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Los Angeles

Religiousness, Spirituality, and Mechanisms of Health Effects
in Mothers During the First Postpartum Year

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Psychology

by

Alyssa Cory Dahlen Cheadle

2016

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ABSTRACT OF THE DISSERTATION

Religiousness, Spirituality, Psychosocial Resources,
and Depressive Symptoms, Inflammation, and Stress Hormones
in Mothers During the First Postpartum Year

by

Alyssa Cory Dahlen Cheadle

Doctor of Philosophy in Psychology

University of California, Los Angeles, 2016

Professor Christine Dunkel Schetter, Chair

Religion and spirituality are major forces in the lives of Americans and are especially salient for women and families in the time surrounding the birth of a child. A large and growing body of research indicates that specific aspects of religiousness and spirituality are associated with better physical and mental health. However, the mechanisms of these associations are not well understood, though many have been hypothesized. The hypothesized mechanisms are reviewed to develop a conceptual model of religiousness, spirituality, physical and mental health, and their mechanisms and empirical evidence supporting these pathways is examined. This conceptual model provides the basis for several hypotheses tested in three studies which examined associations of religiousness and spirituality, together and separately, with three markers of health: depressive symptoms, the inflammatory marker, C-reactive protein, and the

diurnal slopes of the stress hormone, cortisol, and tested psychosocial resources as a mechanism of these associations in a large sample of postpartum women. Psychosocial resources and the religiousness and spirituality constructs were operationalized with multiple measures and tested in a study of low income postpartum women who were of diverse ethnicity.

Results indicated that psychosocial resources composed of indices of mastery, self-esteem and optimism were associated with religiousness and spirituality. Furthermore, religiousness and spirituality were associated with depressive symptoms and C-reactive protein, but not diurnal cortisol slope. In particular, higher religiousness and spirituality both together and separately predicted lower depressive symptoms throughout the first year postpartum. Higher religiousness and spirituality together and spirituality alone predicted lower C-reactive protein at six months postpartum. The psychosocial resource factor composed of mastery, self-esteem, and optimism mediated the associations of religiousness and spirituality with depressive symptoms, but not of associations of religiousness and spirituality with C-reactive protein. These findings contribute substantially to existing knowledge by demonstrating a link between spirituality and inflammation for the first time, and regarding psychological resources as mechanisms of associations of religiousness, spirituality, and health-related outcomes. These findings can guide future research on associations of religiousness, spirituality, and health and their mechanisms.

The dissertation of Alyssa Cory Dahlen Cheadle is approved.

Julienne Elizabeth Bower

Constance L. Hammen

Calvin J. Hobel

Baldwin Way

Christine Dunkel Schetter, Committee Chair

University of California, Los Angeles

2016

“Were the whole realm of nature mine, that were a present far too small.
Love so amazing, so divine, demands my soul, my life, my all.” – Isaac Watts

Soli Deo Gloria.

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CURRICULUM VITAE

Alyssa Cory Dahlen Cheadle

Education

Master of Arts, Psychology, University of California, Los Angeles, 2012

Master of Theological Studies, Harvard Divinity School, 2010

Bachelor of Arts, Psychology, Biology, Luther College, 2008

Honors

UCLA Faculty Women's Club Scholarship, 2014

Health Psychology Paper Prize, UCLA Department of Psychology, 2014

NIMH Pre-Doctoral Training Grant, 2012-2014

Graduate Summer Research Mentorship Award, 2012

UCLA Alumni Fellowship, 2011

Publications

Cheadle, A. C. D., & Toussaint, L. L. (2015). Forgiveness and physical health in healthy populations. Invited chapter in E. Worthington, D. R. Williams, and L. L. Toussaint (Eds.), *Forgiveness and health: Scientific evidence and theories relating forgiveness to better health*. Springer Publishers.

Cheadle, A. C. D., Dunkel Schetter, C., Lanzi, R. G., Vance, M. R., Sahadeo, L. S., Shalowitz, M., & CCHN. (2015). Spiritual and religious resources in African American women: Protection from depressive symptoms after childbirth. *Clinical Psychological Science*, 3(2), 283-291.

- Accortt, E. E., **Cheadle, A. C. D.**, & Dunkel Schetter, C. (2015). Prenatal depression and adverse birth outcomes: An updated systematic review. *Maternal and Child Health Journal, 19*(6), 1306-1337.
- Seawell, A. H., Toussaint, L. L., & **Cheadle, A. C. D.** (2014). Prospective associations between unforgiveness and physical health and positive mediating mechanisms in a nationally representative sample of older adults. *Psychology & Health, 29*(4), 375-389.
- Toussaint, L. L., Owen, A. D., & **Cheadle, A. C. D.** (2012). Forgive to live: Forgiveness, health, and longevity. *Journal of Behavioral Medicine, 35*(4), 375-386.
- Toussaint, L., Peddle, N., **Cheadle, A. C. D.**, Sellu, A., & Luskin, F. (2009). Striving for peace through forgiveness in Sierra Leone: Effectiveness of a psychoeducational forgiveness intervention. In A. Kalayjian and D. Eugene (Eds.), *Mass trauma and emotional healing around the world: Rituals and practices for resilience and meaning-making*. Praeger: Santa Barbara, CA.
- Toussaint, L. & **Cheadle, A. C. D.** (2009). Unforgiveness and the broken heart: Unforgiving tendencies and 12-month prevalence of cardiovascular health conditions. In M. T. Evans and E. D. Walker (Eds.), *Religion and psychology*. Nova Publishers: NY.
- Toussaint, L. & **Cheadle, A. C. D.** (2009). Unforgiveness and lifetime prevalence of psychopathology: Findings from an epidemiological study of United States adults. In M. T. Evans and E. D. Walker (Eds.), *Religion and psychology*. Nova Publishers: NY.

Chapter One: Mechanisms of Religiousness, Spirituality, and Health

Cheadle, A. C. D. & Dunkel Schetter, C. (*under review*). Seeking answers: A conceptual review of mechanisms of health associations with religiousness and spirituality. *Social and Personality Psychology Compass*.

Abstract

Religion and spirituality are major forces in the lives of Americans. A large and growing body of research indicates that specific aspects of religiousness and spirituality are associated with better physical and mental health. In this article, we specify some hypothesized mechanisms involving social, behavioral, psychological, and biological processes, and summarize some of the evidence pertaining to these pathways. This endeavor generates testable hypotheses for future research. Interdisciplinary research is especially well suited to examining these potential pathways. Social and personality psychology play a pivotal role in this future research agenda.

Seeking answers: A conceptual review of mechanisms of beneficial health associations with religiousness and spirituality

Religion and spirituality are major forces in the lives of Americans despite recent declines. According to The Pew Forum on Religion & Public Life (2008, 2015), 77% of Americans report a religious affiliation. Beyond religious affiliation, the majority of Americans hold religious beliefs. For example, 71% of Americans say that they are absolutely certain that there is a God. Furthermore, religion is relevant to the behavior of Americans, in that 55% report praying daily and nearly 40% report attending religious services at least once a week. Given the common nature of religious beliefs and behaviors, they are worthy of study by social and behavioral scientists.

A growing body of research shows that various aspects of religiousness and spirituality (R/S) are associated with better physical and mental health. Health outcomes that are robustly linked to R/S include the “ultimate” health outcome, mortality (e.g., McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000), as well as the leading causes of death in the United States, cancer and cardiovascular disease (e.g. Gillum & Ingram, 2006; Schnall et al., 2010), and also one of the most prevalent mental illnesses in the United States, that is, depression (Smith, McCullough, & Poll, 2003). These findings make R/S of particular relevance to those who study physical and mental health and the many biopsychosocial mechanisms responsible.

Religiosity and spirituality are typically considered to be interrelated but empirically and theoretically distinct. Both are conceptualized as dimensions of human experience that involve beliefs, practices, and experiences related to transcendent or sacred reality (Hill et al., 2000; cf. Koenig, 2008). However, religiousness is typically thought of as involving behaviors related to organized traditions, whereas spirituality usually refers to beliefs and experiences.

This paper reviews the relevant theories and outlines hypothesized mechanisms regarding associations of religiousness, spirituality and health. Because religion and spirituality are robustly associated with both physical and mental health, untangling the mechanisms will advance knowledge and future research. Furthermore, these mechanisms have implications for improving wellness within communities and for individuals. We identify four possible pathways—social, behavioral, psychological and biological—and summarize evidence for each of these pathways. Where possible, we focus on studies that specifically test mediation by these pathways. Finally, we highlight promising areas for future research.

Mechanisms of the Associations of Religiousness, Spirituality, and Health

A number of mechanisms have been proposed to explain the associations of religiousness and spirituality with health outcomes. Dimensions of both religiousness and spirituality may have influence through more proximal social, behavioral, and psychological influences on mental and physical health. In Figure 1, the key pathways from R/S to mental and physical health are depicted. Dimensions of religiousness and spirituality are shown as distinct for the most part but with some overlap, as consistent with definitions and common use.

In the study of mechanisms, other factors could be considered including genetics, personality, and propensity for risk-taking, all of which may account for the associations of religiousness, spirituality, and health (D’Onofrio, Eaves, Murrelle, Maes, & Spilka, 1999; Ellison & Levin, 1998; George, Ellison, & Larson, 2002). Although these are worthy of further study, they are not within the purview of this paper.

Social Mechanisms

Many religious and spiritual groups, practices, and behaviors are inherently social. Social support and social interaction are generally beneficial to health based on considerable empirical

evidence (Cohen, 2004; Thoits, 2011). As a result, many scholars have hypothesized that R/S may influence health through their social concomitants and effects (Powell, Shahabi, & Thoresen, 2003). In Figure 1, these pathways are represented by paths leading from religiousness and spirituality to social factors (paths a and d), and paths leading from social factors to mental and physical health (paths g and j). The health-relevant social components of R/S likely also include emotional and tangible social support, as well as characteristics of relationships with family members. Empirical evidence supports these associations. Religiousness and spirituality are related to greater social support and especially emotional support (e.g., Krause & Bastida, 2009), tangible or instrumental support, especially among African Americans (e.g., Chatters, Taylor, Lincoln, & Schroepfer, 2002), greater social capital, and greater marital and family quality and stability (e.g., Mahoney, Pargament, Tarakewshar, & Swank, 2008; cf. Brown, Orbuch, & Bauermeister, 2008).

A handful of studies support the hypothesis that social factors may be mechanisms of the associations of religiousness and health by demonstrating mediation. For instance, in a longitudinal study of over 8,000 U.S. adults, Gillum and colleagues (2008) found that Americans who report attending religious services at least weekly have a lower mortality risk than those who never attend services over an average eight and a half year followup; this effect was partially mediated by reports of social support received outside of their religious communities. Social support from family, friends, and others has also been shown to mediate associations of religiousness and mental health outcomes among college students (Salsman, Brown, Brechting, & Carlson, 2005) and clinical samples of HIV (Prado, Feaster, Schwartz, Pratt, & Smith, 2004) and cardiac surgery patients (Ai, Park, Huang, Rodgers, & Tice, 2007). However, other studies do not support a mediating role of social support though they do show associations of

religiousness and mental health variables (e.g., Sternthal, Williams, Musick, & Buck, 2010). Although perceived social support was similarly not a mediator of the association of religiousness and depression in a large study of American adults, further examination pointed to the importance of another social factor, social integration which mediated the association of religious service attendance and depressive symptoms (Schnittker, 2001). Thus, other aspects of social life are worthy of consideration as mechanisms of the association of religiousness and health and may deserve greater attention. No studies were identified that tested mediation of associations of R/S and health by tangible support, social capital, or marital or family characteristics, however, preliminary evidence affirms that these factors are related to R/S and to health relevant outcomes, and therefore, they are promising candidates for mechanisms.

Behavioral Mechanisms

Religious and spiritual practices involve behaviors and rituals specific to the communities in which those practices take place, and the beliefs inherent to those traditions. These rituals and behaviors may have an impact on health through emotional processing, expression, catharsis and other mechanisms, and thus, may be part of the various mechanisms explaining the associations of R/S and health. In addition to these rituals and behaviors, religiousness and spirituality are associated with particular health behaviors and health-relevant social behaviors. In Figure 1, these pathways are represented by paths leading from religiousness and spirituality to behavioral factors (paths **b** and **e**,) and paths leading from behavioral factors to mental and physical health (paths **h** and **k**).

Some empirical evidence suggests that the behavioral rituals associated with R/S are linked to better health. One's own prayer (versus intercessory prayer) is associated with better mental health in adults and among undergraduate college students (e.g., Ellison, Boardman,

Williams, & Jackson, 2001; cf. Masters & Spielmans, 2007). Engaging in religious or spiritual ritual may also influence health through other health-relevant processes such as instilling peace and calm, strengthening religious and spiritual belief and commitment, and promoting social connections (Ellison, Burdette, & Hill, 2009; Schnittker, 2001).

Most robustly, R/S are clearly tied to health behaviors. Religious and spiritual people have better diets (e.g., Debnam, Holt, Clark, Roth, & Southward, 2012; Park, Edmondson, Hale-Smith, & Blank, 2009; cf. Hill, Burdette, Ellison, & Musick, 2006), engage in more physical activity (Hill et al., 2006; Park et al., 2009), have better medical regime adherence (e.g., Strawbridge, Shema, Cohen, & Kaplan, 2001; cf. Kremer, Ironson, & Porr, 2009), and engage in fewer health degrading behaviors like substance use and risky sex (Strawbridge et al., 2001; cf. Hill et al., 2006; Park et al., 2009). Each of these health behaviors is associated with good health outcomes and mortality, and thus, could be mechanisms of the associations of R/S and health. Despite these associations, there is little research concerning their functioning as actual mechanisms, or mediators, of associations of R/S and health. Future research should focus on whether these behaviors mediate associations of religiousness, spirituality, and health, not simply seek to demonstrate that these behaviors are common among religious and spiritual persons or that these behaviors are associated with mental and physical health.

Psychological Mechanisms

Many dimensions of religiosity and spirituality likely have their effects on health through psychological pathways. For example, associations of R/S and health may be explained by conceptualizing religiousness and spirituality as worldviews that enable people to make meaning of their lives (Park, 2007). In samples from both the United States and abroad, Diener and colleagues (2011) have demonstrated that religiousness is associated with greater well-being and

that this association is mediated by purpose and meaning in life (Diener, Tay, & Myers, 2011). These factors have also been shown to mediate associations of religiousness and mental health in clinical samples (Contrada et al., 2008; cf. Nelson et al., 2009).

Psychosocial Resources. It has been theorized that positive psychosocial resources, especially optimism, mastery, self-esteem, and gratitude—each of which are emphasized and valued by religious and spiritual traditions—may be higher in religious and spiritual people. These resources have well-established salutary associations with health and clearly mediate associations of health and other psychosocial factors (e.g., Rasmussen, Scheier, & Greenhouse, 2009; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000; Sowislo & Orth, 2013). Accordingly, there is some evidence that suggests that optimism, mastery, self-esteem, and positive affect, in particular, may be mechanisms of associations of R/S and health.

Although optimism has mixed associations with religiousness and spirituality (e.g., Ciarrocchi, Dy-Liacco, Deneke, 2008; Mattis, Fontenot, Hatcher-Kay, Grayman, & Beale, 2004), evidence from a few studies is clearer that optimism mediates associations of spirituality and religiousness with various health outcomes, both mental and physical. First, in a sample of undergraduates, optimism, as well as social support, mediated the association between intrinsic religiousness and life satisfaction (Salsman, Brown, Brechting, & Carlson, 2005). Similarly, in a large sample of students interviewed shortly after the 9/11 terrorist attacks, prayer and strength of faith affected anxiety and depression through positive attitudes, including optimism (Ai, Tice, Peterson, & Huang, 2005). Lastly, Ai's team also found that optimism mediated the association of use of petitionary prayer and postoperative well-being in adults after open-heart surgery (Ai, Tice, Huang, Rodgers, & Bolling, 2008).

Religious and spiritual commitment is theorized to engender both mastery and self-esteem, and empirical evidence provides mixed support for these associations (e.g., Kashdan & Nezlek, 2012; Oates & Goode, 2013). Despite these associations, few studies have tested whether these factors mediate associations of R/S and health. In a large sample of adolescents from the Add Health study, both internal and external religiousness inversely predicted depressive symptoms after one year, and self-esteem partially mediated this association for European American and African American adolescents (Le, Tov, & Taylor, 2007). Similar mediation of the effect of spirituality on depressive symptoms has been shown in a sample of Puerto Rican women with HIV (Simoni & Ortiz, 2003). However, two large studies found that self-esteem did not mediate the association of religiousness and health outcomes (Ellison et al., 2001; Musick, House, & Williams, 2004). Only one study was identified that tested mastery as a mechanism of an association of religiousness and mental health and mediation was not seen (Schieman, 2008).

Though sometimes considered an indicator of emotional or mental health rather than a contributor to health, some researchers have investigated the possibility that positive affect mediates the associations of R/S and health. In two studies of people with cancer, positive affect has been shown to mediate these associations: for cancer-related health behavior performance (Park et al., 2009) and for emotional functioning (Holt et al., 2011). These studies suggest that for some, positive affect may be an important contributor to the associations of R/S and health.

Another hypothesis is that religious and spiritual values and practices may help individuals to regulate their negative emotions and thereby lead to better mental and physical health. Religious coping, a strategy of emotional regulation, is linked to better mental health in non-clinical samples (e.g., Schwartz, Meisenhelder, Ma, Reed, 2003) and physical health in

clinical samples (e.g., Ai, Peterson, Bolling, & Rodgers, 2006). However, we identified no studies that tested religious coping or other emotion regulation strategies as mechanisms of associations of R/S and health. Furthermore, particular beliefs and behaviors considered to be methods of “religious” coping may be other behaviors already hypothesized as mechanisms of this such as prayer or seeking social support.

In sum, there is some evidence supporting psychological mechanisms of associations of R/S and health including meaning and purpose, psychosocial resources, and emotion regulation or religious coping. Each of these pathways is ripe for further investigation to uncover important links between R/S and health.

Biological Mechanisms

The hypothesized biological mechanisms possibly explaining the associations of R/S to health have been less studied. Yet religiousness and spirituality have been linked with biological markers known to be relevant to multiple diseases and to general health. These include HPA products such as cortisol (e.g., Carrico et al., 2006) and markers of inflammation (e.g., Ford, Loucks, & Berkman, 2006; King, Mainous, Steyer, & Pearson, 2001; Lutgendorf, Russell, Ullrich, Harris, & Wallace, 2004). It has been suggested that biological markers and the associated underlying physiological processes may be a mechanism of the association of R/S and health (Seeman, Dubin, & Seeman, 2003). In Figure 1, these pathways are represented by paths leading from religiousness and spirituality to biological mechanisms, paths **q** and **r**, and paths leading from social factors to mental and physical health, paths **s** and **t**. Furthermore, it is likely that the social, behavioral, and psychological mechanisms hypothesized to mediate the associations of R/S and health are also associated with markers of physiological processes. In Figure 1, these potential pathways are represented by paths **n**, **o**, and **p**. In sum, there are clear

opportunities for researchers to further investigate these pathways ideally in collaboration across areas of expertise.

Discussion

There are many social, behavioral, and psychological factors that may function as mechanisms explaining associations of R/S with health. Some—such as social support, meaning in life, and psychosocial resources—have been shown to be mediators of these associations whereas others have been shown to be associated with religiousness and/or spirituality and are health-relevant, but have not been explicitly tested as mechanisms.

Among the four sets of mechanisms, we recommend further testing of the hypothesized social mechanisms in particular. It has been well established that R/S are associated with greater social support and future research should test the hypothesis that social support mediates associations of R/S and physical health.

Hypothesized behavioral mechanisms of the associations of religiousness and health have perhaps been the least generative of the suggested mechanisms, but a review of research highlights two important areas for future research. First, the idea that ritual participation reduces anxiety and thereby improves health is a hypothesis that could be tested through experimental methods, but only one such study was identified (Anastasi & Newberg, 2008). Second, it is clear that R/S are associated with better health behaviors such as exercise and diet, however, these have been little tested as mediators. Such research could make significant contributions by examining prospective associations of religiousness and spirituality, health behaviors, and physical health outcomes like disease and mortality. Many of the proposed psychological mechanisms are also ripe for further testing.

Research on biological and physiological mechanisms of associations of R/S and health is in its infancy. Basic research is needed to establish the strength and nature of associations of dimensions of religiousness and spirituality with biological markers of particular physiological pathways. In addition, tests of mediation effects of these biological markers will be extraordinarily instructive for this field.

Importantly, the mechanisms summarized herein do not function in isolation. These processes influence and interact with each other. In the next generation of research, it is important to consider links between variables rather than individual pathways alone. Indeed, there is some evidence of this. For instance, social support appears to mediate the associations of R/S and health behaviors (Debnam, et al., 2012). Other research indicates that relationships with God are associated with health, and this association appears to be mediated by aspects of R/S (e.g., Miner, 2009). These findings hint at the potential complexity of associations of dimensions of religiousness and spirituality, social, psychological, behavioral, and biological mediators, and physical and mental health outcomes yet to be uncovered.

Lastly, research on religiousness, spirituality and health has been limited by methodological issues including lack of agreement on definitions of religiousness and spirituality, poor measures of religiousness and spirituality, a dearth of programmatic research, and small samples. Researchers must endeavor to address these limitations as future research investigates mechanisms of associations of religiousness and spirituality and health.

Understanding these mechanisms is important in order to advance knowledge and to inform efforts to improve wellness within communities and for individuals. Interdisciplinary research is especially well suited to examining these potential pathways. Social, personality, and health psychology play a pivotal role in this future research agenda on social, behavioral,

psychological, and biological mechanisms of the associations of religiousness and spirituality with mental and physical health.

References

- Ai, A. L., Park, C. L., Huang, B., Rodgers, W. L., & Tice, T. N. (2007). Psychosocial mediation of religious coping styles: a study of short-term psychological distress following cardiac surgery. *Personality & Social Psychology Bulletin*, *33*(6), 867–882.
- Ai, A. L., Peterson, C., Tice, T. N., Bolling, S. F., & Koenig, H. G. (2004). Faith-based and secular pathways to hope and optimism subconstructs in middle-aged and older cardiac patients. *Journal of Health Psychology*, *9*(3), 435–450.
- Ai, A. L., Tice, T. N., Huang, B., Rodgers, W., & Bolling, S. F. (2008). Types of prayer, optimism, and well-being of middle-aged and older patients undergoing open-heart surgery. *Mental Health, Religion & Culture*, *11*(1), 131–150.
- Anastasi, M. W., & Newberg, A. B. (2008). A preliminary study of the acute effects of religious ritual on anxiety. *Journal of Alternative and Complementary Medicine*, *14*(2), 163–165.
- Brown, E., Orbuch, T. L., & Bauermeister, J. A. (2008). Religiosity and marital stability among Black American and White American couples. *Family Relations*, *57*(2), 186-197.
- Carrico, A. W., Ironson, G., Antoni, M. H., Lechner, S. C., Durán, R. E., Kumar, M., & Schneiderman, N. (2006). A path model of the effects of spirituality on depressive symptoms and 24-h urinary-free cortisol in HIV-positive persons. *Journal of Psychosomatic Research*, *61*(1), 51–58.
- Chatters, L. M., Taylor, R. J., Lincoln, K. D., & Schroepfer, T. (2002). Patterns of informal support from family and church members among African Americans. *Journal of Black Studies*, *33*(1), 66-85.
- Ciarrocchi, J. W., Dy-Liacco, G. S., & Deneke, E. (2008). Gods or rituals? Relational faith, spiritual discontent, and religious practices as predictors of hope and optimism. *The Journal of Positive Psychology*, *3*(2), 120–136.
- Cohen, S. (2004). Social relationships and health. *American Psychologist*, *59*(8), 676-684.
- Colman, I., Naicker, K., Zeng, Y., Atallahjan, A., Senthilselvan, A., & Patten, S. B. (2011). Predictors of long-term prognosis of depression. *Canadian Medical Association Journal*, *183*(17), 1969-1976.
- Contrada, R. J., Boulifard, D. A, Hekler, E. B., Idler, E. L., Spruill, T. M., Labouvie, E. W., & Krause, T. J. (2008). Psychosocial factors in heart surgery: presurgical vulnerability and postsurgical recovery. *Health Psychology*, *27*(3), 309–319.

- D'Onofrio, B. M., Eaves, L. J., Murrelle, L., Maes, H. H., & Spilka, B. (1999). Understanding biological and social influences on religious affiliation, attitudes, and behaviors: A behavior genetic perspective. *Journal of Personality*, *67*(6), 953-984.
- Debnam, K., Holt, C. L., Clark, E. M., Roth, D. L., & Southward, P. (2012). Relationship between religious social support and general social support with health behaviors in a national sample of African Americans. *Journal of Behavioral Medicine*, *35*(2), 179–189.
- Diener, E., Tay, L., & Myers, D. G. (2011). The religion paradox: If religion makes people happy, why are so many dropping out? *Journal of Personality and Social Psychology*, *101*(6), 1278–1290.
- Ellison, C. G., Boardman, J. D., Williams, D. R., & Jackson, J. S. (2001). Religious involvement, stress, and mental health: Findings from the 1995 Detroit Area Study, *Social Forces*, *80*(1), 215–249.
- Ellison, C. G., Burdette, A. M., & Hill, T. D. (2009). Blessed assurance: Religion, anxiety, and tranquility among US adults. *Social Science Research*, *38*(3), 656–667.
- Ellison, C. G., & Levin, J. S. (1998). The religion-health connection: Evidence, theory, and future directions. *Health Education & Behavior*, *25*(6), 700–720.
- Ford, E. S., Loucks, E. B., & Berkman, L. F. (2006). Social integration and concentrations of C-reactive protein among US adults. *Annals of Epidemiology*, *16*(2), 78–84.
- George, L. K., Ellison, C. G., & Larson, D. B. (2002). Explaining the relationships between religious involvement and health. *Psychological Inquiry*, *13*(3), 190–200.
- George, L. K., Larson, D. B., Koenig, H. G., & McCullough, M. E. (2000). Spirituality and health: what
- Gillum, R. F., & Ingram, D. D. (2006). Frequency of attendance at religious services, hypertension, and blood pressure: the third national health and nutrition examination survey. *Psychosomatic Medicine*, *68*(3), 382-385.
- Gillum, R. F., King, D. E., Obisesan, T. O., & Koenig, H. G. (2008). Frequency of attendance at religious services and mortality in a U.S. national cohort. *Annals of Epidemiology*, *18*(2), 124–129.
- Hill, P. C., Pargament, K. I., Hood, R. W., McCullough, M. E., Swyers, J. P., Larson, D. B., & Zinnbauer, B. J. (2000). Conceptualizing Religion and Spirituality: Points of

- Commonality, Points of Departure. *Journal for the Theory of Social Behaviour*, 30(1), 51–77.
- Hill, T. D., Burdette, A. M., Ellison, C. G., & Musick, M. a. (2006). Religious attendance and the health behaviors of Texas adults. *Preventive Medicine*, 42(4), 309–312.
- Holt, C. L., Wang, M. Q., Caplan, L., Schulz, E., Blake, V., & Southward, V. L. (2011). Role of religious involvement and spirituality in functioning among African Americans with cancer: testing a mediational model. *Journal of Behavioral Medicine*, 34(6), 437–448.
- Kashdan, T. B., & Nezlek, J. B. (2012). Whether, when, and how is spirituality related to well-being? Moving beyond single occasion questionnaires to understanding daily process. *Personality & Social Psychology Bulletin*, 38(11), 1523–1535.
- King, D. E., & Pearson, W. S. (2001). The relationship between attendance at religious services and cardiovascular inflammatory markers. *Psychiatry: Interpersonal and Biological Processes*, 31(4), 415–425.
- Koenig, H. G. (2008). Concerns about measuring “spirituality” in research. *The Journal of Nervous and Mental Disease*, 196(5), 349–355.
- Krause, N. M., & Bastida, E. (2009). Core religious beliefs and providing support to others in late life. *Mental Health, Religion & Culture*, 12(1), 75–96.
- Kremer, H., Ironson, G., & Porr, M. (2009). Spiritual and mind-body beliefs as barriers and motivators to HIV-treatment decision-making and medication adherence? A treatment study. *AIDS Patient Care and STDs*, 23(2), 127-134.
- Le, T. N., Tov, W., & Taylor, J. (2007). Religiousness and depressive symptoms in five ethnic adolescent groups. *International Journal for the Psychology of Religion*, 17(3), 209–232.
- Lutgendorf, S. K., Russell, D. W., Ullrich, P., Harris, T. B., & Wallace, R. (2004). Religious participation, interleukin-6, and mortality in older adults. *Health Psychology*, 23(5), 465–475.
- Mahoney, A., Pargament, K. I., Tarakeshwar, N., & Swank, A. B. (2008). Religion in the home in the 1980s and 1990s: A meta-analytic review and conceptual analysis of links between religion, marriage, and parenting. *Psychology of Religion and Spirituality*, S(1), 63-101.
- Masters, K. S., & Spielmann, G. I. (2007). Prayer and health: Review, meta-analysis, and research agenda. *Journal of Behavioral Medicine*, 30(4), 329-338.

