well-being to prevalent MetS as well as individual components of the MetS, controlling for a relevant set of covariates. Although there was no relationship between R/S predictors and the MetS, secondary analyses indicated a significant zero-order correlation between relational spiritual well-being and lower prevalence of the MetS in those of Mexican origin only, which was no longer significant when adjusting for covariates. Significant

zero-order correlations, which held up after controlling for other R/S predictors and covariates indicated that greater meaning/peace was associated with lower waist circumference, and greater faith was associated with lower diastolic blood pressure. Future studies should examine these relationships longitudinally and explore the possible mechanisms explaining these relationships.

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Chapter 1: Introduction

Hispanics in the United States

According to the 2010 U.S. Census Bureau, Hispanics/Latinos make up 16.3% percent of the U.S. population and are the largest ethnic minority group in the U.S. Furthermore, they accounted for 56% of the nation's growth since the year 2000 (Pew Hispanic Center, 2011). The terms Hispanic and Latino are often used interchangeably, but have different origins and are often differentially preferred by those of different Hispanic nationalities and geographic location within the US. However, within their countries of origin, Hispanics would generally not describe themselves this way, but rather by their nationality, such as Cuban, Mexican, Puerto Rican, Colombian, etc. (Garcia-Preto, 2005). For consistency, the term Hispanic will be used throughout this paper. Although Hispanics are often referred to as a monolithic ethnic group, there is much heterogeneity both between and within ethnic subgroups; however, a majority of research in the U.S. has focused on Hispanics as a whole, or exclusively on Mexican Americans or low SES groups, limiting conclusions that can be drawn about other Hispanic ethnic groups or Hispanics of higher SES (Gallo, Penedo, Espinosa de los Monteros, & Arguelles, 2009).

The majority of Hispanics in the U.S. reside within the nine U.S. states of Arizona, California, Colorado, Florida, Illinois, New Mexico, New Jersey, New York and Texas, with 46.5% of Hispanics living in California and Texas alone. However, the numbers of Hispanics who live in other states are increasing (Pew Hispanic Center, 2011). Those of Mexican origin account for approximately 65% of the U.S. Hispanic population, and while those of Mexican, Puerto Rican, and Cuban origin were until

recently the three largest Hispanic groups in the U.S., the population of Salvadorans has since marginally surpassed that of Cubans, accounting for 3.6% of the Hispanic population. Foreign-born immigrants account for over one-third of Hispanics in the U.S, and over two-thirds of those who are foreign-born are not U.S. citizens (Pew Hispanic Center, 2011a).

Spanish is the common language spoken by Hispanics. Ability to speak English well as well as frequency of Spanish and English use varies largely by generation, and for Hispanic immigrants, by time having lived in the US. Amongst Hispanic immigrants, only 23% report speaking English very well, while 88% of second generation Hispanics and 94% of third generation Hispanics report speaking English very well. The percentage of immigrants who speak English very well rises to 43% for those who have been residents of the U.S. for at least 26 years. 52% of Hispanic immigrants speak only Spanish in the home, while only 7% of immigrants speak mainly or only English at home, compared to their adult children, of whom about half speak mainly or only English at home. These percentages rise in the workplace as compared to the home, with more Hispanics speaking mainly or only English at work. Of the various subgroups, Puerto Ricans and South Americans are the most likely to report being proficient in English, and Mexicans the least so. Language is a major cause of discrimination against Hispanics in the U.S., and 46% of Hispanics rate language as the top cause of discrimination against them. The majority of Hispanics also report that they believe that in order to be successful in the U.S., they must learn English (Pew Hispanic Center, 2007a).

Overall, Hispanics face more socioeconomic adversity than Non-Hispanic Whites. Hispanics complete fewer years of education than non-Hispanic Whites, Blacks, and

Asians in the U.S. Furthermore, Hispanics have a higher unemployment rate than Whites, are more likely to have lower incomes than Whites, and are more likely to work in low paying and physically demanding jobs. Additionally, Hispanics have a high poverty rate, with 23% of Hispanics of all ages living in poverty, compared with 10% of non-Hispanic Whites (Pew Hispanic Center, 2011b). Socioeconomic status (SES) varies between Hispanic subgroups, with those of Mexican, Puerto Rican, and Dominican origin suffering the poorest socioeconomic conditions, and Cuban Americans maintaining a relatively higher SES. Across ethnic subgroups, foreign-born Hispanics have lower income than U.S. born Hispanics (Reimers, 2006).

In addition to the socioeconomic adversity that many Hispanics face, there is often the added stress for Hispanic immigrants of adjusting to a new system of beliefs that may vary markedly from their own (Caplan, 2007). A growing body of research is focusing on the process of acculturation in Hispanics, or the continuous first-hand contact of groups of individuals of different cultures, and the subsequent changes in cultural patterns of either or both groups (Redfield, Linton, & Herskovits, 1936). The term *acculturative stress* refers to the various stressors individuals of a cultural group face as they come into contact with a new culture, and includes multiple dimensions such as instrumental/environmental stress, social/interpersonal stress, and societal stress. In addition to some of the adversities mentioned previously, such as financial stress, unemployment, lack of education, and language barriers, Hispanic immigrants may also experience a loss of social networks and social status within the community, family and intergenerational conflict, changing gender roles, discrimination, and stress regarding their legal status in the U.S. (Caplan, 2007).

Hispanic Health in the United States

The Hispanic population as a whole experiences a disproportionate number of adverse socioeconomic circumstances and culturally specific stressors. In addition to those already discussed, 31.3% of Hispanics are without health insurance (Pew Hispanic Center, 2011b). Hispanics generally have less health insurance coverage than non-Hispanic Whites, and may be less likely to utilize some available healthcare services (Harris, 2001). Access to and utilization of healthcare services varies by Hispanic country of origin and length of time having lived in the U.S. Data from the Medical Expenditure Panel Survey indicates that Cubans and South Americans are more likely than Mexicans, Puerto Ricans, or Central Americans and Caribbeans to have any private health insurance coverage, and Puerto Ricans are the most likely to have public coverage only. Those who were born in the U.S. or have lived in the U.S. for at least 15 years are more likely to have private or public health coverage, and less likely to be uninsured during the year (Weinick, Jacobs, Stone, Ortega, & Burstin, 2004).

Considering the adverse socioeconomic conditions and the various culturally specific stressors experienced by many Hispanics, it seems plausible that the Hispanic population as a whole would have poorer health outcomes compared to groups of higher SES such as non-Hispanic Whites. Despite having lower SES and seemingly higher risk, Hispanics exhibit some better health outcomes than non-Hispanic whites and other racial and ethnic groups, although this may vary by ethnic subgroup and status as an immigrant or U.S. born Hispanic. This phenomenon is known as the Hispanic Paradox (Gallo et al., 2009; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005; Myers & Rodriguez, 2003). For example, Hispanics have lower overall mortality rates than both non-Hispanic

Whites and Blacks in the U.S. Cardiovascular Disease (CVD) is the leading cause of death in the U.S. for most racial and ethnic groups, including Hispanics, yet Hispanics have lower mortality due to CVD than both Non-Hispanic Whites and Blacks. In contrast, they have higher rates of diabetes and obesity overall than Non-Hispanic Whites, depending on ethnic subgroup and gender (Myers & Rodriguez, 2003; Okosun et al., 2000; National Center for Health Statistics, 2011). In addition to having higher rates of diabetes, Hispanics are more likely than Non-Hispanic Whites to develop diabetes-related complications such as end-stage renal disease (Myers & Rodriguez, 2003).

Research has shown that health outcomes may vary among Hispanics with amount of acculturation to the Westernized lifestyle of the U.S., although the research on acculturation and health has been limited primarily to Mexican Americans (Lara et al., 2005). Evidence suggests that with increased acculturation, physical health status declines and rates of chronic illnesses such as CVD increase due to Westernized lifestyle factors such as higher calorie and fat intake and reduced energy expenditure. This may not be the case for all Hispanic subgroups and illnesses, however, with one study finding that Mexican Americans with increased levels of acculturation, independent of SES, had reduced prevalence of diabetes (Hazuda, Haffner, Stern, & Eifler, 1988). In Hispanics, acculturation may also influence different aspects of health in varying ways, having more negative effects on lifestyle behaviors and more positive effects on health care use such as having health insurance and utilizing more preventive services (Lara et al., 2005). In addition to increased acculturation, acculturative stress in Hispanics has been associated with declines in physical health and in poorer self-rated physical health (Finch & Vega, 2003).

Certain shared cultural values among Hispanics may influence health behavior and health outcomes as well as act as protective factors from poor health outcomes (Gallo et al., 2009). For example, *familismo*, or the strong identification of individuals with and loyalty towards both their nuclear and extended families, is an important and pervasive cultural value shared by many Hispanics. The family, arguably the most important institution for many Hispanics, is described as a cohesive group and an emotional and instrumental support system which may protect members from the negative outcomes of emotional and physical stressors and for which members can rely on more heavily than external sources of support. Research has shown that certain aspects of familismo may decline with increasing levels of acculturation to westernized American culture in the U.S., but perceived support from the family does not decline (Sabogal, Marin, Otero-Sabogal, Marin, & Perez-Stable, 1987).

In addition to and likely influenced by the cultural value of familismo, religiosity and spirituality (R/S) are an integral part of Hispanic culture (Campesino & Schwartz, 2006). More than 90% of Hispanics identify with a specific religion, 68% of whom are Roman Catholics, 15% born-again or evangelical Protestants, and approximately 10% spread among Protestant and other Christian denominations. 8% of Hispanics do not identify with a specific religion or are atheist or agnostic, and fewer than 1% identify with Judaism or other non-Christian faiths (Pew Hispanic Center, 2007b). Although the rest of the U.S. population is also fairly religious, Hispanics appear to be different in how they practice and in the intensity of their beliefs. For example, Hispanics are more likely than non-Hispanics to say that religion is very important in their lives. For the majority of Hispanics, God is an active force in daily life, and most Hispanics pray every day, have a

religious object in their home, and attend religious service at least once per month, with almost half reporting they attend religious services at least once per week (Pew Hispanic Center, 2002).

Spirituality may act as a protective factor and a source of strength for families in coping with acculturative stressors and other adversities. Aspects of R/S such as religious service attendance have been associated with psychological well-being in Mexican American families and with physical health status in Mexican American women (Campesino & Schwartz, 2006). Across ethnic groups, greater R/S has been associated with better health behaviors, self-rated health, well-being, life satisfaction, and objective measures of health such as lower mortality and rates of CVD (Chida, Steptoe, & Powell, 2009; Gallo et al., 2009). As with other empirical research on Hispanics, the limited number of studies on R/S in Hispanics has targeted primarily Mexican Americans, again limiting conclusions that can be made about the influence of R/S on health and well-being in other Hispanic subgroups.

Religiosity and Spirituality

Defining and Differentiating Religiosity and Spirituality

The terms religiosity and spirituality have commonly been used simultaneously and interchangeably within psychological and health research (George, Larson, Koenig, & McCullough, 2000); however, a growing number of individuals who identify themselves as spiritual do not necessarily identify with any religious belief, doctrine, or denomination (Campesino & Schwartz, 2006), and researchers are beginning to distinguish spirituality and religiosity as somewhat overlapping, yet distinct

multidimensional constructs. Although definitions vary, religiosity and spirituality can generally be defined as "any feelings, thoughts, experiences and behaviors that arise from a search for the sacred," (Hill, Pargament, McCullough, Swyers, & Larson, 2000, pg. 66). The term religiosity was traditionally used as a broad construct referring to both substantive elements such as beliefs, practices and relationships that are related to a higher power, or the sacred, as well as more functional elements that emphasize how religious beliefs and practices are used to deal with existential concerns such as meaning and suffering. Religiosity is now commonly more narrowly defined as the behaviors or organized practices of a particular religious institution, while the term spirituality often refers to how people attain goals such as meaning and purpose in life and interconnectedness with others, the world, and/or a supreme being (Zinnbauer, Pargament, & Scott, 1999).

Both religiosity and spirituality are regarded as multidimensional constructs (Hill et al., 2000) and researchers have developed a number of instruments in an attempt to operationalize and capture the various dimensions of interest within the areas of psychology and health (Egbert. Mickley, & Coeling, 2004). Religiosity scales often distinguish between the constructs of extrinsic and intrinsic religiosity, with extrinsic religiosity referring to instrumental purposes of religion (e.g. provides a source of comfort, establishes a person in the community; Allport & Ross, 1967), and intrinsic religiosity referring to how one lives their religion in everyday life (e.g. experiencing the presence of the divine, religious beliefs lying behind one's approach to life; Hoge, 1972). Religiosity is also measured by assessing frequency of religious service attendance (organizational religion), and frequency of private religious activity such as private

prayer, bible study, or meditation (non-organizational religion; Koenig, Meador, & Parkerson, 1997). Spiritual well-being (SWB) is often measured by assessing domains such as one's relationship with and faith in God, finding meaning and satisfaction with life, feeling connected to others, forgiveness, and compassion (Ironson et al., 2002; Paloutzian & Ellison, 1982; Peterman, Fitchett, Brady, Hernandez, & Cella, 2002). Dimensions of religiosity and spirituality can be examined individually and have been found to relate differentially to health-related quality of life outcomes; yet results have differed by study and by population (Bredle et al., 2011; Canada, Murphy, Fitchett, Peterman, & Shover, 2008).

