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Abstract

Numerous studies suggest that religious involvement tends to favor healthy biological functioning across the life course. The primary aim of this chapter is to review and explain these patterns. Toward this end, we develop several biopsychosocial models of religious involvement and biological functioning. These models incorporate pathways related to social resources, psychological resources, healthy behaviors, and various biological processes. We conclude that additional research is needed to establish associations with understudied biological outcomes (e.g., epigenetics, infant mortality, and telomeres), individual mechanisms, more elaborate causal models, and sub-group variations. It is also important for future studies to thoroughly explore the “dark side” of religion and to formally test alternative explanations, including health selection, personality selection, and genetic selection. Research along these lines would provide a more comprehensive understanding of how and why religious involvement might contribute to biological functioning across the life course.

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In 1847, Francis Galton defined the terms of the so-called “nature versus nurture” debate:

Nature is all that a man brings with himself into the world; nurture is every influence from without that affects him after his birth. The distinction is clear: the one produces the infant such as it actually is, including its latent faculties of growth of body and mind; the other affords the environment amid which the growth takes place, by which natural tendencies may be strengthened or thwarted, or wholly new ones implanted. Neither of the terms implies any theory; natural gifts may or may not be hereditary; nurture does not especially consist of food, clothing, education or tradition, but it includes all of these and similar influences whether known or unknown. (Galton 1847, p. 12)

For over a century, human scientists were divided along the lines of nature or nurture. The debate peaked in the twentieth century when biological scientists really began to study human development and behavior at the molecular level. During the 1960s and 1970s, the emergence of socio-environmental perspectives “pitted those who believed that we are determined only by our genes against those who believed we are determined only by our environment” (Nature Editorial Group 2012, p. 143).

Due to advances in the study of gene-environment interactions and epigenetics, biological scientists have moved beyond exclusive models of biological determinism to acknowledge that genetic processes and environmental conditions often depend on each other (Freese 2008; Landecker and Panofsky 2013). For the most part, sociologists have ignored developments in the biological sciences and have sustained a “nurture fortress” to defend against essentialist notions of biological determinism that are now obsolete. Biologists used to be the problem. Now sociologists are the problem. With few exceptions, sociologists “are still immured in their fortress, struggling to catch up with a debate that has shifted from nature-or-nurture to nature-and-nurture, or are unable to shake off their distrust of scientists, worrying that scientists will force them to play second fiddle in their own territory: the environment” (Nature Editorial Group 2012, p. 143).

In the twenty-first century, it is no longer tenable to endorse the perspectives of nature-only or nurture-only or nature “versus” nurture. These approaches are generally inadequate and incorrect (Bradshaw and Ellison 2009; Freese 2008; Landecker and Panofsky 2013). According to Landecker and Panofsky (2013, p. 353), the twenty-first century (and beyond) will be “a time of renegotiation and reconfiguring of the biological, the social, and their interrelation, and sociology has an important role to play in this process.”

With this in mind, the aim of our chapter is to chip away at the “nurture fortress” by providing an overview of research linking religious involvement and various indicators of health and

biological functioning across the life course, including gene-environment interplay, birth weight, preterm birth, infant mortality, allostatic load, disability, and adult mortality. In each section, we offer clear conceptual definitions and concise summaries of previous research. We conclude by highlighting several important avenues for future research in the sociological study of religion and biological functioning.

Gene-Environment Interplay

Genetic differences contribute to individual variation on virtually all aspects of mental health, physical health, and biological functioning. For example, twin, adoption, and molecular genetic studies have shown that genetic factors shape common affective disorders like depression (Caspi et al. 2003; Kendler 2001; Sullivan et al. 2000) and anxiety (Crowe et al. 1983; Finn and Smoller 2001). It is also well established that schizophrenia and other forms of severe psychopathology are strongly influenced by genetic factors (Gottesman 1991). A number of studies have found evidence for genetic effects on many forms of cancer (Benhamou and Sarasin 2005), blood pressure (Whitfield and McClearn 2005), lung capacity (McClearn et al. 1994; Whitfield et al. 1999), chronic pain (Zondervan et al. 2005), body mass (Johnson and Krueger 2005), physical strength (Carmelli and Reed 2000), eating disorders (Kendler 2001; Polivy and Herman 2002), vulnerability to substance abuse (Kreek et al. 2005), and birth outcomes like weight, length, and head circumference (Lunde et al. 2007). There is even some evidence to suggest that genetic influences shape physiological responses to stress (Gillespie et al. 2009), cortisol levels (Wüst et al. 2000), heart rate variability (Uusitalo et al. 2007), insulin and glucose levels (Snieder et al. 1999), and alcohol metabolism (Li et al. 2001).