- Mattis, J. S., Fontenot, D. L., & Hatcher-Kay, C. A. (2003). Religiosity, racism, and dispositional optimism among African Americans, *Personality and Individual Differences*, 34, 1025–1038.
- McCullough, M. E., Hoyt, W. T., Larson, D. B., Koenig, H. G., & Thoresen, C. E. (2000). Religious involvement and mortality: A meta-analytic review. *Health Psychology*, 19(3), 211–222.
- Miner, M. (2009). The impact of child-parent attachment, attachment to God, and religious orientation on psychological adjustment. *Journal of Psychology and Theology*, 37, 114–124.
- Musick, M. A., House, J. S., & Williams, D. R. (2004). Attendance at religious services and mortality in a national sample. *Journal of Health and Social Behavior*, 45(2), 198–213.
- Nelson, C., Jacobson, C. M., Weinberger, M. I., Bhaskaran, V., Rosenfeld, B., Breitbart, W., & Roth, A. J. (2009). The role of spirituality in the relationship between religiosity and depression in prostate cancer patients. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, 38(2), 105–114.
- Oates, G. L., & Goode, J. (2013). Racial Differences in Effects of Religiosity and Mastery on Psychological Distress: Evidence from National Longitudinal Data. *Society and Mental Health*, 3(1), 40–58.
- Park, C. L. (2007). Religiousness/spirituality and health: A meaning systems perspective. *Journal of Behavioral Medicine*, 30, 319–328.
- Park, C. L., Edmondson, D., Hale-Smith, A., & Blank, T. O. (2009). Religiousness/spirituality and health behaviors in younger adult cancer survivors: does faith promote a healthier lifestyle? *Journal of Behavioral Medicine*, 32(6), 582–591.
- Powell, L. H., Shahabi, L., & Thoresen, C. E. (2003). Religion and spirituality: Linkages to physical health. *American Psychologist*, 58(1), 36–52.
- Prado, G., Feaster, D. J., Schwartz, S. J., Pratt, I. A., & Smith, L. (2004). Religious involvement, coping, social support, and psychological distress in HIV-seropositive African American mothers, *AIDS and Behavior*, 8(3), 221-235.
- Pew Forum on Religion & Public Life. (2008). *U.S. religious landscape survey religious beliefs and practices: Diverse and politically relevant*.
- Pew Forum on Religion & Public Life. (2015). *U.S. public becoming less religious*.

- Powell, L. H., Shahabi, L., & Thoresen, C. E. (2003). Religion and spirituality: Linkages to physical health. *American Psychologist*, *58*(1), 36–52.
- Rasmussen, H. N., Scheier, M. F., & Greenhouse, J. B. (2009). Optimism and physical health: A meta-analytic review. *Annals of Behavioral Medicine*, *37*(3), 239–256.
- Salsman, J. M., Brown, T. L., Brechting, E. H., & Carlson, C. R. (2005). The link between religion and spirituality and psychological adjustment: the mediating role of optimism and social support. *Personality & Social Psychology Bulletin*, *31*(4), 522–535.
- Schieman, S. (2008). The Education-Contingent Association Between Religiosity and Health: The Differential Effects of Self-Esteem and the Sense of Mastery. *Journal for the Scientific Study of Religion*, *47*(4), 710–724.
- Schnall, E., Wassertheil-Smoller, S., Swencionis, C., Zemon, V., Tinker, L., O’Sullivan, M. J., ... Goodwin, M. (2010). The relationship between religion and cardiovascular outcomes and all-cause mortality in the Women’s Health Initiative Observational Study. *Psychology & Health*, *25*(2), 249–263.
- Schnittker, J. (2001). When is faith enough ? The effects of religious involvement on depression. *Journal for the Scientific Study of Religion*, *3*, 393–411.
- Schwartz, C., Meisenhelder, J. B., Ma, Y., & Reed, G. (2003). Altruistic social interest behaviors are associated with better mental health. *Psychosomatic Medicine*, *65*(5), 778–785.
- Seeman, T. E., Dubin, L. F., & Seeman, M. (2003). Religiosity/spirituality and health: A critical review of the evidence for biological pathways. *American Psychologist*, *58*(1), 53–63.
- Simoni, J. M., & Ortiz, M. Z. (2003). Mediational models of spirituality and depressive symptomatology among HIV-positive Puerto Rican women. *Cultural Diversity & Ethnic Minority Psychology*, *9*(1), 3–15.
- Smith, T. B., McCullough, M. E., & Poll, J. (2003). Religiousness and depression: Evidence for a main effect and the moderating influence of stressful life events. *Psychological Bulletin*, *129*(4), 614–636.
- Sowislo, J. F., & Orth, U. (2013). Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychological Bulletin*, *139*(1), 213–240.
- Steger, M. F., & Frazier, P. (2005). Meaning in life: One link in the chain from religiousness to well-being. *Journal of Counseling Psychology*, *52*(4), 574–582.

- Sternthal, M. J., Williams, D. R., Musick, M. A., & Buck, A. C. (2010). Depression, anxiety, and religious life: A search for mediators. *Journal of Health and Social Behavior*, *51*(3), 343–359.
- Strawbridge, W. J., Shema, S. J., Cohen, R. D., & Kaplan, G. A. (2001). Religious attendance increases survival by improving and maintaining good health behaviors, mental health, and social relationships. *Annals of Behavioral Medicine*, *23*(1), 68–74.
- Taylor, S. E., Kemeny, M. E., Reed, G., Bower, J. E., & Gruenewald, T. L. (2000). Psychological resources, positive illusions, and health. *American Psychologist*, *55*(1), 99–109.
- Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, *52*(2), 145-161.

Figures

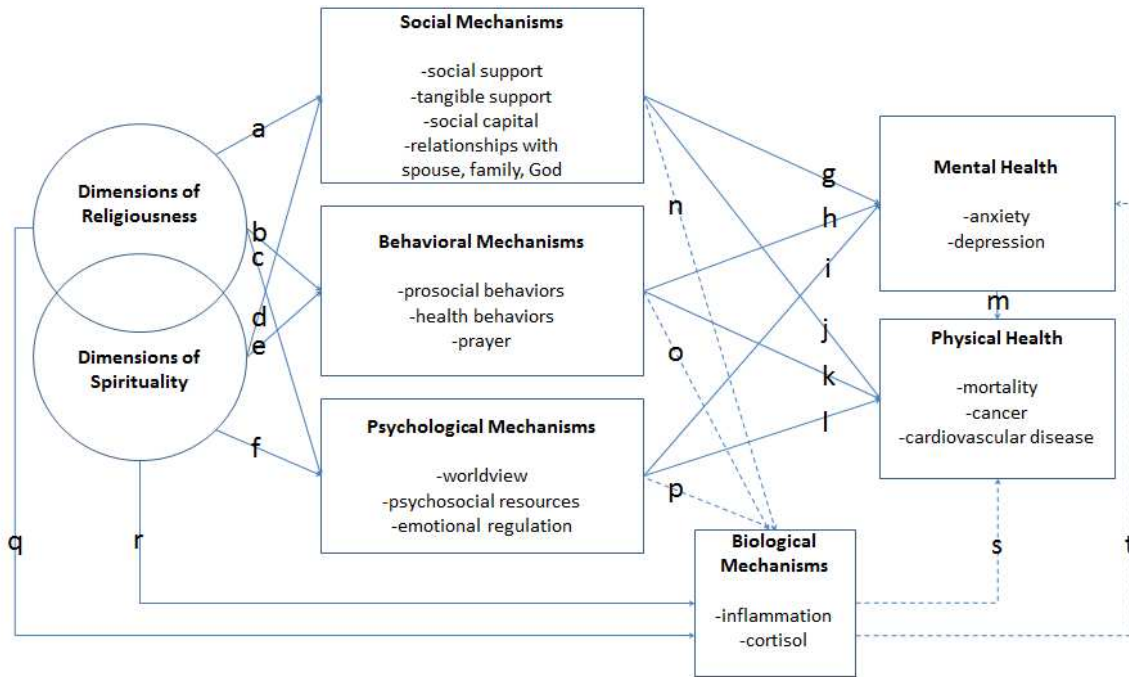


Figure 1. Conceptual model of mechanisms of religiousness, spirituality, and health. Pathways from religiousness and spirituality to social (a and d), behavioral (b and e), and psychological mechanisms (c and f) and from those mechanisms to mental and physical health (paths g-l) may explain the observed associations between religiousness and spirituality and health. Potential biological mechanisms are represented by paths leading from religiousness and spirituality to biological mechanisms, paths q and r, and paths leading from social factors to mental and physical health, paths s and t. Potential associations of social, behavioral, and psychological mechanisms and markers of physiological processes are represented by paths n, o, and p.

Chapter Two: Postpartum Religiousness, Spirituality, and Health

It is of particular interest to study the associations of religiousness and spirituality and health in pregnancy and post partum. Pregnancy and childbirth are times in the lives of women and families when religiousness and spirituality are especially salient. The birth of a child often occasions discussions of religious issues including religious rituals surrounding birth (e.g. baptism, brit milah) and parental decision making about religious rearing of children (Onedera, 2008; see Brown & Hall, 1997 for a historical perspective). Many religions attach especial spiritual significance to childbirth and parenthood as well, seeing parenthood as the purpose of marriage and the family as the unit of religious practice (Onedera, 2008). Many mothers and fathers view pregnancy, childbirth, and parenthood through religious and spiritual lenses. This is evidenced by the frequent use of spiritual and religious terms like “divine” and “transcendent” in pregnancy and birth narratives (Klassen, 2001). Interviews in a study of married couples pregnant with their first child indicate that many parents view childbirth through spiritual lenses and describe the experiences of pregnancy using religious and spiritual language and themes, characterizing pregnancy as sacred and a manifestation of God's will (Mahoney, Pargament, & DeMaris, 2009). The enhanced salience of religiousness and spirituality during pregnancy and the postpartum period and the perception of pregnancy and parenthood as sacred make this an interesting time to consider these factors and health.

Mental Health in the Perinatal Period

In addition to being an interesting time to study religiousness and spirituality, pregnancy and post partum are marked by unique patterns of mental health and biological markers of health. Affective disorders are more prevalent during pregnancy and postpartum than at other times in women's lives. Postpartum depression is a form of major depression not distinct from major

depression in terms of symptoms, but temporally bound by the postpartum period. Conservative estimates of rates of postpartum depression (PPD) range from 7-13% (Rich-Edwards et al., 2006) making this type of depression as prevalent as major depressive disorder among non-pregnant women (Bennett, Einarson, Taddio, Koren, & Einarson, 2004). Women who experience postpartum affective disorders are more likely to have difficulty returning to pre-pregnancy levels of general well-being and employment functioning (Beck, 2002) and to experience relationship stress (Abrams & Curran, 2007). Additionally, PPD is associated with increased risk of poor infant-parent attachment and low rates of breastfeeding which can lead to greater risk of cognitive, psychological and behavioral problems in childhood and beyond (Beck, 1995; Field et al., 1985; Murray & Cooper, 1996; Paul, Downs, Schaefer, Beiler, & Weisman, 2013). Given the consequences of prenatal and postpartum affective disorders, it is critical to identify aspects of women's lives that may prevent or ameliorate symptoms of depression and anxiety.

Biological Processes in Pregnancy and Post Partum

Inflammation. Inflammatory processes are also different during pregnancy and postpartum than in the non-pregnant body. Inflammation levels lower in pregnancy because the fetus contains elements foreign to the mother's body and it would be undesirable to mount an inflammatory response against the fetus (Christian, 2012). This lower inflammation has been evidenced both by levels of inflammatory markers circulating in blood (Coussons-Read, 2012) and by lower symptoms of inflammatory illnesses like autoimmune disorders during pregnancy (Gilli et al., 2010; Kraus et al., 2010). The systemic decrease in inflammation is linked to a down-regulation of neuroendocrine responses to stress that are also typical of pregnancy (Coussons-Read, 2012). However, inflammation plays an important role in the normal onset of labor in a process called cervical ripening in which the cervix softens and dilates in order to

allow passage of the fetus (Coussons-Read, Okun, Schmitt, & Giese, 2005). Thus, if inflammatory levels are heightened due to some other process, like infection, before the pregnancy's term, it can lead to premature birth (Coussons-Read, 2012). There is less research on these trends during the postpartum period, but a recent investigation showed a pattern of change with acute markers of inflammation increasing postpartum, though CRP decreased (Christian & Porter, 2014a; cf. Yim et al., 2010).

Stress hormones. Lastly, physiological systems associated with stress function differently during pregnancy and postpartum which can lead to differences in hormones associated with stress. In the typical, non-pregnant body, each product of the HPA axis acts on the axis to suppress further production via negative feedback. However, in pregnancy, the placenta produces CRH and this production is stimulated by cortisol. This causes a simultaneous increase in cortisol, CRH, and ACTH in both the mother and the fetus throughout pregnancy (Davis & Sandman, 2010). Maternal cortisol increases up to four times regular levels during normal gestation and this increase can be even greater in women experiencing stress, depression or anxiety, or pregnancy-specific distress (Sandman et al., 2006). It appears that cortisol decreases after birth throughout the postpartum period, though evidence is scant (Conde & Figueiredo, 2014; Jung et al., 2011; Lee, Hyun, & Rha, 2006).

Religiousness, Spirituality, and Health in Pregnancy and Post Partum

Other than qualitative research during pregnancy and postpartum pointing to the importance of religiousness or spirituality, there has been little research on associations of religiousness and spirituality and either health or physiological processes. Notably, there is a small literature on religiousness or spirituality and postpartum depression. However, no studies were identified testing associations of religiousness and spirituality with postpartum

inflammation or postpartum stress hormone levels. The present study is novel in testing each of these. Drawing on the extant research on associations of religiousness and spirituality and health and markers of physiological processes outside of the postpartum period, associations with these factors can be developed.

Religiousness, spirituality, and mental health in pregnancy and post partum. In general, there is very little research on the role of religiousness and spirituality in maternal mental health during pregnancy or postpartum. However, a small literature shows that religious participation and spiritual behaviors and experiences are associated with lower postpartum depression. A prospective study of over 300 women found that prenatal levels of organized religious participation were significantly predictive of lower postpartum depressive symptoms at 6 weeks postpartum, independent of antenatal depressive symptoms. Social support and self-rated religiosity and spirituality were marginally predictive (Mann, McKeown, Bacon, Vesselinov, & Bush, 2007; cf. Jesse & Swanson, 2007; Jesse, Walcott-McQuigg, Mariella, & Swanson, 2005). More recently, work by our group with an African American sample from the Community and Child Health Network study found that both religiosity and spirituality independently predicted favorable trajectories of depressive symptoms such that women higher in religiousness and spirituality had no change in depressive symptoms whereas women low in either had increases in depressive symptoms over the six months after the birth of their children (Cheadle et al., 2015). Furthermore, the association of religiousness and depressive symptoms in that analysis was mediated by spirituality. This publication, along with studies that show that religiousness and spirituality are associated with lower symptoms of anxiety and depression in the general population, indicates that religiousness and spirituality have implications for lower anxiety and depression in postpartum period (Baetz, Bowen, Jones, & Koru-Sengul, 2006;

Ellison, Burdette, & Hill, 2009; Jacobs, Miller, Wickramaratne, Gameroff, & Weissman, 2012; Koenig, King, & Carson, 2012; Mofidi et al., 2006; Sternthal, Williams, Musick, & Buck, 2010).

Religiousness, spirituality, and inflammation in the perinatal period. No published research was identified on religiousness or spirituality and inflammation during pregnancy or the postpartum period. However, a few studies link religiousness to inflammation in healthy (non-clinical) samples as reviewed above (Bellinger et al., 2014; Ford, Loucks, & Berkman, 2006; King et al., 2001; Loucks, Berkman, Gruenewald, & Seeman, 2005; Lutgendorf, Russell, Ullrich, Harris, & Wallace, 2004). These studies disproportionately focus on older adults (King et al., 2001; Loucks et al., 2005; Lutgendorf et al., 2004) and some find associations only in men, not women (Ford et al., 2006; Loucks, Berkman, Gruenewald, & Seeman, 2006). Thus, the hypothesis that religiousness and spirituality would be associated with lower inflammation in pregnant and postpartum women is somewhat consistent with these findings generally, but not with any research particular to women of childbearing age or pregnant and postpartum women.

Religiousness, spirituality, and stress hormones in the perinatal period. Very little research has been done on associations of religiousness or spirituality and stress hormones during pregnancy or the postpartum period. One study was identified in which 120 pregnant women completed questionnaires and blood draws at 14-20 weeks gestation (Latendresse & Ruiz, 2010). In this sample, pregnant women who reported using religion to cope with stress had substantially higher odds of having high levels of the stress hormone corticotropin-releasing hormone (CRH) which is involved in the production of cortisol and the HPA stress response. This was the only study identified that examined associations of religiousness or spirituality and corticotropin-releasing hormone in any population as well as the only study identified that examined associations of religiousness or spirituality and stress hormones in pregnant or

postpartum women. However, again, research in healthy and clinical populations suggests that religiousness and spirituality are beneficially associated with stress hormones though most of this work has been on cortisol. One unique experimental study of young, healthy participants found that people higher in religiousness and people who reported greater frequency of prayer had lower cortisol levels after a laboratory stressor (Tartaro, Luecken, & Gunn, 2005). In a study of women with fibromyalgia, a stress-related condition, medium/high religiosity was associated with healthy cortisol profiles characterized by high morning and low evening levels whereas women who reported low religiosity had flat cortisol slopes (Dedert et al., 2004). Additionally, in the context of HIV, various aspects of religiousness and spirituality including faith in God and religious behavior were associated with lower cortisol levels (Bormann, Aschbacher, Wetherell, Roesch, & Redwine, 2009; Carrico et al., 2006; Ironson et al., 2002). Taken together, these studies suggest that religiousness and spirituality would be associated with lower levels of stress hormones in pregnant and postpartum women though they are not extensive or with the same population.

Summary

In summary, religiousness and spirituality are important forces in the lives of Americans. As a result, research on this topic has been in progress for several decades. The literature involves samples almost entirely from the U.S. and can be summarized as follows. First, research has established that these forces are associated with better health outcomes across samples of various types including lower mortality. Second, a large body of research demonstrates that religiousness and spirituality are associated with fewer symptoms of depression and anxiety in the general population and in various clinical samples (e.g., cancer patients, cardiovascular surgical patients). Third, a small literature has shown that religiousness and spirituality are

associated with lower markers of inflammation and with lower levels of stress hormones but not necessarily in women or in the perinatal period. Fourth, the literature reviewed indicates that religiousness and spirituality are socially and cognitively salient during pregnancy and post partum. However, the links between religiousness, spirituality, and physical or mental health during pregnancy and post partum are not well established, although a small literature documents associations of religiousness and spirituality with fewer symptoms of depression in postpartum women. Fifth, associations between religiousness and spirituality and other markers of health during pregnancy or post partum (including inflammation and stress hormones) are untested, but research in other samples supports this premise. Finally, mechanisms explaining these associations have been proposed that draw on research linking religiousness and spirituality to social, behavioral, biological, and psychological processes known to be linked to better health. In particular, theoretical and empirical evidence suggests that both religiousness and spirituality are associated with greater psychosocial resources, like optimism, mastery, self-esteem, gratitude, and forgiveness, which may be mechanisms of associations of religiousness and spirituality and health (Cheadle & Dunkel Schetter, Study 1, under review). Therefore, further research on these processes with a theoretical foundation and strong methodologies is warranted.

Chapter Three: Studies Overview and CCHN Methods

Conceptual Model for Proposed Research

The preceding background literature and the proposed mechanisms of the associations of religiousness and spirituality with health are represented in Figure 1 and represent the foundation of the current research. In brief, this research examines the potential mediation via psychosocial resources of the associations of religiousness and spirituality with one marker of mental health and two markers of health-related biological processes. Hypotheses derived within this framing were tested in a study of women over the postpartum year. The central hypothesis was that religiousness and spirituality are associated with better mental health and biomarkers of health in postpartum women and that psychosocial resources would mediate these associations.

Specific Aims and Hypotheses

Specific Aim 1: Determine whether religiousness and spirituality are associated with psychosocial resources in postpartum women.

Hypothesis 1: Religiousness and spirituality will be associated with higher levels of mastery, self-esteem, and optimism.

Specific Aim 2: Determine whether religiousness and spirituality are associated with symptoms of depression in postpartum women.

Hypothesis 2: Both religiousness and spirituality will be associated with **a)** lower depressive symptoms at one, six, and 12 months after birth and **b)** with favorable trajectories of depressive symptoms over the year after birth. That is, those higher in religiousness and spirituality will have smaller increases in depressive symptoms over time during the postpartum.

Specific Aim 3: Determine whether psychosocial resources mediate associations of religiousness and spirituality with symptoms of depression in postpartum women.

Hypothesis 3: The association of religiousness and spirituality with **a)** lower depressive symptoms and **b)** favorable trajectories of depressive symptoms will be mediated by psychosocial resources. That is, those higher in religiousness and spirituality will have higher levels of mastery, optimism, and self-esteem which will be associated with lower depressive symptoms and favorable trajectories of depressive symptoms.

Specific Aim 4: Determine whether religiousness and spirituality are associated with markers of inflammation in postpartum women.

Hypotheses 4: Both religiousness and spirituality will be independently associated with lower levels of CRP at **a)** six and **b)** 12 months after birth.

Specific Aim 5: Determine whether psychosocial resources mediate associations of religiousness and spirituality with lower levels of CRP.

Hypothesis 5: The association of religiousness and spirituality with lower levels of CRP at **a)** six and **b)** 12 months postpartum will be mediated by psychosocial resources. That is, those higher in religiousness and spirituality will have higher levels of mastery, optimism, and self-esteem which will be associated with lower CRP.

Specific Aim 6: Determine whether religiousness and spirituality are associated with stress hormone levels in postpartum women.

Hypotheses 6: Both religiousness and spirituality will be independently associated with steeper negative cortisol slopes at **a)** six and **b)** 12 months after birth.

Specific Aim 7: Determine whether psychosocial resources mediate associations of religiousness and spirituality with diurnal cortisol slopes in postpartum women.

Hypothesis 7: The association of religiousness and spirituality with steeper negative cortisol slopes at **a)** six and **b)** twelve months after birth will be mediated by psychosocial

resources. That is, those higher in religiousness and spirituality will have higher levels of mastery, optimism, and self-esteem which will be associated with steeper negative slopes of diurnal cortisol.

Exploratory Aim: Examine differential associations of religiousness and spirituality with markers of health.

It is possible that religiousness and spirituality will be differentially associated with symptoms of depression, markers of inflammation, and levels of stress hormones. No hypotheses were derived from theory or research in this area, however, this was tested.

Current Studies

Dissertation Overview

Hypotheses were addressed in three distinct studies as well as preliminary analyses. Because Hypothesis 1 underlies some of the remaining hypotheses in each study (i.e., Hypotheses 3, 5, and 7), it was tested as a preliminary step. Results of these analyses are presented in Chapter Four. Hypotheses 2 and 3 are addressed in Study One (Chapter Five). Hypotheses 4 and 5 are addressed in Study Two (Chapter Six). Hypotheses 6 and 7 are addressed in Study Three (Chapter Seven). Exploratory aims are addressed throughout the chapters.

CCHN Study Data

Specific aims are addressed using a dataset collected by the Community Child Health Network (CCHN). This dataset is a very rich source of information on the proposed topics and includes measures of religiousness and spirituality and psychosocial resources that are more detailed than those found in other studies. Furthermore, the CCHN sample is large and diverse in terms of race/ethnicity. These characteristics make these data well suited to the aims. All hypotheses were tested in data from the Community Child Health Network (CCHN) study.

Participants

In CCHN, participating mothers and fathers were recruited from hospitals at five sites within the United States after the birth of a child. The five study sites included three urban cities (Los Angeles, Baltimore and Washington, DC), one mixed urban-suburban site (Lake County, IL), and one rural site (Eastern North Carolina). Participants who met the following criteria were eligible to participate: (1) age between 18 and 40 (2) self-identification as either White/Caucasian, Latina/Hispanic, and/or African-American/Black (3) ability to converse in either English or Spanish (4) residence in one of the target zip codes for at least six months (5) 4 or fewer children (5) no plans to be surgically sterilized following the birth of the index child.

Women were recruited following the birth of a child and followed for up to 2.5 years through the birth of a subsequent child. Participants were primarily recruited in the hospital following the birth. CCHN's recruitment plan oversampled for African-American and Latina race/ethnicity, preterm birth status, and low SES. Given the local demographics, Washington, DC and Baltimore sites recruited more African-American participants whereas Los Angeles and Chicago-Lake Shore recruited more Latino/a participants. With the mother's permission, the baby's father was invited to participate in the study. Mothers and fathers were interviewed individually using semi-structured interview protocols at one month (T1), six months (T2), and 12 months post birth (T3). Interviews were conducted in the participant's language of choice (English or Spanish) by community members experienced or trained in community research and/or clinical service delivery. The trained interviewers conducted all assessments in the participant's home or another convenient setting. Interviewers were also trained to collect biological data at these study visits including 1) blood pressure, 2) height and weight for BMI, 3) waist and hip measurements, and 4) blood spots. See Figure 2 for a timeline of interviews and

biomarker collection points. Relevant measures collected at each study visit are summarized throughout the studies and full measures are provided in the Appendix.

In total, CCHN recruited 3,441 women. However, 804 of these women did not complete any of the interviews at one, six, or 12 months postpartum, and thus were dropped from the dataset, leaving 2,637 participants. At six months postpartum, 54 women reported being pregnant and at 12 months postpartum, an additional 131 women reported being pregnant. Because the intended sample for this study was postpartum women, pregnant women were dropped from the dataset resulting in 2,452 participants. Lastly, 51 multi-racial women and 2 women of unknown race/ethnicity were dropped from the dataset in keeping with previous CCHN publications which examined racial/ethnic disparities which was CCHN's main goal. This resulted in a final sample of 2,399 participants.

Of these 2,399 participants, 2,287 (95%) completed the T1 interview at 2 to 16 weeks after the birth of a child or completed a subset of the T1 questions at the T3 interview in what was referred to as the "T1 catch-up interview". At six months postpartum, 1,604 (7%) women completed the T2 interview. At 12 months, 1,588 (7%) participants completed the T3 Interview. The sample used for the analyses of this study varied depending on the variables used and the type of analysis.

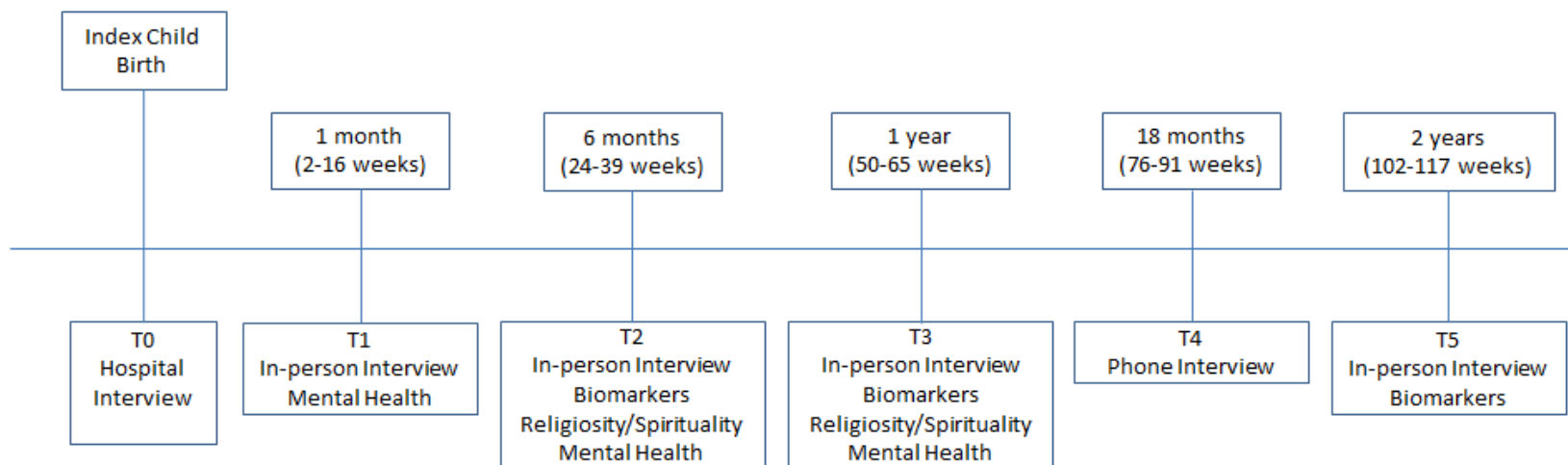


Figure 2. Community Child Health Network (CCHN) interview and biomarker collection timeline.

Demographic Measures

Demographic information was collected at recruitment and throughout the study.

Race/ethnicity. Participants self-reported their primary racial/ethnic identification at the time of study enrollment as African American/Black, White/Caucasian or Latina/Hispanic.

SES. Participant education and household income were recorded during the interview of the study visit at 1 month postpartum. Participants reported the number of years of education they had completed which resulted in a continuous education variable. During the T1 interview, participants were asked to report a range in which their household income in the previous calendar year (pre-tax) fell, using ordered categories. The midpoint value for each category was assigned to create a continuous gross household income variable. Per capita household income was computed by dividing gross household income by the number of household members. Due to variability in the cost of living across the five study sites, per capita household income was adjusted using cost of living indices available from the US Census Bureau. Because the distribution of per capita household income was not normally distributed and included several outliers at the upper end of the distribution, this variable was truncated at \$70,000 such that all women with a per capita household income of \$70,000 or over have a value of \$70,000. Because the distribution of this truncated variable was not normally distributed, a log transformation was calculated for use in analyses.

Relationship status. At 1 month postpartum, women were asked about their relationship statuses with their babies' fathers. They were also asked whether or not they were living with the baby's father. At the following study visits, women were asked in the interview about whether their relationship status with the babies' fathers had changed. On the basis of these data, two variables were formed; the first represents whether a participant was married to her baby's father

at any time during the first year of the study and the second represents whether a participant lived with her baby's father (i.e., they were "cohabiting") during the first year of the study.

Key Study Variable Measures

Descriptions of relevant variables are provided within the studies below. In general, religiousness and spirituality were assessed at six and 12 months postpartum, psychosocial resources were assessed at 1, 6, and 12 months postpartum, and biomarkers were collected at six and 12 months postpartum.