Frequency of religious service attendance is the most commonly used proxy for religiosity and spirituality (R/S) in predicting physical health outcomes (Holt-Lundstad, Steffen, Sandberg, & Jenson, 2011); yet religious service attendance does not capture all of the various dimensions of R/S that could positively influence health. R/S have important relationships with social-psychological phenomena that can influence health, such as social networks, cognitive phenomena, affect and emotion, and personality (Hill et al., 2000). In order to develop a more comprehensive understanding of how R/S relate to various health outcomes, more research examining specific domains within R/S other than religious service attendance is needed.

The Role of Religiosity and Spirituality in Physical Health

R/S have been shown in many studies to be protective of various health conditions. For example, research suggests that those who are more religious or spiritual have lower all-cause mortality and lower CVD incidence and mortality (Chida, Steptoe, & Powell, 2009; McCullough et al., 2000; Powell, Shahabi, & Thoreson, 2003). A meta-

analysis of 69 prospective, observational studies investigating the association between R/S and mortality in healthy populations showed that R/S was protective of both all-cause and cardiovascular mortality. The included studies used primarily religious service attendance as a measure of R/S, but results were also significant for studies that examined multi-dimensional aspects of R/S (Chida, Steptoe, & Powell, 2009). Another review study using a levels-of-evidence approach found persuasive evidence that religious service attendance was protective of mortality and some evidence that R/S was protective of CVD incidence (Powell, Shahabi, and Thoreson, 2003).

In addition to reducing the risk of all-cause mortality, CVD, and CVD mortality, studies have found that greater R/S is inversely related to risk factors for health conditions such CVD, type-2 diabetes (T2D), and the Metabolic Syndrome (MetS; a clustering of risk factors of metabolic origin), both in response to controlled laboratory stressors and as ambulatory measures. Edmondson et al. (2005) found that among primarily Caucasian female college students who were administered the Spiritual Well-being Scale and exposed to a laboratory stressor, greater scores on the Existential Well-being subscale predicted lower mean heart rate and reduced heart rate reactivity, and greater scores on the Religious Well-being subscale predicted reduced systolic blood pressure (SBP) reactivity. Another study of primarily Caucasian college students who were exposed to a laboratory stressor found that higher composite R/S scores, forgiveness, and frequency of prayer predicted lower cortisol responses, while higher composite R/S scores, frequency of prayer, and religious service attendance predicted lower blood pressure in males and higher blood pressure in females (Tartaro, Luecken, & Gunn, 2005). Other studies of adult, primarily Caucasian populations have found that

non-attenders of religious services had elevated levels of inflammatory markers of cardiovascular risk (King, Mainous, Steyer, & Pearson, 2001), and that greater SWB was associated with lower blood pressure, lower levels of an inflammatory marker, lower fasting glucose, lower cholesterol levels, and lower triglycerides (Doster, Harvey, Riley, Goven and Moorefield, 2002; Holt-Lundstad et al., 2011). In the previous studies, some significant relationships were no longer significant when controlling for certain variables such as smoking or BMI.

The majority of empirical research in the area of R/S and physical health outcomes has been conducted with primarily Caucasian samples. Results of a study of older Mexican Americans indicated that weekly religious service attendance was associated with a 32% reduction in mortality compared with those who never attended religious services, over an 8-year follow-up period (Hill, Angel, Ellison, & Angel, 2005). A study of primarily Hispanic female college students found that participants were at risk for the MetS and T2D, and that existential well-being was associated with lower weight (Rauschuber et al., 2005). However, these are two of very few studies examining the link between R/S and specific physical health outcomes in Hispanic populations. As R/S is an important part of Hispanic culture, more research in this area is warranted.

There are a number of hypothesized mechanisms to explain how R/S may protect against poor health outcomes. R/S may influence strategies used to cope with stressful circumstances and engender more positive emotions. Spiritual and religious people may also be more optimistic, have greater locus of control and higher self-esteem, as well as lower rates of mental illness. Involvement at a religious institution in addition to other dimensions of R/S may result in higher levels of social support, which is known to have

protective effects on health. Additionally, aspects of R/S such as personal beliefs and specific religious practices may promote healthier lifestyle behaviors such as refraining from smoking, limiting alcohol intake, eating healthier, and exercising more (George, Ellison, & Larson, 2002; Powell et al., 2003; Seybold & Hill, 2001).

Empirical research provides evidence that multiple dimensions of R/S may be protective of poor physical health outcomes, particularly mortality, CVD incidence and mortality, and numerous individual risk factors for CVD and other health conditions. There are no previous studies examining the relationship between R/S and the Metabolic Syndrome (MetS), a co-occurring group of risk factors for conditions such as all-cause mortality, CVD, and T2D; yet, R/S has been shown to be protective of mortality and CVD, and inversely related to several components of the MetS, indicating that dimensions of R/S could plausibly play a protective role in the development of the MetS through various physiological, psychological, and behavioral processes.

The Metabolic Syndrome

The MetS is the presence of an often co-occurring cluster of risk factors of metabolic origin including abdominal obesity, raised blood pressure or hypertension, raised triglycerides, dyslipidemia, and elevated glucose levels and is characterized by having at least three of the aforementioned conditions, although definitions vary slightly due to disagreement on the specific criteria (Grundy, 2007). There is also disagreement over whether there is an underlying pathophysiological mechanism responsible for the MetS, or if it is merely a group of risk factors that co-occur together more frequently than expected by chance alone, reducing the clinical utility of identifying the MetS (Cornier et

al., 2008). The major risk factors for the MetS appear to be obesity and insulin resistance (Grundy, 2011). Having the MetS significantly increases risk for CVD, T2D, and all-cause mortality (Gami et al., 2007; Haffner, 2006), and, arguably, the presence of the MetS confers significantly greater risk than the presence of one of the risk factors in isolation (Grundy, Brewer, Cleeman, Smith, & Lenfant, 2004). Data from the National Health and Nutrition Examination Survey (NHANES) indicate that the prevalence of the MetS in the U.S. population was almost 23% from 1988-1994 and rose to almost 35% from 1999-2002 and 34% from 2003-2006. Prevalence increases with older age through the age of 70, with more than 50% of adults age 60 and over meeting criteria for the MetS. Prevalence also increases with higher BMI and with lower SES. Mexican Americans, and particularly Mexican American women, had the highest prevalence of the MetS compared to White and Black Americans (Ervin, 2009; Ford, 2005; Park et al., 2003).

Lifestyle and behavioral factors play a significant role in the risk for developing the features that define the MetS. Studies have found that those who smoke, are physically inactive, consume alcohol heavily or not at all, and have a high carbohydrate and low fiber intake are significantly more likely to have the MetS (Park et al., 2003, Carnethon et al, 2004). In contrast, those who engage in more leisure time exercise, eat a healthy diet consisting of lower total fat consumption, higher fiber consumption, higher fruit/vegetable consumption, and fewer sweets, and consume alcohol in low or moderate quantities are less likely to have one or more features of the MetS (Lidfelt et al, 2003).

In addition to behavioral determinants, psychosocial factors have been associated with prevalence of the MetS as well as individual components of the MetS. Depression,

for which there is a large research base indicating its significant relationship to CVD (Rugulies, 2002), has also been significantly associated with prevalence of the MetS and individual components such as central adiposity, insulin resistance (Goldbacher & Matthews, 2007), and hypertension (Bosworth, Bartash, Olsen, & Steffens, 2003). Furthermore, longitudinal studies have indicated that depression significantly predicts later development of the MetS (Goldbacher & Matthews, 2007) and that women with a history of Major Depressive Disorder (MDD) are twice as likely to have the MetS, controlling for demographic and lifestyle factors (Kinder, Carnethon, Palaniappan, King, & Fortmann, 2004). In addition to depression, psychosocial factors such as hostility, anger, and more negative life events have been positively associated with and predictive of the MetS (Goldbacher & Matthews, 2007; Vogelzangs et al, 2007). Lack of social support, which has been widely studied as a risk factor for CVD, may also be associated with the MetS. Vogelzangs et al. (2007) found that inadequate emotional support was positively related to prevalence of the MetS in elderly persons.

As previously stated, data suggest that prevalence of the MetS may be higher in Mexican Americans than in White and Black Americans (Ford, 2005; Park et al., 2003). Overall, Hispanics have higher rates of obesity and diabetes, both of which are often associated with the MetS (Myers & Rodriguez, 2003; National Center for Health Statistics, 2011), possibly contributing to this disparity in prevalence. However, the MetS is not well studied in Hispanic subgroups other than Mexican Americans, and more research is warranted to draw conclusions about prevalence and risk and protective factors for the MetS that are more specific to Hispanic culture and psychosocial processes.

Proposed Study

Greater R/S appears to protect against certain poor health outcomes including all-cause mortality and CVD incidence and mortality. There is also evidence to suggest that R/S may be protective of various risk factors (e.g., hypertension, fasting glucose) for these health conditions. The majority of studies examining the link between R/S and health conditions such as CVD have primarily used frequency of religious service attendance as a proxy for R/S without considering the multidimensional nature of R/S as well as the differentiation between religious beliefs/practices and spirituality. R/S has not yet been studied in relation to the MetS, a significant risk factor for CVD and T2D. Given the evidence that having greater R/S has been inversely associated with several individual components of the MetS and is protective of CVD, it is possible that R/S could be protective of the development of the MetS. Furthermore, R/S are hypothesized to be protective of health outcomes through various physiological, behavioral, and psychosocial processes that may also influence development of the MetS. Of importance is that both R/S and the MetS have not been well studied in Hispanics, and the existing research has focused primarily on Mexican Americans. R/S is an integral part of Hispanic culture and may be protective of health outcomes that are influenced by phenomena such as acculturation, stress, and other psychosocial adversities experienced disproportionately by Hispanics in the U.S.

The proposed study used structural equation modeling (SEM) to explore the cross-sectional relationship between several dimensions of R/S and the MetS in a large, population-based sample of Hispanic adults in the U.S. The first step involved evaluating a second-order latent factor of the SWB measure used in the present study within a

measurement model. SCAS investigators preliminarily established the first-order factor structure of the SWB measure included in the present study, using individual items as indicators of underlying dimensions within the full measure. In the proposed study, the resulting factors were then used to derive a second-order factor of overall SWB, in addition to examining the individual dimensions separately. Although research has shown that individual dimensions of R/S could relate to mental and physical health outcomes differentially in certain illness populations (Bredle et al., 2011), results have been mixed and there are no a priori hypotheses for how dimensions of SWB may differentially relate to the MetS or its individual components. Therefore, an overall latent SWB variable derived from the shared variance of individual dimensions of SWB may be a more robust estimate of relationships examined within the present analyses, and will be examined in addition to examining the individual factors of SWB. The statistical advantage of using a latent variable of SWB over simply summing the item scores to derive an overall SWB score is that in latent variable models, values of unique variance, including error variance, are estimated as part of the model rather than assuming that variables are measured without error. This corrects for bias in the estimates of effects among variables (Coffman & MacCallum, 2005).

The resulting latent factor of SWB was then included within an overall structural model as a correlate of the MetS along with two measures of religiosity. Sociodemographic and behavioral variables that are commonly associated with the MetS were controlled for in the model. Additionally, because there is controversy over the uniformity of the MetS, the R/S variables were explored in relation to the individual

components of the MetS as well. The proposed measurement and overall structural models are shown in Figures 1-3.

For the proposed study, the following hypotheses were tested:

Specific Aim 1: To examine a second-order latent factor of SWB derived from several preliminarily established underlying factors of the SWB measure, within a measurement model using confirmatory factor analysis (CFA).

Hypothesis 1: CFA will support a second-order latent factor of SWB with several underlying first-order factors.

Specific Aim 2: To test a structural equation model that simultaneously examines the relationship of several dimensions of R/S [frequency of religious service attendance, frequency of private religious activities, and a latent construct representing SWB or separate dimensions of SWB (meaning/peace, faith, relational) with prevalent MetS in a middle aged (45 years) or older Hispanic population.

Hypothesis 2a: Greater frequency of religious service attendance will be significantly and independently associated with lower likelihood of having the MetS.

Hypothesis 2b: Greater frequency private religious activity will be significantly and independently associated with lower likelihood of having the MetS.

Hypothesis 2c: Higher scores on a latent construct representing SWB (or on separate dimensions of SWB) will be significantly and uniquely associated with lower likelihood of having the MetS.

Specific Aim 3: To examine the extent to which measures and constructs of R/S are associated with individual components of the MetS.

Hypothesis 3: Measures and constructs of R/S will be significantly and independently associated with each component of the MetS.

Chapter 2: Method

Participants

Participants were self-identified Hispanics/Latinos age 45-74 years who were enrolled in the National Institutes of Health (NIH)-funded Hispanic Community Health Study/Study of Latinos (HCHS/SOL), a prospective, population based epidemiologic study of the prevalence of multiple health conditions and their risk factors, with an emphasis on CVD. The present study includes a sub-sample of participants (N = 3,278) who completed the baseline examination of the HCHS/SOL and who were subsequently enrolled in a Sociocultural Ancillary Study (SCAS) that examined additional socioeconomic, sociocultural, and psychological risk and protective factors. Participants include Hispanics of Mexican, Puerto Rican and Dominican, Cuban, and Central and South American origin living in defined communities in the Bronx, NY; Chicago, IL; Miami, FL; and San Diego, CA.