While important, genetic factors are only one of many distinct influences on health and biological functioning. A growing number of studies have suggested that religious involvement also plays a role (Koenig et al. 2012). Although findings are

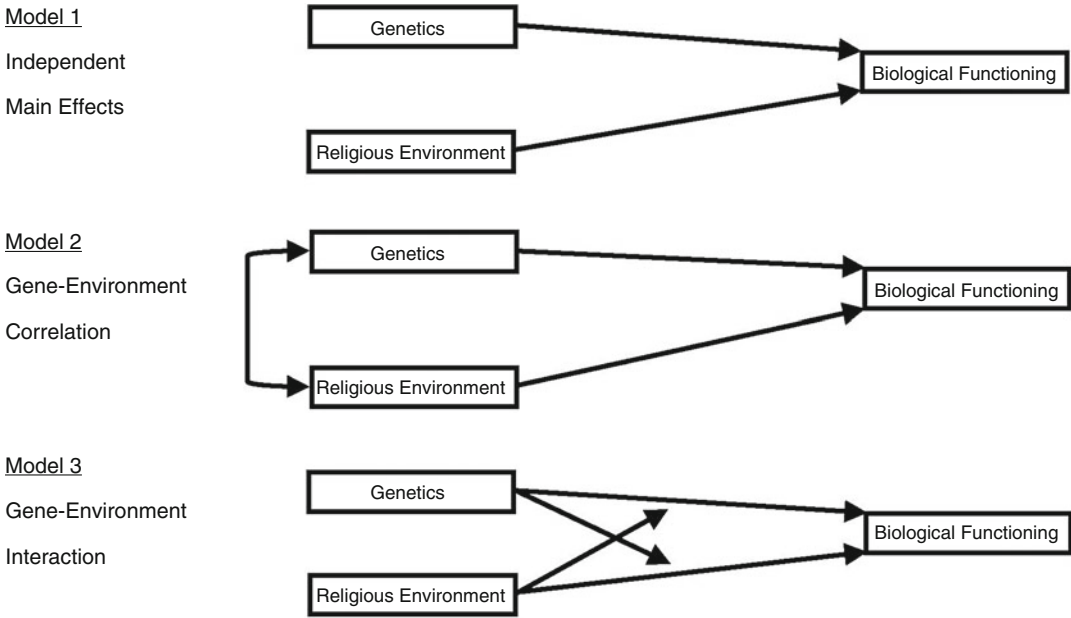


Fig. 2.1 Conceptual models of gene-religious environment interplay

not unequivocal, research has shown that multiple aspects of religious life (e.g., service attendance, prayer and meditation, feelings of attachment to God, and belief in an afterlife) have salutary effects on health and biological functioning (Koenig et al. 2012). Proposed explanations for these findings tend to center on religion’s ability to reduce exposure to social stressors, provide psychosocial resources that can be used to deal with stressors when they do occur, and to offer distinctive coping styles (Koenig et al. 2012; Pargament 1997) (see also Krause’s Chap. 14, on “Aging” in this volume).

For the most part, scholars have focused on either genetic influences or religious influences, and very little research has examined how these two factors might work together to shape health and biological functioning. Model 1 of Fig. 2.1 depicts the independent main effects of both genetic factors and environmental influences (which includes religious involvement). However, an emerging interdisciplinary paradigm strongly suggests that genetic and environmental influences may not work in completely independent ways (Caspi et al. 2003; Rutter et al. 2006; Shanahan and Hofer 2005). Instead, they may function

through gene-environment correlations (Model 2) and gene-environment interactions (Model 3).