Overview of Data Analysis

A data set containing all relevant CCHN study variables was created from the CCHN database. Analyses proceeded with calculations of descriptive characteristics of all study variables, including means, standard deviations, and normality of distributions. Bivariate associations between variables were also computed and examined.

To test the study hypotheses, I used a variety of quantitative methods including ANOVA, correlation, t-tests, and factor analysis that culminated in a model testing using structural equation modeling. For all structural equation models, I used maximum likelihood estimation methods which allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used to estimate all structural equation models. Particular methods are described in the data analysis sections specific to each study hypothesis.

Chapter Four: Preliminary CCHN Analyses

Descriptive Statistics

Demographics. In order to characterize the sample of participants in CCHN prior to hypothesis testing, demographic characteristics for the total sample are presented in Table 1. Participants' age ranged from 18 to 42 and, on average, participants were about 26 years old ($M = 25.71$, $SD = 5.69$). Participants had attended an average of nearly 13 years of schooling ($M = 12.93$, $SD = 2.98$), equivalent to just beyond high school, and participants had an average per capita household income of around \$15,000 ($M = \14936.22). The average per capita household income adjusted for the cost of living in the individual study sites was slightly lower ($M = \$12,358.71$). Descriptive statistics for the truncated and transformed income variables are also displayed in the table. The majority of participants identified as African American (53.7%) and the remaining participants were White (21.8%) and Latina (24.6%). A minority of participants were married to their babies' fathers (30.9%), some were living with him ("cohabiting") but not married (26.2%), and the majority were not married or cohabiting with the baby's father (37.8%). Lastly, participants were fairly evenly distributed between the study sites with the smallest group coming from North Carolina (16.5%) and the largest group coming from Baltimore (21.8%).

Table 1.

Demographic Characteristics – Continuous Variables

	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% missing
Age	2399	25.71	5.69	18.00	41.69	0.70	2.55	9%
Years of education	2267	12.93	2.98	2	26	0.30	4.62	14%
Income – per capita household	2284	\$14,936.22	25,067.42	0	375,000.00	7.08	79.55	13%
Income – per capita household adjusted for cost of living [†]	2284	\$11,531.33	13,538.69	0	70,000	2.17	8.31	13%
Income – log of per capita household adjusted for cost of living [†]	2239	8.68	1.37	3.20	11.16	-0.77	3.66	15%

[†] For variables represented in these rows, income was truncated at \$70,000.00

Table 2.

Demographic Characteristics – Categorical Variables

	<i>n</i>	%	% missing
Categorical variables			
Race/ethnicity			0%
African American	1287	53.7%	
White	522	21.8%	
Latina	590	24.6%	
Relationship status			5%
Not married or cohabiting	907	37.8%	
Cohabiting, not married	629	26.2%	
Married	742	30.9%	
Study Site			0%
Baltimore	522	21.8%	
Lake County, IL	520	21.7%	
LA County	462	19.3%	
Eastern NC	396	16.5%	
Washington, DC	499	20.8%	

Bivariate associations. Bivariate analyses of demographic characteristics were also conducted to further describe the sample. For pairs of continuous variables, correlations were conducted and are reported in Table 3. ANOVAs were conducted for associations of continuous variables with categorical variables and chi-square tests were conducted for associations of categorical variables with categorical variables; *F* statistics that were significant at the $p < .05$ level were followed up with pairwise t-tests with Sidak correction for multiple comparisons.

Correlational analyses indicated the demographic characteristics mother's age, years of education, and income were all significantly and positively inter-correlated. These correlations were of moderate size indicating that these variables shared 13-18% variance between them.

Table 3.

Correlations of Continuous Demographic Characteristics

	(1)	(2)
(1) Age	1	
(2) Years of education	0.429***	1
(3) Income – log of per capita household adjusted for cost of living [†]	0.367***	0.403***

[†] Income was truncated at \$70,000.00; * $p < 0.05$; ** $p < 0.01$; *** $p < .001$

ANOVAs, t-tests, and chi-square tests were conducted to examine associations of age, years of education, income, marital status, race/ethnicity, and study site. ANOVAs revealed racial/ethnic differences in age, years of education, and income. In the case of age, White mothers ($M = 29.65$, $SD = 6.05$) were significantly older than Latina mothers ($M = 25.71$, $SD = 5.24$) who were in turn significantly older than African American mothers ($M = 24.12$, $SD = 4.91$); $F(2, 2396) = 205.98$, $p < .001$. For years of education, White mothers had the highest number of years ($M = 15.36$, $SD = 3.16$) and significantly higher than African American mothers ($M = 12.75$, $SD = 2.10$) who had, in turn, significantly higher years of education than Latina mothers ($M = 11.13$, $SD = 3.00$); $F(2, 2264) = 352.96$, $p < .001$. Income differed only in that White mothers had higher per capita household income ($M = \$21882.25$) than both African American ($M = \$8978.36$) and Latina mothers ($M = \7870.78); $F(2, 2236) = 149.71$, $p < .001$ (note: the ANOVA was conducted using the log transformed income variable, however, the means of the truncated variable before transformation are reported to allow for interpretation). Chi-square analyses also revealed racial/ethnic differences in relationship status (marital status and cohabitation status) and in study site. Racial/ethnic groups did not have similar proportions of married and cohabiting mothers. White women were more likely to be married (70% were married) whereas African American and Latina women were less likely to be married (86% of African American and 60% of Latina women were not married); $\chi^2 = 436.98$, $p < .001$. Lastly,

chi-square analyses showed that racial/ethnic groups were not evenly distributed among the study sites. African American women were concentrated in the Baltimore, North Carolina, and Washington, DC sites; White participants were least likely to be in the DC site whereas they were more evenly distributed across the rest of the sites; Latino participants were mostly in the Chicago and Los Angeles sites whereas they were relatively absent from the North Carolina and Baltimore sites; $\chi^2 = 891.69, p < .001$. Thus, these analyses indicate that sample demographics differ substantially by race/ethnicity.

T-tests and chi-square analyses showed demographic differences between women by relationship status as well. Married women were significantly older ($M = 29.74, SD = 5.56$) than non-married women ($M = 23.78, SD = 4.64$); $t(2282) = -26.89, p < .001$; similarly, cohabiting women were significantly older ($M = 27.24, SD = 5.83$) than those women not living with their babies' fathers ($M = 23.43, SD = 4.61$); $t(2276) = -16.53, p < .001$. Similarly, married women had more years of education ($M = 14.55, SD = 12.16$), as did cohabiting women ($M = 13.36, SD = 3.41$), than those not married ($M = 12.16, SD = 2.24$) and not cohabiting ($M = 12.29, SD = 2.01$), respectively; $t(2262) = -19.40, p < .001$, and $t(2256) = -8.48, p < .001$. Married ($M = \$18,642.09$) and cohabiting women ($M = \$13,474.65$) also had higher levels of income compared to their single counterparts (unmarried women: $M = \$8,109.67$; non-cohabiting women: $M = \$8,614.29$); $\chi^2 = 207.16, p < .001$ and $\chi^2 = 158.12, p < .001$, respectively (note: the ANOVA was conducted using the log transformed income variable, however, the means of the truncated variable before transformation are reported to allow for interpretation). Chi-square analyses revealed that relationship status was not equally distributed among racial/ethnic groups as described above. Relationship status was not equally distributed among study site either (for marital status, $\chi^2 = 207.16, p < .001$; cohabitation status, $\chi^2 = 158.12, p < .001$). Women in

Baltimore, Washington, D.C., and North Carolina were less likely to be married whereas women in Chicago and Los Angeles were equally likely to be married or not. Women in Chicago and Los Angeles were more likely to be cohabiting whereas women in Baltimore, North Carolina, and Washington, D.C., were equally likely to be cohabiting or not. Thus, these analyses indicate that sample background variables differ substantially by relationship status.

ANOVAs and chi-square analyses revealed demographic differences between women by study site as well. Maternal age, years of education, and per capita income all differed by study site. Maternal age was highest among women in Los Angeles followed by women in Chicago, and women in North Carolina, Washington, D.C., and Baltimore were the youngest. Similarly, women in Los Angeles had the most years of education and the highest per capita household income. Site differences are detailed in Table 4. Women in the study sites also differed by relationship status and race as described in chi-square analyses above.

Table 4.

ANOVAs for Demographic Characteristics by Study Site

	Chicago	LA	NC	DC	Baltimore	<i>df</i>	<i>F</i>	<i>p</i>
Maternal age	26.46 ^a (5.78)	28.07 ^b (6.21)	24.09 ^{cde} (4.75)	24.83 ^{cde} (5.11)	24.96 ^{cde} (5.55)	4, 2394	27.46	<.001
Years of education	12.67 ^{acde} (3.18)	13.74 ^b (3.52)	13.12 ^{ace} (2.26)	12.52 ^{ade} (3.01)	12.80 ^{acde} (2.60)	4, 2262	11.56	<.001
Income – log of per capita household adjusted for cost of living [‡]	\$13,063.59 ^{ab} (13736.94)	\$14,844.08 ^{abd} (19134.95)	\$9,181.11 ^{cde} (11441.50)	\$10,288.03 ^{bcd} (10902.40)	\$10394.42 ^{bcd} (10894.80)	4, 2234	6.23	<.001

Note. The ANOVA for income was conducted using the log transformed income variable, however, the means of the truncated variable before transformation are reported to allow for interpretation

[‡] Income was truncated at \$70,000.00

Hypothesis 1a. *Religiousness and spirituality will be independently associated with higher levels of mastery, optimism, and self-esteem.*

Methods

This hypothesis was tested in the full CCHN sample of 2,399 postpartum women.

Measures of Religiousness and Spirituality

At six months post partum (T2), participants completed various questions about religiosity and spirituality. Measures were adapted by community participatory methods withing CCHN from scales published in the Fetzer Multidimensional Measurement of Religiousness/Spirituality for Use in Health Research (MMRS; Fetzer/NIA, 1999). Additional questions regarding religiousness and spirituality were assessed at 12 months post partum (T3). For the purposes of the analyses, all religiousness and spirituality items will be coded such that higher responses or scores are indicative of greater religiousness and spirituality.

At T2, participants were asked, “Do you have any specific religious background?,” and “Do you currently identify with or belong to any particular religious group?” and selected responses from a list including no religion, Roman Catholic, Episcopalian/Anglican/Church of England [sic], Protestant (Baptist, Methodist, Presbyterian), Evangelical Christian, Other Christian, Shi’ite Moslem, Sunni Moslem, Jew, Hindu, Jain, Sikh, Buddhist, other. Current religious affiliation and religious background were dichotomized to represent having an affiliation or not. Those participants who identified with a current religious affiliation were asked about **religious service attendance**, “How often do you usually attend religious services?” Responses on a 6-point scale ranged from *nearly everyday – 4 or more times a week* [sic] to *never*. All participants were asked, “To what extent do you consider yourself a religious

person?...”; responses on a 4-point scale ranged from very religious to not religious at all. This item was used as a single item indicator of religious identity.

Also at six months post partum (T2), they were asked to what extent participants find strength and comfort in their religion, feel deep inner peace or harmony, and experience a divine presence in their lives. Items were rated on a 6-point scale with responses ranging from *never or almost never* to *many times a day*. Only participants who identified with a current religious affiliation and indicated that they attended religious services at least a few times per year were asked the question about finding strength and comfort in their religion. For purposes of composite creation, scores missing on the item assessing strength and comfort in one's religion were imputed as follows: if a participant had no religious background in addition to no current religious affiliation, that participant was assumed to find no strength or comfort from religion and was assigned a score of 0 corresponding to “never or almost never;” if a participant did have a religious background though no current affiliation, that participant was assigned a score of the mean of the participant's responses to the other two items from the Daily Spiritual Experiences scale. Scores on these three items were averaged to create an index of **daily spiritual experiences**. All participants were also asked, “To what extent do you consider yourself a spiritual person?...”; responses on a 4-point scale ranged from *very spiritual* to *not spiritual at all*. This item was used as a single item indicator of **spiritual identity**.

At 12 months postpartum (T3), a series of questions about religious beliefs and behaviors were asked. Questions were taken from a religiosity scale developed for use with African American women (Lukwago, Kreuter, Bucholtz, Holt, & Clark, 2001). To develop an index of **private religious behaviors**, the count of, “Do you agree or disagree with the following

statements?...I often read religious books, magazines, and pamphlets., I often watch or listen to religious programs on TV or radio., I pray often.,” was summed.

Psychosocial Resource Measures

Mastery. At 1 month postpartum (T1), mastery was assessed using the 7-item Mastery Scale (Pearlin & Schooler, 1978). This scale was modified slightly for use in CCHN; items were embedded with six other items assessing self-esteem, and the instructions were changed to be appropriate for use with all items. Responses were given on a 5-point scale ranging from *strongly disagree* to *strongly agree*. Two negatively worded items were reverse coded and then all items were summed to create a total mastery score, such that higher scores reflect greater mastery.

Self-esteem. A 6-item modified version of the Rosenberg Self-Esteem Scale was used to assess trait self-esteem at T1 (Rosenberg, 1965). The response scale used to assess self-esteem was identical to those described above for the Mastery scale. Four of the original items from the Rosenberg scale were omitted and slight changes were made through community participatory processes to the remaining six questions to aid participant understanding of the items. Negatively worded items were reverse scored and all items were summed to generate a total self-esteem score such that higher scores on this scale reflect greater self-esteem.

Dispositional optimism. Dispositional optimism was measured at T2 with a modified version of the 8-item Life Orientation Test (Scheier & Carver, 1985). The instruction set used in CCHN omitted a sentence found in the original instructions asking participants to be honest and accurate, and were also edited to include an introduction to the section of the interview. Responses were on a 5-point scale ranging from *I agree a lot* to *I disagree a lot*. Four filler items were embedded in the scale. All positively worded items were reverse coded and all non-filler

items were summed to generate a total optimism score such that higher scores indicate greater optimism.

Data Analysis

Data analysis for this hypothesis included univariate and bivariate techniques, factor analysis, and culminated in model testing using multivariate structural equation models. First, frequencies and descriptive statistics were used to summarize data on religiousness and spirituality and psychosocial resources. Correlational analyses and ANOVAs were used to test bivariate associations between religiousness and spirituality and psychosocial resources as well as between these and other study variables. Lastly, structural equation models using maximum likelihood estimation were used to test hypotheses by modeling associations between religiousness and spirituality and psychosocial resources as described in detail for each analysis below. Maximum likelihood estimation allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used for all structural equation models.

Preliminary Results

Descriptive Statistics

Religiousness and spirituality. Descriptive statistics for religiousness and spirituality measures are provided in Table 5. These data were missing for 40-60% of the sample with missingness attributable to sample attrition at the second and third timepoints as well as skip logic inherent to the design of the interview as described above. At six months after birth, 64% of the sample declared a religious affiliation and on average participants reported attending religious services a few times a year to a few times a month ($M = 3.75$, $SD = 1.07$). Thus, these women were slightly less religious than the general population, but similar to people of this age group (Pew Forum on Religion & Public Life, 2008; 2015). Participants rated themselves as

slightly to *moderately* religious ($M = 2.56, SD = 0.93$) and reported engaging in about half of the private religious behaviors surveyed ($M = 1.56, SD = 1.13$). Participants rated themselves as more spiritual than religious with the average rating corresponding to *moderately* spiritual ($M = 2.83, SD = 0.87$). On average, participants reported having the spiritual experiences surveyed *most days* ($M = 4.10, SD = 1.04$) with finding strength and comfort in religion being the most common spiritual experience ($M = 4.45, SD = 1.25$; note: this question was asked only of participants who declared a religious affiliation as described above).

Table 5.

Religious and Spiritual Characteristics

	Timepoint	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% Missing
Religious service attendance	T2	1033	3.75	1.07	1	6	-0.44	2.74	67% (1603)
Religious identity	T2	1600	2.56	0.93	1	4	-0.12	2.17	43% (1036)
Daily spiritual experiences	T2	914	4.10	1.04	1.33	6	-0.25	2.35	72% (1722)
Strength/comfort		920	4.45	1.25	1	6	-0.51	2.37	72% (1716)
Divine presence		1593	3.54	1.49	1	6	-0.03	2.00	43% (1043)
Deep inner peace/harmony		1592	3.75	1.29	1	6	-0.07	2.34	44% (1044)
Spiritual identity	T2	1599	2.83	0.87	1	4	-0.27	2.32	43% (1037)
Religious affiliation	T2	64% affiliated (1027), 36% not (570)							33% (1039)
Private religious behaviors	T3	1585	1.56	1.13	0	3	-0.05	1.61	44% (1051)
Read religious media		43% yes (687), 57% no (898)							44% (1051)
Watch/listen to Religious media		43% yes (687), 57% no (898)							44% (1051)
Pray often		70% yes (1104), 30% no (481)							44% (1051)

Table 6.

Psychosocial Resource Characteristics

	Timepoint	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% Missing
Mastery	T1	2285	28.06	4.08	14	35	-0.34	2.86	13% (351)
Self-Esteem	T1	2285	25.90	3.15	9	30	-0.77	4.19	13% (351)
Optimism	T2	1601	31.07	5.15	10	40	-0.43	3.09	39% (1035)

Psychosocial resources. Descriptive statistics for measures of psychosocial resources are provided in Table 6. On average, participants had a total score of 28 on the Mastery Scale ($M = 28.06$, $SD = 4.08$), representing that they reported that they *agree* with each statement on average. In this sample, the Mastery Scale had a scale reliability of $\alpha=0.703$. Self-esteem was also high with an average total score of nearly 26 ($M = 25.90$, $SD = 3.15$), representing that participants reported that they *agree to strongly agree* with most statements. In this sample, the self-esteem composite had a scale reliability of $\alpha=.800$. On average, total optimism scores were around 31 out of a total possible score of 40 ($M = 31.07$, $SD = 5.15$) representing an average response of *I neither agree nor disagree to I agree a little* to each statement. In this sample, the optimism composite had a scale reliability of $\alpha = .670$.

Bivariate associations between religiousness, spirituality, and psychosocial resources. Correlational analyses were conducted to investigate the associations of measures of religiousness, spirituality, and psychosocial resources (See Table 7). In general, measures of religiousness were significantly and positively correlated with one another, as were measures of spirituality with one another. Furthermore, measures of religiousness and measures of spirituality were significantly and positively correlated. Measures of psychosocial resources were significantly and positively correlated with one another as well.

Lastly, correlations between psychosocial resource measures and measures of religiousness and spirituality were mixed. In general, psychosocial resources were not significantly correlated with measures of religiousness, however, optimism was significantly and positively correlated with private religious behavior, though the association was small ($r = 0.115$). Self-esteem was significantly and positively correlated with self-rated religious identity, though the association was also small ($r = 0.055$). On the contrary, psychosocial resources were

significantly correlated with measures of spirituality across the board with one exception being the association between mastery and self-rated spiritual identity which was marginal but in the expected direction ($r=0.050, p = 0.052$).

Table 7.

Correlations of Religious and Spiritual Characteristics and Psychosocial Resources

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Religious attendance	1									
(2) Private religious behavior	0.455***	1								
(3) Religious identity	0.355***	0.471***	1							
(4) Spiritual identity	0.217***	0.493***	0.350***	1						
(5) Daily spiritual experiences	0.261***	0.389***	0.443***	0.473***	1					
(6) Strength/comfort	0.306***	0.404***	0.447***	0.386***	--	1				
(7) Divine presence	0.217***	0.351***	0.343***	0.451***	--	0.469***	1			
(8) Deep inner peace/harmony	0.190***	0.312***	0.284***	0.400***	--	0.440***	0.521***	1		
(9) T1 Mastery	-0.009	-0.004	0.011	0.050	0.171***	0.107**	0.096***	0.204***	1	
(10) T1 Self-Esteem	0.028	0.034	0.055*	0.061*	0.206***	0.121***	0.126***	0.256***	0.677***	1
(11) T2 Optimism	0.041	0.115***	0.037	0.156***	0.335***	0.221***	0.224***	0.359***	0.369***	0.383***

* $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Bivariate associations of religiousness and spirituality. The demographic characteristics of participants by continuous measures of religiousness and spirituality are shown in Table 8. Bivariate associations were computed for all women out of the total 2,399 participants with available data for relevant variables. Correlational analyses indicate that measures of religiousness were generally not associated with age, though one's self-rating of religious identity was significantly and inversely associated with age. Conversely, measures of spirituality were significantly and positively associated with age, though the correlations were small. Similarly, only one's religious identity was significantly associated with per capita household income and this association was negative whereas income was positively associated with both spiritual identity and daily spiritual experiences. The same pattern was observed for associations between years of education and religiousness and spirituality.

In sum, bivariate correlations demonstrated associations of religiousness and spirituality with greater age, income, and years of education. These analyses were conducted as a preliminary step before analyzing models described below to determine which variables needed to be considered as covariates in the structural equation models. Because income, age, and education are correlated in this sample, only income was used as a covariate in structural equation models. Furthermore, age in this sample is narrow as participants are all of reproductive age, thus, it is arguably not a good covariate.

Table 8.

Correlations of Continuous Demographic Characteristics and Religious and Spiritual Characteristics

	(9) age	(10) income*	(11) years education
(1) Religious attendance	-0.004	-0.045	-0.019
(2) Private religious behavior	0.047	-0.018	0.010
(3) Religious identity	-0.078**	-0.113***	-0.140***
(4) Spiritual identity	0.147***	0.099***	0.137***
(5) Daily spiritual experiences	0.179***	0.091**	0.106**
(6) Strength/comfort	0.090**	0.010	0.055
(7) Divine presence	0.082**	0.049	0.039
(8) Deep inner peace/harmony	0.135***	0.120***	0.096***
(9) Age	1	0.367***	0.429***
(10) log of per capita household income adjusted for cost of living [†]	0.367***	1	0.403***
(11) Years education	0.429***	0.403***	1

[†] Income was truncated at \$70,000.00; *p < 0.05; **p < 0.01; ***p < .001

Results of ANOVAs and t-tests revealed a typical pattern of association between religiousness and spirituality and study site, relationship status, and race/ethnicity. Religious attendance, private religious behavior, and religious identity all differed by center and race and in addition, private religious behavior differed by relationship status. In general, North Carolina and DC exhibited significantly higher levels of religiousness and spirituality than other sites and Chicago exhibited significantly lower levels than other sites (See Table 9), though levels were nearly indistinguishable by site in terms of their corresponding likert scale category. In general, being married was associated with higher religiousness and spirituality (See Table 10), however, in the case of private religious behaviors, married participants had lower levels than those not married. A similar pattern was observed for comparisons of women cohabiting to those not cohabiting, however, there was no significant difference for religious attendance or religious identity. Lastly, ANOVAs revealed that, in general, African American participants reported the highest levels of religiousness whereas White participants reported the lowest levels (See Table

11). African Americans also reported the highest levels of spirituality, however, Latinas reported the lowest levels.

Table 9.

ANOVAs for Religious and Spiritual Characteristics by Study Site

	Chicago		LA		NC		DC		Baltimore		<i>df</i>	<i>F</i>	<i>p</i>
Religious attendance	3.55 ^{ade}	(1.10)	3.87 ^{bde}	(3.87)	3.99 ^{be}	(3.99)	3.66 ^{abe}	(1.04)	3.76 ^{abcde}	(1.14)	4, 1028	5.76	<.001
Private religious behavior	1.13 ^{abd}	(1.06)	1.42 ^{abe}	(1.16)	2.03 ^e	(1.01)	1.73 ^{de}	(1.11)	1.63 ^{bde}	(1.12)	4, 1580	31.05	<.001
Religious identity	2.43 ^{abde}	(0.92)	2.58 ^{abcde}	(0.90)	2.73 ^{bde}	(0.88)	2.55 ^{abcde}	(0.89)	2.57 ^{abcde}	(0.90)	4, 1595	4.40	.002
Spiritual identity	2.70 ^{abe}	(0.84)	2.80 ^{abcde}	(0.88)	2.93 ^{abcde}	(0.84)	2.92 ^{bde}	(0.84)	2.83 ^{abcde}	(0.93)	4, 1594	4.02	.003
Daily spiritual experiences	3.95	(1.16)	4.07	(1.00)	4.16	(0.97)	4.23	(1.05)	4.12	(0.97)	4, 909	2.02	.089

Table 10.

t-tests Comparing Religious and Spiritual Characteristics of Married and Unmarried Participants

	Married		Not Married		<i>t</i>	<i>df</i>	<i>p</i>
Religious attendance	3.78	(1.12)	3.72	(1.02)	-0.76	976	0.447
Private religious behavior	1.36	(1.15)	1.68	(1.10)	5.41	1527	<.001
Religious identity	2.64	(0.98)	2.53	(0.90)	-2.20	1511	0.029
Spiritual identity	2.99	(0.84)	2.77	(0.88)	-4.60	1510	<.001
Daily spiritual experiences	4.22	(1.09)	4.02	(1.02)	-2.72	867	0.007

Table 11.

ANOVAs for Religious and Spiritual Characteristics by Race/Ethnicity

	African American		Latina		White				
							<i>df</i>	<i>F</i>	<i>p</i>
Religious attendance	3.83 ^{ab}	(1.03)	3.80 ^{ab}	(1.08)	3.51 ^c	(1.13)	2, 1030	7.56	<.001
Private religious behavior	1.97 ^a	(1.02)	1.34 ^b	(1.11)	0.87 ^c	(0.98)	2, 1582	155.09	<.001
Religious identity	2.68 ^a	(0.92)	2.56 ^b	(0.75)	2.26 ^c	(1.04)	2, 1597	27.80	<.001
Spiritual identity	2.91 ^{ac}	(0.88)	2.66 ^b	(0.78)	2.82 ^{ac}	(0.91)	2, 1596	11.00	<.001
Daily spiritual experiences	4.20 ^{ac}	(1.01)	3.98 ^{bc}	(1.04)	3.99 ^{ac}	(1.11)	2, 911	4.91	0.008

Bivariates of psychosocial resources. The demographic characteristics of participants by continuous measures of psychosocial resources are shown in Table 12. In general, psychosocial resources were significantly and positively associated with age, income, and years of education, though these associations were small.

Table 12.

Correlations of Continuous Demographic Characteristics and Religious and Spiritual Characteristics

	(6) age	(7) income	(8) years education
(1) T1 Mastery	0.097***	0.156***	0.270***
(2) T1 Self-Esteem	0.072***	0.117***	0.197***
(3) T2 Optimism	0.171***	0.177***	0.234***
(4) Age	1	0.367***	0.429***
(5) log of per capita household income adjusted for cost of living [†]	0.367***	1	0.403***
(6) Years education	0.429***	0.403***	1

[†] Income was truncated at \$70,000.00; *p < 0.05; **p < 0.01; ***p < .001

Results of ANOVAs and t-tests revealed a generally consistent pattern. In terms of site differences, participants in DC generally had the highest levels of psychosocial resources, though this was not the case for mastery (see Table 13). As with religiousness and spirituality, married participants had higher levels of all psychosocial resources than non-married participants (See Table 14). These differences were evident for cohabitation status as well, though for self-esteem, the difference was only marginal. There was a consistent pattern of differences in psychosocial resources by race/ethnicity as well: White and African American participants tended to have similar levels of psychosocial resources and both had higher levels than Latina women (see Table 15).

Table 13.

ANOVAs for Psychosocial Resource Characteristics by Study Site

	Chicago		LA		NC		DC		Baltimore		<i>df</i>	<i>F</i>	<i>p</i>
Mastery	27.64	(4.02)	28.37	(4.03)	28.14	(4.23)	28.28	(4.16)	27.99	(3.95)	4, 2280	2.33	0.054
Self-esteem	25.56 ^{abe}	(3.19)	25.86 ^{abcde}	(2.96)	26.15 ^{bcde}	(3.17)	26.41 ^{bcd}	(3.27)	25.57 ^{abce}	(3.05)	4, 2280	6.77	<0.001
Optimism	31.17 ^{abcde}	(5.23)	31.34 ^{abcde}	(5.05)	30.57 ^{abde}	(4.97)	31.91 ^{abd}	(5.15)	30.41 ^{abce}	(5.15)	4, 1596	4.66	<0.001

Table 14.

t-tests Comparing Psychosocial Resource Characteristics of Married and Unmarried Participants

	Married		Not Married		<i>t</i>	<i>df</i>	<i>p</i>
Mastery	28.52	(3.89)	27.85	(4.15)	-3.67	2280	<.001
Self-esteem	26.21	(2.99)	25.75	(3.22)	-3.25	2280	.001
Optimism	32.35	(5.10)	30.53	(5.06)	-6.52	1512	<.001

Table 15.

ANOVAs for Psychosocial Resource Characteristics by Race/Ethnicity

	African American		Latina		White		<i>df</i>	<i>F</i>	<i>p</i>
Mastery	28.34 ^{ac}	(4.13)	26.97 ^b	(4.06)	28.58 ^{ac}	(3.76)	2, 2282	277.28	<.001
Self-esteem	26.16 ^{ac}	(3.15)	25.21 ^b	(3.02)	25.99 ^{ac}	(3.18)	2, 2282	17.89	<.001
Optimism	30.97	(5.08)	30.88	(5.69)	31.51	(4.72)	2, 1598	1.76	0.173

Latent Factors

As a preliminary step to estimating models for hypothesis testing, latent factors representing religiousness and spirituality and psychosocial resources were developed. These factors are used in all or most of the analyses in Studies 1, 2, and 3.

Religiousness and spirituality. Pairwise correlation analyses indicated that measures of religiousness and spirituality were significantly correlated with one another as displayed in Table 7. Correlations ranged from 0.190 to 0.493 and all were significant at the $p < .001$ level. Measures of religiousness correlated with each other from 0.355 to 0.471. Measures of spirituality correlated with each other from 0.386 to 0.473. Measures of religiousness correlated with measures of spirituality from 0.190 to 0.447 with the smallest associations being between religious attendance and individual spiritual experiences. These correlations supported the creation of a latent factor representing religiousness and spirituality using all measures of religiousness and spirituality. One of the exploratory aims of the studies was to explore the predictive value of religiousness and spirituality individually. To facilitate this, two additional factors were created with religiousness and spirituality indicators separated.