Inclusion/Exclusion Criteria

Participants were required to be age 18-74 years and to self-identify as Hispanic or Latino. Participants less than 45 years of age were excluded from the proposed analyses because the prevalence of the MetS is relatively lower in younger adults (Grundy, 2011). Participants were also required to reside within the pre-defined geographic locations of the four communities chosen for the study. Persons were excluded if they were on active military service, not currently living at home, planning to move from the area in the next six months, not able to complete the study in English or Spanish, or physically unable to attend the clinic examination.

Measures

Religiosity

Religiosity was measured at the Sociocultural Ancillary Study (SCAS) assessment with the Duke University Religion Index (DUREL; Koenig, Meador, & Parkerson, 1997), which assesses several dimensions of religiosity including frequency of religious service attendance, frequency of private religious practices such as prayer and meditation, and intrinsic religiosity. The present study used two items assessing frequency of religious service/meeting attendance and frequency of private religious activities. To measure frequency of religious service attendance, participants were asked, "How often do you attend church or other religious meetings?" The item has six response options ranging from "never" to "more than once per week." To measure frequency of private religious activities, participants were asked, "How often do you spend time in private religious activities, such as prayer, meditation, or bible study?" The item has six response options ranging from "rarely or never" to "more than once a day." The DUREL has demonstrated excellent internal consistency and support for convergent and construct validity (Storch et al., 2004). The two items used from the DUREL are shown in the Appendix.

Spiritual Well-being

SWB was measured at the SCAS assessment with the Functional Assessment in Chronic Illness Therapy – Spiritual Well-Being Scale, Expanded version (FACIT-Sp-Ex; Peterman, et al., 2002), which is shown in the Appendix. The measure consists of 23 items rated on a 5-point Likert scale from "not at all" to "very much." The original 12-item measure is composed of subscales measuring the domains of Meaning (e.g. "I feel a

sense of purpose in my life"), Peace (e.g. "I feel a sense of harmony within myself"), and Faith (e.g. "I find comfort in my faith or spiritual beliefs"). It was initially developed and tested in English and Spanish with a multiethnic sample (44% Latino) with current or past diagnoses of Cancer and/or HIV. Principal components analysis of the 12 items resulted in two underlying factors, one consisting of the 8 items measuring Meaning and Peace (items 1-8), and the other consisting of 4 items measuring Faith (items 9-12). It demonstrated good internal consistency in the total scale and the two subscales (Cronbach's α = .81-.88; Peterman et al., 2002), and it is these two subscales that are most commonly used in the literature. Subsequent factor analyses in both a predominantly white female sample as well as a more ethnically diverse sample of male and female cancer survivors indicated that a three-factor structure, consisting of two factors representing Meaning (items 2, 3, 5 and 8) and Peace (items 1, 4, 6 and 7) separately and one factor representing Faith (items 9-12), was a significantly improved model to the original two-factor model consisting of Meaning/Peace and Faith subscales (Canada et al., 2008; Murphy et al., 2010). The expanded 23-item version includes additional items within domains including connectedness (e.g. "I feel connected to other people"), appreciation (e.g. "Throughout the course of my day, I feel a sense of thankfulness for what others bring to my life"), and forgiveness (e.g. "I am able to forgive others for any harm they have ever caused me). Two items referring to one's illness in the expanded version (e.g. "My illness has strengthened my faith or spiritual beliefs) were reworded with the phrase "difficult times," to make them applicable to a general population. The psychometric properties of the expanded version of the FACIT-Sp have not been well studied (Bredle et al., 2011), particularly in populations with

persons who may not have a chronic illness. Only one study has examined the factor structure of the expanded version in a sample of predominantly male, White and African American patients with HIV/AIDS. Results of the exploratory factor analysis yielded three factors. Replicating previous findings from study of the original 12-item scale, items loaded on two factors representing Meaning/Peace (items 1-8, 14, 15, and 21) and Faith (items 9-11, 13). In addition, a third factor representing relational aspects of SWB (Relational) was derived from several of the new items (15, 17, 18, 22, and 23). Three items (13, 19, and 20) loaded well on two of the factors. (Cotton, Peterman, Kudel, Leonard, and Tsevat, 2011). Thus, previous research indicates that the FACIT-Sp-Ex is likely to have either three (meaning/Peace, faith, and relational) or four (meaning, peace, faith, relational) factors. Within the present sample, the three factor model was the best fit for the data.

The Metabolic Syndrome

Meeting criteria for the MetS will be assigned to participants following National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III guidelines (NCEP, 2002), with updates and modifications suggested by National Heart, Lung, and Blood Institute (NHLBI), which requires the presence of 3 or more of the following:

- Waist circumference > 102 cm (men) and > 88 cm (women)
- Blood pressure ≥ 130 / ≥ 85 mm Hg, or self-report use of anti-hypertension medications
- Triglycerides ≥ 150 mg/dL
- High-density lipoprotein cholesterol (HDL-c) < 40 mg/dL (men) and < 50 mg/dL (women)

- Fasting plasma glucose (FPG) ≥ 100 mg/dL, or self-report use of anti-diabetic medication

This information was collected by laboratory examination and by participant self-report of medications at the baseline examination.

Covariates

Sociodemographic variables were assessed at the baseline HCHS/SOL examination using standard questionnaires and included age, gender, acculturation (Short Acculturation Scale for Hispanics), total combined yearly household income, education (less than high school, high school graduate, beyond high school), and Hispanic origin (Mexican, Puerto Rican, Dominican, Cuban, Central and South American, more than one, or other). Additional control variables assessed at the HCHS/SOL baseline examination included tobacco use, alcohol use, and physical activity. Dietary behavior was measured in the present study, but the data were not available for inclusion at the time the present analyses were conducted. Lifestyle and behavioral covariates were measured as follows:

Tobacco Use

Tobacco use was measured at the baseline examination with items from the 2000-2002 Health and Nutrition Examination Survey (NHANES; National Center for Health Statistics, 1994). Items assessed current and past cigarette smoking history and lifetime use of other tobacco products, including cigars and pipes. In the current study, smoking status will be defined as “current regular smoker,” “former regular smoker,” or “never a regular smoker.”

Alcohol Consumption

Alcohol consumption was measured at the baseline examination. The present study used items taken from the Multi-Ethnic Study of Atherosclerosis (MESA; Bild, Bluemke, & Burke, 2002) assessing the amount of habitual weekly consumption of specific types of alcohol in standard drink units (Beer = 12oz. glass or 355ml bottle; Wine = 3.5oz glass, 1 bottle =750ml= 8 glasses; Hard spirits = 1.5oz. or 1 shot). Examples of alcoholic beverages that may be traditionally used within the Hispanic population (e.g. pulque, aguardiente) were incorporated into the interviewer test in order to prompt participants and to correctly classify types of alcohol. The present study will define alcohol use as "none," light" (less than or equal to 7 drinks per week), "moderate" (8-14 drinks per week), and "heavy" (15 or more drinks per week).

Physical Activity

Physical Activity was measured at the baseline examination with a modified 18-item version of the Global Physical Activity Questionnaire (GPAQ; Armstrong & Bull, 2006), which assesses current habitual number of days per week and time spent doing vigorous and moderate intensity physical activities. It focuses on work-related activities, walking or bicycling for transportation, leisure or recreational activities, and sedentary behaviors. The GPAQ has been tested for validity and reliability in nine countries and demonstrates good concurrent validity and good to excellent test-retest reliability (Cronbach's alphas 0.67 to 0.81). In the present study, physical activity will be measured as the typical number of hours per week spent doing physical activities of vigorous and moderate intensity.

Procedure

Participant Sampling and Recruitment

HCHS/SOL. Recruitment was implemented through a two-stage area household probability design with the goal of recruiting 4,000 persons at each of the four field sites, for a total enrollment of approximately 16,000 participants over three years. Selection was stratified based on defined geographic blocks near the four field centers and by demographic variables including age, concentration of Hispanic/Latino households, and low vs. high SES (as measured by the proportion of persons with at least a high school education), each based on the 2000 decennial Census. Over-sampling at both stages of sample selection was used to increase the likelihood of yielding an eligible household, resulting in participants being selected with unequal probabilities of selection. Those aged 45-74 years were over-sampled. Participants were given sample weights, which were taken into account in statistical analyses. Once a household was selected, all eligible household members were invited to participate. A more detailed explanation of the sampling method is described elsewhere (LaVange et al., 2010).

SCAS. Participants were a random sub-sample of the HCHS/SOL cohort who consented to be contacted for ancillary studies, with the goal of recruiting 5280 participants (1320 per field site) aged 18-74 years. One participant per household was targeted, and selection was stratified based on age and SES to ensure a distribution similar to the parent study. Participants who agreed to be contacted for ancillary research were recruited within three to six months of their HCHS/SOL baseline examination, but following the telephone-based food frequency assessment (final step of the baseline exam).

Screening

HCHS/SOL. Selected households were sent an initial mailing describing the study. Households were then contacted by telephone for telephone screening or visited in-person by a study recruiter if no phone number was available or phone contacts were unsuccessful. All study staff were bilingual, allowing for the use of Spanish or English at the preference of the potential participant. Persons who met the eligibility criteria and agreed to participate were scheduled for a consenting and assessment appointment at the field center clinic. Women who were pregnant were scheduled for a visit approximately three months postpartum.

SCAS. Selected participants were contacted by phone (or another agreed upon method) by bilingual research health interviewers within six months of their baseline examination. Health interviewers provided an overview of the study and attempted to arrange a consenting and assessment appointment at the field center clinic (or in participant homes in some cases).

Assessment

HCHS/SOL. The baseline examination took place at each field center's specialized examination site and consisted of collecting personal information, completing interviewer-administered questionnaires, and a laboratory examination. All sites were convenient to public transportation and provided a van or taxi service to assist participant attendance. Participants were reimbursed for expenses involved in attending the examination. The examination averaged seven hours in length and began in the morning to allow for a fasting blood draw. Informed consent was obtained prior to beginning the examination. Participants then had measurements collected that required obtaining in the

fasting state. Participants were provided with a snack to break their fast at the appropriate time in the examination. To ensure participant safety, procedures were not performed if contraindicated. Questionnaires were interviewer-administered in English or Spanish at the preference of the participant. All questionnaires were either previously translated into Spanish through a standard process, or newly translated into Spanish, certified by an independent translator, and tested by focus groups at each field center. Complete documentation of the examination content, questionnaires, forms, and a manual of procedures are available at the study web site (Hispanic Community Health Study (HCHS), Manual 02). In addition, details on the laboratory collection, processing and analysis can be found in the laboratory manual at the study web site (HCHS, Manual 07)

SCAS. Assessments, which took 1 to 3 hours to complete, consisted of questionnaires administered in English or Spanish by trained, bi-lingual, bi-cultural research assistants. Data were entered directly into a computer based data management system developed and maintained by the Coordinating Center Breaks were offered as needed, and participants received $60 for their time and effort, as well as reimbursement for travel expenses as appropriate. Questionnaire translation procedures were consistent with the HCHS/SOL parent study.

Chapter 3: Statistical Analyses

Preliminary Analyses

All preliminary analyses were performed using SPSS Version 19.0. Variables were evaluated for the extent of missing data, outliers, and univariate normality. Distributions were considered non-normal if the absolute value of the skew index was greater than 3.0 and the kurtosis index was greater than 10.0 (Kline, 2011). Triglycerides (skew index = 22.89, kurtosis = 1027.22) and glucose (skew index = 4.16, kurtosis = 21.00) were log transformed to achieve approximate normality. Weighted means and standard errors for continuous variables and weighted percentages for categorical variables were evaluated for all variables in order to characterize the sample.

Primary Analyses

Structural Equation Modeling (SEM)

All primary analyses were performed in MPlus version 7.0 (MPlus; Los Angeles, CA), a computer tool used for SEM. SEM is an approach used to test models based on a priori hypotheses about patterns of variances and covariances among a set of observed and/or latent variables. In addition to analyzing individual parameter estimates, including coefficients for both direct and indirect effects, SEM confirms whether or not the hypothesized model is supported by the data being analyzed and allows for the testing and comparison of alternative a priori models as well as model generation, or modification of a model that does not fit the data well. The goal in model generation is to retain a model that is theoretical, reasonably parsimonious, and reasonably well supported by the data (Kline, 2011).

Model fit can be determined by numerous fit indexes calculated within SEM. The following fit indexes were used in the proposed analyses: Chi-square statistic (χ^2; tests the prediction that there are no discrepancies between the population covariances and those predicted by the model, and is the most widely reported test statistic in SEM), comparative fit index (CFI; measures the relative improvement in the fit of the researcher's model over that of a baseline model), root mean square error of approximation (RMSEA; a parsimony-adjusted index that tests lack of fit to the data) and standardized root mean square residual (SRMR; the overall difference between the observed and predicted correlations). SEM techniques require large samples. The following guidelines are recommended for determining sample size: small, N < 100; medium, N = 100 – 200; large, N > 200. The power of the χ^2 to detect model-data discrepancies increases with increasing sample size, so it can happen that in very large samples (e.g. N = 5000), a chi-square test is failed even with only slight difference between observed and predicted covariances (Kline, 2011). Because of the large sample size used in the proposed study, only the CFI, SRMR, and RMSEA was used to determine acceptable model fit, although the results of the χ^2 were also reported. The following guidelines were used to determine acceptable model fit in the proposed study: CFI ≥.95, SRMR ≤.08, and RMSEA ≤.06 (Kline, 2011).