Gene-environment correlations (rGE) occur when genetic factors and environmental influences like religious involvement are not independent, but are instead associated in some way. We have already reviewed evidence showing that genetic influences shape health and biological functioning. It turns out that religious involvement is also, to some extent, heritable. For example, studies show that genetic differences contribute to individual variations in religious service attendance, religious salience, biblical literalism, born-again experiences, fundamentalist orientations, religious coping, intrinsic and extrinsic religious motivations, and spirituality (Beer et al. 1998; Bouchard et al. 1999; Bradshaw and Ellison 2008; Kendler et al. 1997). In other words, genetic differences across individuals help us to understand why some individuals are more religious than others. Since religion and health are both influenced by genetic factors, it is conceivable that they are linked with each other through common genetic causes. This possibility has important implications for research on religion, health, and biological functioning.

According to previous research, rGE have three forms: passive, evocative, and active (Jaffee and Price 2007; Reiss et al. 2000; Scarr and McCartney 1983). Passive rGE occur when individuals share genes with people who also contribute to or are a part of their environments. For example, genetic liabilities for alcohol and drug misuse have been associated with decreased moral-religious emphases in families (Jang et al. 2001). In essence, genetic dispositions for substance misuse are correlated with, and subsequently contribute to, the religiosity of families (an environmental condition). This finding alone has serious implications for how we interpret common associations in the literature. In this particular example, we cannot fully understand the association between religion and substance abuse without also examining genetic influences.

In contrast to passive rGE, evocative rGE occur when our genetic makeup induces responses from others in our environments. For example, some individuals are genetically-predisposed toward aggressive or antisocial behavior, and such behavior has a tendency to “evoke” punitive environmental responses like punishment or avoidance (Jaffee et al. 2004). In the religious realm, individuals who suffer from health-related conditions that are genetically-influenced and stigmatized may experience negative responses in the social environment, which could discourage participation in organized religion. Of course individuals also possess desirable traits that are genetically-influenced, including, for example, charisma, passion for leadership, and empathy for others. These traits may evoke positive responses from individuals in a way that facilitates positive experiences within religious communities.

The final type—active rGE—occur when individuals actively seek out or construct environments that fit their genetic tendencies or motivations (Scarr and McCartney 1983). For instance, genetic factors clearly influence mental health, and individuals suffering from psychopathology routinely try to improve their condition through various coping mechanisms. It is quite common for people experiencing emotional pain to seek out comfort and support from church

members and divine others (Kirkpatrick 2005; Pargament 1997). Another example involves individuals who are genetically-predisposed toward social engagement and altruistic behavior. Such individuals may select themselves into frequent participation in religious organizations that provide social activities and opportunities for community service.

Genetic and environmental influences might also condition or moderate the effects of each other through gene-environment interactions (GxE). GxE are distinct from rGE. GxE are unique because they suggest that (1) genetic influences may be more or less pronounced depending upon environmental conditions, and that (2) environmental influences may be enhanced or attenuated depending on genetic differences across individuals (Boomsma et al. 1999; Caspi et al. 2003; Jaffee et al. 2005; Shanahan and Hofer 2005). The GxE concept is profoundly important to the study of religion, health, and biological functioning. It suggests that genetic influences may be moderated by religious involvement, and that the influence of religion may be stronger or weaker depending upon the genetic makeup of individuals.

There are several examples of GxE in the literature. Researchers have found that genetic influences on alcohol abuse are less important among religious adolescents (Button et al. 2010). We also know that a religious upbringing can moderate genetic influences on indicators of personality like disinhibition (Boomsma et al. 1999) and neuroticism (Willemsen and Boomsma 2007). There is even compelling evidence to suggest that religiosity can protect against genetic predispositions toward smoking initiation (Timberlake et al. 2006), delinquency (Beaver et al. 2009), sexual behavior (Halpern et al. 2007), and illicit drug use (Dew and Koenig 2014). GxE scholars argue that environmental conditions like religious involvement can (1) trigger genetic risk factors, (2) compensate for genetic vulnerabilities, (3) provide social control mechanisms that inhibit genetic tendencies, and (4) enhance desirable genetic predispositions (Shanahan and Hofer 2005).