Religiousness/spirituality factor. For the purposes of this study, the three spiritual experiences from the Daily Spiritual Experiences Scale were included as separate indicators of the religiousness/spirituality factor to be consistent with the single-item nature of the majority of the other measures of religiousness and spirituality. Private religious behaviors was included as a count variable created from three single items which were dichotomous, and thus, could not easily be used as single indicators. Thus, the latent factor of religiousness and spirituality had the following indicators: religious attendance, private religious behavior, religious identity, spiritual identity, finding strength/comfort in one's religion, experiencing a divine presence, and

experiencing deep inner peace/harmony. To test this latent factor, a structural equation measurement model was estimated in Stata 13. All factor loadings were significant, above 0.40, and in the expected directions and fit was acceptable for a latent factor (CFI=0.874). The sample size for factor analysis was limited by missingness of the indicators; sample size for this factor was 705. The measurement model is shown in Figure 3.

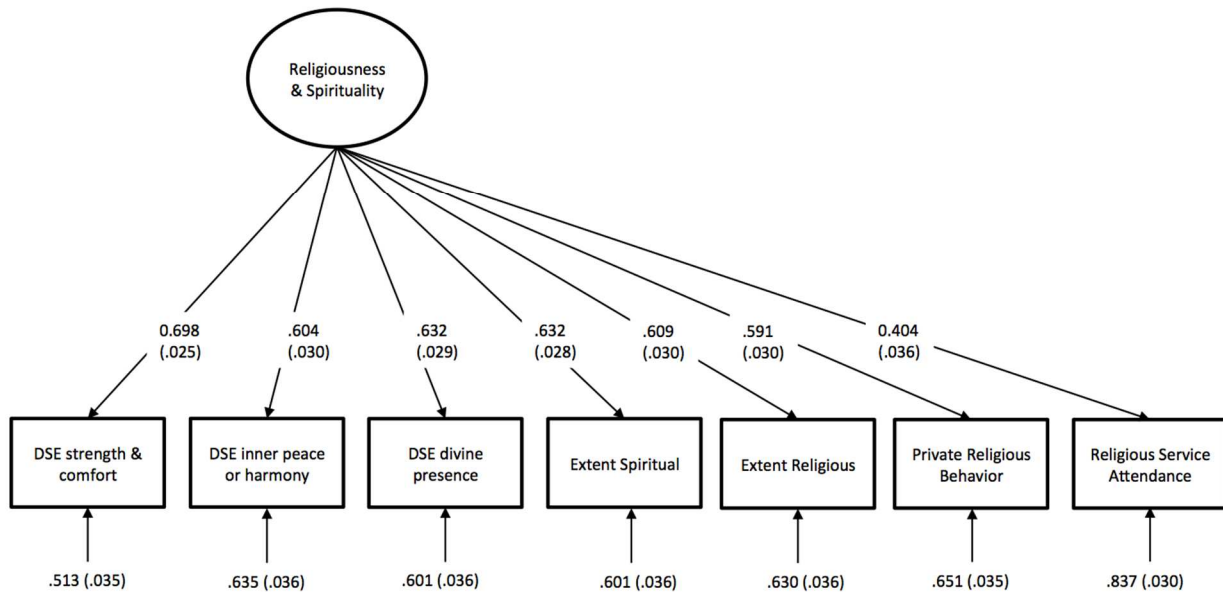


Figure 3. Factor loadings for the measurement model of religiousness and spirituality.

Religiousness factor. The latent factor of religiousness had the following indicators: religious attendance, private religious behavior, and religious identity. All factor loadings were significant, above 0.55, and in the expected directions and fit was excellent (CFI=1.00). Sample size for this factor was 799.

Spirituality factor. The latent factor of spirituality had the following indicators: spiritual identity, finding strength/comfort in one’s religion, experiencing a divine presence, and

experiencing deep inner peace/harmony. All factor loadings were significant, above 0.50, and in the expected directions and fit was excellent (CFI=0.995). Sample size for this factor was 914.

Although fit was better for the latent factors that treat religiousness and spirituality separately, hypotheses were tested with the latent factor that represented religiousness and spirituality together in order to test the original hypotheses. In order to explore whether religiousness and/or spirituality were separately associated with the outcomes in question, final models were tested and reported with separate religiousness and spirituality latent factors.

Psychosocial resources. Pairwise correlation analyses indicated that total scores of measures of psychosocial resources were significantly correlated with one another as displayed in Table 7. Correlations ranged from 0.383 to 0.677 and all were significant at the $p < .001$ level. These correlations support the creation of a latent factor representing psychosocial resources using measures mastery, optimism, and self-esteem. To test this latent factor, a structural equation measurement model was estimated in Stata 13. All factor loadings were significant and in the expected directions and fit was good (CFI=0.980). All factor loadings were significant, above 0.45, and in the expected directions and fit was excellent (CFI=1.00).

Test of Hypothesis 1

Hypothesis 1. *Religiousness and spirituality will be associated with higher levels of mastery, optimism, and self-esteem.*

To test Hypothesis 1 and determine whether religiousness/spirituality are associated with psychosocial resources, structural equation modeling was used. The two latent factors and their association were modeled. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

First, a structural equation model in which religiousness/spirituality predicted psychosocial resources was tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was marginal (CFI=0.886) and the association between religiousness and psychosocial resources was significant and positive ($\beta=0.201, p < .001$). Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of five theoretically consistent modifications: all correlations between indicators of the latent variable representing religiousness and spirituality (four total: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity) and one correlation between indicators of the latent variable representing psychosocial resources (self-esteem with mastery).

A second model was run that included the five suggested correlations. This model had acceptable fit to the data (CFI=0.961) and all factor loadings and regression coefficients were significant, in particular, the association of religiousness/spirituality and psychosocial resources was significant and positive ($\beta=0.397, p < .001$), consistent with Hypothesis 1. Models were recalculated to examine whether inclusion of income would alter the findings. Income was significantly associated with higher religiousness and spirituality and its inclusion did impact the fit by lowering it. Income was included in the final model. See Figure 4 for coefficients and detailed fit statistics.

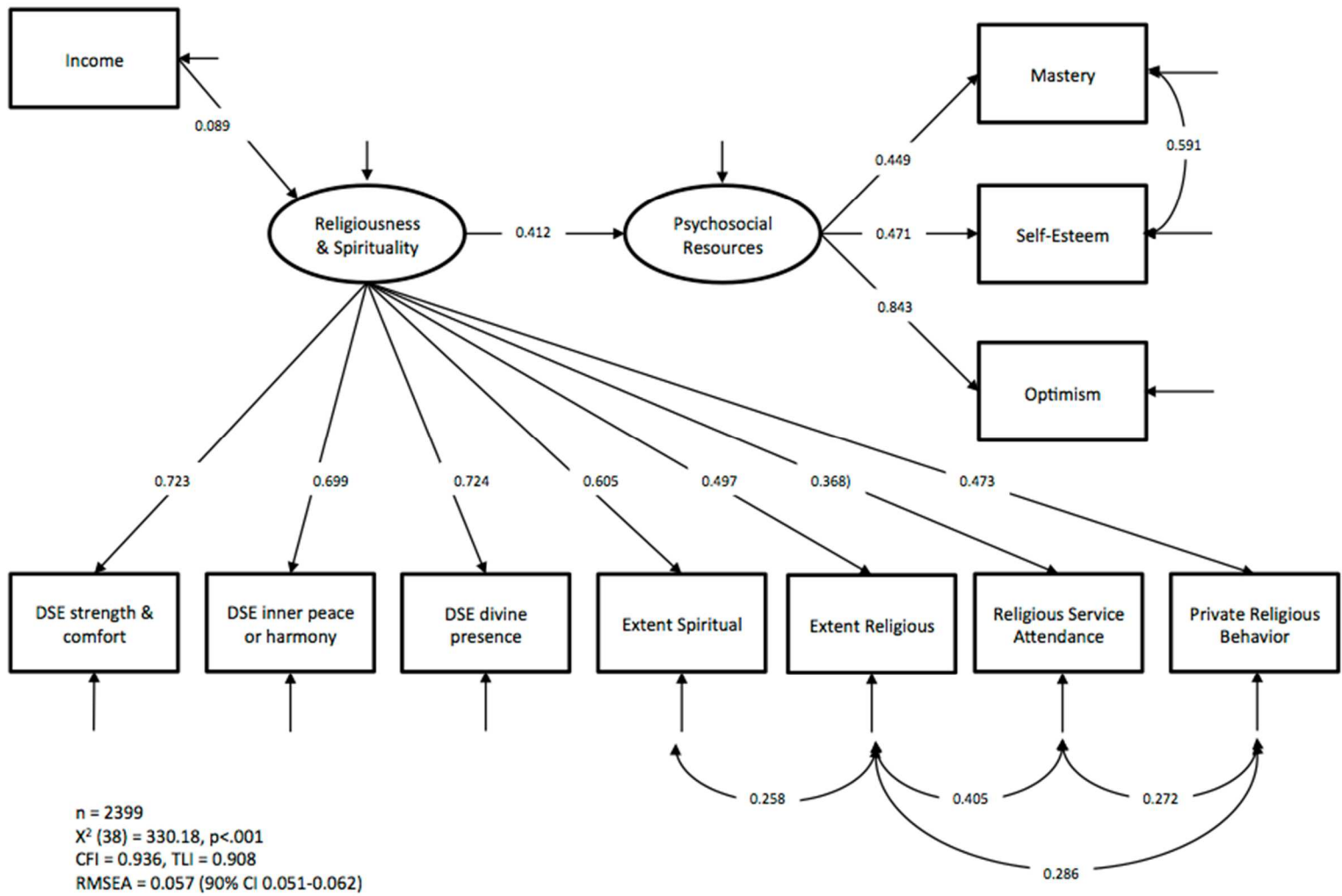


Figure 4. Structural equation model of the association of religiousness and spirituality and psychosocial resources

Exploratory aims. To address the possibility that religiousness and spirituality would separately be associated with psychosocial resources, the final model was estimated two more times, once with the four measures of religiousness constituting a latent factor indexing religiousness and once with the three measures of spirituality constituting a latent factor of spirituality.

Though the model of religiousness alone had a good fit to the data (CFI=0.951), the religiousness factor was not significantly associated with the psychosocial resources latent factor ($\beta = 0.050, p = 0.132$). Note that in this model, no correlations between indicators of religiousness were estimated because they were unnecessary without indicators of spirituality present. In contrast, spirituality alone was significantly associated with psychosocial resources ($\beta = 0.474, p < .001$) and this model also had good fit (CFI=.957). In the individual studies reported below, religiousness and spirituality are tested together and separately as predictors.

Chapter Five

Study 1: Religiousness, Spirituality and Depression

Hypotheses 2a and b: *Religiousness and spirituality are hypothesized to be associated with lower depressive symptoms and favorable trajectories of depressive symptoms throughout the postpartum period.*

Hypotheses 3a and 3b: *The psychosocial resources of optimism, mastery, and self-esteem will mediate the associations of religiousness and spirituality with depressive symptoms.*

Exploratory aim: Differential associations of religiousness and spirituality with depressive symptoms will be examined.

Methods

Hypotheses 2 and 3 were tested in the full CCHN sample of 2,399 postpartum women.

Measures

Depressive symptoms. At the T1, T2, and T3 visits, the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) was administered to participants verbally or via written questionnaire. The EPDS is a screening instrument validated for use during the first year postpartum by both mothers and fathers and consists of 10 items that pertain to the severity of common depressive symptoms (e.g., difficulty sleeping due to unhappiness, looking forward with enjoyment to things; See Appendix). Respondents are asked to choose one of four responses that best describes how they have been feeling in the past 7 days. Total possible scale scores range from 0 to 30. The Cronbach alpha coefficients for the scale were above 0.80 at each timepoint in African American women in this sample (Cheadle et al., 2015). In addition, a categorical depression index was created which categorized respondents as not depressed (scores

0-8), possible depression (scores 9-12), or probable depression (scores of 13 or greater, or endorsement of suicidal thoughts).

Data Analysis

Data analysis for these hypotheses included univariate and bivariate techniques and culminated in model testing using multivariate structural equation models. First, frequencies and descriptive statistics were used to summarize data on depression. Correlational analyses and ANOVAs were used to test bivariate associations between depression and other study variables. Lastly, structural equation models using maximum likelihood estimation were used to test hypotheses by modeling associations between religiousness and spirituality, psychosocial resources, and depression as described in detail for each analysis below. Maximum likelihood estimation allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used for all structural equation models.

Study One Results

Descriptive Statistics

Depressive symptoms. Descriptive statistics for depressive symptom measures are provided in Table 16 and Table 17. These data were missing for 17% of the sample at the first study visit and for 40% of the sample at the respective visits with the increase attributable to sample attrition. At 1 month after birth, the mean EPDS score was 4.62 ($SD = 4.62$) and a majority (84.5%) of mothers' scores fell below 9 and thus these mothers were categorized as non-depressed. Almost 8% (7.9%) of mothers' scores fell between 9 and 12, or in the possible depression range, and 7.6% of mothers had scores above 12 and were categorized as probably depressed at time of the T1 visit. Mean EPDS scores did not increase substantially from T1 to T2

($M = 5.01$) or T3 ($M = 4.81$). At T2, a majority of mothers were categorized as non-depressed (84.5%), 8% of mothers had possible depression, and nearly 9% (8.6%) of women were categorized as probably depressed. At T3, a majority of women were categorized as non-depressed (83.1%), 7% of women were categorized as possibly depressed, and nearly 10% (9.8%) were categorized as probably depressed. Thus, although most mothers were likely not depressed at each timepoint, a small but important percentage of women were possibly or probably depressed at each timepoint.

Table 16.

Depressive Symptom Characteristics

	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% missing
T1 EPDS	2188	4.62	4.62	0	26	1.26	4.65	17% (488)
T2 EPDS	1602	5.01	4.62	0	29	1.22	4.78	40% (1034)
T3 EPDS	1585	4.81	4.70	0	26	1.27	4.63	40% (1051)

Note. EPDS = Edinburgh Postnatal Depression Scale

Table 17.

Depressive Symptom Category Characteristics

	<i>n</i>	%
T1		
Not depressed	1849	84.5
Possible depression	173	7.9
Probable depression	166	7.6
T2		
Not depressed	1337	83.5
Possible depressed	127	7.9
Probably depressed	138	8.6
T3		
Not depressed	1317	83.1
Possible depressed	113	7.1
Probably depressed	155	9.8

Bivariate associations. The demographic characteristics of participants by continuous EPDS score is reported in Table 18. Bivariate associations were computed for all women out of the total 2,399 participants with available data for relevant variables.

Correlational analyses indicated that depressive symptom level (EPDS score) at no timepoint was significantly associated with age. In contrast, at each timepoint, both per capita household income [adjusted for cost of living, truncated at \$70,000 and log transformed due to skewness] and years of education were significantly and inversely associated with depressive symptom levels at each timepoint.

In sum, bivariate correlations demonstrated associations of depression with income and years of education. These analyses were conducted as a preliminary step before analyzing models described below to determine which variables were uniquely predictive of depressive symptom scores and, thus, needed to be considered as covariates in the structural equation models. Because income and education are correlated in this sample, only income was used as a covariate in structural equation models.

Table 18.

Correlations of Depressive Symptom Scores and Continuous Demographic Characteristics

	(1)	(2)	(3)	(4)	(5)
(1) T1 EPDS	1				
(2) T2 EPDS	0.473***	1			
(3) T3 EPDS	0.424***	0.523***	1		
(4) Age	-0.014	-0.025	0.037	1	
(5) log of per capita household income adjusted for cost of living [‡]	-0.086***	-0.116***	-0.064*	0.367***	1
(6) Years education	-0.049*	-0.103***	-0.026*	0.429***	0.403***

[‡] Income was truncated at \$70,000.00; *p < 0.05; **p < 0.01; ***p < .001

Note. EPDS = Edinburgh Postnatal Depression Scale

Results of ANOVAs and t-tests revealed that depression scores at each timepoint did not generally differ by race/ethnicity, marital status, or cohabitation status, but did differ by study site. Specifically, depression scores did not differ by race/ethnicity at one or six months postpartum (T1 or T2), but at 12 months postpartum (T3), Latina women had higher scores ($M = 5.47, SD = 4.43$) than did African American women ($M = 4.50, SD = 4.87$), $F(2, 1582) = 5.82$,

$p = 0.003$. Depressive symptom scores did not differ by marital status at T1 and T3, however, at six months postpartum (T2), unmarried women had significantly higher depressive symptom scores ($M = 4.80$, $SD = 4.87$) compared to married women ($M = 4.68$, $SD = 4.30$), $t(1512) = 2.83$, $p = 0.005$. Depressive symptom scores did not differ by cohabitation status at 1 month postpartum, however, at six and 12 months postpartum, cohabiting women (six months $M = 4.76$, $SD = 4.31$; 12 months $M = 4.58$, $SD = 4.47$) had lower depressive symptom scores than those not living with their babies' fathers (six months $M = 5.19$, $SD = 4.89$; 12 months $M = 5.04$, $SD = 4.99$); six months postpartum, $t(1506) = 1.77$, $p = 0.038$; 12 months postpartum, $t(1521) = 1.84$, $p = 0.033$. Study sites did show differences in depression scores at each time point (see Table 19). At 1 month after the birth of the baby, women at all sites (Chicago, LA, North Carolina, DC) had higher depression scores than women in Baltimore. At six months postpartum, women in Los Angeles had marginally higher depression scores than women in Baltimore, however, there were no differences in depression scores across the other sites. At 12 months postpartum, women in Chicago, LA, and DC had significantly higher depression scores than women in Baltimore and women in Chicago had significantly higher scores than women in North Carolina.

Correlational analyses were also conducted to determine how depression was associated with markers of religiousness and spirituality and psychosocial resources at each time point (see Table 20). These bivariate analyses revealed that EPDS scores at 1 month postpartum were significantly associated with levels of daily spiritual experiences as well as levels of mastery and self-esteem at one month postpartum and optimism at six months. Similarly, EPDS scores at six months postpartum were associated with levels of daily spiritual experiences, religious identity, mastery, optimism, and self-esteem. Depression scores at 12 months were associated with levels

of religious attendance, private religious behavior, daily spiritual experiences, mastery, optimism, and self-esteem.

Hypothesis Testing on Depression

To determine whether the latent Religiousness/Spirituality factor predicted depressive symptoms, structural equation modeling was used. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

Trajectories of depressive symptoms. First, a longitudinal growth curve (LGC) model in which religiousness/spirituality predicted women's trajectories of depressive symptoms over the first year of their babies' lives was tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was not ideal (CFI=0.880) and all of the factor loadings and regression coefficients were significant in the expected direction.

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity.

A second LGC model was run that included these four correlations as well as income as a covariate. This model had acceptable fit (CFI=0.926) and all of the factor loadings and regression coefficients were significant excepting the effect of income on depression slope. In particular, the R/S factor significantly predicted a lower intercept of depressive symptoms ($\beta = -0.182, p < .001$) as well as a negative or decreasing slope, or trajectory, of depressive symptoms from 1 to 6 to 12 months postpartum ($\beta = -0.135, p = 0.037$). The effect of income on the slope of depression was marginal ($\beta = -0.088, p = 0.055$) and in the expected direction.

Table 19.

ANOVAs for Depressive Symptom Scores by Study Site

	Chicago		LA		NC		DC		Baltimore		<i>df</i>	<i>F</i>	<i>p</i>
T1 EPDS	4.83 ^{abcd}	(4.70)	5.22 ^{abcd}	(4.76)	5.19 ^{abcd}	(4.76)	4.64 ^{abcd}	(4.72)	3.42 ^e	(4.33)	(4, 2183)	11.39	<.001
T2 EPDS	5.24 ^{abcde}	(4.50)	5.47 ^{abcd}	(4.25)	4.77 ^{abcde}	(4.83)	5.32 ^{abcde}	(4.72)	4.38 ^{acde}	(4.65)	(4, 1597)	3.07	0.016
T3 EPDS	5.82 ^{abd}	(4.62)	5.14 ^{abcd}	(4.23)	4.31 ^{bcde}	(4.90)	5.30 ^{abcd}	(4.74)	3.42 ^{ce}	(4.55)	(4, 1580)	14.72	<.001

Note. EPDS = Edinburgh Postnatal Depression Scale

Table 20.

Correlations of Religiousness and Spirituality, Psychosocial Resources, and Depressive Symptoms

	(1)	(2)	(3)
(1) T1 EPDS	1		
(2) T2 EPDS	0.473***	1	
(3) T3 EPDS	0.424***	0.523***	1
(4) Religious attendance	-0.005	-0.060	-0.119***
(5) Private religious behavior	-0.006	-0.053	-0.075**
(6) Daily spiritual experience	-0.176***	-0.216***	-0.169***
(7) Religious identity	0.042	-0.087***	-0.046
(8) Spiritual identity	0.039	-0.031	-0.042
(9) T1 Mastery	-0.423***	-0.297***	-0.287***
(10) T2 Optimism	-0.303***	-0.458***	-0.295***
(11) T1 Self-esteem	-0.412***	-0.301***	-0.259***

* $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Note. EPDS = Edinburgh Postnatal Depression Scale

Models were recalculated to examine whether inclusion of income as a covariate and exclusion of women using SSRI antidepressants who could alter the findings because women on SSRIs had higher depression scores. Coefficients and fit statistics did not differ significantly depending on inclusion of income, though fit was improved when income was not included. Exclusion of SSRIs did not impact the model when income was not included, however, when income was included as a covariate and women using SSRI antidepressants were excluded, the effect of income on depression was significant rather than marginal ($\beta = -0.080, p = 0.042$) and the effect of religiousness and spirituality and depression slope was marginal ($\beta = -0.107, p = 0.058$); the effect of religiousness and spirituality on the intercept of depression remained significant ($\beta = -0.188, p < .001$). No adjustments were made on the basis of these findings, thus, the final model included women on antidepressants and income as a covariate. See Figure 5 for coefficients and detailed fit statistics.

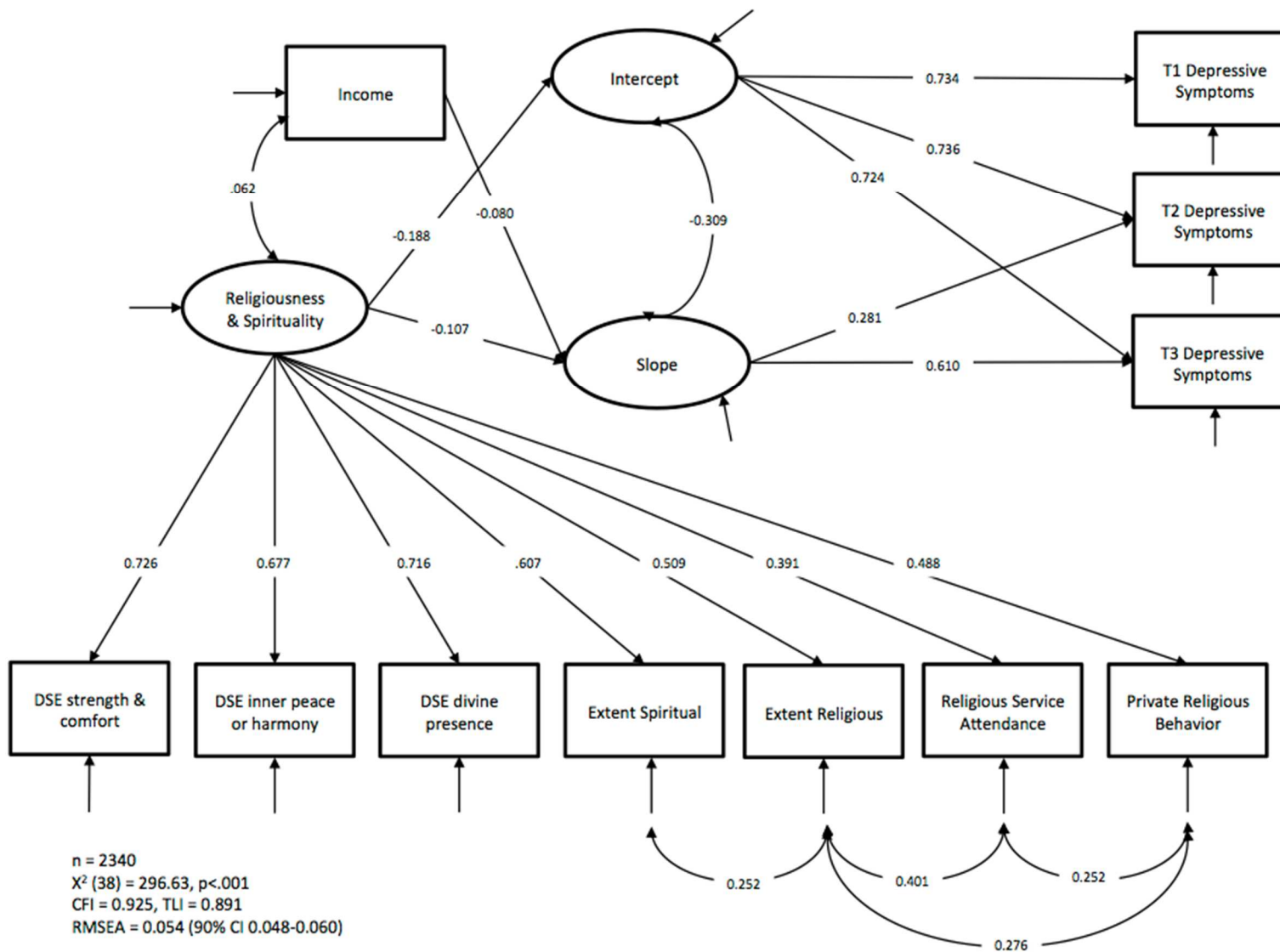


Figure 5. Structural equation model of religiousness and spirituality predicting the trajectory of depressive symptoms over the year postpartum

Depressive symptoms throughout the postpartum year. Because trajectories of depressive symptoms did not vary substantially between participants, Hypothesis 2 was also tested using a latent factor of depressive symptoms created by using EPDS scores at each timepoint as indicators. This model was run without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was not good (CFI=0.895). Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity.

A second model was tested with the suggested modifications and with income as a covariate. This model had acceptable fit in the data (CFI=0.934). All factor loadings and regression coefficients were significant, and in particular, the religiousness and spirituality factor predicted lower levels of depressive symptoms as indexed by the latent factor ($\beta=-0.236$, $p < .001$). Income was associated with lower depressive symptoms as indexed by the latent factor ($\beta=-0.124$, $p < .001$). Models were recalculated to examine whether exclusion of women using SSRI antidepressants would alter the findings. Coefficients and fit statistics did not differ significantly depending on exclusion of women on SSRI antidepressants.

Mediation by psychosocial resources. As a preliminary step to testing the hypothesized mediation model, initial models were run to test whether the proposed mediator, psychosocial resources, predicted depressive symptoms. Because the slope of depressive symptoms did not vary adequately to test prediction of the slope, I tested the association of psychosocial resources to depressive symptoms as indexed by a latent factor. All models were run in the full sample of

2,399 women using maximum likelihood to account for missing values. Because these models are part of a preliminary step to testing mediation, results are described but the model is not presented in full. The model was first tested without inclusion of covariates and had acceptable fit in the data (CFI=0.928). All factor loadings and regression coefficients were significant, and in particular, the psychosocial resource factor predicted lower levels of depressive symptoms as indexed by the latent factor ($\beta = -0.655, p < .001$).

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of one theoretically consistent modification, the correlation between two of the latent variable representing psychosocial resources: Self-esteem and mastery scores, both at 1 month postpartum. A second model was run that included this correlation as well as income as a covariate predicting depressive symptoms. This model had good fit in the data (CFI=0.961) and all factor loadings and regression coefficients were significant. Depressive symptoms were predicted negatively by psychosocial resources as indexed by a latent factor ($\beta = -0.850, p < .001$) and, unexpectedly, positively by income ($\beta = 0.073, p = 0.007$).

Models were recalculated to examine whether inclusion of income as a covariate and exclusion of women using SSRI antidepressants would alter the findings. Coefficients and fit statistics did not differ significantly depending on inclusion of income as a covariate. Exclusion of women using SSRI antidepressants slightly improved fit, but did not affect estimates of effects. No adjustments were made on the basis of these findings, thus, the final model included women on antidepressants and income as a covariate.

Lastly, the full hypothesized mediation model was tested to determine whether the association of religiousness and spirituality to depressive symptoms as indexed by a latent factor

would be explained by psychosocial resources. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

The mediation model was first tested using the modifications established in previous models: indicators were allowed to correlate as in the final models illustrating associations of religiousness and spirituality and psychosocial resources to depressive symptoms as indexed by a single factor. This model evidenced good fit (CFI=0.938) and all factor loadings and regression coefficients were significant. In particular, the total effect of religiousness and spirituality on depressive symptoms was significant and in the expected direction ($\beta = -0.248, p < .001$) as was the effect of psychosocial resources on depressive symptoms ($\beta = -0.882, p < .001$). In order to determine whether there was evidence for mediation, the direct and indirect effects of religiousness and spirituality on depressive symptoms were calculated. Interestingly, the direct effect of religiousness and spirituality on depressive symptoms was positive ($\beta = 0.127, p = 0.001$) whereas the indirect effect of religiousness and spirituality on depressive symptoms through psychosocial resources was negative ($\beta = -0.375, p < .001$). This pattern of effects is indicative of “inconsistent mediation” which is a type of mediation, however it is distinct from consistent mediation in which the direct and mediated effects have the same sign (MacKinnon, Krull, & Lockwood, 2000).