Because the primary outcome variable in the proposed structural model (prevalent MetS) is binary, a logistic method was used to test the hypotheses. Maximum likelihood estimation with robust standard errors (MLR) in Mplus calculates logistic regression coefficients in the case of binary outcome variables (Muthén & Muthén, 2007). MLR was also used to test hypotheses with continuous outcome variables.

Missing Data

SEM allows for data to be analyzed using the full information maximum likelihood (FIML) approach. Assuming that data are normally distributed and are missing at random (MAR; the probability of a missing value on a variable is unrelated to the values of the variable itself), this approach provides an unbiased estimate of parameters by treating the missing data as random variables to be removed from the likelihood fit function as if they were never sampled, rather than deleting cases or imputing missing observations. This approach is usually more accurate than other approaches for handling missing data (Schafer and Graham, 2002). It is not possible to test whether data are MAR because it would require knowledge of the missing values; therefore, MAR-based analyses must proceed under the assumption that data are MAR (Ender, 2006).

Specific Aim 1

Hypothesis 1: Prior to the proposed analysis, SCAS investigators established the first-order factor structure of the FACIT-Sp-Ex at the item level, resulting in three underlying dimensions of SWB within the measure: meaning/peace, faith, and relational. For the proposed analyses, the first-order factor measurement model was examined within a measurement model using CFA to derive a second-order latent factor of SWB, which was then incorporated in the overall proposed structural model. The proposed measurement model is shown in Figure 2, with rectangles representing observed variables and ovals representing the latent factors derived from the indicators.

Fit indexes were examined and coefficients, or loadings, relating the SWB factor to each first-order factor were evaluated for statistical significance with a p-value $\leq .05$ indicating an acceptable loading.

Specific Aim 2

Hypotheses 2a, 2b, and 2c: Prior to testing the full model, bivariate associations of each R/S variable with the MetS were established. In addition, multiple logistic regression analyses were conducted for each individual R/S predictor while adjusting for sociodemographic covariates, and then again while adjusting for both sociodemographic and lifestyle covariates. Covariates were adjusted for by specifying a direct path from each covariate to the outcome. Covariates with categorical responses (e.g. Hispanic background) were be dummy-coded. Path coefficients for each predictor were evaluated for statistical significance, with a p-value ≤ .05 indicating a significant relationship between predictor and outcome.

A logistic structural equation model was tested in which the observed variables of frequency of religious service attendance and frequency of private religious activity and the latent SWB variable were specified as having direct paths to the MetS as a binary outcome (participant meets criteria or does not). One model was tested while adjusting for sociodemographic covariates, and a second model tested while adjusting for both sociodemographic and lifestyle covariates. In addition to testing the latent SWB variable, the individual first-order SWB factors (meaning/peace, faith, and relational) were also tested as predictors of the MetS simultaneously with religious service attendance and private religious activity in order to examine whether or not dimensions of SWB have differential associations with the MetS. The overall proposed structural model is depicted in Figure 3. The observed variables that define the latent factors and the residuals are excluded to simplify the figure.

Specific Aim 3

Hypotheses 3a, 3b, and 3c: The analyses used to test Aim 2 were repeated with the individual components of the MetS as continuous outcomes. Models were tested in which each of the observed and latent predictors (including covariates) as stated above were specified as having direct paths to each of the five individual components of the MetS. The components were tested as continuous variables to allow for examination of the linear relationship between the predictors and each component of the MetS. Path coefficients were evaluated for statistical significance.

Chapter 4: Results

Preliminary Analyses

Normality

Normality testing revealed approximately normal distributions for all study variables, except for triglycerides (skew index = 22.89, kurtosis = 1027.22) and glucose (skew index = 4.16, kurtosis = 21.00), which were both positively skewed. Both variables were log transformed to approximate normality before including in statistical analyses. Study variables were also screened to ensure there were no outlying values beyond the possible range of values for each variable.

Sample Description

Participants were an average of 57 years of age (SE = .24) and 56% were female. Participants were of diverse Hispanic origin (29% Mexican, 28% Cuban, 19% Puerto Rican, 12% Central/South American, 10% Dominican, and 1% more than one/other origin). Interviews were conducted primarily in Spanish (85%). More than half of participants (57%) reported a yearly household income less than $20,000, with 41% not completing high school education, 20% completing high school, and 39% completing education beyond high school.

49% of all participants aged 45-74 years (46% of males; 52% of females) met criteria for the Metabolic Syndrome, the primary outcome variable examined in the study, with prevalence varying by Hispanic origin (Dominican = 45%; Central/South American = 49%; Cuban = 54%; Mexican = 50%; Puerto Rican = 50%; More than one/Other = 49%) . With regards to religion, the majority of participants identified as Roman Catholic (61%), with approximately 8% not identifying with any religion. This was fairly

comparable to the percentages cited by the Pew Hispanic Center (Pew Hispanic Center, 2007b), who reported that 68% of Hispanics are Roman Catholic and 8% do not identify with a religion. Almost half of participants (46%) reported attendance at religious services once per week or more than once per week, and more than half (55%) reported engaging in private religious activity such as prayer, meditation, or bible study daily or more than once daily. Weighted sample descriptives for all sociodemographic, lifestyle, R/S, and MetS variables are reported in Table 1.

Analysis of Covariates

Bivariate associations of sociodemographic and lifestyle controls with the MetS and MetS components were estimated in order to establish preliminary relationships of covariates with outcome variables. Logistic regression was used to test associations with prevalent MetS, and linear regression was used to test associations of continuous and dummy-coded categorical variables with individual MetS components.

Age (OR = 1.05, 95% CI = 1.04-1.07), being of Cuban origin (reference group = Mexican; OR = 1.39, 95% CI = 1.05-1.84), and being a former smoker as opposed to never smoking (OR = 1.57, 95% CI = 1.26-1.96), were all positively significantly related to prevalence of the MetS. Being male (OR = .79, 95% CI = .65-.97), education level (OR = .82, 95% CI = .72-.93), income (OR = .78, 95% CI = .70-.87), acculturation (OR = .83, 95% CI = .70-.98), and physical activity (OR = .88, 95% CI = .82-.95) were all significantly inversely related to prevalence of the MetS. Alcohol use and being a current smoker were not significantly related to prevalence of the MetS. Covariates were differentially associated with individual components of the MetS, with increasing age, being male, and being a former smoker all significantly and positively related with the

majority of MetS components. Standardized estimates of associations of covariates with MetS and the individual components are reported in Table 2.

Primary Analyses

Specific Aim 1: Spiritual Well-being Measurement Model

Preliminary to the present study, investigators examined the first-order factor structure of the 23-item FACIT-Sp-Ex, the scale used to measure SWB in the HCHS/SOL Sociocultural Ancillary Study. The entire SCAS sample (N = 5,275) was included in those analyses. CFA at the item level indicated that a three-factor structure with SWB factors of meaning/peace, faith, and relational was the best fitting model. Item 12 ("even during difficult times, things will be ok") was removed from the model because modification indices showed it loaded well on more than one factor. Item 13 ("I feel connected to a higher power") was originally included in the relational factor, but loaded on the faith factor. Multiple residual variances of items within factors were correlated to improve model fit.

Within the present study, a second-order latent factor of SWB combining the Meaning/Peace, Faith, and Relational factors was specified within a measurement model, using the sub-sample of participants aged 45-74. The second-order factor represents the shared variance among the three factors. CFA indicated that this model fit the data well [($\chi^2(197) = 1807.45$, $p < .0001$, CFI = .95 , RMSEA = .05 , SRMR = .04)], after constraining equal the residual variances of the Meaning/Peace and Relational factors. All loadings were significant ($p<.001$). The standardized loading of the Faith factor (0.69) on the second-order SWB factor was lower than the loadings for the

Meaning/Peace (0.90) and Relational (0.95) factors. The final measurement model with first-order factor loadings on the SWB latent variable is depicted in Figure 4.

Intercorrelations of Religiosity/Spirituality Variables

Correlations between all R/S variables were estimated. All R/S variables were significantly correlated with one another (*p's*<.001). meaning/peace and relational factors were very strongly correlated with each other (0.84). The items included in the faith factor (e.g. "I find strength in my faith or spiritual beliefs," "I feel connected to a higher power") appear as though they might be more strongly related to religiosity than other items in the FACIT-Sp-Ex. Indeed, frequency of religious service attendance and private religious activity were most strongly correlated with each other (0.45) and with the Faith factor (0.42 and 0.50), were moderately correlated with the overall SWB factor (0.30 and 0.35) and were more weakly correlated with the meaning/peace factor (0.19 and 0.21) and with the relational factor (0.25 and 0.29). All correlation coefficients are reported in Table 3.

Specific Aim 2: Religiosity/Spirituality Associations with the Metabolic Syndrome

Bivariate associations of R/S variables with the prevalent MetS were evaluated to determine preliminary relationships between variables before inclusion in multiple regression analyses. Models were tested using a stepped approach. Subsequent to estimating bivariate associations, each individual R/S predictor was separately included in a regression model that adjusted for sociodemographic covariates, and then a model that adjusted for both sociodemographic and lifestyle covariates. Lastly, models including all R/S variables (religious service attendance, private religious activity, and

meaning/peace, faith, relational, or overall SWB) simultaneously while adjusting for only sociodemographic controls and then for both sociodemographic and lifestyle controls were tested.

R/S observed and latent variables, which included frequency of religious service attendance, frequency of private religious activity, meaning/peace, faith, relational, and overall SWB were not significantly associated with prevalence of the MetS in bivariate models. R/S variables remained unrelated to the MetS in models adjusting for covariates and in models including R/S variables simultaneously while adjusting for covariates. Odds ratios are reported in Tables 4-5. Covariates that were significantly associated with the MetS within overall models that included all R/S variables and covariates were age, income, and being a former smoker. Increasing age and being a former smoker as opposed to never having smoked were associated with greater likelihood of having the MetS. Higher income was associated with lower likelihood of having the MetS. Other covariates were not significantly associated with prevalence of the MetS within the overall models.

Specific Aim 3: Religiosity/Spirituality Associations with Individual Components of the Metabolic Syndrome

The analyses used to test Aim 2 were repeated with the individual components of the MetS as continuous outcomes. All standardized estimates are reported in Tables 4-5.

Waist Circumference

Religious service attendance, private religious activity, and faith were not significantly associated with waist circumference. Higher scores on the relational factor were significantly associated with lower waist circumference in the bivariate model (β = -

.05, p<.05), but did not remain significantly associated in models adjusting for covariates or other R/S predictors. Higher scores on the meaning/peace factor were significantly associated with lower waist circumference (β = -.07, p<.05) and remained significantly associated while adjusting for sociodemographic covariates (β = -.07, p<.05) and for lifestyle covariates (β = -.07, p<.05). Higher meaning/peace also remained significantly associated with lower waist circumference when adjusting for the other R/S predictors in addition to all covariates (β = -.14, p<.05). Higher levels of overall SWB were significantly associated with lower waist circumference in the bivariate model (β = -.06, p<.05) and while controlling for both sociodemographic and lifestyle variables (β = -.06, p<.05), but remained only marginally significant when frequency of religious service attendance and private religious activity were included in the model, (β = -.06, p=.055). Follow-up examination of waist circumference characteristics within the sample indicated that the average waist circumference of women was substantially greater than the MetS cut-off of 88 cm (M = 99.04, SE = .39) and that the average waist circumference of men was slightly less than than the MetS cut-off of 102 cm (M = 101.23, SE = .42).

HDL Cholesterol

Religious service attendance (β = .05, p<.05), private religious activity (β = .08, p<.01), relational (β = .05, p<.05) and overall SWB (β = .05, p<.05) were all related to higher HDL cholesterol in bivariate models (higher levels of HDL are desired). No variables remained significantly associated with HDL in models adjusting for covariates or other R/S variables.

Fasting Plasma Glucose (FPG)

Higher levels of relational (β = -.06, p<.05) and overall SWB (β = -.05, p<.05) were associated with lower FPG levels in bivariate models, but did not remain significant when adjusting for covariates or other R/S variables. No other R/S variables were significantly associated with FPG.

Triglycerides

R/S variables were not significantly associated with triglycerides levels in either bivariate or multivariate models.

Blood Pressure

Both greater frequency of religious service attendance (β = -.07, p<.01) and higher scores on faith (β = -.06, p<.05) were significantly associated with lower DBP. Religious service attendance was no longer significant when adjusting for covariates or other R/S variables. The faith factor, however, remained significantly associated with DBP when adjusting for all covariates as well as religious service attendance, private religious activity, meaning/peace, and relational. Higher scores on the faith factor were associated with lower DBP. Interestingly, greater frequency of private religious activity, which was not significantly associated with blood pressure when tested individually without other R/S variables, was significantly associated with higher DBP (β = .07, p<.05) when adjusting for all covariates as well as private religious activity and the three individual SWB factors (but not when adjusting for the overall SWB factor). R/S variables were not significantly associated with SBP in either bivariate or multivariate models.