The studies reviewed so far suggest that genetic effects vary across levels of religiosity, but it is also possible for the effects of religiosity to be moderated by genetic differences. For example, a recent experimental study showed that the link between religion and prosocial behavior may only exist among individuals who inherit certain variations of a dopamine-related gene (Sasaki et al. 2013). A follow-up experiment found that the association between religious priming (e.g., the presentation of religious word strings) and self-control was more pronounced among subjects who inherited a specific version of an oxytocin gene (Sasaki et al. 2015).

Low Birth Weight, Preterm Birth, and Infant Mortality

When babies are born weighing less than 2500 g (5 pounds, 8 ounces), they are considered to be low birth weight. The category of very low birth weight is used to describe those babies born weighing less than 1500 g (3 pounds, 4 ounces). In 2013, approximately 8 % of all singleton (non-twin) births were classified as low birth weight, with 1.4 % of newborns classified as very low birthweight (Martin et al. 2015). When babies are born before 37 weeks of gestation, they are labeled preterm. Nearly 70 % of low birthweight babies are preterm births (March of Dimes 2014). Finally, infant mortality refers to the death of babies before their first birthdays. The infant mortality rate is an estimate of the number of infant deaths per 1000 live births. Currently, for every 1000 babies born in the United States, six will die within their first year.

Few studies consider whether the health benefits of religious involvement might extend across generations (from mother to child), as evidenced by favorable birth outcomes. Using data from the Mater-University of Queensland Study of Pregnancy, Najman et al. (1988) showed that regularly attending (weekly or monthly) affiliates of Christian sects (e.g., Jehovah's Witnesses, Mormons, and Seventh Day Adventists) and mainstream Christian groups (Protestants and Catholics) tend to exhibit lower rates of low birth

weight than so-called "lukewarm Christians," those who affiliate with mainstream Christian groups but attend religious services less than monthly. Although their work does not focus on religion per se, Reichman et al. (2008) used data from the U.S. Fragile Families and Child Wellbeing study to show that unmarried urban mothers who attend religious services at least once per week tend to exhibit lower rates of low birth weight than unmarried urban mothers who never attend religious services. Burdette and colleagues (2012) also used the Fragile Families data, but they focused specifically on religion and confirmed that maternal religious attendance can protect against low birth weight.

We could find only two studies focusing on religion and preterm birth or infant mortality. In their study of African American and white women in North Carolina, Dole and colleagues (2004) found no association between maternal church attendance and preterm birth. In a study of members of the Church of Jesus Christ of Latter Day Saints (LDS or Mormons) in Utah, Woolley et al. (1982) found that the risk of neonatal mortality was lower when christenings were performed by the baby's father (defined as high activity members) than when the christenings were performed by a nonrelative (defined as low activity members). They also reported that the risk of neonatal mortality was comparable for families with fathers who performed christenings and families of non-LDS respondents.

Why might religious attendance protect against negative birth outcomes like low birth weight and infant mortality? Previous research has identified several explanations that are at least theoretically viable (Burdette et al. 2012; Elsenbruch et al. 2007; Jesse et al. 2006; Jesse and Reed 2004; Magaña and Clark 1995; Mann et al. 2007; Najman et al. 1988; Page 2004; Page et al. 2009). Drawing on this body of research, Fig. 2.2 emphasizes explanations related to social resources (e.g., social support), psychological resources (e.g., control beliefs), mental health (e.g., depression), and health-related behavior (e.g., smoking).