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested no theoretically consistent modifications. Models were recalculated to examine whether inclusion of income as a covariate and exclusion of women using SSRI antidepressants would alter the findings. Inclusion of income reduced the fit of the model slightly and was not found to have a significant effect on income itself. Exclusion of women using SSRI antidepressants slightly improved fit. No adjustments were made on the basis

of these findings; thus, the final model included women on antidepressants and did not include income as a covariate. See Figure 6 for coefficients and detailed fit statistics.

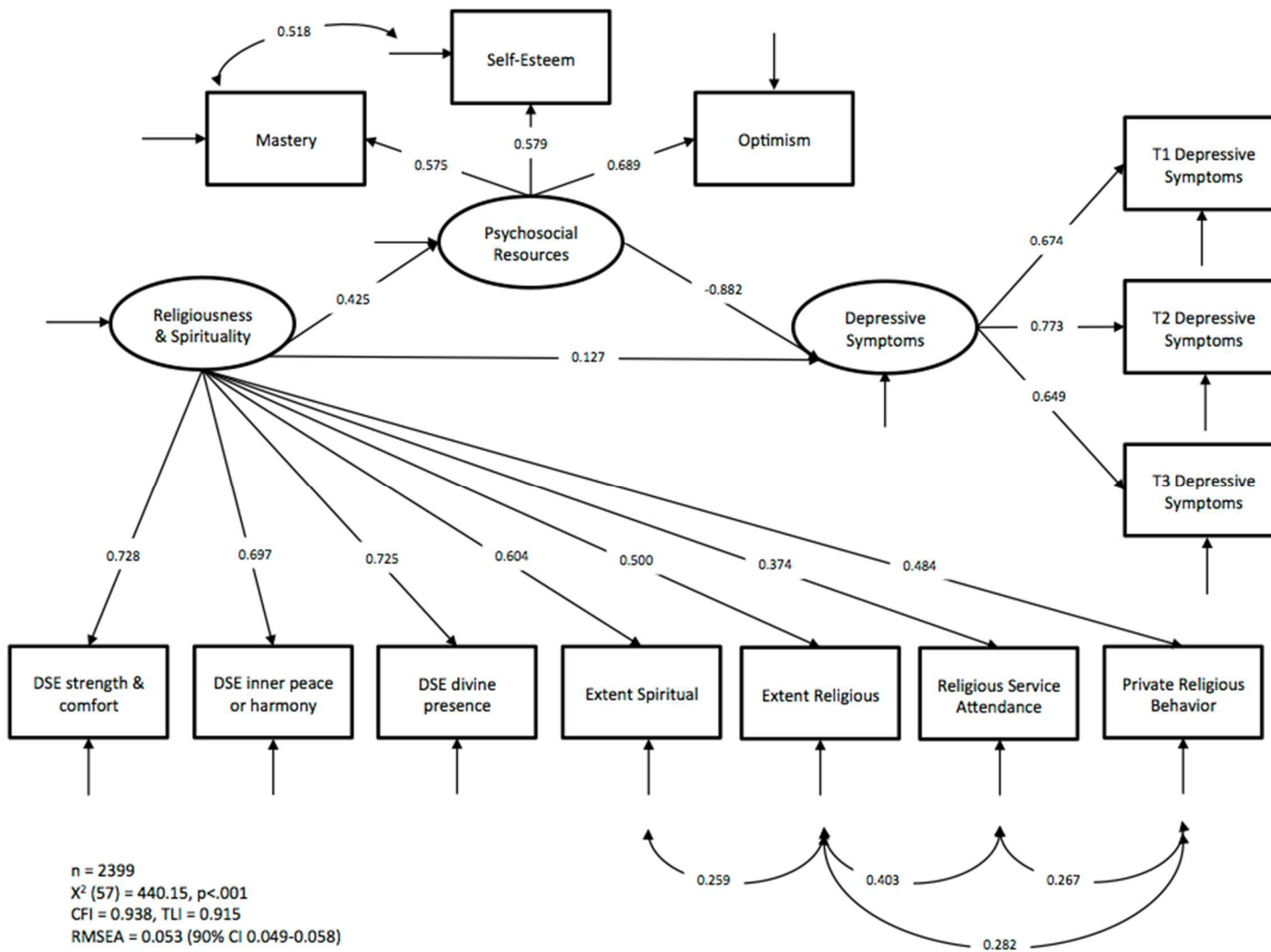


Figure 6. Structural equation model of psychosocial resources mediating the association of religiousness and spirituality and depressive symptoms

Exploration of religiousness and spirituality separately. To address the hypothesis that religiousness and spirituality would separately predict depressive symptoms, and that this association would be mediated by psychosocial resources, the final model of the latent factor of depressive symptoms was estimated two more times, once with the four measures of religiousness constituting a latent factor indexing religiousness and once with the three measures of spirituality constituting a latent factor of spirituality.

In the full mediation model which had good fit (CFI=0.959), religiousness alone did predict depressive symptoms indexed by a latent factor (total effect, $\beta = -0.108$, $p = 0.001$) as did psychosocial resources ($\beta = -0.831$, $p < .001$). However, the direct effect of religiousness was near zero with psychosocial resources in the model ($\beta = -0.002$, $p = 0.958$). The indirect effect of religiousness through psychosocial resources, was also significant ($\beta = -0.109$, $p < .001$), evidencing nearly full mediation. [Note: in this model, no correlations between indicators of religiousness were estimated. They were unnecessary without indicators of spirituality present.]

In the full mediation model which had acceptable fit (CFI=0.945), spirituality alone predicted lower depressive symptoms indexed by a latent factor (total effect, $\beta = -0.274$, $p < .001$) as did psychosocial resources ($\beta = -0.903$, $p < .001$). However, the direct effect of spirituality was positive with psychosocial resources in the model ($\beta = 0.160$, $p < .001$). The indirect effect of religiousness through psychosocial resources was also significant but negative ($\beta = -0.434$, $p < .001$), evidencing inconsistent mediation.

Study One Discussion

The aims of Study 1 were to determine whether religiousness and spirituality were associated with symptoms of depression and their trajectories in postpartum women and to test whether this association was mediated by psychosocial resources (Hypotheses 2 and 3). I

hypothesized that religiousness and spirituality would predict lower depressive symptoms at each timepoint, and that religiousness and spirituality would predict favorable trajectories of depressive symptoms over the year after birth. Further it was hypothesized that psychosocial resources (optimism, mastery, and self-esteem) would mediate the associations of religiousness and spirituality with depressive symptoms. These hypotheses were confirmed for depressive symptoms at individual timepoints and partially confirmed for trajectories of depressive symptoms.

On the whole, mothers in this sample were not highly depressed, as they exhibited a few symptoms of mild severity on average at all points throughout the postpartum period. Furthermore, there was little variability in slope of depressive symptoms over time, or little change upwards or downwards. These characteristics make it more difficult to identify statistically significant predictors. Nonetheless, religiousness and spirituality, when combined, predicted a decreasing trajectory of depressive symptoms from one to six months and six to 12 months postpartum despite the low variability in slopes of depressive symptoms among participants. In addition, religiousness and spirituality when combined predicted lower depressive symptoms on the whole using a latent factor indicated by depressive symptom scores at one, six, and 12 months. The effect of religiousness and spirituality on depressive symptoms was stronger for the latent factor than for the trajectories, though both models had adequate fit. This is consistent with Hypotheses 2a and 2b.

Consistent with Hypothesis 3, the psychosocial resources latent factor mediated the observed association between religiousness and spirituality and depressive symptoms at one, six, and 12 months postpartum. This means that postpartum women who have greater religiousness and spirituality have significantly higher levels of the psychosocial resources of mastery,

optimism, and self-esteem, and that these psychosocial resources, in turn, predict significantly lower depressive symptoms.

An exploratory aim of this study was to examine differential associations with depressive symptoms and psychosocial resources by religiousness and spirituality measured separately. As hypothesized, both religiousness and spirituality separately predicted depressive symptoms and both of these associations were mediated by psychosocial resources. The sizes of the effects differed somewhat with spirituality having a stronger effect.

The finding that religiousness and spirituality, together and separately, are associated with lower depressive symptoms in postpartum women has not been tested before in the way it was here. Although there is a strong literature that shows a small and negative effect of religiousness on depressive symptoms (Smith, McCullough, & Poll, 2003), very few studies have tested similar effects of spirituality (Baetz et al., 2006; Miller & Wickramaratne, 2012; Mofidi et al., 2006; Sternthal et al., 2010). Furthermore, a handful of studies have documented these associations in postpartum women, but these studies have been limited by small samples and measurement of spirituality with single item or single dimension measures (Mann et al., 2007; cf. Jesse & Swanson, 2007; Jesse et al., 2005). In a previous study of the African American women in the CCHN data, I and my coauthors showed that religiousness and spirituality independently predicted favorable trajectories of depressive symptoms (Cheadle et al., 2015). The present study extends these findings to the full, diverse sample of White, Latina, and African American women in CCHN and adds in other ways.

Specifically, this study produced new evidence consistent with a meditational pathway or strengthening the associations of religiousness and spirituality with depressive symptoms, via higher psychosocial resources among more religious and/or spiritual women. Research in general

populations has supported the hypothesis that psychosocial resources may be a mechanism of the associations of religiousness and spirituality and depression by testing associations of religiousness and spirituality and psychosocial resources, often individually, and associations of psychosocial resources and health. However, few studies have tested full meditational pathways and few if any have used multidimensional measures of psychosocial resources or religiousness and spirituality. Moreover, no studies were identified that tested mechanisms of this association in postpartum women. In sum, Study 1 showed that religiousness and spirituality are associated with lower depressive symptoms in postpartum women and that psychosocial resources are a mechanism of this association.

Chapter Six: Study 2: Religiousness, Spirituality, and Inflammation

Hypotheses 4a and 4b: *Both religiousness and spirituality are hypothesized to be independently associated with CRP at six and 12 months postpartum.*

Hypothesis 5a and 5b: *The psychosocial resources of optimism, mastery, and self-esteem are hypothesized to mediate the associations of religiousness and spirituality with cortisol slope.*

Exploratory aim: Differential associations of religiousness and spirituality with depressive symptoms will be examined.

Methods

Hypotheses were tested in the full CCHN sample of 2,399 postpartum women.

Measures

Inflammation. High sensitivity C-reactive protein (hsCRP) was measured in finger stick blood spots provided by participants at six months (T2) and 1 year postpartum (T3). This method offers an efficient and convenient way to measure CRP in community populations because venipuncture is not required and nonmedical personnel can collect samples. Blood spot levels of hsCRP have shown strong correlations with serum levels of hsCRP (Kapur, Kapur, & Zava, 2008; McDade, Burhop, & Dohnal, 2004). In this study, the participant's finger was pricked with a sterile contact-activated lancet (commonly used by diabetics to test blood glucose levels) and five or more drops of blood were spotted onto blood spot collection cards purchased from Ahlstrom. The card was allowed to dry for 30 minutes before being stored in a plastic bag with desiccant and then frozen at -30. Samples were later shipped in insulated boxes for testing by ZRT (Beaverton, OR) using manual 96 well ELISA.

CRP values greater than 3 mg/L are generally thought to indicate increased risk of CVD due to chronic low-grade inflammation, whereas concentrations of CRP > 10 mg/L are assumed to be the results of acute infection or injury. However, CRP levels in postpartum women are slightly elevated in comparison to nulliparous women (Burlingame, Ahn, & Tang, 2013; Groer et al., 2005; Kuzawa, Adair, Borja, & McDade, 2013) and clinical cutoffs have not been established in this population.

Medical characteristics.

Chronic conditions. Information on physical health status including medical conditions was collected from participants' hospital charts at study enrollment and in the T2 interview. Participants were classified as having a particular condition if their charts indicated a history of that infection or illness during the most recent pregnancy or if they reported during the T2 interview that a doctor or nurse had ever said that they had the condition. A summary count of the all major health problems or chronic medical conditions was created including high blood pressure or hypertension, anemia and other blood problems, high cholesterol, heart problems, diabetes, kidney problems, liver problems/hepatitis, cancer, thyroid problems, asthma/reactive airway disease/bronchitis, epilepsy, periodontal/gum disease, tuberculosis and HIV/AIDS.

Medication use. Information about medication usage was also collected during the interview at six months postpartum. Medications including anti-hypertensives, cholesterol-lowering, and antidepressants can have anti-inflammatory effects (Jain & Ridker, 2005; Kenis & Maes, 2002) whereas use of oral contraceptives has been associated with higher CRP (Buchbinder et al., 2008; Williams, Williams, Milne, Hancox, & Poulton, 2004). Dichotomous variables (0 = no, 1 = yes) indicating self-reported use of these medications were created.

Data Analysis

Data analysis for these hypotheses included univariate and bivariate techniques and culminated in model testing using multivariate structural equation models. First, frequencies and descriptive statistics were used to summarize data on depression. Correlational analyses and ANOVAs were used to test bivariate associations between C-reactive protein and other study variables. Lastly, structural equation models using maximum likelihood estimation were used to test hypotheses by modeling associations between religiousness and spirituality, psychosocial resources, and C-reactive protein as described in detail for each analysis below. Maximum likelihood estimation allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used for all structural equation models.

Study Two Results

Descriptive Statistics

Inflammation. Descriptive statistics for C-reactive protein (CRP) are provided in Table 21. Because CRP was collected at the 6 and 12 month visits, there was substantial missing data due to attrition. In addition, some participants with complete study visits were missing CRP data due to refusal or insufficient blood quantity for the CRP assay; however, this affected fewer than 2% of participants.

The distribution of CRP at six months postpartum was markedly positively skewed and there were several outliers at the upper end of the distribution. Values of CRP ranged from 0.1 to 36.6 mg/L with 0.1 being the lower detection limit of the assays. The mean CRP value in the sample was 3.98 ($SD = 3.73$); 46.2% of women with CRP data had values over 3 mg/L and 7.8% had values over 10 mg/L. Prior to analyses, values of CRP were log transformed to normalize the

distributions. Following the transformation, there were no remaining extreme values (≥ 3 standard deviations above the mean) and thus, none were excluded from analyses.

The distribution of CRP at 12 months postpartum was also positively skewed and there were several outliers at the upper end of the distribution. Values of CRP ranged from 0.1 to 36.4 mg/L. The mean CRP value in the sample was 4.21 ($SD = 4.30$); 45.8% of women with CRP data had values over 3 mg/L and 10.6% of women had values over 10 mg/L. Prior to analyses, values of CRP were log transformed to normalize the distributions. Following the transformation, there were not remaining extreme values (≥ 3 SDs above the mean) and thus, none were excluded from analyses.

Table 21.

CRP Characteristics

	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% missing
T2 hsCRP	1501	3.98	3.73	0.10	36.6	1.40	6.98	43.1%
T2 log hsCRP	1501	0.81	1.22	-2.30	3.60	-0.57	2.60	43.1%
T3 hsCRP	1495	4.21	4.30	0.10	36.4	1.81	9.03	43.3%
T3 log hsCRP	1495	0.79	1.31	-2.31	3.28	-0.54	2.46	43.3%

Bivariate associations. The demographic characteristics of participants by C-reactive protein values are reported in Table 22. Bivariate associations were computed for all women out of the total 2,399 participants with available data for relevant variables.

Correlational analyses indicated that log-transformed CRP values were not associated with the demographic characteristics of age, income [adjusted for cost of living, truncated at \$70,000 and natural log transformed due to skewness], or years of education. These analyses were conducted as a preliminary step before analyzing models described below to determine which variables were uniquely predictive of CRP and thus needed to be considered as covariates in structural equation models. On the basis of these results, inclusion of demographic covariates was not required based on association with CRP.

Results of ANOVAs and t-tests revealed that CRP at six months postpartum did not generally differ by race/ethnicity, marital or cohabitation status, or center. Specifically, CRP value did not differ by race/ethnicity, $F(2, 1498) = 2.50, p = 0.083$. CRP value did differ between women married ($M = 0.75, SD = 1.15$) and those not married ($M = 0.87, SD = 1.24$); $t(1430) = 1.73, p = 0.042$, but there were no differences between women living with a partner and those not cohabiting with a partner. Generally, there were no differences between study sites in terms of CRP values, however, a significant difference between CRP values for women in Los Angeles ($M = 0.61, SD = 1.14$) and North Carolina ($M = 0.939, SD = 1.248$) was revealed ($p = 0.039$) by multiple comparison tests following a significant ANOVA, $F(4, 1496) = 2.97, p = 0.018$.

Table 22.

Correlations of CRP and Demographic Characteristics

	(1)	(2)	(3)	(4)
(1) T2 logCRP	1			
(2) T3 logCRP	0.661***	1		
(3) Age	0.030	-0.006	1	
(4) log of per capita household income adjusted for cost of living [†]	-0.014	-0.058*	0.367***	1
(5) Years education	-0.042	-0.070**	0.429***	0.403***

[†] Income was truncated at \$70,000.00; * $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Correlational analyses were also conducted to determine how CRP values were associated with other medical variables and risk factors including BMI, waist:hip ratio (WHR), chronic conditions, and use of various medications (see Table 23). These bivariate analyses revealed that CRP values at six months postpartum were positively associated with both concurrent BMI and WHR. CRP values were also positively associated with the number of chronic conditions a woman had. In terms of medication used, CRP values were associated only with blood pressure medication usage whereas CRP was not associated with use of hormonal

birth control, steroids, NSAIDs, or SSRI antidepressants. Interestingly, BMI had a similar pattern of association and was significantly positively associated with both chronic conditions and use of blood pressure medication in addition to WHR. These results suggested that we should treat BMI, WHR, chronic conditions, and blood pressure medication usage as potential covariates in structural equation models. Because BMI and WHR are related and are associated in these data ($r = 0.320, p < .001$), it is typical to use only one of these variables as a covariate (e.g., Czernichow, Kengne, Stamatakis, Hamer, & Batty, 2011; Vazquez, Duval, Jacobs, & Silventoinen, 2007). In our structural equation models, BMI was used because of its strong association with CRP values and because WHR may be less meaningful in postpartum women. All models and their covariates are described in detail below.

Lastly, correlational analyses were conducted to determine whether C-reactive protein values were associated with markers of religiousness and spirituality and psychosocial resources (see Table 24). These analyses revealed that CRP values at six months postpartum were not associated with religiousness, spirituality, or any of the psychosocial resources at the bivariate level. However, as correlational analyses described above indicate, both CRP and religiousness and spirituality are significantly associated with BMI, and thus, it is possible that bivariate analyses that do not account for BMI are unable to capture the complexity of associations of CRP and religiousness and spirituality.

Table 23. *Correlations of CRP and Medical Characteristics*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) log of hsCRP (T2)	1									
(2) T2 BMI	0.505***	1								
(3) T2 WHR	0.213***	0.320***	1							
(4) log of hsCRP (T3)	0.661***	0.522***	0.241***	1						
(5) T3 BMI	0.501***	0.970***	0.306***	0.537***	1					
(6) T3 WHR	0.241***	0.321***	0.549***	0.249***	0.341***	1				
(7) Blood pressure medication	0.066*	0.101***	0.094***	0.091**	0.109***	0.060*	1			
(8) Hormonal birth control	0.033	-0.041	-0.067*	0.049	-0.029	-0.051	-0.006	1		
(9) Chronic conditions	0.065*	0.104***	0.007	0.031	0.073*	-0.017	0.130***	-0.006	1	
(10) Steroids	0.004	0.025	0.008	-0.007	0.032	0.023	0.029	0.027	0.168***	1
(11) NSAIDs	0.020	0.044	0.020	0.012	0.043	0.048	0.031	0.003	0.076**	0.034

*p < 0.05; **p < 0.01; ***p < .001

Table 24.

Correlations of CRP at Times 2 and 3, Religiousness and Spirituality, and Psychosocial Resources

	(1)	(2)
(1) log of hsCRP (T2)	1	
(2) log of hsCRP (T3)	0.661***	1
(2) Religious attendance	-0.005	-0.016
(3) Private religious behavior	0.017	0.043
(4) Daily spiritual experience	0.005	0.011
(5) Religious identity	-0.007	0.002
(6) Spiritual identity	-0.027	-0.015
(7) T1 mastery	0.011	0.010
(8) T2 optimism	-0.028	-0.014
(9) T1 self-esteem	-0.029	-0.021

*p < 0.05; **p < 0.01; ***p < .001

Hypothesis Testing on C-Reactive Protein

Inflammation at six months postpartum. To determine whether the latent Religiousness/Spirituality factor predicted CRP values at six and 12 months postpartum, structural equation modeling was used. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

First, a structural equation model in which religiousness/spirituality predicted women’s level of CRP at six months postpartum was tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was marginal (CFI=0.863) and CRP was not significantly predicted by the religiousness/spirituality latent factor ($\beta = -0.023, p = 0.416$). A second model was run which included BMI at six months postpartum as a covariate but was otherwise identical to the first. This model also had marginal fit (CFI=0.879), however, in this model, all factor loadings and regression coefficients were significant and in the expected directions. Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications,

all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity.

A third model was run that included the four suggested correlations as well as BMI as a covariate. This model had acceptable fit (CFI=0.953) and all factor loadings and regression coefficients were significant and in the expected directions. Specifically, religiousness/spirituality as indexed by a latent factor was associated with lower levels of CRP six months postpartum ($\beta = -0.061, p = 0.015$) whereas BMI at six months postpartum was associated with higher levels of CRP ($\beta = .510, p < .001$).

Models were recalculated to examine whether inclusion of chronic conditions or use of medications, specifically hormonal birth control and blood pressure medication, would alter the findings. Though hormonal birth control use was significantly associated with higher level of CRP ($\beta = 0.054, p = 0.020$), its inclusion did not impact overall fit or direction or significance of other effects. Neither chronic conditions nor use of blood pressure medications [tested in separate models] were significant predictors of levels of CRP nor did their inclusion impact overall fit or direction or significance of other effects. The final model included both BMI and hormonal birth control use as covariates. See Figure 7 for coefficients and detailed fit statistics.

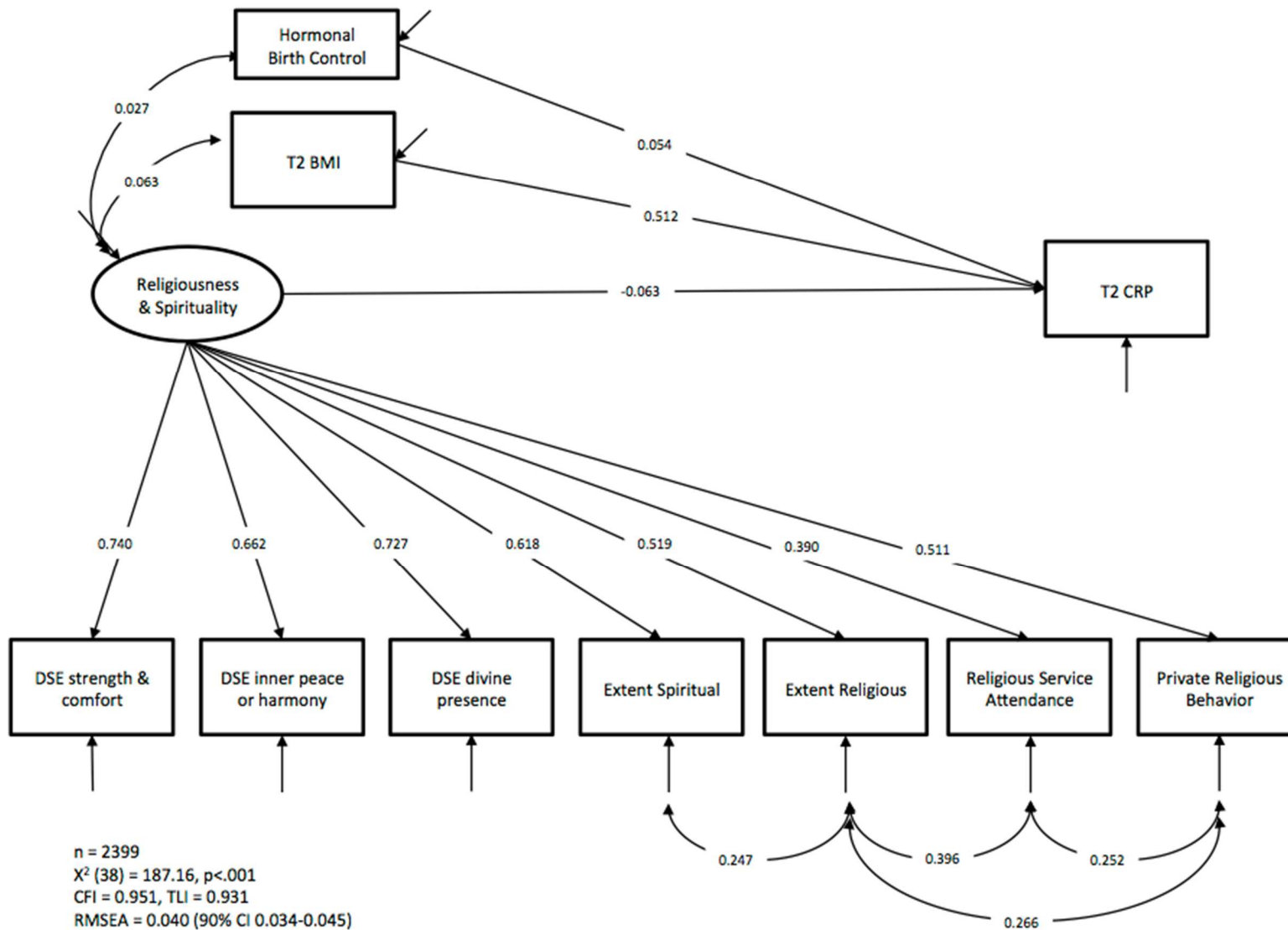


Figure 7. Structural equation model of religiousness and spirituality predicting C-reactive protein at six months postpartum

Mediation by psychosocial resources. As a preliminary step to testing the hypothesized mediation model, initial models were run to test whether the proposed mediator, psychosocial resources, predicted C-reactive protein levels. All models were run in the full sample of 2,399 women using maximum likelihood estimation to account for missing values. As this model does not address a specific hypothesis of the study, the full model with all estimates is not presented.

First, a structural equation model in which psychosocial resources predicted level of CRP at six months postpartum was tested without inclusion of covariates or additional correlation or error covariance paths. This model had acceptable fit in the data (CFI=0.955) and CRP was not significantly predicted by the psychosocial resource latent factor ($\beta = -0.017, p = 0.640$). A second model was run which included BMI at six months postpartum as a covariate but was otherwise identical to the first. This model also had good fit (CFI=0.963) and CRP was not significantly predicted by the psychosocial resource latent factor ($\beta = -0.017, p = 0.513$), but was predicted by BMI at six months postpartum as expected ($\beta = 0.506, p < .001$). Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses did not suggest any theoretically consistent modifications.

Models were recalculated to examine whether inclusion of chronic conditions or use of medications, specifically hormonal birth control and blood pressure medication, would alter the findings. Though hormonal birth control use was significantly associated with higher level of CRP ($\beta = 0.052, p = 0.024$), its inclusion did not impact overall fit or direction or significance of other effects. Neither chronic conditions nor use of blood pressure medications [tested independently of one another] were significant predictors of levels of CRP nor did their inclusion impact overall fit or direction or significance of other effects. No adjustments were made on the basis of these findings, thus, the final model included only BMI as a covariate. The results of this

model do not support the hypothesis that psychosocial resources predict inflammation as indexed by CRP.

Lastly, the full hypothesized model was tested to determine whether the association between the religiousness and spirituality latent factor and CRP would be explained by psychosocial resources. Though the proposed mediator, psychosocial resources, was not associated with the outcome, CRP, the full model was tested as an exploration (see MacKinnon, 2008). All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

The mediation model was first tested using the modifications established in previous models: indicators were allowed to correlate as in the final models illustrating associations of religiousness and spirituality to CRP. As the association between religiousness and spirituality and CRP was evidenced only when BMI was included as a covariate, BMI was included in the initial mediation model. The model evidenced acceptable fit to the data (CFI=0.944) and all factor loadings were significant. The direct effect of religiousness and spirituality, as indexed by a latent factor, on CRP values was significant and negative ($\beta = -0.061, p = 0.022$). Psychosocial resources were significantly associated with religiousness and spirituality ($\beta = 0.252, p < .001$). However, psychosocial resources did not significantly predict CRP values ($\beta = -0.001, p = 0.965$). Furthermore, the indirect effect of religiousness and spirituality on CRP through psychosocial resources were not significant ($\beta = 0.000, p = 0.965$).

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested no additional theoretically consistent modifications. Models were recalculated to examine whether inclusion of chronic conditions or use of medications, specifically hormonal birth control and blood pressure medication, would alter the

findings. Though hormonal birth control use was significantly associated with higher level of CRP ($\beta = 0.054, p = 0.020$), its inclusion did not impact overall fit or direction or significance of other effects. Neither chronic conditions nor use of blood pressure medications [tested independently of one another] were significant predictors of levels of CRP nor did their inclusion impact overall fit or direction or significance of other effects. No adjustments were made on the basis of these findings, thus, the final model included only BMI as a covariate. The results of this model suggest that psychosocial resources do not mediate the association of religiousness and spirituality and CRP values.

Exploratory aims. To address the exploratory aim of examining whether religiousness and spirituality would independently predict CRP, the final model of CRP was estimated two more times, once with the four measures of religiousness constituting a latent factor indexing religiousness and once with the three measures of spirituality constituting a latent factor of spirituality.