Secondary Analyses

Because no R/S variables were associated with the prevalence of the MetS, the primary outcome variable of interest, the possibility of other variables moderating the relationship between R/S and prevalent MetS was explored. Specifically, gender, acculturation, age, and Hispanic origin were examined as possible moderating variables.

Acculturation was transformed into a dichotomous variable by dividing participants at the 50^{th} percentile. As a result, participants with acculturation scores less than or equal to 1.7 were included in the "low acculturation" group, and participants with acculturation scores greater than 1.7 were included in the "high acculturation" group. Age was also transformed into a dichotomous variable in order to examine associations between participants aged 45-59 years and participants aged 60-74 years. Because there were fewer participants of Puerto Rican, Central/South American, or more than one/other origin than of Mexican or Cuban origin, Hispanic origin was collapsed into three groups: Mexican, Cuban, and Other, in order to examine associations as a function of origin.

The first step in the analyses involved examining the bivariate relationship of each individual R/S variable with prevalent MetS separately as a function of each moderator variable. Significant bivariate relationships were followed by examining the associations within models that included covariates and all R/S predictors.

When examining associations between R/S variables and the MetS separately by male and female gender, there were no significant associations of R/S variables with prevalent MetS. In addition, there were no significant associations of R/S variables with prevalent MetS when examining separately across low and high acculturation or across age groups 45-59 years and 60-74 years. Because no bivariate relationships were

significant, follow-up analyses within multivariate models were not conducted. Non-significant results are not reported here.

When examining associations across Mexican, Cuban, or Other Hispanic origin, there were no significant relationships between R/S variables and the MetS with the exception of the relational factor, which was significantly associated with lower prevalence of the MetS in participants of Mexican origin only (OR = .74, 95% CI = .56-.97). When including sociodemographic covariates (age, gender, education, income, and acculturation) in the model, the association between relational and prevalent MetS in those of Mexican origin was trending towards significance (OR = .78, 95% CI = .60-1.01). When including sociodemographic and lifestyle covariates (smoking, alcohol, physical activity), the association did not remain significant (OR = .79, 95% CI .60-1.04). Nor did it remain significant when including all covariates in addition to frequency of religious service attendance and private religious activity (OR = .78, 95% CI = .53-1.05).

Chapter 5: Discussion

Previous research has found that religiosity and spirituality (R/S) are associated with better health outcomes, including lower all-cause mortality and lower CVD incidence and mortality. In addition, R/S appears to be protective of risk factors such as hypertension, high fasting glucose levels, inflammation, and elevated cardiovascular reactivity, factors that may be implicated in the development of diseases such as CVD and T2D. To my knowledge, this was the first study to examine whether multiple dimensions of R/S are associated with prevalence of the MetS, a cluster of risk factors that pose a significant risk for both CVD and T2D. Furthermore, the study built upon previous research relating R/S to physical health by examining these relationships within a large sample of U.S. Hispanic adults aged 45-74 of diverse origin and geographic location, a population that has been understudied with regards to R/S and many health outcomes.

The present study used structural equation modeling to examine whether observed and latent variables representing R/S (i.e. frequency of religious service attendance, frequency of private religious activity, meaning/peace, relational, faith, and overall SWB) were associated with prevalent MetS or its components (waist circumference, HDL cholesterol, fasting plasma glucose, triglycerides, and blood pressure), and whether they had significant independent associations with the outcomes when adjusting for other R/S predictors in addition to relevant covariates. Additionally, the study aimed to explore the utility of a second-order latent variable of SWB derived from several dimensions of SWB within the FACIT-SP-Ex, the measure of SWB used in the present study.

Spiritual Well-being Measurement Model

Prior to the present study, SCAS investigators determined the first-order factor structure of the FACIT-Sp-Ex within the entire SCAS sample aged 18-74, resulting in three underlying factors of SWB within the measure: meaning/peace, faith, and relational. The meaning/peace factor measures the degree to which individuals feel at peace and that their lives have meaning and purpose. The faith factor measures the degree to which individuals find comfort and strength in their faith or spiritual beliefs. The relational factor measures the degree to which individuals feel love, thankfulness, compassion, and connection with others.

Within the present study, a measurement model was tested in which a second-order latent variable of SWB was derived from the three first-order factors of the FACIT-Sp-Ex. Results indicated that the measurement model fit the data well, with meaning/peace and relational factors loading most strongly on the overall SWB factor. Previous studies using the FACIT-Sp-Ex to examine the association between SWB and health outcomes have generally summed the scores of all 23 items to derive an overall measure of SWB. Furthermore, because the factor structure of the expanded FACIT-Sp has not been well-established, prior studies have summed the scores of the items within the previously established meaning/peace, and faith subscales, but have not examined a separate relational subscale as it relates to health outcomes. The use of a measurement model within the present study allowed for the use of three separate dimensions of SWB including the more recent relational factor, as well as an overall SWB factor that represents the shared variance among the three dimensions and accounts for measurement error.

It should be noted that although the FACIT-Sp-Ex was developed as a measure of what many commonly consider representative of dimensions of spiritual well-being, it is possible that individuals who score high on the measure do not consider themselves to be spiritual individuals.

Associations of R/S Variables with the Metabolic Syndrome

A primary aim of the study was to explore the associations between R/S predictors and the prevalence of MetS, examining the dimensions of R/S individually and while adjusting for relevant covariates as well as the other R/S predictors. None of the R/S predictors were significantly associated with the MetS when examined individually or when including covariates. Secondary analyses were conducted in order to explore the possibility that variables including gender, acculturation, age, or Hispanic origin moderated the relationship between R/S and the MetS. R/S variables were not significantly associated with the MetS when examining associations as a function of gender, low and high acculturation, or age groups 45-59 and 60-74. When examining associations across Hispanic origins of Mexican, Cuban, or other origin, the relational factor of SWB was associated with lower prevalence of the MetS, only in those of Mexican origin. However, the association did not remain significant while adjusting for sociodemographic and lifestyle covariates.

As this was the first study to examine whether R/S is associated with the MetS, it is plausible that there is not a direct relationship between R/S and the MetS in a large, Hispanic sample. Variables not examined in the present study could moderate the relationship. It is also possible that R/S acts as a buffer, or protective factor against

stressful and/or negative life events. It has been hypothesized that R/S has effects on health in part by influencing the strategies individuals use to cope in stressful circumstances (Park, 2007). Religious and/or spiritual individuals may remain more optimistic and think more positively in the face of negative life events. Hispanics may face disproportionate amounts of socioeconomic and culturally specific stressors. Yet, for those who experience fewer life stressors, R/S could play a less important role in protecting from various negative health outcomes.

Associations of R/S Variables with Individual Components of the MetS

The present study further aimed to explore the association between R/S variables and the five individual components of the MetS. In contrast with previous research, none of the R/S predictors were associated with triglycerides or with SBP. However, there is research to suggest that the R/S and blood pressure association is stronger for DBP than for SBP (Buck et al., 2009), which is consistent with results of the present study. R/S predictors were associated with waist circumference, HDL cholesterol, fasting plasma glucose, and diastolic blood pressure, but the majority of the associations were no longer significant when adjusting for sociodemographic and lifestyle covariates, indicating that for most associations, R/S predictors did not independently explain variability in the outcomes.

A factor representing meaning/peace was significantly and independently associated with waist circumference when adjusting for other R/S predictors and covariates. Overall SWB remained marginally independently associated with waist circumference. Higher scores on meaning/peace and overall SWB were associated with

lower waist circumference. Existing literature suggests that waist circumference, a measure of central adiposity, may be a more useful predictor than BMI of poor health outcomes (Visscher, et al., 2001). In the present sample of Hispanic middle-age and older adults, average waist circumference among Hispanic women was greater than the cut-off values used to meet criteria for the MetS and among Hispanic men was only slightly under the cut-off, indicating that this may be an area of greater risk for Hispanics as well as an area where intervention is warranted.

Interestingly, in the present study, SWB (i.e. meaning/peace and overall SWB) was associated with waist circumference, but religiosity predictors were not. The religiosity variables used in the study were single-item indicators of religious behavior (i.e. frequency of religious service attendance and private religious activity such as prayer and meditation). Perhaps finding meaning, purpose and peace in life has a more important influence on factors that influence waist circumference then does merely the act of engaging in specific religious behaviors. It is unclear from the present study what mechanisms are involved in the relationship between SWB and waist circumference. The associations were independent of lifestyle behaviors including physical activity, smoking, and alcohol use. However, dietary behavior variables, which could explain part of the relationship, were not included as covariates in the present study. Although some prior studies have found correlations between R/S and dietary and other health behaviors, past research has focused primarily on African American populations (Reeves, Adams, Dubbert, Hickson, and Wyatt, 2012; Underwood and Powell, 2006).

Higher scores on a factor representing faith were significantly associated with lower DBP when adjusting for covariates and R/S predictors. Research examining

dimensions of R/S in relation to cardiovascular reactivity have found that greater R/S is associated with decreased blood pressure reactivity during acute laboratory stressors (Edmondson et al. (2005). Items included within the Faith factor of the FACIT-Sp-Ex are related to finding comfort and strength or coping with difficult times. Higher levels of Faith, as it was measured within this study, may be associated with lower DBP through increased use of adaptive coping and ability to manage stressful life events. Religiosity predictors, which were strongly correlated with the faith factor, were not associated with lower DBP in the present study. Interestingly, frequency of private religious activity was associated with *higher* DBP, but only when adjusting for covariates and R/S predictors, not when considered alone. It is unclear why the relationship is only significant within multivariate models. There has been some research to suggest that dimensions of R/S are associated with higher DBP (Buck, 2009). Findings relating prayer as a form of spiritual coping to health outcomes have been mixed, with prayer sometimes associating with worse health (Gall et al., 2005). However, results from cross-sectional studies must be interpreted cautiously, as individuals may pray more when they are in worse health (Gall et al.).

Results of the present study indicated that several dimensions of R/S were not directly associated with the MetS in Hispanic adults middle aged and older. However, some dimensions of R/S were associated with individual components of the MetS, including waist circumference and diastolic blood pressure. Furthermore, dimensions of SWB related to outcomes independently of single item indicators of religiosity including frequency of service attendance and private religious activity. In addition, examining

dimensions of SWB separately may have more utility for understanding relationships between dimensions of SWB and health outcomes than using an overall SWB factor.

Limitations and Future Directions

The present study has several limitations. First, the data are cross-sectional. Results must be interpreted with caution regarding directionality of the relationships as well as causality, which cannot be inferred within the present study. It is also possible that other variables not included within the analyses may confound the findings, although many variables that have been known to be predictors of the MetS were controlled for in the present study. Dietary behavior was not controlled for because the data were unavailable while the analyses were conducted. Despite these limitations, the present study has a number of strengths. It may be the first study to examine R/S in relation to objective measures of risk factors for CVD and T2D within a large, population-based sample of Hispanic adults of diverse Hispanic origin and geographic location. It also examined multiple dimensions of R/S, including factors of SWB that take into account measurement error, in addition to the single-item indicators of R/S that have predominantly been examined in previous studies.

Although R/S did not have a direct relationship with the MetS in the present sample of Hispanic adults, it is possible that R/S may serve as a buffer against stressful life events or against negative emotional states such as depression, which may influence the mechanisms involved in the development of the MetS. Future work within the HCHS/SOL SCAS sample could focus on clarifying the role (e.g. direct or buffering factor) of R/S in its relationship to risk factors for diseases of metabolic origin such as

CVD and T2D. In addition, it is important that studies examine samples longitudinally in order to determine the temporal relationship between R/S and health outcomes. Furthermore, studies should examine intermediary variables that may explain the relationships found within the present study between dimensions of R/S and waist circumference and DBP. This may be one of few studies to have found a link between SWB and weight, or in this case, waist circumference, within middle aged/older Hispanics. If results are replicated within longitudinal studies and mechanisms established, future interventions targeting weight loss and/or blood pressure in Hispanics might benefit from addressing spiritual well-being within those interventions.

References

Abraido-Lanza, A. F., Guier, C., Colon, R. M. (1998). Psychological thriving among Latinas with chronic illness. *Journal of Social Issues, 54,* 405-424.

Allport, G. W., & Ross, J. M. (1967). Personal religious orientation and prejudice. *Journal of Personality and Social Psychology, 5,* 432–443.

Armstrong, T. & Bull, F. (2006). Development of the World Health Organization Global Physical Activity Questionnaire (GPAQ). *Journal of Public Health, 14*, 66-70.

Bild, D. E., Bluemke, D. A., Burke, G. L., et al. (2002). Multi-ethnic study of atherosclerosis: objective and design. *American Journal of Epidemiology, 156,* 871-881. PMCID: PMC12397006.

Bosworth H. B., Bartash, R. M., Olsen, M. K., & Steffens, D. C. (2003). The association of psychosocial factors and depression with hypertension among older adults. *International Journal of Geriatric Psychiatry, 18,* 1142-1148.