Religiousness alone was only marginally predictive of lower CRP ($\beta = -0.046, p = 0.083$), however, this model had good fit to the data (CFI=0.970). Of note, in this model, no correlations between indicators of religiousness were estimated because they were unnecessary without indicators of spirituality present. In contrast, spirituality alone did significantly predict lower CRP ($\beta = -0.059, p = 0.020$), and this model also had good fit to the data (CFI=0.980).

Inflammation at 12 months postpartum. In order to test the hypothesized model for CRP values at 12 months postpartum, a structural equation model in which religiousness/spirituality predicted women's level of CRP at 12 months postpartum was tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was marginal (CFI=0.863) and CRP was not significantly predicted by the

religiousness/spirituality latent factor ($\beta = -0.029, p = 0.337$). A second model was run which included BMI at 12 months postpartum as a covariate but was otherwise identical to the first. This model also had marginal fit (CFI=0.879) and the effect of religiousness/spirituality on CRP remained non-significant ($\beta = -0.033, p = 0.197$).

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity. A third model was run that included the four suggested correlations as well as BMI as a covariate. This model had acceptable fit (CFI=0.950) and all factor loadings were significant though the effect of religiousness/spirituality on CRP remained non-significant ($\beta = -0.023, p = 0.377$). See Figure 8 for coefficients and detailed fit statistics. Because religiousness/spirituality did not significantly predict CRP values at 12 months postpartum, the full hypothesized mediation model was not tested nor were its other components (i.e., whether psychosocial resources predict CRP at 12 months postpartum).

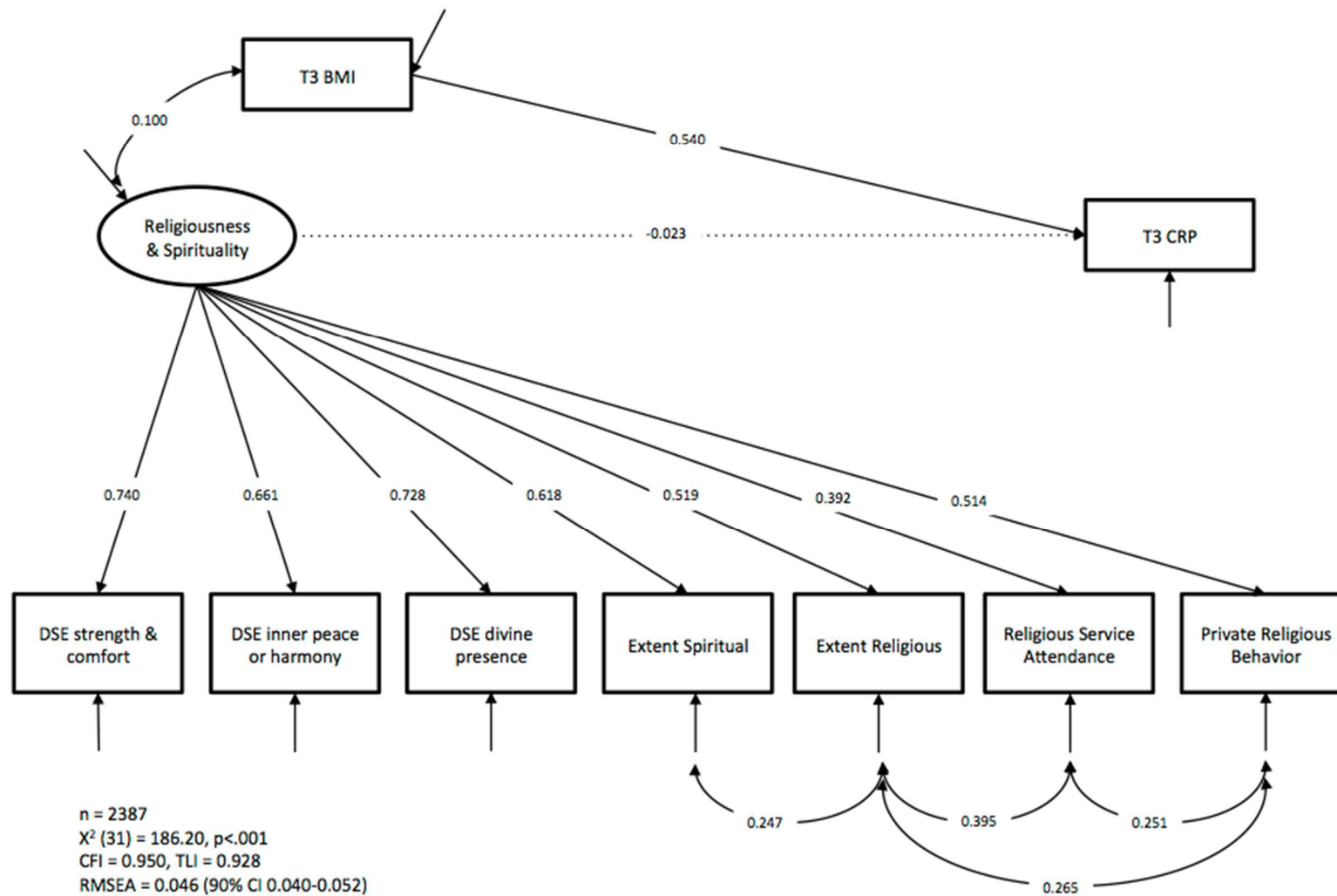


Figure 8. Structural equation model of religiosity and spirituality predicting C-reactive protein at 12 months postpartum

Followup Analyses on Religiousness, Spirituality, Inflammation, and Depression

Although it was not an original hypothesis, results of previous analyses raised the research question of whether C-reactive protein levels might mediate the observed associations of religiousness and spirituality with depressive symptoms. As discussed in Chapter One, biological processes, including inflammation, are hypothesized as potential mechanisms of observed associations of religiousness and spirituality and health (Seeman, Dubin, & Seeman, 2003). These data together with the preceding results offer a unique opportunity to test one instance of this mechanism.

Analyses were conducted in the full CCHN sample of 2,399 postpartum women.

Religiousness, spirituality, depressive symptoms, and C-reactive protein were measured and assessed as described in Study 1 and herein Study 2. Analyses for the present research question concerned CRP measured at six months postpartum and depressive symptoms measured at one, six, and 12 months postpartum.

Data analysis for this research question involved model testing using multivariate structural equation models using maximum likelihood estimation as described in detail for each analysis below. Maximum likelihood estimation allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used for all structural equation models.

Descriptive Statistics

Bivariate associations. For the purpose of these followup analyses, correlations between CRP levels and depressive symptom score at each timepoint were conducted. Opposite to expectations, CRP levels and depressive symptom scores were inversely associated and this association was marginal at 1 month postpartum, significant at six months postpartum ($p =$

0.040), and not significant at 12 months postpartum. However, when women using SSRI antidepressants were excluded, the association of CRP and depressive symptoms at six months postpartum was only marginally significant. See Table 25.

Table 25.

Correlations of CRP and Depressive Symptoms in the Sample with and without Women Using Antidepressant SSRIs

	Women on SSRIs included (1) log of HsCRP	Women on SSRIs excluded (1) log of HsCRP
(1) log of HsCRP	1	1
(2) T1 EPDS	-0.046, $p = 0.090$	-0.038
(3) T2 EPDS	-0.053*	-0.047, $p = 0.077$
(4) T3 EPDS	-0.028	-0.027

* $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Note. EPDS = Edinburgh Postnatal Depression Scale

Also relevant to these analyses are the findings that CRP was significantly associated with BMI, number of chronic conditions, and blood pressure medication use but was not associated with age, income, or years of education and did not generally differ by race/ethnicity, study site, or relationship status (marital or cohabitation status). In contrast, depressive symptom levels were significantly and negatively associated with both per capita household income and years of education. Because of the correlation between these covariates, in all analyses reported in the previous studies, only income was used as a covariate of depressive symptoms. Furthermore, depressive symptom scores did not generally differ by race/ethnicity or relationship status, however, there were significant differences in depressive symptoms across study sites. In regards to religiousness and spirituality, previous analyses indicated significant and positive associations between spirituality and age, income, and years education and a significant and negative association between one measure of religiousness, one's religious identity, and age, income, and years of education, though these associations were small. Previous analyses revealed systematic differences in religiousness and spirituality

between study site, relationship status, and race/ethnicity group. Based on these findings taken together, BMI and income were tested as covariates in the models as described below.

Religiousness and Spirituality and Depressive Symptoms Mediated by CRP

To determine whether the association of the latent Religiousness/Spirituality factor and depressive symptoms as indexed by a latent factor was mediated by levels of CRP, structural equation modeling was used. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

In the process of testing mediation, it is typical to establish that the predictor is, at minimum, associated with both the mediator and the outcome. In this case, both of these associations were established in the models presented in the results section of previous studies. Religiousness and spirituality, as a latent factor, do significantly predict lower depressive symptoms as indexed by a latent factor ($\beta = -0.236, p < .001; CFI=0.934$). Similarly, religiousness and spirituality, as a latent factor, significantly predict lower levels of hsCRP at six months postpartum ($\beta = -0.061, p = 0.015; CFI=0.953$). Given that these preliminary steps were already conducted in previous studies, analysis for this question proceeded directly to testing the full mediation model.

To test the mediation of associations of religiousness and spirituality and depression by CRP, first, a model was run in which the latent factor indexing religiousness and spirituality predicted depressive symptoms, as indexed as a latent factor, and the psychosocial resources latent factor mediated that association. This model did not include any covariates nor additional correlation or error covariance paths. This model had marginal fit to the data ($CFI=0.861$) and all factor loadings were significant. Regression coefficients of representing the effect of religiousness and spirituality on depressive symptoms were significant (direct: $\beta =$

-0.205, $p < .001$; total: $\beta = -0.204$, $p < .001$) as was the effect of depressive symptoms on CRP, though this association was negative which was unexpected ($\beta = -0.065$, $p = 0.030$). Notably, the effect of religiousness and spirituality on CRP was not significant. This was also the case in the previously reported model of religiousness and spirituality and CRP when BMI was not included in the model as a covariate. In addition, modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity.

A second model was estimated in which BMI was included as a covariate and the four correlations between indicators of religiousness and spirituality suggested by the modification indices were included. This model had acceptable fit to the data (CFI=0.932) and all factor loadings and regression coefficients were significant with the exception of the indirect effect of religiousness and spirituality on depression through CRP ($\beta = 0.004$, $p = 0.104$). In addition, the association of CRP and depressive symptoms was significant but negative as in the first model ($\beta = -0.059$, $p = 0.018$).

Models were recalculated to examine whether inclusion of income as a covariate of depression and chronic conditions or use of medications, specifically hormonal birth control and blood pressure medication, as covariates of CRP would alter the findings. When included as the only covariate, income had a significant and negative association with depressive symptoms ($\beta = -0.126$, $p < .001$) and its inclusion improved the overall fit (CFI=0.939). Income was retained in the remaining models. Neither chronic conditions nor use of blood

pressure medications had a significant effect on CRP nor did their inclusion, individually, impact the overall fit of the models. Use of hormonal birth control did have a significant and positive impact on CRP ($\beta = 0.053, p = 0.020$) and did not lower the fit (CFI=0.939). Models were also recalculated excluding women using SSRI antidepressants; exclusion of women on SSRIs did not change direction, significance, or fit of any variations of the model. The final model included women on SSRIs and included income as a covariate of depression and BMI and hormonal birth control use as covariates of CRP. The results of this model do not support the hypothesis that CRP mediates the association of religiousness and spirituality and depression. See Figure 9 for coefficients and detailed fit statistics.

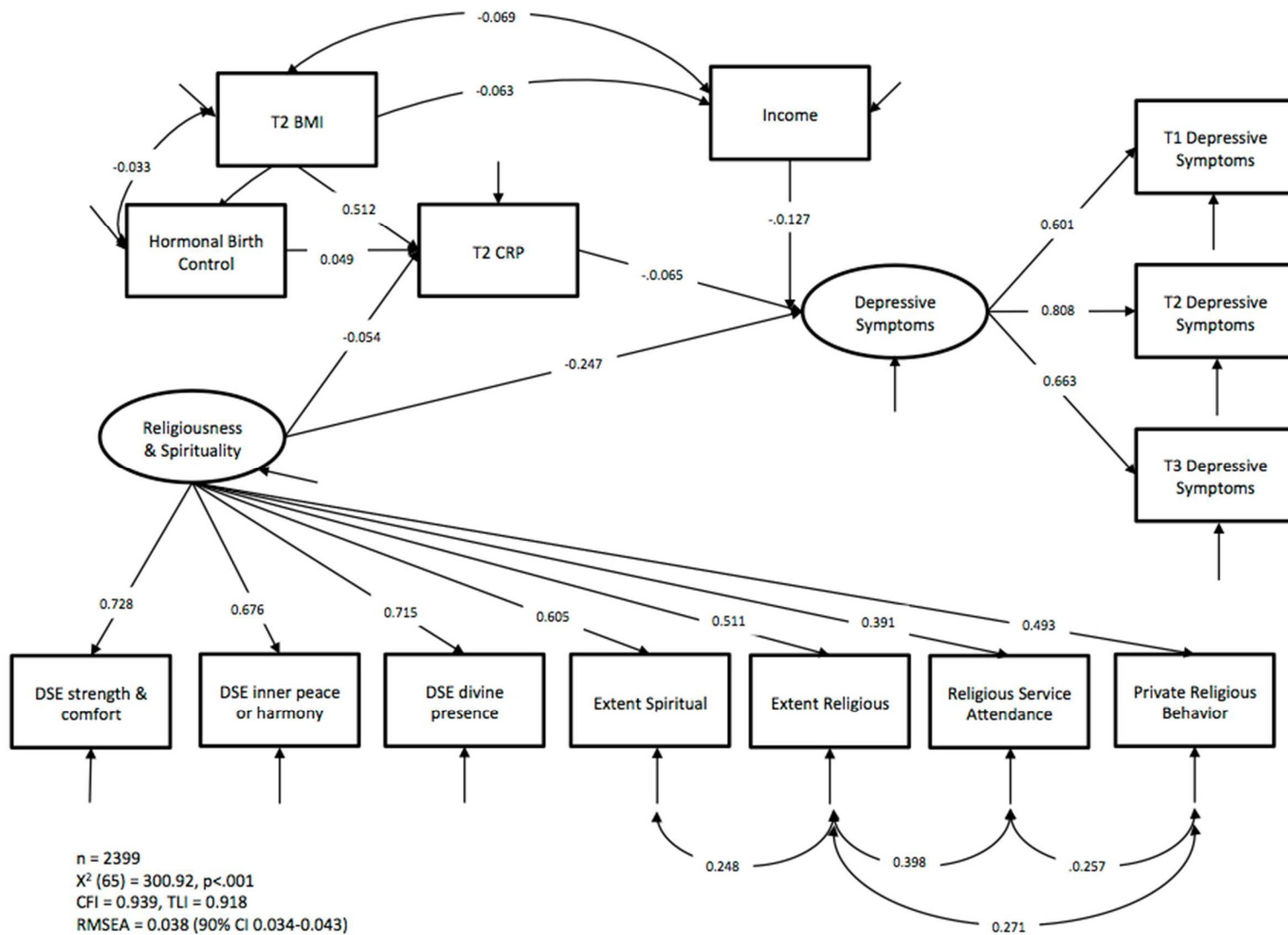


Figure 9. Structural equation model of CRP mediating the association of religiousness and spirituality and depressive symptoms

Study Two Discussion

The aims of Study 2 were to determine whether religiousness and spirituality were associated with inflammation, specifically CRP, in postpartum women, and to test whether this association was mediated by psychosocial resources (Hypotheses 4 and 5). In this sample of postpartum women, CRP levels were high with the means above 3 mg/L at both six and 12 months postpartum and a notable proportion of women had CRP levels above 10 mg/L at each timepoint. In the general population, values above 3 mg/L indicate risk for CVD and values above 10 mg/L indicate acute infection or injury. However, in postpartum women, it is not yet clear whether these cutoffs apply (Burlingame et al., 2013; Groer et al., 2005; Kuzawa et al., 2013). In previous research on CRP in this sample, data were handled as they were in the present study, that is, outliers were not excluded but values were transformed for analyses (Guardino, 2014).

I hypothesized that religiousness and spirituality would, separately and together, predict lower CRP at six and 12 months postpartum and that psychosocial resources, specifically optimism, mastery, and self-esteem, would mediate the association of religiousness and spirituality and CRP. Overall, results were partially consistent with these hypotheses; religiousness and spirituality together did predict lower CRP at six months postpartum, as did spirituality alone, but not at 12 months postpartum, and this association was not mediated by psychosocial resources.

At six months postpartum, religiousness and spirituality combined had a small and negative effect on CRP; that is, women higher in religiousness and spirituality had lower CRP levels. However, this was only the case when the positive association of BMI and CRP was taken into account by controlling BMI. Religiousness and spirituality are associated with BMI in the

general literature (e.g., Kim, Sobal, & Wethington, 2003) and in this sample on postpartum women. Thus, it is expected that BMI could suppress the associations of religiousness and spirituality and inflammation (MacKinnon et al., 2000). Generally, this finding thus supports Hypothesis 4a. Although only a handful of studies have tested associations of religiousness and/or spirituality and inflammation, this finding is consistent with past research (Ford et al., 2006; King et al., 2001; Loucks et al., 2005; Lutgendorf et al., 2004). However, these studies have usually tested religious service attendance as the primary marker of religiousness and spirituality. Thus the present study is novel in comparison in terms of the multidimensional measure of religiousness and spirituality and its association with lower inflammation, specifically CRP. At 12 months postpartum, the findings for CRP were not consistent with findings at six months postpartum; religiousness and spirituality together were not associated with CRP at that timepoint.

An aim of this study, as in Study 1, was to examine differential associations with CRP by religiousness and spirituality individually. This is an especially important question given that the previous findings on religiousness/spirituality and inflammation have focused disproportionately on religious service attendance. In the present study, religiousness alone was not significantly associated with CRP, though the association was in the expected direction and marginal ($p < .10$). The measure of religiousness used in the present study contained an item on religious service attendance, thus, this finding is only somewhat consistent with prior research as the observed association is marginal, not significant. However, in contrast this sample is composed of relatively younger women whereas previous studies have focused on older men and women. Because inflammation and CRP increase with age (Woloshin & Schwartz, 2005) as inflammation-related diseases and diseases of aging increase in prevalence (Ershler & Keller,

2000), it is possible that psychosocial factors like religiousness and spirituality have more predictive power in older adults than in reproductive age women.

In contrast to religiousness, spirituality alone was significantly associated with lower CRP. I have not identified any studies that have explicitly tested associations of inflammation and spirituality alone. This finding suggests that there may be something important about the spiritual aspects of combined indicators and that spirituality may perhaps drive observed associations of religiousness and inflammation. Spirituality has, in fact, been proposed as a “mechanism” of the associations of religiousness and health, and at least one study has supported this hypothesis for mental health (Cheadle et al., 2015). The findings of this study suggest that spirituality is an important resource to study as a potential predictor of inflammation and underlines the necessity of separating religiousness from spirituality.

Though religiousness and spirituality are thought of as trait variables that do not vary substantially from month to month in adults, it is notable that the majority of measures of religiousness and spirituality were assessed at six months postpartum and thus, were simultaneously assessed with the six month postpartum CRP values. Thus, the associations with CRP are only cross-sectional and not longitudinal. Previous studies showing associations of religiousness and spirituality and inflammation are also cross-sectional with one exception (Lutgendorf et al., 2004). Inflammation is often proposed as a potential mechanism of the observed associations of religiousness and cardiovascular disease outcomes (e.g., Ford et al., 2006), however, the lack of evidence of a prospective association casts doubt on this proposed mechanism. It is possible that the nature of inflammation during the postpartum, particularly of CRP as a marker which is thought to decrease throughout the postpartum period (Christian & Porter, 2014), does not permit a strong test of longitudinal associations with psychosocial factors.

However, in the present sample, CRP did not decrease from six to 12 months postpartum overall in the sample. Variability did increase from six to 12 months, so elevations at six months may be more systematic. If this were the case, it is possible that these systematic elevations may be more predictable by psychosocial factors like religiousness and spirituality than are outlying elevations at 12 months. Additional study of both typical inflammation trajectories during postpartum and associations of religiousness and spirituality and CRP plus other markers of inflammation are necessary to fully interpret the findings of the present study.

Contrary to expectations, the psychosocial resources factor, (mastery, self-esteem, and optimism) was not associated with CRP. Furthermore, contrary to Hypothesis 5a, psychosocial resources did not mediate the association of the religiousness and spirituality factor with CRP values at six months postpartum. Thus, in Study 2, I demonstrated that religiousness and spirituality together, and spirituality alone, are associated cross-sectionally with lower C-reactive protein values.

Chapter Seven: Study 3: Religiousness, Spirituality, and Cortisol

Hypotheses 6a and b: *Both religiousness and spirituality are hypothesized to be independently associated with steeper slopes of diurnal cortisol at six and twelve months after birth.*

Hypotheses 7a and b: *The psychosocial resources of optimism, mastery and self-esteem are hypothesized to mediate the associations of religiousness and spirituality with cortisol slope.*

Exploratory aim: Differential associations of religiousness and spirituality with diurnal cortisol slope will be examined.

Methods

Hypotheses were tested in the full CCHN sample of 2,399 postpartum women.

Measures

Diurnal cortisol slope. Participants were taught how to collect saliva samples via passive drool into sampling tubes. Participants were given saliva collection kits and instructed to collect two saliva samples on the morning of the following day and one sample on that evening. All samples were refrigerated until they were returned to the study office. Samples were frozen until shipped to the ZRT laboratory for analysis. The intra- and interassay coefficients of variance were 5.5% and 7.6%, respectively.

Diurnal cortisol slope was calculated from the AM and PM cortisol measurements by dividing the difference between the AM and PM cortisol measurements by the hours between the AM and PM cortisol measurements (based on the times recorded by participants). Before doing the calculation, AM and PM cortisol measurements were converted from ng/mL to $\mu\text{g/dL}$, and measures greater than 1.8 were winsorized to 1.8 ($\mu\text{g/dL}$). Because diurnal slope values were highly kurtotic (see Table 26), all values over three standard deviations from the sample mean

were dropped (Dettling, Gunnar, & Donzella, 1999). Because outliers remained, any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations. Fewer than 1% of cortisol values were truncated or winsorized.

Data Analysis

Data analysis for these hypotheses included univariate and bivariate techniques and culminated in model testing using multivariate structural equation models. First, frequencies and descriptive statistics were used to summarize data on cortisol. Correlational analyses and ANOVAs were used to test bivariate associations between cortisol and other study variables. Lastly, structural equation models using maximum likelihood estimation were used to test hypotheses by modeling associations between religiousness and spirituality, psychosocial resources, and cortisol as described in detail for each analysis below. Maximum likelihood estimation allowed for utilization of all available data and participants regardless of missingness (Enders, 2010). Statistical analyses were conducted using Stata 13 and MPlus 7 (Muthén & Muthén, 2015) was used for all structural equation models.

Table 26.

Diurnal Cortisol Slope Characteristics

	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	% missing
T2 Cortisol slope	886	-0.022	0.026	-0.121	0.138	0.676	8.432	66.4%
T2 Cortisol slope ^λ (transformed)	860	-0.023	0.020	-0.084	0.039	0.023	3.847	67.4%
T3 Cortisol slope	837	-0.022	0.024	-0.130	0.092	-0.142	5.557	68.3%
T3 Cortisol slope ^λ (transformed)	824	-0.022	0.021	-0.085	0.048	-0.278	3.231	68.7%

^λ All values over three standard deviations from the sample mean were dropped, then any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations

Study Three Results

Descriptive Statistics

Cortisol slope. Descriptive statistics for cortisol slope measures are provided in Table 26. These data were missing for a majority of the sample due to attrition as well as incomplete participant participation in cortisol data collection and insufficient samples for assay analyses. At six months after birth, the mean diurnal cortisol slope was slightly negative ($M = -0.022$, $SD = 0.026$); after transformation, the mean remained negative and similar in magnitude ($M = -0.023$, $SD = 0.020$). At 12 months postpartum, the mean diurnal slope was also negative and nearly identical in magnitude before and after transformation.

Bivariate associations. The demographic characteristics of participants by transformed cortisol slope values at six and 12 months postpartum are presented in Table 27. Bivariate associations were computed for all women out of the total 2,399 participants with available data for relevant variables. Correlational analyses indicated that cortisol slopes at both timepoints were modestly and inversely correlated with age, income, and years of education.

Results of ANOVAs and t-tests revealed that cortisol slope did differ by categorical demographics as well. Diurnal cortisol slopes were significantly steeper [and negative] for married women (six months postpartum $M = -0.025$, $SD = 0.019$; 12 months postpartum $M = -0.028$, $SD = 0.020$) as compared to unmarried women at 6 ($M = -0.021$, $SD = 0.021$) and 12 ($M = -0.018$, $SD = 0.021$) months postpartum (six months postpartum $t(837) = 2.852$, $p = 0.005$; 12 months postpartum $t(803) = 6.423$, $p < .001$). This was true as well for cohabiting women ($M = -0.019$, $SD = 0.020$) compared to non-cohabiting women ($M = -0.024$, $SD = 0.021$) at 12 months postpartum ($t(802) = 3.52$, $p < .001$), but not six months postpartum. Diurnal cortisol slope also differed by study site at both timepoints (See Table 28). These differences did not have a

uniform pattern; Baltimore participants had the flattest diurnal cortisol slopes at both six and 12 months postpartum. Lastly, cortisol slope differed by race/ethnicity. At both timepoints, White (six months postpartum $M = -0.027$, $SD = 0.020$; 12 months postpartum $M = -0.029$, $SD = 0.021$) and Latina (six months postpartum $M = -0.025$, $SD = 0.017$; 12 months postpartum $M = -0.027$, $SD = 0.020$) women had significantly steeper [and negative] slopes than African American women (six months postpartum $M = -0.019$, $SD = 0.021$, $F(2, 857) = 13.36$, $p < .001$; 12 months postpartum $M = -0.016$, $SD = 0.020$, $F(2, 821) = 37.46$, $p < .001$).

Table 27.

Correlations of Diurnal Cortisol Slope and Demographic Characteristics

	(1)	(2)	(3)	(4)
(1) T2 cortisol slope ^λ	1			
(2) T3 cortisol slope ^λ	0.237***	1		
(3) Age	-0.100**	-0.152***	1	
(4) log of per capita household income adjusted for cost of living [†]	-0.086*	-0.140***	0.367***	1
(5) Years education	-0.115***	-0.137***	0.429***	0.403***

[†] For variables represented in these rows, income was truncated at \$70,000.00; ^λ all values over three standard deviations from the sample mean were dropped, then any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations; * $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Table 28.

ANOVAs for Diurnal Cortisol Slope at Times 2 and 3 by Study Site

	Chicago	LA	NC	DC	Baltimore			
T2 cortisol slope ^λ	-0.027 ^{abc} (0.019)	-0.027 ^{abcd} (0.018)	-0.022 ^{abcde} (0.020)	-0.021 ^{bcde} (0.018)	-0.018 ^{cde} (0.023)	<i>df</i>	<i>F</i>	<i>p</i>
T3 cortisol slope ^λ	-0.027 ^{abcd} (0.020)	-0.029 ^{abc} (0.021)	-0.024 ^{abcd} (0.020)	-0.022 ^{abd} (0.019)	-0.015 ^e (0.022)	4, 855	8.14	<.001
						4, 819	15.24	<.001

^λ all values over three standard deviations from the sample mean were dropped, then any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations

Table 29.

ANOVAs for Diurnal Cortisol Slope at Times 2 and 3 at Breastfeeding Status

	Never breastfed	Breastfed but stopped before T2	Breastfeeding at T2 (stopped before T3)	Breastfeeding at T3			
T2 cortisol slope ^λ	-0.021 ^{abc} (0.022)	-0.021 ^{abc} (0.020)	-0.027 ^{abcd} (0.019)	-0.028 ^{cd} (0.018)	<i>df</i>	<i>F</i>	<i>p</i>
T3 cortisol slope ^λ	-0.017 ^a (0.021)	-0.023 ^{bcd} (0.021)	-0.026 ^{bcd} (0.025)	-0.027 ^{bcd} (0.018)	3, 851	5.41	0.001
					3, 653	6.39	<.001

^λ all values over three standard deviations from the sample mean were dropped, then any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations

Additional ANOVAs were conducted to determine if there were differences in diurnal cortisol slope by breastfeeding status as breastfeeding is known to affect cortisol (Tu, Lupien, & Walker, 2006). Cortisol slope at both six and 12 months postpartum did indeed differ by breastfeeding status as illustrated in Table 29. Women who were still breastfeeding at 12 months postpartum had steeper [negative] diurnal cortisol slopes at both six and 12 months postpartum than those who had never breastfed.

Correlational analyses were also conducted to determine how diurnal cortisol slopes were associated with markers of religiousness and spirituality and psychosocial resources at each timepoint (see Table 30). These bivariate analyses revealed that cortisol slopes were not generally associated with these factors with the exception of religious attendance; at six months postpartum, higher religious attendance was associated with steeper [negative] cortisol slopes, though this association was small ($r = -0.075, p < .05$).

Table 30.