Bredle, J. M., Salsman, J. M., Debb., S. M., Arnold, B. J., & Cella, D. (2011). Spiritual Well-Being as a Component of Health-Related Quality of Life: The Functional Assessment of Chronic Illness Therapy—Spiritual Well-Being Scale (FACIT-Sp). *Religions, 2,* 77-94.

Buck, A. C., Williams, D. R., Musick, M. A. & Sternthal, M. J. (2009). An examination of the relationship between multiple dimensions of religiosity, blood pressure, and hypertension.

Campesino, M., & Schwartz, G. E. (2006). Spirituality among Latinas/os: Implications of culture in conceptualization and measurement. *Advances in Nursing Science, 29,* 69-81.

Canada, A. L., Murphy, P. E., Fitchett, G., Peterman, A., Schover, L. R. (2008) A 3-factor model for the FACIT-Sp. *Psycho-Oncology, 17*, 908–916.

Caplan, S. (2007). Latinos, acculturation, and acculturative stress: A dimensional concept analysis. *Policy, Politics, and Nursing Practice, 8,* 93-106.

Carnethon, M. R., Loria, C. M., Hill, J. O., Sidney, S. S., Savage, P. J., & Liu, K. (2004). Risk factors for the Metabolic Syndrome: The Coronary Artery Risk Development in Young Adults (CARDIA) study, 1985–2001. *Diabetes Care, 27*, 2707-2715.

Chida, Y., Steptoe, A., & Powell, L. H. (2009). Religiosity/spirituality and mortality. *Psychotherapy and Psychosomatics, 78*, 81-90.

Coffman, D. L., & MacCallum, R. C. (2005). Using parcels to convert path analysis models into latent variable models. *Multivariate Behavioral Research, 40,* 235-259.

Cornier, M. A., Dabelea, D., Hernandez, T. L., Lindstrom, R. C., Steig, A. J., Stob, N. R., et al. (2008). The metabolic syndrome. *Endocrine Reviews, 29,* 777-822.

Doster, J. A., Harvey, M. B., Riley, C. A., Goven, A. J., & Moorefield, R. (2002). Spirituality and cardiovascular risk. *Journal of Religion and Health*, *41*(1), 69-79.

Edmondson, K. A., Lawler, K. A., Jobe, R. L, Younger, J. W., Piferi, R. L., & Jones, W. H. (2005). Spirituality predicts health and cardiovascular responses to stress in young adult women. *Journal of Religion and Health, 44,* 161-171.

Egbert, N., Mickley, J., & Coeling, H. (2004). A review and application of social scientific measures of religiosity and spirituality: Assessing a missing component in health communication research. *Health Communication, 16*(1), 7-27.

Enders, C. K. (2006). A primer on the use of modern missing-data methods in psychosomatic medicine research. *Psychosomatic Medicine, 68,* 427-436.

Ervin, R. B. (2009). *Prevalence of metabolic syndrome among adults 20 years of age and over, by sex, age, race and ethnicity, and body mass index: United States, 2003–2006* (National Health Statistics Reports No. 13). Hyattsville, MD: National Center for Health Statistics. Retrieved from http://www.cdc.gov/nchs/data/nhsr/nhsr013.pdf

Finch, B. K., & Vega, W. A. (2003). Acculturation stress, social support, and self-rated health among Latinos in California. *Journal of Immigrant Health, 5,* 109-117.

Ford, E. S. (2005). Prevalence of the metabolic syndrome defined by the International Diabetes Federation among adults in the U.S. *Diabetes Care, 28,* 2745-2749.

Gall, T. L., Charbonneau, C., Clarke, N. H., Grant, K., et al. (2005). Understanding the nature and role of spirituality in relation to coping and health. *Canadian Psychology, 46,* 88-104.

Gallo, L. C., Penedo, F. J., Espinosa de los Monteros, K., & Arguelles, W. (2009). Resiliency in the face of disadvantage: Do Hispanic cultural characteristics protect health outcomes? *Journal of Personality, 77,* 1707-1746.

Gami, A. S., Witt, B. J., Howard, D. E., Erwin, P. J., Gami, L. A. Somers, V. K., et al. (2007). Metabolic syndrome and risk of incident cardiovascular events and death: a systematic review and meta-analysis of longitudinal studies. *Journal of the American College of Cardiology. 49*, 403-414.

Garcia-Preto, N. (2005). Latino families: An overview. In M. McGoldrick,, J. Giordano, & N. Garcia-Preto (Eds.), *Ethnicity & family therapy* (pp. 153-165). New York, NY: The Guilford Press.

George, L. K., Ellison, C. G., & Larson, D. B. (2002). Explaining the relationships between religious involvement and health. *Psychological Inquiry*, *13*, 190-200.

George, L. K., Larson, D. B., Koenig, H. G., & McCullough, M. E. (2000). Spirituality and health: What we know, what we need to know. *Journal of Social and Clinical Psychology, 19,* 102-116.

Goldbacher, E. M. & Matthews, K. A. (2007). Are psychological characteristics related to risk of the metabolic syndrome? A review of the literature. *Annals of Behavioral Medicine, 34,* 240-252.

Grundy, S. M., Brewer, H. B., Cleeman, J. I., Smith, S. C., Lenfant, C. (2004). Definition of Metabolic Syndrome: Report of the National Health, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. *Circulation, 109,* 433-438.

Grundy, S. M. (2007). Metabolic Syndrome: A Multiplex Cardiovascular Risk Factor. *Journal of Clinical Endocrinology and Metabolism*, *92*, 399-404.

Grundy, S. M. (Ed.) (2011). *Atlas of atherosclerosis and the metabolic syndrome* (5th ed.). New York, NY: Spring Science and Business Media.

Haffner, S. M. (2006).. Relationship of metabolic risk factors and development of cardiovascular disease and diabetes. *Obesity*, *14*, 121S-127S.

Harris, M. I. (2001). Racial and ethnic differences in health care access and health outcomes for adults with T2D. *Diabetes Care, 24*, 454-459.

Hill, T. D., Angel, J. L., Ellison, C. G., & Angel, R. J. (2005). Religious attendance and mortality: An 8-year follow-up of older Mexican Americans. *Journal of Gerontology, 60B,* S102-S109.

Hill, P. C., Pargament, K., McCullough, M. E., Swyers, J. P., & Larson, D. B. (2000). Conceptualizing religion and spirituality: points of commonality, points of departure.
Journal for the Theory of Social Behavior, 30, 51-77.

Hispanic Community Health Study. About the Study / Public Manuals and Docs, Manual 02 Field Center Procedures. Retrieved from http://www.cscc.unc.edu/hchs

Hispanic Community Health Study. About the Study / Public Manuals and Docs, Manual 07 Biospecimen Collection & Processing. Retrieved from http://www.cscc.unc.edu/hchs

Hoge, D. R. (1972). A validated intrinsic religious motivation scale. *Journal for the Scientific Study of Religion, 11,* 369–376.

Hazuda, H. P., Haffner, S. M., Stern, M. P., & Eifler, C. W. (1988). Effects of acculturation and socioeconomic status on obesity and diabetes in Mexican Americans. *American Journal of Epidemiology, 128*, 1289-1301.

Holt-Lunstad, J., Steffen, P. R., Sandberg, J., & Jenson, B. (2011). Understanding the connection between spiritual well-being and physical health: an examination of ambulatory blood pressure, inflammation, blood lipids and fasting glucose. *Journal of Behavioral Medicine,* online only.

Ironson, G., Solomon, G. F., Balbin, E. G., O'Cleirigh, C., George, A. Kumar, M. et al. (2002). The Ironson-Woods spirituality/religiousness index is associated with long survival, health behaviors, less distress, and low cortisol in people with HIV/AIDS. *Annals of Behavioral Medicine, 24*, 34–48.

Ironson, G., Stuetzle, R., & Fletcher, M. A. (2006). An increase in religiousness/spirituality occurs after HIV diagnosis and predicts slower disease progression over 4 years in people with HIV. *Journal of General Internal Medicine, 21,* 562-568.

Kinder, L. S., Carnethon, M. R., Palaniappan, L. P., King, A. C., & Fortmann, S. P. (2004). Depression and the metabolic syndrome in young adults: Findings from the third National Health and Nutrition Examination Survey. *Psychosomatic Medicine, 66,* 316-322.

King, D. E., Mainous, A. G., Steyer, T. E., & Pearson, W. (2001). *International Journal of Psychiatry in Medicine, 31*, 415-425.

Kline, R. B. (2011). Principles and practice of structural equation modeling: Third edition. New York, NY: The Guilford Press.

Koenig, H. G., Meador, K., & Parkerson, G. (1997). Religion Index for psychiatric research. *American Journal of Psychiatry, 154*, 885-886.

Lara, M., Gamboa, C., Kahramanian, M. I., Morales, L., & Bautista, D. E. H. (2005). *Annual Review of Public Health, 26,* 367-397.

LaVange, L. M., Kalsbeek, W., Sorlie, P. D., Avlies-Santa, L. M., Kaplan, R. C., Barnhart, J., et al. (2010). Sample design and cohort selection in the Hispanic Community Health Study/Study of Latinos. *Annals of Epidemiology, 20,* 642-649.

Lidfelt, J., Nyberg, P., Nerbrand, C., Samsioe, G., Schersten, B., & Agardh, C. D. (2003). Socio-demographic and psychosocial factors are associated with features of the metabolic syndrome. The Women's Health in the Lund Area (WHILA) study. *Diabetes, Obesity, and Metabolism, 5,* 106-112.

McCullough, M. E., William, H., Larson, D. B, Koenig, H. G. & Thoreson, C. Religious involvement and mortality: A meta-analytic review. *Health Psychology, 19,* 211-222.

Muthén, L. K., & Muthén, B.O. (2007). Mplus user's guide (5th Ed.). Los Angeles, CA: Muthén & Muthén.

Myers, H, F., & Rodriguez, N. (2003). Acculturation and physical health in racial and ethnic minorities. In K. M. Chun, P. B. Organista, & M. Gerardo (Eds.), *Acculturation: Advances in theory, measurement, and applied research* (pp. 163-185). Washington, DC: American Psychological Association.

Murphy, P. E., Canada, A. L., Fitchett, G., Stein, K., Portier, K., Crammer, C., & Peterman, A. H. (2010). An examination of the 3-factor model and structural invariance across racial/ethnic groups for the FACIT-Sp: A report from the American Cancer Society's Study of Cancer Survivors-II (SCS-II). *Psychooncology***,** *19*, 264-272.

National Center for Health Statistics. (1994). Plan and operation of the Third National Health and Nutrition Examination Survey, 1988-94. Series 1: programs and collection procedures. *Vital Health Statistics, 1,* 1- 407.

National Center for Health Statistics. (2011). *Health, United States, 2010, with special feature on death and dying* (Report No. 76–641496). Hyattsville, MD: Centers for Disease Control.

National Cholesterol Education Program (NCEP). (2002). Third report of the National Cholesterol and Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III) final report. *Circulation, 106,* 3143-3421.

Paloutzian, R. F., & Ellison, C. W. (1982). Loneliness, spiritual well-being and quality of life. In L. A. Peplau & D. Perlman (Eds.), *Loneliness: A sourcebook of current theory, research and therapy* (pp. 224–237). New York: Wiley-Interscience.

Park, C. L. (2007). Religiousness/spirituality and health: A meaning systems perspective. *Journal of Behavioral Medicine, 30,* 319-328.

Park, Y., Zhu, S., Palaniappan, L., Heshka, S., Carnethon, M. R., & Heymsfield, S. B. (2003). The metabolic syndrome: Prevalence and associated risk factor findings in the US population from the third National Health and Nutrition Examination Survey, 1988-1994. *Archives of Internal Medicine, 163,* 427-436.

Peterman, A. H, Fitchett, G., Brady, M. J., Hernandez, L., & Cella, D. (2002). Measuring spiritual well-being in people with cancer: the functional assessment of chronic illness therapy--Spiritual Well-being Scale (FACIT-Sp). *Annals of Behavioral Medicine*, *24*(1), 49-58.

Pew Hispanic Center (2007a). *English usage among Hispanics in the United States.* Washington, DC.

Pew Hispanic Center (2007b). *Changing faiths: Latinos and the transformation of American religion.* Washington, DC.

Pew Hispanic Center. (2011a). *Hispanics account for more than half of nation's growth in past decade: Census 2010: 50 million Latinos.* Washington, DC.

Pew Hispanic Center. (2011b). *Statistical Portrait of Hispanics in the United States, 2009.* Washington, DC.

Powell, L. H., Shahabi, L., Thoreson, C. E. (2003). Religion and spirituality. *American Psychologist, 58,* 36-52.

Rauschhuber, M., Lowry, J., Etnyre, A., Gilliland, I., Sethness, R., Sorensen, J., et al. (2005). Hispanic and female College students: Evidence for increased risk for cardiac disease. *Journal of Hispanic Higher Education, 4,* 34-50.

Redfield, R., Linton, R., & Herskovits, M. J. (1936). Memorandum for the study of acculturation. *American Anthropologist, 38*, 149-152.

Reeves, R. R., Adams, C. E., Dubbert, P. M., Hickson, D. A., & Wyatt, S. B. (2012). Are religiosity and spirituality associated with obesity among African Americans in the Southeastern United States (the Jackson Heart Study)? *Journal of Religious Health, 51,* 32-48.

Reimers, C. (2006). Economic well-being. In M. Tienda & F. Mitchell (Eds.), *Hispanics and the future of America* (pp. 291-261). Washington, DC: National Academic Press.

Rugulies, R. (2002). Depression as a predictor for coronary heart disease. A review and meta-analysis. *American Journal of Preventive Medicine, 23*(1), 51-61.

Sabogal, F., Marin, G., Otero-Sabogal, R., Marin, B. V., & Perez-Stable, E. J. (1987). *Hispanic Journal of Behavioral Sciences, 9,* 397-412.

Seybold, K. S., & Hill, P. C. (2001). The role of religion and spirituality in mental and physical health. *Current Directions in Psychological Science, 10,* 21-24.

Schafer, J. L., & Graham, J. W. (2002). Missing data: our view of the state of the art. *Psychological Methods, 7*, 147-77.

Storch, E. A., Roberti, J. W., Heidgerken, A. D., Storch JB, Lewin, A. B., Killiany, E. M. (2004). The Duke Religion Index: a psychometric investigation. *Pastoral Psychology*, *53*, 175-82.

Tartaro, J., Luecken, L. J., & Gunn, H. E. (2005). Exploring heart and soul: Effects of religiosity/spirituality on gender on blood pressure and cortisol stress responses. *Journal of Health Psychology, 10,* 753-766.

Underwood, S. M., & Powell, R. L. (2006). Religion and spirituality: Influence on health/risk behavior and cancer screening behavior of African Americans. *The ABNF Journal, 17,* 20-31.

University of Minnesota. Nutrition Data System for Research. University of Minnesota, Nutrition Coordinating Center
website: http://www.ncc.umn.edu/products/ndsr.html.

Visscher, T. L, Seidell, J. C., Molarius, A., van der Kuip, D., Hofman, A., & Witteman, J. C. (2001). A comparison of body mass index, waist-hip ratio and waist circumference as predictors of all-cause mortality among the elderly: the Rotterdam study. *International Journal of Obesity and Related Metabolic Disorders, 25,* 1730-1735.

Vogelzangs, N., Beekman, A. T. F, Kritchevsky, S. B., Newman, A. B., Pahor, M., Yaffe, K. et al. (2007). Psychosocial risk factors and the Metabolic Syndrome in elderly persons: Findings from the Health, Aging and Body Composition Study. *Journal of Gerontology, 62A*, 563-569.

Weinick, R. M., Jacobs, E. A., Stone, L. C., Ortega, A., & Burstin, H. (2004). Hispanic healthcare disparities: Challenging the myth of a monolithic Hispanic population. *Medical Care, 42,* 313-320.

Zinnbauer, B. J., Pargament, K. I., & Scott, A. B. (1999). The emerging meanings of religiousness and spirituality: Problems and prospects. *Journal of Personality, 67,* 889-919.

Appendix

Duke University Religion Index (2 items)

Directions: Please answer the following questions about your religious involvement.

1. How often do you attend church or other religious meetings?

1 = More than once per week
2 = Once a week
3 = A few times a month
4 = A few times a year
5 = Once a year or less
6 = Never

2. How often do you spend time in private religious activities, such as prayer, meditation, or Bible study?

1 = More than once a day
2 = Daily
3 = Two or more times/week
4 = Once a week
5 = A few times a month
6 = Rarely or never

Functional Assessment in Chronic Illness Therapy –Spiritual Well-Being Scale, Expanded Version (FACIT-Sp-Ex)

Directions: Below is a list of statements that other people coping with difficult times have said are important. Please choose the number that indicates your response as it applies to the past seven days.

1 = Not at all; 2 = A little bit; 3 = Somewhat; 4 = Quite a bit; 5 = Very much

1. I feel peaceful
2. I have a reason for living
3. My life has been productive
4. I have trouble feeling peace of mind
5. I feel a sense of purpose in my life
6. I am able to reach down deep into myself for comfort
7. I feel a sense of harmony within myself
8. My life lacks meaning and purpose
9. I find comfort in my faith or spiritual beliefs
10. I find strength in my faith or spiritual beliefs
11. Difficult times have strengthened my faith or spiritual beliefs
12. Even during difficult times, things will be ok
13. I feel connected to a higher power (e.g., God)
14. I feel connected to other people
15. I feel loved
16. I feel love for others
17. I am able to forgive others for any harm they have ever caused me
18. I feel forgiven for any harm I may have ever caused
19. Throughout the course of my day, I feel a sense of thankfulness for my life
20. Throughout the course of my day, I feel a sense of thankfulness for what others bring to my life
21. I feel hopeful
22. I feel a sense of appreciation for the beauty of nature
23. I feel compassion for others in the difficulty they are facing

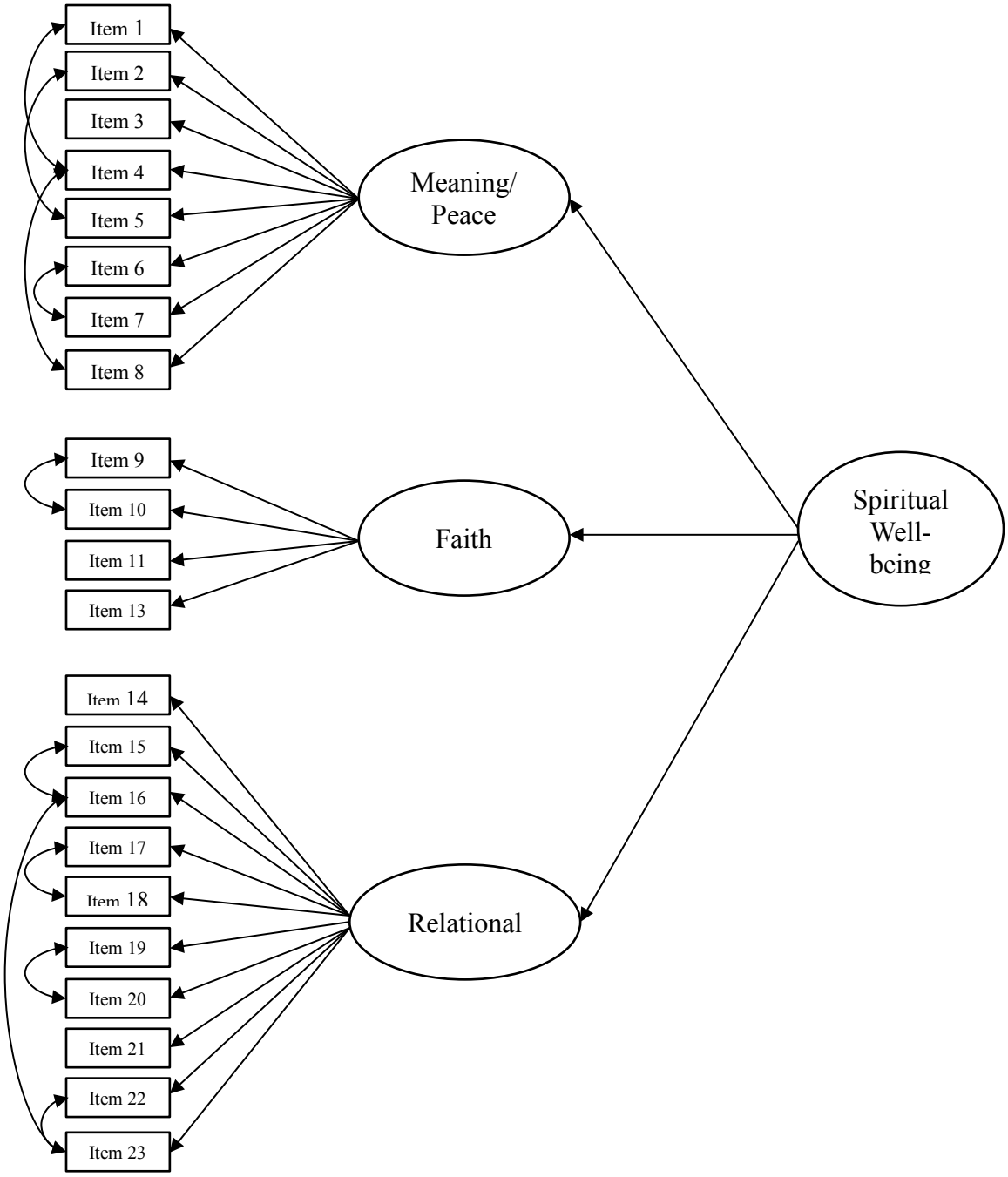

Figure 1. The measurement model that was examined within the overall proposed structural model in the current study. The first-order factors of the spiritual well-being (SWB) second-order latent factor were established preliminarily by SCAS investigators examining the first-order factor structure of the FACIT-Sp-Ex at the item level, within the entire SCAS sample. Residual variances are excluded in order to simplify the figure. Double-headed arrows between items indicate *residual variances* that were correlated to improve model fit within the first-order measurement model established by SCAS investigators.

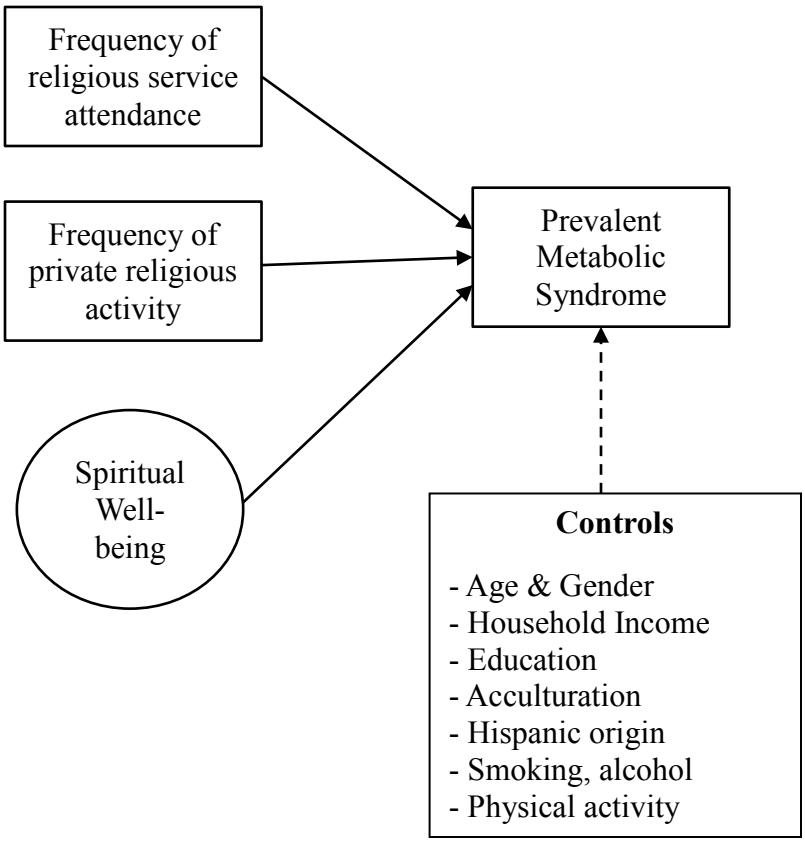

Figure 2. The overall structural model that was evaluated in the proposed study. The model suggests that higher scores on two dimensions of religiosity and a latent variable derived from several dimensions of SWB will each be significantly and uniquely associated with lower likelihood of having the metabolic syndrome, adjusting for a relevant set of covariates. The model was also tested with the first-order SWB factors in place of the overall SWB latent.

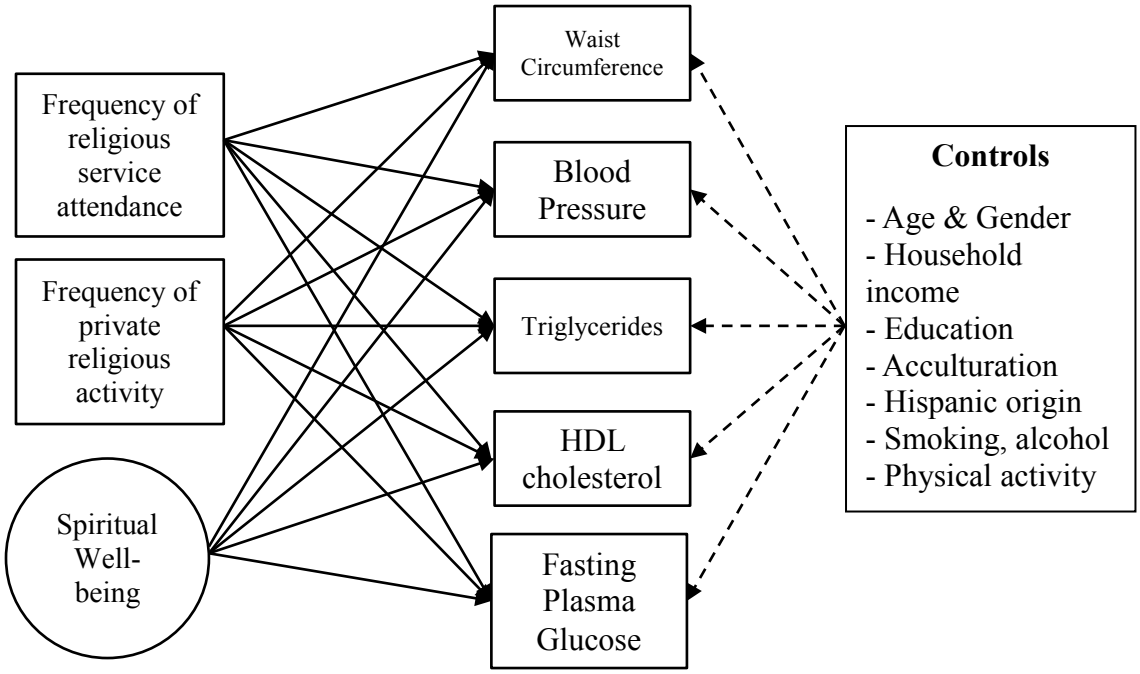

Figure 3. The overall proposed structural model depicting the relationship between dimensions of religiosity and spirituality and the individual components of the metabolic syndrome. The model suggests that higher scores on two dimensions of religiosity and a latent variable derived from several dimensions of SWB will each be significantly and uniquely associated individual components of the metabolic syndrome, adjusting for a relevant set of covariates. The model was also tested with the first-order SWB factors in place of the overall SWB latent.