Correlations of Diurnal Cortisol Slope at Times 2 and 3, Religiousness and Spirituality, and Psychosocial Resources

	(1)	(2)
(1) T2 cortisol slope ^λ	1	
(2) T3 cortisol slope ^λ	0.237***	1
(2) Religious attendance	-0.053	-0.092, $p = 0.060$
(3) Private religious behavior	0.075*	0.055
(4) Daily spiritual experience	-0.002	0.028
(5) Religious identity	0.002	-0.006
(6) Spiritual identity	-0.004	0.029
(7) T1 Mastery	0.008	-0.017
(8) T2 Optimism	0.035	-0.028
(9) T1 Self-esteem	0.027	-0.000

^λ all values over three standard deviations from the sample mean were dropped, then any values over three standard deviations above the mean were winsorized by transforming them into the mean plus three standard deviations; * $p < 0.05$; ** $p < 0.01$; *** $p < .001$

Hypothesis Testing on Cortisol

To determine whether the latent Religiousness/Spirituality factor predicts diurnal cortisol slope at 6 and/or 12 months postpartum, structural equation modeling was used. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

Cortisol at six months postpartum. First, a structural equation model in which religiousness/spirituality predicted women's diurnal cortisol slope values at six months postpartum was tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was marginal (CFI=0.861) and cortisol was not significantly predicted by the religiousness/spirituality latent factor ($\beta=0.001$, $p = 0.408$). Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity. A second model was run which included these modifications. This model had acceptable fit (CFI=0.949), but cortisol was not predicted by religiousness/spirituality ($\beta = 0.038$, $p = 0.321$).

Models were recalculated to examine whether inclusion of income or breastfeeding status [breastfeeding at six months postpartum versus not] would alter the findings. Though both income and breastfeeding were significantly associated with diurnal cortisol slope, their inclusion, separately or together, did not impact overall fit or direction or significance of other effects. When both covariates were included, fit was acceptable (CFI=0.948). See Figure 10 for coefficients and detailed fit statistics. Because religiousness/spirituality did not significantly predict diurnal cortisol slope values at six months postpartum, the full hypothesized mediation

model was not tested nor were its other components (i.e., whether psychosocial resources predict cortisol at six months postpartum).

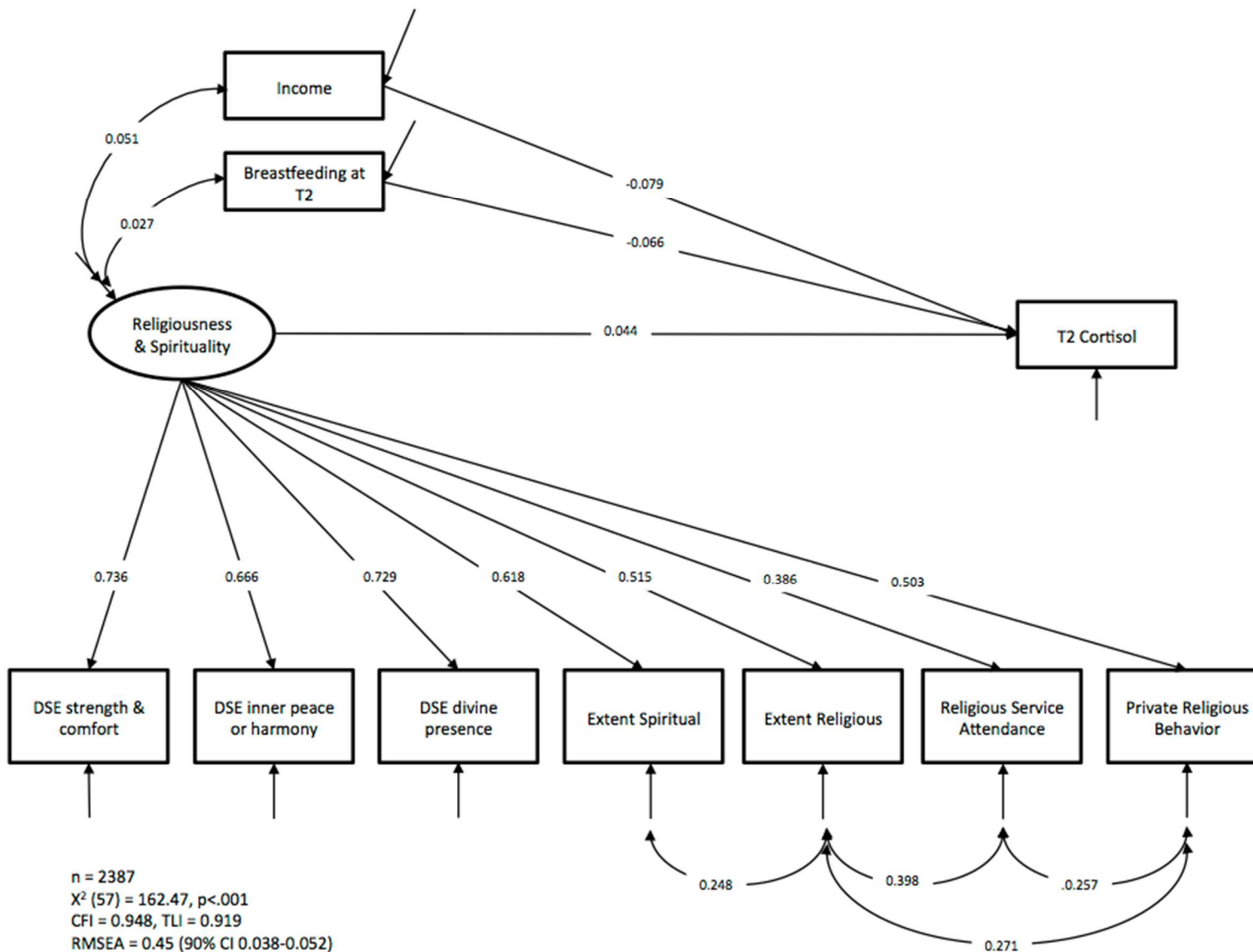


Figure 10. Structural equation model of religiousness and spirituality predicting diurnal cortisol slope at six months postpartum

Cortisol at 12 months postpartum. To determine whether the latent Religiousness/Spirituality factor predicts CRP values at 12 months postpartum, structural equation modeling was used. All models were run in the full sample of 2,399 women using maximum likelihood to account for missing values.

As for diurnal slope at six months postpartum, to test whether religiousness/spirituality predicted cortisol at 12 months postpartum, a structural equation model in which religiousness/spirituality predicted women's diurnal cortisol slope values at 12 months was first tested without inclusion of covariates or additional correlation or error covariance paths. Fit for this model was marginal (CFI=0.855) and cortisol was not significantly predicted by the religiousness/spirituality latent factor ($\beta=0.033$, $p = 0.415$).

Modification indices (LaGrange Multiplier tests) were consulted for the potential of improving fit. These analyses suggested inclusion of four theoretically consistent modifications, all correlations between indicators of the latent variable representing religiousness and spirituality: spiritual identity with religious identity, religious attendance with private religious behavior, religious attendance with religious identity, and private religious behavior with religious identity. A second model was run which included these modifications. This model had acceptable fit (CFI=0.943), but cortisol was not predicted by religiousness/spirituality ($\beta = 0.002$, $p = 0.257$).

Models were recalculated to examine whether inclusion of income or breastfeeding status [breastfeeding at 12 months postpartum versus not] would alter the findings. Though both income and breastfeeding were significantly associated with diurnal cortisol slope, their inclusion, separately or together, did not impact overall fit or direction or significance of other effects. When both covariates were included, fit was acceptable (CFI=0.950). See Figure 11 for

coefficients and detailed fit statistics. Because religiousness/spirituality did not significantly predict diurnal cortisol slope at 12 months postpartum, the full hypothesized mediation model was not tested nor were its other components (i.e., whether psychosocial resources predict cortisol at 12 months postpartum).

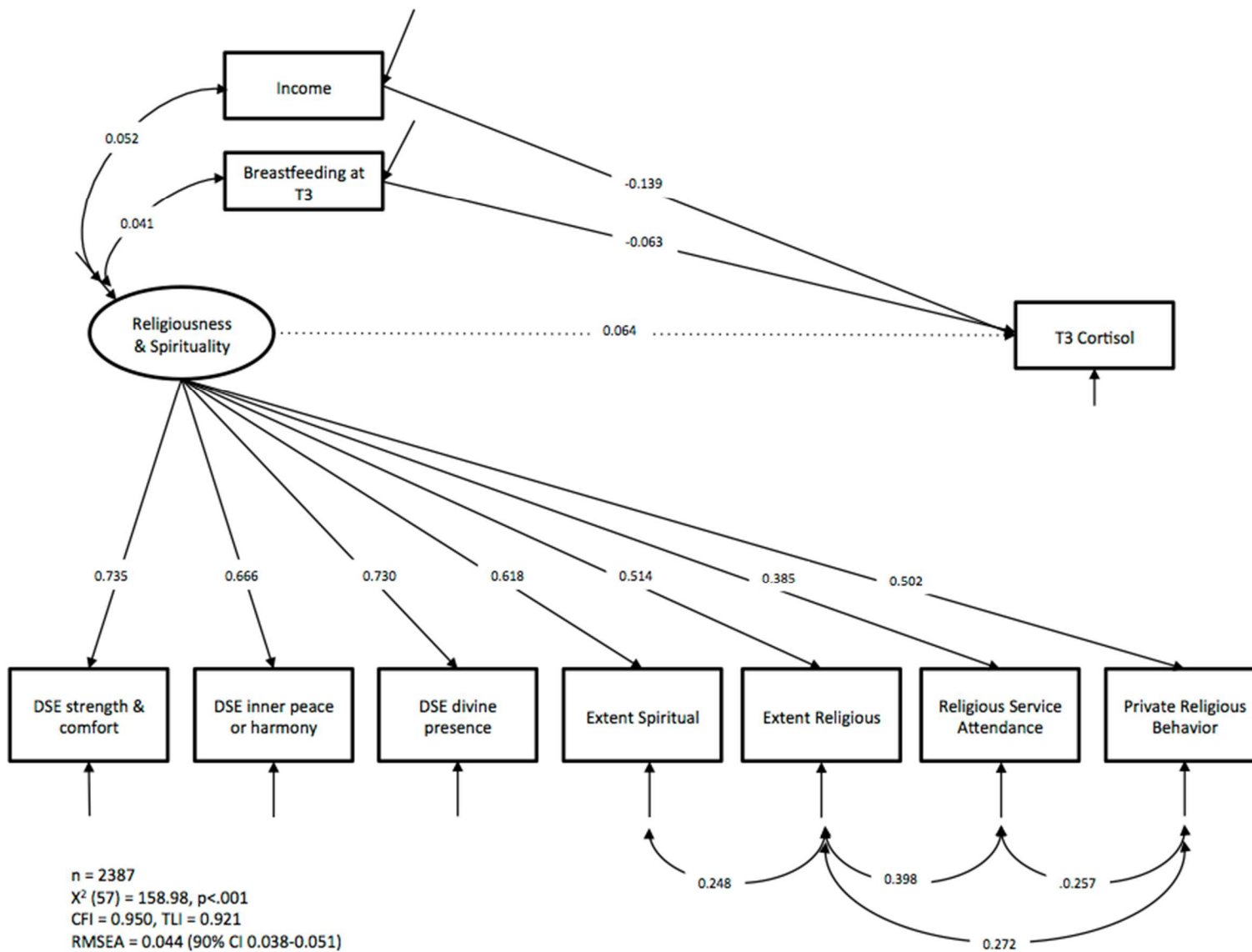


Figure 11. Structural equation model of religiousness and spirituality predicting diurnal cortisol slope at 12 months postpartum

Study Three Discussion

The aims of Study 3 were to determine whether religiousness and spirituality were associated with the diurnal slope of the stress hormone, cortisol, in postpartum women and to test whether this association was mediated by psychosocial resources (Hypotheses 6 and 7). On average, women in this postpartum sample had declining cortisol levels throughout the day reflected by negative diurnal cortisol slopes at both six and 12 months postpartum. Very little research has been conducted on cortisol in the postpartum and with uneven methodology, thus it is difficult to make a direct comparison of diurnal slope values. Nonetheless, these values are in the range of those observed by other teams during postpartum (e.g., Bublitz & Stroud, 2012; Tu et al., 2006), though they are lower (e.g., Scheyer & Urizar, 2015) and higher (e.g., Urizar & Muñoz, 2011) than those in results of one team. Of note, the cortisol data were handled identically here as in previous published studies on cortisol in this sample (e.g., Guardino et al., 2016; Saxbe et al., 2015).

I hypothesized that religiousness and spirituality would, independently and together, predict steeper and more negative diurnal cortisol slopes at both six and 12 months postpartum. I also hypothesized that the psychosocial resources of optimism, mastery, and self-esteem would mediate the association of religiousness and spirituality and cortisol slope in postpartum women. These hypotheses were not confirmed in the present study. In sum, religiousness and spirituality did not predict diurnal cortisol slopes at six months or 12 months postpartum. Many possible reasons for this lack of support of the hypotheses are noted in the general discussion.

Chapter Eight: General Discussion & Conclusions

The purpose of the studies in this dissertation was to investigate associations of religiousness and spirituality and health as indexed by two biomarkers and depressive symptoms, and mediation by psychosocial resources in postpartum women. The foundation of each of these studies concerned the association of religiousness and spirituality to psychosocial resources which have been previously hypothesized as a key explanation for associations of religiousness and spirituality with health outcomes. This link has been demonstrated in a handful of previous studies, but primarily for individual psychosocial resources, not multiple resources considered together (Ai, Tice, Huang, Rodgers, & Bolling, 2008; Ai, Tice, Peterson, & Huang, 2005; Le, Tov, & Taylor, 2007; Salsman, Brown, Brechting, & Carlson, 2005; Simoni & Ortiz, 2003). Furthermore, these studies have been conducted in undergraduate and clinical samples, and primarily tested individual aspects of religiousness and/or spirituality rather than employing measures of multiple dimensions, as was done here. The findings of the three studies in this dissertation have many implications for understanding the associations of religiousness, spirituality, and health and their mechanisms beyond what is in the literature presently.

Religiousness, Spirituality, and Personal Resources

First, the results indicate that a multidimensional factor composed of measures of various aspects of religiousness and spirituality was strongly associated with a multidimensional psychosocial resources factor composed of three major resources. That is, women higher in religiousness and spirituality were also higher in the combination of optimism, self-esteem, and mastery. Because these psychosocial resources have demonstrated associations with mental and physical health in healthy and clinical populations, this finding supports the theoretical premise that resources are key mechanisms or pathways in the link between religiousness and spirituality

and health outcomes. Furthermore, when measures of religiousness were considered separately from measures of spirituality, only spirituality was significantly associated with psychosocial resources in this sample. This finding points to the importance of studying religiousness and spirituality both together and separately as their mechanisms with health may differ. However, religiousness and spirituality tend to co-occur within individuals; religious people who are also spiritual are likely to have higher psychosocial resources.

That people who are more religious and spiritual are higher in these resources is an important implication for those who hope to understand the complexity of how religion and spirituality play out in everyday life and health more broadly. These resources enable people to manage stress and function better on a daily basis. Over time, these aspects may translate into better measurable health outcomes. If this were the case, it raises interesting questions about how religious and spiritual experience and participation may engender or increase these resources. Were we to fully understand this, then promotion of these resources in many settings including religious ones might promote better health.

Importantly, this and other studies do not establish a causal link. It is possible that religious and spiritual belief and participation lead to these higher psychosocial resources. Alternatively, it is also possible that individuals with high trait psychosocial resources tend to seek religious and spiritual practices and experiences and hold religious and spiritual beliefs. The present studies cannot rule out this possibility. It will be useful for future studies to investigate the longitudinal associations of religiousness, spirituality, and psychosocial resources, if any. Third variables may also be responsible for the association. In these studies, some of these variables were accounted for, like socioeconomic status, or not applicable, like age and gender.

However, future studies should test additional third variables including genetic factors and personality.

Religiousness, Spirituality, and Depression and Biological Processes

The three studies of this dissertation tested associations of religiousness and spirituality with depressive symptoms, CRP, and cortisol as main aims and hypotheses.

Depressive symptoms. In Study 1, both religiousness and spirituality together and independently predicted favorable trajectories and lower levels of depressive symptoms throughout the postpartum year. This is consistent with a small body of previous research (e.g., Cheadle et al., 2015, Mann, McKeown, Bacon, Vesselinov, & Bush, 2007) and underscores qualitative data that suggest that religiousness and spirituality are relevant and important for health in the perinatal period. Building on this first finding, I showed that for depressive symptoms, the associations with religiousness and spirituality were mediated by psychosocial resources. That is, women high in religiousness and/or spirituality had higher levels of the psychosocial resources of personal mastery, dispositional optimism, and self-esteem, which, in turn, were associated with more favorable depressive symptom levels. Though two other studies have shown that individual psychosocial resources mediate associations of individual aspects of religiousness and/or spirituality and mental health in small samples (Le et al., 2007; Simoni & Ortiz, 2003), this study is the first to show this using multidimensional measures of religiousness, spirituality, and psychosocial resources in a nonclinical sample of young women.

This is an important set of findings because postpartum depression is a major health concern that affects up to 13% of women in the United States (Rich-Edwards et al., 2006). PPD has significant consequences for its sufferers including employment difficulties, relationship stress, and poor outcomes for infants of depressed mothers (Abrams & Curran, 2007; Beck,

1995; Beck, 2002; Field et al., 1985; Murray & Cooper, 1996; Paul et al., 2013). Because PPD is a prevalent and serious condition, it is important to determine what protective factors may be present in women's lives. Religiousness and spirituality are prevalent in the United States and especially among women (Pew, 2015). For women at risk for postpartum, it may be useful to consider women's religious and spiritual practice along with the psychosocial resources with which they are associated including optimism, self-esteem, and mastery.

Inflammation. In Study 2, religiousness and spirituality combined into one factor predicted lower levels of C-reactive protein, a marker of inflammation, at six months postpartum, but not later at 12 months postpartum. Independently, spirituality was associated with lower levels of CRP whereas religiousness was only marginally so. A small literature has found religiousness to be associated with markers of inflammation, primarily CRP but also IL-6, fibrinogen, and other cytokines and cytokine ratios. However, these studies have primarily used older adult samples (Bellinger et al., 2014; Loucks et al., 2005, 2006; Lutgendorf et al., 2004) and some have found this association only in men, not women (Ford et al., 2006; Loucks et al., 2006). Furthermore, a number of these studies were not designed specifically to examine associations of religiousness and inflammation, but rather, religious service attendance or participation is included as one indicator of social integration (Ford et al., 2006; Loucks et al., 2005, 2006). This study is the first to demonstrate an association of multidimensional religiousness and spirituality, not solely religious practices or attendance, with inflammation. Importantly, this study demonstrates this association in a sample of young adult women in contrast to previous findings. Furthermore, to my knowledge, no published studies have tested or found such an association with any measures of spirituality, thus, the present study is the first known to demonstrate an association of multidimensional spirituality and inflammation,

particularly CRP. These findings are important because religiousness and spirituality are robustly associated with long-term health outcomes, like cardiovascular disease and mortality (Masters & Hooker, 2013; McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000), for which inflammatory processes are relevant and may be an explanatory factor.

None of the associations observed between religiousness and spirituality and CRP were mediated by psychosocial resources, but in this sample, CRP was not associated with psychosocial resources and thus mediation was unlikely. Thus, women high in religiousness and spirituality had lower inflammation six months after the birth of their children; however, this was not due to the associations of religiousness and spirituality with psychosocial resources.

Evidence of associations of psychosocial resources with lower inflammation is scant, though it does exist (Marteinsdottir, Ernerudh, Jonasson, Kristenson, & Garvin, 2016; Roepke & Grant, 2011; Roy et al., 2010). Thus, it is possible that psychosocial resources are not the best candidate for mechanisms of the associations of religiousness and spirituality and inflammation. Possibly future studies could focus on health behaviors, another hypothesized mechanism, which may be more relevant to inflammation (Ford, 2002; Giugliano, Ceriello, & Esposito, 2006). Doing so could help to inform theoretical understandings of the impacts of religiousness and spirituality on health as well as have practical implications for persons for whom high inflammation is a health risk.

The CRP findings are novel even without mediation or prospective findings because previous research has primarily considered only religiousness, and specifically religious service attendance, as a predictor of inflammation, and has done so primarily among older adults. Study 2 provides further evidence for an important association between religiousness and inflammation and is the first to do so for spirituality exclusively. At the same time, this study does not provide

an explanation for this association. Future research might focus fruitfully on alternative mechanisms such as behavioral mechanisms, especially health behaviors, as hypothesized in the conceptual model of associations of religiousness and spirituality and health.

Also in Study 2, an exploratory analysis was conducted to test a possible mediation of the associations of religiousness and spirituality and depressive symptoms observed in Study 1 by inflammation due to the inflammatory nature of depression (Miller, Maletic, & Raison, 2009). Although religiousness and spirituality together were associated with both depressive symptoms and with CRP, this study's findings do not support CRP as a mechanism of this association. It appears based on the evidence here that psychological mechanisms, like psychosocial resources, are more relevant to the associations of religiousness and spirituality and mental health, and that an inflammatory mechanism may not be as powerful, though further research focused on a broad array of inflammatory markers in clinical and nonclinical samples is warranted.

Cortisol. In Study 3, religiousness and spirituality did not predict diurnal cortisol slopes in women during the postpartum period at either six or 12 months postpartum. Failure to support hypotheses may be attributable to a number of factors. In CCHN, cortisol collection was done at home. This is typical of procedure for cortisol diurnal rhythm research, but in CCHN, the sample was low income and the home context was not the usual home collection setting. Participant failure to collect their samples or collect them correctly resulted in substantial missing data; that is, diurnal cortisol slope was missing for over 65% of this sample at both six and 12 months postpartum. Though the present study employed maximum likelihood estimation in the structural equation models to be able to utilize data from most participants, it would be ideal to have full data for cortisol measures and not rely on missing data techniques. However, the attempt and

ability to collect home cortisol in low income diverse women is important and something upon which future studies can improve.

Secondly, much of the research linking measures of cortisol to psychosocial factors has been conducted in clinical populations of persons with diseases for which cortisol is relevant and potentially dysregulated (e.g., cancer, HIV, fibromyalgia; Carrico et al., 2006; Ironson et al., 2002; Latendresse & Ruiz, 2010; McGregor et al., 2004). Again, it is possible that any effects of psychological and social factors on cortisol are more detectable for dysregulated cortisol characteristic of clinical samples. However, this sample did include a large number of women who were obese and unhealthy compared to population samples of women in this age range.

Lastly, previous research that has linked measures of cortisol to religiousness and spirituality or psychosocial factors has been conducted in substantially different settings than the present study such as acute stress paradigms in experimental settings with manipulated stressors designed to elevate cortisol (e.g., Bostock, Hamer, Wawrzyniak, Mitchell, & Steptoe, 2011; Tartaro et al., 2005). It is quite possible that any effects of psychological and social factors on cortisol measures are more detectable for acute elevations of cortisol than daily cortisol levels that reflect long-term patterns of cortisol regulation.

These findings are useful in directing future study of religiousness and spirituality and biological markers of stress. In future research, it may be best to examine associations of religiousness and spirituality with measures of cortisol in the context of acute stress. To test hypotheses of this type for chronic stress, it will be necessary to consider a sample that is capable of collecting salivary cortisol samples at home or head hair cortisol samples. Understanding these associations may have implications for how religiousness and spirituality affect health over time through impacts on repeated stress throughout one's lifetime. It is also possible to consider

hair cortisol in future studies as it reflects chronic stress (Russell, Koren, Rieder, & Van Uum, 2012).

Strengths and Limitations

These studies, and the dataset on which they were all based, had several methodological strengths. First, in terms of measurement of religiousness and spirituality, CCHN is a rich resource especially in comparison to many studies in the literature. Multiple measures of both religiousness and spirituality allowed for consideration of these factors as one factor and separately. This is unusual in the field of religiousness and spirituality and health because previous studies generally examine associations of particular dimensions of religiousness or spirituality, often religious service attendance, with health and markers of health, though there are notable exceptions. Furthermore, multiple measures of psychosocial resources allowed for consideration of a multidimensional psychosocial resources factor as a mediator of associations of religiousness and health in contrast to much of the existing research which typically considers only one psychosocial resource as a mediator of religiousness and spirituality and health (see Simoni & Ortiz, 2003 for an exception).

In addition, the use of structural equation modeling is unique in the field of religiousness and spirituality and health (with notable exceptions in the research programs of Amy Ai and R. David Hayward). This technique allows for multiple measures of religiousness, spirituality, psychosocial resources and health to be utilized in one model that tests their interrelations. The associations of religiousness, spirituality, health, and their potential mechanisms are complex and structural equation modeling is especially advantageous for exploring that complexity.

Also, the CCHN sample is unique in terms of its racial/ethnic diversity and its focus on women of low socioeconomic status for whom religiousness and spirituality may be especially

relevant (Rees, 2009) and who are infrequently studied. Community participatory methods enabled researchers to recruit and conduct assessments in homes and study a group not often recruited or retained. The longitudinal nature of the study is also a strength as it allowed for multiple assessments of the study outcomes including, as relevant to the present studies, depressive symptoms, C-reactive protein, and cortisol.

The longitudinal design of the study also posed some limitations. Missing data percentages were fairly high (up to 70%) for some key variables in the three studies. In particular, due to a planned but theoretically inconsistent skip pattern in the interview questions on religiousness and spirituality, many women were missing important data on religiousness and/or spirituality. Furthermore, due to the field nature of the study, some blood spots and substantial saliva samples were missed or were unable to be assayed resulting in missing data in these outcomes. Relatedly, CRP was sampled only once at each timepoint and diurnal cortisol was sampled only on one day at each timepoint making these measures less reliable than is ideal. However, in order to account for missing data, structural equation modeling with maximum likelihood estimation was used, thus, missing data should not impact the findings of the studies. CCHN was conducted in the homes of low income families and the ability to obtain better biomarker data was hampered and unlike clinical or laboratory studies.

Future Directions

There are some future directions that this work also indicates. The novel methods used to assess the mediation of the effect of multiple dimensions of religiousness and spirituality by multiple psychosocial resources should be employed in future studies for which this general hypothesis is an interest. Specifically, studies of individual resources or individual aspects of religiousness and spirituality do not help to illuminate the mechanisms of associations of

religiousness, spirituality and health before overall associations with psychosocial resources are established. In addition, future research on associations of religiousness and spirituality and psychosocial resources would contribute substantially by determining the causal direction of this association through longitudinal designs. Understanding this can help target efforts to improve health through these mechanisms.

These studies add to the small literatures on religiousness and spirituality and biological processes. In the case of inflammation, this is the first study to demonstrate an association of spirituality and a marker of inflammation, in this case, C-reactive protein. Additional research is called for to replicate this finding in other samples and to test mechanisms of this association as well as test inflammation as a mechanism of associations of religiousness and spirituality and health outcomes for which inflammation is relevant. In the case of cortisol, the findings of this study point to the importance of continuing research on associations of religiousness and spirituality and stress hormones in acute laboratory settings and in clinical populations.

Summary

Overall, the conceptual framework described in Chapter 1, together with the results of these three studies provide important contributions to theory and research on mechanisms of observed associations of religiousness, spirituality, and health. These findings provide evidence for some potential pathways and not others, which in itself is useful, as it may inform the focus of future research. It is important to continue to investigate associations of religiousness and spirituality and their mechanisms because they are important factors in the health and well-being of religious and spiritual persons who make up a majority of the United States adult population. This is of particular importance among women in the perinatal period for whom religiousness and spirituality may be especially salient and important. Having a child is often a religious and

spiritual experience for families and women in particular. Taking into account this background factor in new and expecting mothers may offer new inroads into maternal child health.

Understanding the mechanisms at work can inform the care of religious and spiritual individuals and their religious communities and can also point to important factors, like psychosocial resources, which may be influential among secular persons as well.

Appendix

CCHN Measures

T1 SECTION 9 FOR MOTHER

Subject ID: [] - [] - [] [] [] [] []
 Visit Date: [] / [] / [] [] [] [] [] []
 Interviewer ID: [] [] [] [] [] [] [] []

SECTION 9: ATTITUDES ABOUT SELF

The next set of questions concern **general feelings about yourself**. For each item please tell me if you strongly agree, agree, feel neutral, disagree, or strongly disagree.
USE CARD C FOR THESE QUESTIONS

		STRONGLY DISAGREE	DISAGREE	NEITHER AGREE OR DISAGREE	AGREE	STRONGLY AGREE
1.	I feel that I'm a person of worth, at least on an equal basis with others. (1000)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
2.	I often feel helpless in dealing with the problems of life. (1010)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
3.	At times I think I am no good at all. (1020)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
4.	I take a positive attitude toward myself. (1030)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
5.	There is really no way I can solve some of the problems I have. (1040)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
6.	What happens to me in the future mostly depends on me. (1050)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
7.	I have very little control over the things that happen to me. (1060)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
8.	On the whole, I am satisfied with myself. (1070)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
9.	There is little I can do to change many of the important things in my life. (1080)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
10.	I can do just about anything I really set my mind to. (1090)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
11.	All in all, I am inclined to feel that I'm a failure. (1100)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
12.	Sometimes I feel that I'm being pushed around in life. (1110)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
13.	I feel that I have a number of good qualities. (1120)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

SECTION 5 INTERVIEW VERSION: EPDS

The next set of questions is about how you are feeling. We are interested in how you have been feeling in the **past 7 days**, not just how you feel today.

In the past 7 days...

1. ...have you been able to laugh and see the funny side of things? Would you say... (1020) ₀ as much as you always could,
₁ not quite so much now,
₂ definitely not so much now, or
₃ not at all as usual?
2. ...have you looked forward with enjoyment to things? Would you say... (1030) ₀ as much as you ever did,
₁ rather less than you used to,
₂ definitely less than you used to, or
₃ hardly at all?
3. ...have you blamed yourself unnecessarily when things went wrong? Would you say... (1040) ₃ most of the time,
₂ some of the time,
₁ not very often, or
₀ not at all?
4. ...have you been anxious or worried for no good reason? Would you say... (1050) ₀ not at all,
₁ hardly ever,
₂ sometimes, or
₃ very often?

In the past 7 days...