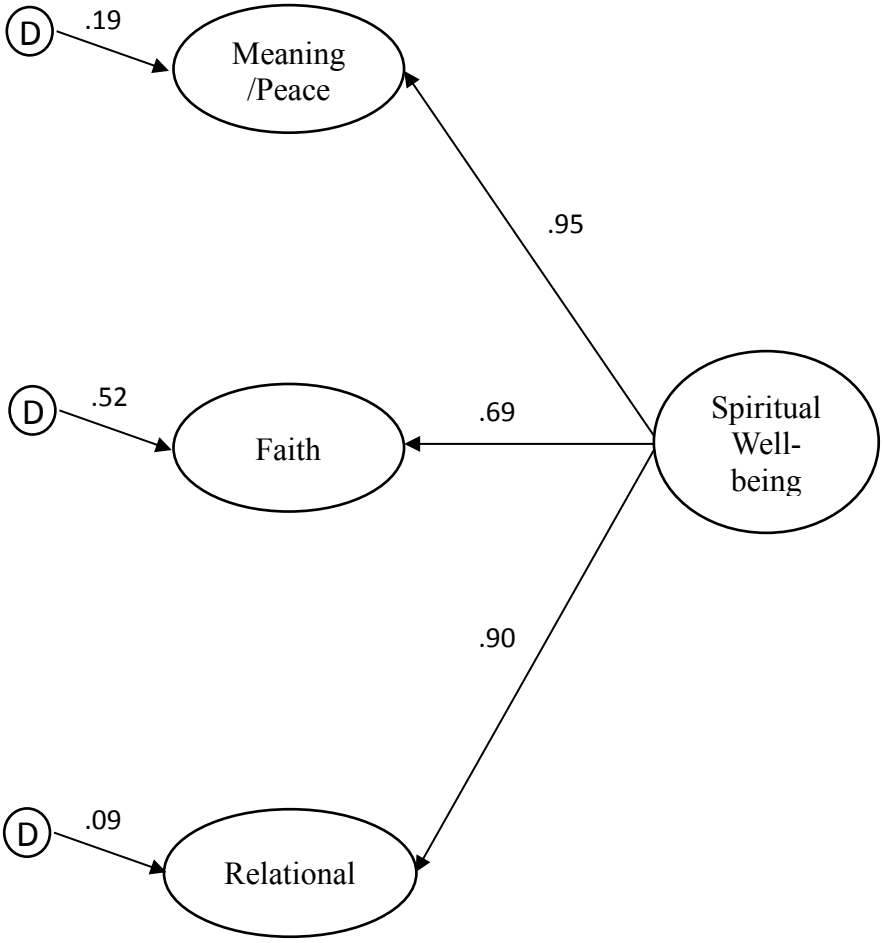

Figure 4. The second-order latent variable measurement model examined within the study. The model was tested on the SCAS sub-sample aged 45-74. Item-level indicators are excluded in order to simplify the figure. Small circles labeled D represent residual variance in the latent factors. Standardized estimates are provided. All factor loadings are significant (p<.001).

Table 1.

Weighted Sample Descriptives for Sociodemographic, Lifestyle, Religiosity/Spirituality, and Metabolic Syndrome Variables (Total N = 3278)

Variable	*Mean*	*SE*
Age (years)	56.84	.24
Acculturation (1-5)	1.91	.03
Physical activity (minutes/day)	90.87	3.73
Metabolic Syndrome Components		
Waist Circumference (cm)	100.00	.32
HDL-cholesterol (mg/dL)	49.60	.37
Fasting Glucose (mg/dL)	107.55	.89
Triglycerides (mg/dL)	152.12	4.17
Systolic Blood Pressure	129.27	.47
Diastolic Blood Pressure	75.50	.31

	Weighted Percentage
Metabolic Syndrome Prevalence	49.1%
Male Gender	43.6%
Interview language	
English	15.3%
Spanish	84.7%
Hispanic origin	
Mexican	28.7%
Puerto Rican	19.0%
Dominican	10.4%
Cuban	28.3%
Central/South American	12.3%
More than one/other	1.3%
Education	
Less than high school	40.6%
High School or equivalent	20.4%
Beyond high school	39.0%

Table 1 continued.

	Weighted Percentage
Yearly family income	
≤ $20,000	56.6%
$20,001-$40,000	28.3%
$40,001-$75,000	9.2%
>$75,000	5.9%
Cigarette Use	
Never	54.2%
Former	25.7%
Current	20.1%
Weekly Alcohol Use	
None	39.8%
Light (≤7 drinks)	40.6%
Moderate (8-14 drinks)	12.1%
Heavy (≥15 drinks)	7.5%
Religious Identification	
None	7.6%
Roman Catholic	61.4%
Baptist	1.8%
Pentecostal	6.0%
Other Protestant	1.1%
Jehovah's Witness	3.4%
Mormon	0.4%
Christian (nonspecified)	14.5%
Jewish	0.5%
Muslim	0.0%
Other faith	3.2%
Religious service frequency	
Never	18.4%
Once a year or less	8.0%
A few times a year	13.9%
A few times a month	13.7%
Once a week	26.7%
More than one per week	19.3%
Private religious activity	
Rarely or never	18.5%
A few times a month	8.0%
Once a week	8.2%
Two or more times/week	10.0%
Daily	41.8%
More than once/day	13.6%

Table 2.

Bivariate Associations of Covariates with Metabolic Syndrome Outcomes

	MetS	WC	HDL	FPG	Trig	SBP	DBP
Control Variable							
Age	1.05***	.09**	.01	.09***	-.03	.33***	-.11***
Gender (F = 0, M = 1)	.79*	.08***	-.28***	.09***	.08***	.05	.06**
Education	.82**	-.04	.01	-.07**	-.03	-.08**	.01
Income	.78***	-.01	.03	-.05*	-.03	-.14***	-.06
Acculturation	.83*	.07**	.003	.01	.03	-.07**	.06*
Hispanic Background (ref = Mexican)							
Cuban	1.39*	-.05	-.02	.01	.001	.14***	.16***
Dominican	.97	-.05	.06**	-.03	-.05*	.09***	.17***
Central/South American	1.16	-.05*	-.02	.01	.01	.07**	.10***
Puerto Rican	1.18	.03	.01	.06*	.02	.10***	.16***
More than one/other	1.15	.003	-.01	-.01	.01	.08**	.08**
Physical Activity	.88**	-.09***	-.02	-.04*	-.01	-.07***	-.01
Smoking Status (ref = never)							
Former	1.57***	.07**	-.13***	.07**	.08***	.001	.01
Current	1.02	-.07**	-.11***	-.01	.03	-.02	.04
Alcohol Use (ref = none)							
Light	.93	-.03	-.03	.03	.04	.07*	.06
Moderate	.84	-.01	.02	-.01	.02	.13***	.12***
Heavy	1.03	.01	.05	.09*	.06	.15***	.13***

* $p \leq .05$. ** $p \leq .01$. ***$p \leq .001$. (two-tailed tests).

Note. Estimates are reported as odds ratios for MetS and as standardized coefficients for all other outcomes. MetS = metabolic syndrome; WC = waist circumference; HDL = high density lipoprotein cholesterol; FPG = fasting plasma glucose; Trig = Triglycerides; SBP = systolic blood pressure; DBP = diastolic blood pressure.

Table 3.

Intercorrelations between Religiosity/Spirituality Scales/Factors

Scale/Factor	1	2	3	4	5	6
1. Religious Service Attendance	__	.45	.19	.42	.25	.30
2. Private Religious Activity		__	.21	.50	.29	.35
3. Meaning/Peace			__	.55	.84	__
4. Faith				__	.68	__
5. Relational					__	__
6. Spiritual Well-being Total						__

Note: Estimates are reported as standardize coefficients. All variables are significantly correlated with one another (*p's*<.001).

Table 4.

Regression Estimates for Religiosity/Spirituality Variables and Metabolic Syndrome Outcomes

	MetS	WC	HDL	FPG	Trig	SBP	DBP
Religious Service Attendance							
Model 1	1.00	.01	.05*	-.001	- .02	- .03	- .07**
Model 2	.98	.002	.01	.003	- .01	- .04	- .02
Model 3	.98	- .01	.01	- .002	- .01	- .03	- .02
Private Religious Activity							
Model 1	1.02	- .02	.08**	- .04	.02	.01	- .01
Model 2	.98	- .01	.02	- .03	- .01	- .01	.02
Model 3	.98	- .02	.03	- .03	- .01	.002	.03
Meaning/Peace							
Model 1	.88	- .07*	.03	- .04	- .02	.001	- .01
Model 2	.95	- .07*	.02	- .01	.01	----	.01
Model 3	.95	- .07*	.01	- .02	.01	----	.003
Faith							
Model 1	1.03	- .03	.05	- .04	- .001	- .02	- .06*
Model 2	1.00	- .02	- .001	- .03	- .01	- .04	- .04
Model 3	.99	- .03	- .001	- .03	- .004	- .04	- .04
Relational							
Model 1	.93	- .05*	.05*	- .06*	- .03	- .02	- .01
Model 2	.94	- .03	.02	- .04	- .001	- .02	.001
Model 3	----	- .04	<.001	- .05	.004	- .03	.01
SWB total							
Model 1	.89	- .06*	.05*	- .05*	- .03	- .01	- .01
Model 2	.92	- .05	.02	- .03	- .001	- .01	- .005
Model 3	.91	- .06*	.003	- .04	.002	- .02	- .01

* $p \leq .05$. ** $p \leq .01$. (two-tailed tests). ---- Indicates that model would not converge.
Note. Estimates are reported as odds ratios for MetS and as standardized coefficients for all other outcomes. Model 1 includes the R/S predictor. Model 2 includes the R/S predictor and sociodemographic controls. Model 3 includes all variables from Model 2 as well as lifestyle controls. MetS = metabolic syndrome; WC = waist circumference; HDL = high density lipoprotein cholesterol; FPG = fasting plasma glucose; Trig = Triglycerides; SBP = systolic blood pressure; DBP = diastolic blood pressure.

Table 5.

Regression Estimates for Religiosity/Spirituality Variables and Metabolic Syndrome Outcomes – Simultaneous Models

	MetS	WC	HDL	FPG	Trig	SBP	DBP
Model 1a							
Religious Service Attendance	----	.01	.001	.02	- .01	- .03	- .02
Private Religious Activity	----	- .01	.03	- .02	- .01	.03	.07*
Meaning/Peace	----	- .17*	<.001	.05	.02	.09	.01
Faith	----	- .004	- .04	- .01	- .01	- .07	- .11**
Relational	----	.11	.04	- .07	- .01	- .05	.06
Model 1b							
Religious Service Attendance	.99	.01	<.001	.02	- .004	- .03	- .02
Private Religious Activity	.98	- .02	.04	- .02	- .01	.04	.07*
Meaning/Peace	1.13	- .14*	.02	.06	.02	.11	.03
Faith	1.04	.001	- .02	.002	- .001	- .05	- .10*
Relational	.80	.08	- .01	- .10	- .01	- .08	.02
Model 2a							
Religious Service Attendance	.99	.02	- .004	.02	- .01	- .04	- .04
Private Religious Activity	.99	.001	.02	- .03	- .01	.01	- .04
Overall SWB	.95	- .06	.01	- .03	.004	- .01	- .01
Model 2a							
Religious Service Attendance	.99	.01	- .003	.02	- .01	- .04	- .03
Private Religious Activity	.99	- .004	.03	- .03	- .01	.02	.05
Overall SWB	.94	- .06	- .01	- .04	.01	- .02	- .02

* $p \leq .05$. ** $p \leq .01$. (two-tailed tests).
---- Indicates that model would not converge.
Note. Estimates are reported as odds ratios for MetS and as standardized coefficients for all other outcomes. Models 1a and 2a include R/S predictors listed as well as sociodemographic controls. Models 1b and 2b include R/S predictors listed as well as sociodemographic and lifestyle controls. MetS = metabolic syndrome; WC = waist circumference; HDL = high density lipoprotein cholesterol; FPG = fasting plasma glucose; Trig = Triglycerides; SBP = systolic blood pressure; DBP = diastolic blood pressure.