5. ...have you felt scared or panicked for no very good reason? Would you say... (1060) ₃ quite a lot,
₂ sometimes,
₁ not much, or
₀ not at all?
6. ...have things been getting "on top of you?" Would you say... (1070) ₃ most of the time you haven't been able to cope at all,
₂ sometimes you haven't been coping as well,
₁ most of the time you have coped quite well, or
₀ you have been coping as well as ever?
- IF NEEDS MORE EXPLANATION: ON "TOP OF YOU" MEANS "OVERWHELMING" YOU OR "GETTING THE BEST OF YOU."

7. ...have you been so unhappy that you have had difficulty sleeping? Would you say... (1080) ₃ most of the time,
₂ sometimes,
₁ not very often, or
₀ not at all?
8. ...have you felt sad or miserable? Would you say... (1090) ₃ most of the time,
₂ quite often,
₁ not very often, or
₀ never?
9. ...have you been so unhappy that you have been crying? Would you say... (1100) ₃ most of the time,
₂ quite often,
₁ only occasionally, or
₀ never?

10. ...has the thought of harming yourself occurred to you? Would you say... (1110) ₃ quite often,
₂ sometimes,
₁ hardly ever, or
₀ never?
- FOLLOW STUDY PROTOCOL FOR FOLLOWUP TO AFFIRMATIVE ANSWER.

Optimism/Pessimism

I have a few statements now about your attitude toward life. There are no correct or incorrect answers. Please answer according to your own feelings, rather than how you think "most people" would answer. **CARD I FOR RESPONSES.**

		I AGREE A LOT	I AGREE A LITTLE	I NEITHER AGREE NOR DISAGREE	I DISAGREE A LITTLE	I DISAGREE A LOT	DK	REF
14. In uncertain times, I usually expect the best.	(1130)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
15. It's easy for me to relax.	(1140)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
16. If something can go wrong for me, it will.	(1150)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
17. I always look on the bright side of things.	(1160)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
18. I'm always optimistic about my future.	(1170)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
19. I enjoy my friends a lot.	(1180)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
20. It's important for me to keep busy.	(1190)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
21. I hardly ever expect things to go my way.	(1200)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
22. Things never work out the way I want them to.	(1210)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
23. I don't get upset too easily.	(1220)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
24. I'm a believer in the idea that "every cloud has a silver lining." (there is a positive aspect to all bad things)	(1230)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉
25. I rarely count on good things happening to me.	(1240)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅	<input type="checkbox"/> ₉₈	<input type="checkbox"/> ₉₉

Religious and Spiritual Background

The next set of questions is on your religious and spiritual background. We are interested in religious beliefs and practices because they have been shown to relate to health. There are just a few questions on this topic.

26. To what extent do you consider yourself a religious person? By "religious" we mean *the actual practice of a faith*, such as belonging to or going to a church, temple, mosque, or synagogue. Would you say you are...
- (1250) ₁ very religious,
₂ moderately religious,
₃ slightly religious, or
₄ not religious at all?
27. Do you have any specific religious background (a religion you were raised in)? **CARD J FOR RESPONSES**
- (1260) ₀ NO RELIGION
₁ ROMAN CATHOLIC
₂ EPISCOPELIAN / ANGLICAN / CHURCH OF ENGLAND
₃ PROTESTANT (BAPTIST, METHODIST, PRESBYTERIAN)
₄ EVANGELICAL CHRISTIAN
₅ OTHER CHRISTIAN
₆ SHI'ITE MOSLEM
₇ SUNNI MOSLEM
₈ JEW
₉ HINDU
₁₀ JAIN
₁₁ SIKH
₁₂ BUDDHIST
₁₃ OTHER
(1270) SPECIFY _____
₉₉ REF
28. Do you currently identify with or belong to any particular religious group? **CARD J FOR RESPONSES**
IF NO CURRENT RELIGION OR REF, SKIP TO Q33
- (1280) ₀ NO RELIGION
₁ ROMAN CATHOLIC
₂ EPISCOPELIAN / ANGLICAN / CHURCH OF ENGLAND
₃ PROTESTANT (BAPTIST, METHODIST, PRESBYTERIAN)
₄ EVANGELICAL CHRISTIAN
₅ OTHER CHRISTIAN
₆ SHI'ITE MOSLEM
₇ SUNNI MOSLEM
₈ JEW
₉ HINDU
₁₀ JAIN
₁₁ SIKH
₁₂ BUDDHIST
₁₃ OTHER
(1290) SPECIFY _____
₉₉ REF

29. How often do you usually attend religious services? Would you say nearly everyday, at least once a week, a few times a month, a few times a year, or less than once a year?
IF LESS THAN ONCE A YEAR, NEVER, DK, OR REF, SKIP TO Q33
- (1310) ₁ NEARLY EVERYDAY - 4 OR MORE TIMES A WEEK
₂ AT LEAST ONCE A WEEK - 1 TO 3 TIMES
₃ A FEW TIMES A MONTH - 1 TO 3 TIMES
₄ A FEW TIMES A YEAR
₅ LESS THAN ONCE A YEAR
₆ NEVER
₉₈ DK
₉₉ REF
30. On a typical day of worship (FRI/SAT/SUN), how many hours are you at your place of worship?
- (1320) ___ HRS
31. To what extent do you find strength and comfort in your religion? Would you say...
- (1340) ₁ many times a day,
₂ every day,
₃ most days,
₄ some days,
₅ once in awhile, or
₆ never or almost never?
32. To what extent is your religion involved in any way in how you understand or deal with stressful situations? Would you say...
- (1350) ₁ very involved,
₂ somewhat involved,
₃ not very involved, or
₄ not involved at all?
33. To what extent do you consider yourself a spiritual person? By "spiritual" beliefs or experiences, we mean *what people believe* -- whether or not they participate in organized religion or belong to a religious organization. People can have spiritual beliefs without being religious. Would you say you are...
- (1330) ₁ very spiritual,
₂ moderately spiritual,
₃ slightly spiritual, or
₄ not spiritual at all?
34. To what extent do you feel deep inner peace or harmony? Would you say...
- (1360) ₁ many times a day,
₂ every day,
₃ most days,
₄ some days,
₅ once in awhile, or
₆ never or almost never?

35. To what extent would you say you experience a divine presence in your life? Would you say...

- (1370) ₁ many times a day,
₂ every day,
₃ most days,
₄ some days,
₅ once in awhile, or
₆ never or almost never?

36. To what extent do you look to a higher power such as God for strength, support, and guidance? Would you say...

- (1380) ₁ a great deal,
₂ quite a bit,
₃ somewhat, or,
₄ not at all?

RELIGIOSITY

The next set of questions is on your religion and spirituality. We are interested in religious beliefs and practices because they have been shown to relate to health. There are just a few questions on this topic.

Do you agree or disagree with the following statements?		AGREE	DISAGREE
1. I talk openly about my faith with others.	(1000)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
2. I often read religious books, magazines, and pamphlets.	(1010)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
3. I often watch or listen to religious programs on television or radio.	(1020)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
4. My spiritual beliefs are the foundation of my whole approach to life.	(1030)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
5. I am often aware of the presence of God in my life.	(1040)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
6. I have a personal relationship with God.	(1050)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
7. When I am ill, I pray for healing.	(1060)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
8. I pray often.	(1070)	<input type="checkbox"/> _1	<input type="checkbox"/> _0
9. I rely on God to keep me in good health.	(1080)	<input type="checkbox"/> _1	<input type="checkbox"/> _0

References

- Abrams, L. S., & Curran, L. (2007). Not just a middle-class affliction: crafting a social work research agenda on postpartum depression. *Health & Social Work, 32*(4), 289–96. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18038730>
- Ai, A. L., Tice, T. N., Huang, B., Rodgers, W., & Bolling, S. F. (2008). Types of prayer, optimism, and well-being of middle-aged and older patients undergoing open-heart surgery. *Mental Health, Religion & Culture, 11*(1), 131–150. <http://doi.org/10.1080/13674670701324798>
- Ai, A. L., Tice, T. N., Peterson, C., & Huang, B. (2005). Prayers, spiritual support, and positive attitudes in coping with the September 11 national crisis. *Journal of Personality, 73*(3), 763–91. <http://doi.org/10.1111/j.1467-6494.2005.00328.x>
- Baetz, M., Bowen, R., Jones, G., & Koru-Sengul, T. (2006). How spiritual values and worship attendance relate to psychiatric disorders in the Canadian population. *Canadian Journal of Psychiatry, 51*(6), 654–661. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17696028>
- Beck, C. T. (2002). Postpartum Depression: A Metasynthesis. *Qualitative Health Research, 12*(4), 453–472. <http://doi.org/10.1177/104973202129120016>
- Bellinger, D. L., Berk, L. S., Koenig, H. G., Daher, N., Pearce, M. J., Robins, C. J., ... King, M. B. (2014). Religious Involvement, Inflammatory Markers and Stress Hormones in Major Depression and Chronic Medical Illness, (October), 335–352.
- Bormann, J. E., Aschbacher, K., Wetherell, J. L., Roesch, S., & Redwine, L. (2009). Effects of faith/assurance on cortisol levels are enhanced by a spiritual mantram intervention in adults with HIV: A randomized trial. *Journal of Psychosomatic Research, 66*(2), 161–171. <http://doi.org/10.1016/j.jpsychores.2008.09.017>
- Bostock, S., Hamer, M., Wawrzyniak, A. J., Mitchell, E. S., & Steptoe, A. (2011). Positive emotional style and subjective, cardiovascular and cortisol responses to acute laboratory stress. *Psychoneuroendocrinology, 36*(8), 1175–1183. <http://doi.org/10.1016/j.psyneuen.2011.02.009>
- Bublitz, M. H., & Stroud, L. R. (2012). Childhood sexual abuse is associated with cortisol awakening response over pregnancy: Preliminary findings. *Psychoneuroendocrinology, 37*(9), 1425–1430. <http://doi.org/10.1016/j.psyneuen.2012.01.009>
- Buchbinder, S., Kratzsch, J., Fiedler, G. M., Yar, V., Brugel, M., Leichtle, A., ... Thiery, J. (2008). Body weight and oral contraceptives are the most important modulators of serum CRP levels. *Scandinavian Journal of Clinical and Laboratory Investigation, 68*(2), 140–144. <http://doi.org/10.1080/00365510701487727>
- Burlingame, J., Ahn, H. J., & Tang, W. H. (2013). Changes in cardiovascular biomarkers throughout pregnancy and the remote postpartum period. *American Journal of Obstetrics*

and *Gynecology*, 208(1), S97. <http://doi.org/10.1016/j.ajog.2012.10.372>

- Carrico, A. W., Ironson, G., Antoni, M. H., Lechner, S. C., Durán, R. E., Kumar, M., & Schneiderman, N. (2006). A path model of the effects of spirituality on depressive symptoms and 24-h urinary-free cortisol in HIV-positive persons. *Journal of Psychosomatic Research*, 61(1), 51–8. <http://doi.org/10.1016/j.jpsychores.2006.04.005>
- Cheadle, A. C. D., Dunkel Schetter, C., Gaines Lanzi, R., Reed Vance, M., Sahadeo, L. S., Shalowitz, M. U., ... CCHN, T. (2014). Spiritual and Religious Resources in African American Women: Protection From Depressive Symptoms After Childbirth. *Clinical Psychological Science*. <http://doi.org/10.1177/2167702614531581>
- Christian, L. M. (2012). Physiological reactivity to psychological stress in human pregnancy: Current knowledge and future directions. *Progress in Neurobiology*, 99(2), 106–116. <http://doi.org/10.1016/j.pneurobio.2012.07.003>
- Christian, L. M., & Porter, K. (2014). Longitudinal changes in serum proinflammatory markers across pregnancy and postpartum: effects of maternal body mass index. *Cytokine*, 70(2), 134–40. <http://doi.org/10.1016/j.cyto.2014.06.018>
- Coussons-Read, M. E. (2012). The Psychoneuroimmunology of Stress in Pregnancy. *Current Directions in Psychological Science*, 21(5), 323–328. <http://doi.org/10.1177/0963721412453720>
- Coussons-Read, M. E., Okun, M. L., Schmitt, M. P., & Giese, S. (2005). Prenatal stress alters cytokine levels in a manner that may endanger human pregnancy. *Psychosomatic Medicine*, 67(4), 625–31. <http://doi.org/10.1097/01.psy.0000170331.74960.ad>
- Czernichow, S., Kengne, a-P., Stamatakis, E., Hamer, M., & Batty, G. D. (2011). Body mass index, waist circumference and waist-hip ratio: which is the better discriminator of cardiovascular disease mortality risk? Evidence from an individual-participant meta-analysis of 82 864 participants from nine cohort studies. *Obesity Reviews : An Official Journal of the International Association for the Study of Obesity*, 12(9), 680–687. <http://doi.org/10.1111/j.1467-789X.2011.00879.x>
- Davis, E. P., & Sandman, C. a. (2010). The timing of prenatal exposure to maternal cortisol and psychosocial stress is associated with human infant cognitive development. *Child Development*, 81(February), 131–148.
- Dedert, E. a, Studts, J. L., Weissbecker, I., Salmon, P. G., Banis, P. L., & Sephton, S. E. (2004). Religiosity may help preserve the cortisol rhythm in women with stress-related illness. *International Journal of Psychiatry in Medicine*, 34(1), 61–77. <http://doi.org/10.2190/2Y72-6H80-BW93-U0T6>
- Dettling, A. C., Gunnar, M. R., & Donzella, B. (1999). Cortisol levels of young children in full-day childcare centers: Relations with age and temperament. *Psychoneuroendocrinology*, 24(5), 519–536. [http://doi.org/10.1016/S0306-4530\(99\)00009-8](http://doi.org/10.1016/S0306-4530(99)00009-8)

- Ellison, C. G., Burdette, A. M., & Hill, T. D. (2009). Blessed assurance: Religion, anxiety, and tranquility among US adults. *Social Science Research*, 38(3), 656–667. <http://doi.org/10.1016/j.ssresearch.2009.02.002>
- Ershler, W. B., & Keller, E. T. (2000). AGE-ASSOCIATED INCREASED INTERLEUKIN-6 AND FATILITY, 245–270.
- Ford, E. S. (2002). Does Exercise Reduce Inflammation? Physical Activity and C-Reactive Protein among U.S. Adults. *Epidemiology (Cambridge, Mass.)*, 13(5), 561–568. <http://doi.org/10.1097/01.EDE.0000023965.92535.C0>
- Ford, E. S., Loucks, E. B., & Berkman, L. F. (2006). Social integration and concentrations of C-reactive protein among US adults. *Annals of Epidemiology*, 16(2), 78–84. <http://doi.org/10.1016/j.annepidem.2005.08.005>
- Gilli, F., Lindberg, R. L. P., Valentino, P., Marnetto, F., Malucchi, S., Sala, A., ... Bertolotto, A. (2010). Learning from nature: Pregnancy changes the expression of inflammation-related genes in patients with multiple sclerosis. *PLoS ONE*, 5(January). <http://doi.org/10.1371/journal.pone.0008962>
- Giugliano, D., Ceriello, A., & Esposito, K. (2006). The Effects of Diet on Inflammation. Emphasis on the Metabolic Syndrome. *Journal of the American College of Cardiology*, 48(4), 677–685. <http://doi.org/10.1016/j.jacc.2006.03.052>
- Groer, M. W., Davis, M. W., Smith, K., Casey, K., Kramer, V., & Bulovsky, E. (2005). Immunity, inflammation and infection in post-partum breast and formula feeders. *American Journal of Reproductive Immunology*, 54(4), 222–231. <http://doi.org/10.1111/j.1600-0897.2005.00301.x>
- Guardino, C. M., Schetter, C. D., Saxbe, D. E., Adam, E. K., Ramey, S. L., & Shalowitz, M. U. (2016). Diurnal Salivary Cortisol Patterns Prior to Pregnancy Predict Infant Birth Weight. *Health Psychology*. <http://doi.org/10.1037/hea0000313>
- Ironson, G., Solomon, G. F., Balbin, E. G., O’Cleirigh, C., George, A., Kumar, M., ... Woods, T. E. (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 : A Publication of the Society of Behavioral Medicine*, 24(1), 34–48. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12008793>
- Jacobs, M., Miller, L., Wickramaratne, P., Gameraoff, M. J., & Weissman, M. M. (2012). Family religion and psychopathology in children of depressed mothers: ten-year follow-up. *Journal of Affective Disorders*, 136(3), 320–7. <http://doi.org/10.1016/j.jad.2011.11.030>
- Jain, M. K., & Ridker, P. M. (2005). Anti-inflammatory effects of statins: clinical evidence and basic mechanisms. *Nat Rev Drug Discov*, 4(12), 977–987. <http://doi.org/nrd1901> [pii]r10.1038/nrd1901
- Jesse, D. E., & Swanson, M. S. (2007). Risks and resources associated with antepartum risk for

- depression among rural southern women. *Nursing Research*, 56(6), 378–86.
<http://doi.org/10.1097/01.NNR.0000299856.98170.19>
- Jesse, D. E., Walcott-McQuigg, J., Mariella, A., & Swanson, M. S. (2005). Risks and protective factors associated with symptoms of depression in low-income African American and Caucasian women during pregnancy. *Journal of Midwifery & Women's Health*, 50(5), 405–10. <http://doi.org/10.1016/j.jmwh.2005.05.001>
- Kapur, S., Kapur, S., & Zava, D. (2008). Cardiometabolic risk factors assessed by a finger stick dried blood spot method. *Journal of Diabetes Science and Technology (Online)*, 2(2), 236–241. <http://doi.org/10.1177/193229680800200210>
- Kenis, G., & Maes, M. (2002). Effects of antidepressants on the production of cytokines. *The International Journal of Neuropsychopharmacology / Official Scientific Journal of the Collegium Internationale Neuropsychopharmacologicum (CINP)*, 5(4), 401–412.
<http://doi.org/10.1017/S1461145702003164>
- Kim, K. H., Sobal, J., & Wethington, E. (2003). Religion and body weight. *International Journal of Obesity and Related Metabolic Disorders : Journal of the International Association for the Study of Obesity*, 27, 469–477. <http://doi.org/10.1038/sj.ijo.0802220>
- King, D. E., & Pearson, W. S. (2001). THE RELATIONSHIP BETWEEN ATTENDANCE AT RELIGIOUS SERVICES AND CARDIOVASCULAR INFLAMMATORY MARKERS * † . *Psychiatry: Interpersonal and Biological Processes*, 31(4), 415–425.
- Kraus, T. a., Sperling, R. S., Engel, S. M., Lo, Y., Kellerman, L., Singh, T., ... Moran, T. M. (2010). Peripheral Blood Cytokine Profiling During Pregnancy and Post-partum Periods. *American Journal of Reproductive Immunology*, 64, 411–426.
<http://doi.org/10.1111/j.1600-0897.2010.00889.x>
- Kuzawa, C. W., Adair, L. S., Borja, J., & McDade, T. W. (2013). C-reactive protein by pregnancy and lactational status among Filipino young adult women. *American Journal of Human Biology*, 25(1), 131–134. <http://doi.org/10.1002/ajhb.22351>
- Latendresse, G., & Ruiz, R. J. (2010). Maternal coping style and perceived adequacy of income predict CRH levels at 14-20 weeks of gestation. *Biological Research for Nursing*, 12(2), 125–36. <http://doi.org/10.1177/1099800410377111>
- Le, T. N., Tov, W., & Taylor, J. (2007). Religiousness and Depressive Symptoms in Five Ethnic Adolescent Groups. *International Journal for the Psychology of Religion*, 17(3), 209–232.
<http://doi.org/10.1080/10508610701402259>
- Loucks, E. B., Berkman, L. F., Gruenewald, T. L., & Seeman, T. E. (2005). Social integration is associated with fibrinogen concentration in elderly men. *Psychosomatic Medicine*, 67(3), 353–8. <http://doi.org/10.1097/01.psy.0000160482.89163.e8>
- Loucks, E. B., Berkman, L. F., Gruenewald, T. L., & Seeman, T. E. (2006). Relation of social integration to inflammatory marker concentrations in men and women 70 to 79 years. *The*

American Journal of Cardiology, 97(7), 1010–6.
<http://doi.org/10.1016/j.amjcard.2005.10.043>

- Lukwago, S. N., Kreuter, M. W., Bucholtz, D. C., Holt, C. L., & Clark, E. M. (2001). Development and validation of brief scales to measure collectivism, religiosity, racial pride, and time orientation in urban African American women. *Family & Community Health*, 24(3), 63–71. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11563945>
- Lutgendorf, S. K., Russell, D. W., Ullrich, P., Harris, T. B., & Wallace, R. (2004). Religious participation, interleukin-6, and mortality in older adults. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 23(5), 465–75. <http://doi.org/10.1037/0278-6133.23.5.465>
- MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science: The Official Journal of the Society for Prevention Research*, 1(4), 173–181. <http://doi.org/10.1023/A1026595011371>
- Mann, J. R., McKeown, R. E., Bacon, J., Vesselinov, R., & Bush, F. (2007). Religiosity, Spirituality, and Depressive Symptoms in Pregnant Women. *The International Journal of Psychiatry in Medicine*, 37(3), 301–313. <http://doi.org/10.2190/PM.37.3.g>
- Marteinsdottir, I., Ernerudh, J., Jonasson, L., Kristenson, M., & Garvin, P. (2016). Psychological Resources Are Independently Associated with Markers of Inflammation in a Middle-Aged Community Sample. *International Journal of Behavioral Medicine*.
<http://doi.org/10.1007/s12529-016-9553-z>
- Masters, K. S., & Hooker, S. a. (2013). Religiousness/spirituality, cardiovascular disease, and cancer: Cultural integration for health research and intervention. *Journal of Consulting and Clinical Psychology*, 81(2), 206–16. <http://doi.org/10.1037/a0030813>
- McCullough, M. E., Hoyt, W. T., Larson, D. B., Koenig, H. G., & Thoresen, C. E. (2000). Religious involvement and mortality: A meta-analytic review. *Health Psychology*, 19(3), 211–222. <http://doi.org/10.1037//0278-6133.19.3.211>
- McDade, T. W., Burhop, J., & Dohnal, J. (2004). High-Sensitivity Enzyme Immunoassay for C-Reactive Protein in Dried Blood Spots. *Clinical Chemistry*, 50(3), 652–654.
<http://doi.org/10.1373/clinchem.2003.029488>
- McGregor, B. A., Antoni, M. H., Boyers, A., Alferi, S. M., Blomberg, B. B., & Carver, C. S. (2004). Cognitive-behavioral stress management increases benefit finding and immune function among women with early-stage breast cancer. *Journal of Psychosomatic Research*, 56(1), 1–8. [http://doi.org/10.1016/S0022-3999\(03\)00036-9](http://doi.org/10.1016/S0022-3999(03)00036-9)
- Miller, A. H., Maletic, V., & Raison, C. L. (2009). Inflammation and Its Discontents: The Role of Cytokines in the Pathophysiology of Major Depression. *Biological Psychiatry*, 65(9), 732–741. <http://doi.org/10.1016/j.biopsych.2008.11.029>
- Miller, L., & Wickramaratne, P. (2012). Religiosity and major depression in adults at high risk: a

- ten-year prospective study. *American Journal of ...*, 89–94. Retrieved from <http://m.psychiatryonline.org/article.aspx?articleid=181220&RelatedWidgetArticles=true>
- Mofidi, M., Devellis, R. F., Blazer, D. G., Devellis, B. M., Panter, a T., & Jordan, J. M. (2006). Spirituality and depressive symptoms in a racially diverse US sample of community-dwelling adults. *The Journal of Nervous and Mental Disease*, 194(12), 975–7. <http://doi.org/10.1097/01.nmd.0000243825.14449.de>
- Paul, I. M., Downs, D. S., Schaefer, E. W., Beiler, J. S., & Weisman, C. S. (2013). Postpartum anxiety and maternal-infant health outcomes. *Pediatrics*, 131(4), e1218–24. <http://doi.org/10.1542/peds.2012-2147>
- Rees, T. J. (2009). Is personal insecurity a cause of cross-national differences in the intensity of religious belief? *Journal of Religion and Society*, 11, 1–26. Retrieved from <http://moses.creighton.edu/jrs/2009/2009-17.pdf>
- Rich-Edwards, J. W., Kleinman, K., Abrams, A., Harlow, B. L., McLaughlin, T. J., Joffe, H., & Gillman, M. W. (2006). Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *Journal of Epidemiology and Community Health*, 60(3), 221–7. <http://doi.org/10.1136/jech.2005.039370>
- Roepke, S. K., & Grant, I. (2011). Toward a more complete understanding of the effects of personal mastery on cardiometabolic health. *Health Psychology*, 30(5), 615–32. <http://doi.org/10.1037/a0023480>
- Roy, B., Diez-Roux, A. V., Seeman, T., Ranjit, N., Shea, S., & Cushman, M. (2010). Association of optimism and pessimism with inflammation and hemostasis in the Multi-Ethnic Study of Atherosclerosis (MESA). *Psychosomatic Medicine*, 72(2), 134–40. <http://doi.org/10.1097/PSY.0b013e3181cb981b>
- Russell, E., Koren, G., Rieder, M., & Van Uum, S. (2012). Hair cortisol as a biological marker of chronic stress: Current status, future directions and unanswered questions. *Psychoneuroendocrinology*, 37(5), 589–601. <http://doi.org/10.1016/j.psyneuen.2011.09.009>
- Salsman, J. M., Brown, T. L., Brechting, E. H., & Carlson, C. R. (2005). The link between religion and spirituality and psychological adjustment: the mediating role of optimism and social support. *Personality & Social Psychology Bulletin*, 31(4), 522–35. <http://doi.org/10.1177/0146167204271563>
- Sandman, C. a., Glynn, L., Schetter, C. D., Wadhwa, P., Garite, T., Chicz-DeMet, A., & Hobel, C. (2006). Elevated maternal cortisol early in pregnancy predicts third trimester levels of placental corticotropin releasing hormone (CRH): Priming the placental clock. *Peptides*, 27(2006), 1457–1463. <http://doi.org/10.1016/j.peptides.2005.10.002>
- Saxbe, D. E., Adam, E. K., Schetter, C. D., Guardino, C. M., Simon, C., McKinney, C. O., & Shalowitz, M. U. (2015). Cortisol covariation within parents of young children: Moderation by relationship aggression. *Psychoneuroendocrinology*, 62, 121–128. <http://doi.org/10.1016/j.psyneuen.2015.08.006>

- Scheyer, K., & Urizar, G. G. (2015). Altered stress patterns and increased risk for postpartum depression among low-income pregnant women. *Archives of Women's Mental Health*, 317–328. <http://doi.org/10.1007/s00737-015-0563-7>
- Seeman, T. E., Dubin, L. F., & Seeman, M. (2003). Religiosity/spirituality and health: A critical review of the evidence for biological pathways. *American Psychologist*, 58(1), 53–63. <http://doi.org/10.1037/0003-066X.58.1.53>
- Simoni, J. M., & Ortiz, M. Z. (2003). Mediational models of spirituality and depressive symptomatology among HIV-positive Puerto Rican women. *Cultural Diversity & Ethnic Minority Psychology*, 9(1), 3–15. <http://doi.org/10.1037/1099-9809.9.1.3>
- Smith, T. B., McCullough, M. E., & Poll, J. (2003). Religiousness and depression: Evidence for a main effect and the moderating influence of stressful life events. *Psychological Bulletin*, 129(4), 614–636. <http://doi.org/10.1037/0033-2909.129.4.614>
- Sternthal, M. J., Williams, D. R., Musick, M. a, & Buck, A. C. (2010). Depression, anxiety, and religious life: a search for mediators. *Journal of Health and Social Behavior*, 51(3), 343–59. <http://doi.org/10.1177/0022146510378237>
- Tartaro, J., Luecken, L. J., & Gunn, H. E. (2005). Exploring heart and soul: effects of religiosity/spirituality and gender on blood pressure and cortisol stress responses. *Journal of Health Psychology*, 10(6), 753–66. <http://doi.org/10.1177/1359105305057311>
- Tu, M. T., Lupien, S. J., & Walker, C. D. (2006). Multiparity reveals the blunting effect of breastfeeding on physiological reactivity to psychological stress. *Journal of Neuroendocrinology*, 18(7), 494–503. <http://doi.org/10.1111/j.1365-2826.2006.01441.x>
- Urizar, G. G., & Muñoz, R. F. (2011). Impact of a prenatal cognitive-behavioral stress management intervention on salivary cortisol levels in low-income mothers and their infants. *Psychoneuroendocrinology*, 36(10), 1480–1494. <http://doi.org/10.1016/j.psyneuen.2011.04.002>
- Vazquez, G., Duval, S., Jacobs, D. R., & Silventoinen, K. (2007). Comparison of body mass index, waist circumference, and waist/hip ratio in predicting incident diabetes: A meta-analysis. *Epidemiologic Reviews*, 29(1), 115–128. <http://doi.org/10.1093/epirev/mxm008>
- Williams, M. J. a, Williams, S. M., Milne, B. J., Hancox, R. J., & Poulton, R. (2004). Association between C-reactive protein, metabolic cardiovascular risk factors, obesity and oral contraceptive use in young adults. *International Journal of Obesity and Related Metabolic Disorders : Journal of the International Association for the Study of Obesity*, 28, 998–1003. <http://doi.org/10.1038/sj.ijo.0802713>
- Woloshin, S., & Schwartz, L. M. (2005). Distribution of C-reactive protein values in the United States. *The New England Journal of Medicine*, 352(15), 1611–1613. <http://doi.org/10.1056/NEJM200504143521525>
- Yim, I. S., Glynn, L. M., Dunkel Schetter, C., Hobel, C. J., Chicz-Demet, A., & Sandman, C. A.

(2010). Prenatal beta-endorphin as an early predictor of postpartum depressive symptoms in euthymic women. *Journal of Affective Disorders*, 125(1-3), 128–33.
<http://doi.org/10.1016/j.jad.2009.12.009>