Religious involvement could protect against negative birth outcomes by promoting social

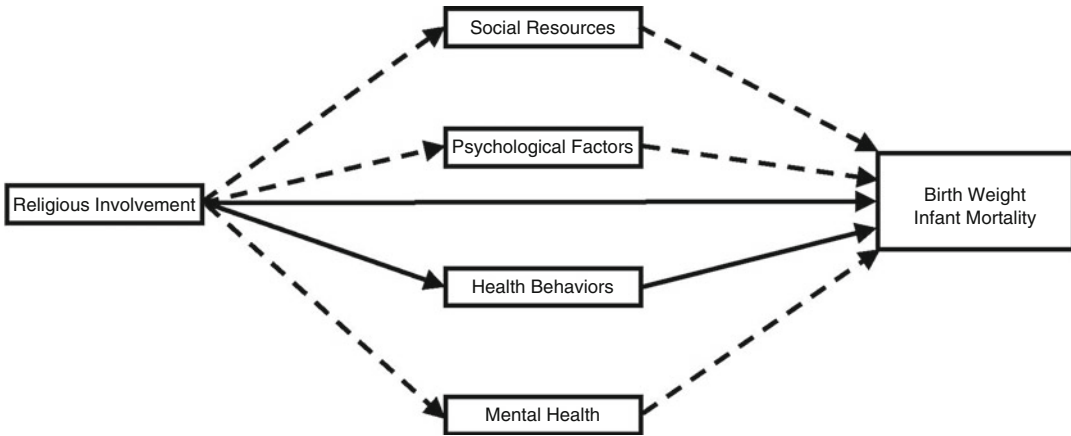


Fig. 2.2 Conceptual model linking religious involvement and birth outcomes *Solid lines indicate that the corresponding pathway has some empirical support. Dashed lines indicate limited empirical support or no empirical support

resources among expecting mothers (Magaña and Clark 1995; Najman et al. 1988). Several studies show that greater religious attendance is associated with higher levels of social integration and social support (Krause 2008; Rote et al. 2013). Krause (2008) explains that religious attendance is an interaction ritual that is characterized by repeated and patterned social contact. Over time, regular social interaction within the same religious community can expand social networks and foster greater contact with network members. Religious communities may also create generally supportive environments through religious socialization (e.g., by encouraging churchgoers to help the less fortunate or by sanctifying family relationships). Social support is extremely important to the health and wellbeing of expecting mothers (Glazier et al. 2004). There is even some evidence to suggest that social support is inversely associated with negative birth outcomes (Elsenbruch et al. 2007).

Religious involvement is also associated with higher levels of psychological resources, including, for example, self-control and personal control or mastery (Dillon and Wink 2007; McCullough and Willoughby 2009; Pascoe et al. 2016). Religious involvement is characterized by social control and self-regulation. Within the context of religious communities, there are social (and perceived divine) sanctions associated with

conformity to and deviance from established religious standards (e.g., behavioral and ritual standards and expectations). Religious involvement contributes to self-control by building generic self-regulatory strength over the life course (McCullough and Willoughby 2009). Because religion is, in many respects, a routine practice of constraint and restraint, religious adults are more likely to believe that they can control their emotions and behavior. A strong sense of divine control may also help to promote a sense of personal control or mastery over various aspects of life when adults trust that anything is possible through faith and a strong partnership with a divine figure (Pascoe et al. 2016). These processes are potentially important in light of research showing that higher levels of mastery are associated with lower levels of pregnancy-related anxiety and lower rates of low birth weight, being small for gestational age, and pre-term birth (Dunkel-Schetter 2009; Goldenberg et al. 1991; Rini et al. 1999).

Religion could also favor infant health by enhancing the mental health of expectant women (Jesse et al. 2006; Magaña and Clark 1995; Page 2004). Studies show that religious attendance is associated with better mental health across a range of indicators, including anger, depression, anxiety, and nonspecific psychological distress (Hill et al. 2011; Koenig et al. 2012). Koenig

et al. (2012) explain that religious involvement benefits mental health by promoting social resources (e.g., social support) and psychological resources (e.g., optimism and a sense of meaning and purpose). Research also suggests that poor mental health is a significant risk factor for several negative birth outcomes, including, for example, preterm birth, intrauterine growth retardation, and low birth weight (Dole et al. 2003; Rondó 2007; Rondó et al. 2003).

Finally, religious involvement may protect against low birth weight and infant mortality by encouraging positive health behaviors and discouraging unhealthy lifestyle choices (Jesse et al. 2006; Jesse and Reed 2004; Magaña and Clark 1995; Page 2004; Page et al. 2009). Studies show that religious attendance is associated with a wide range of healthy behaviors, including, for example, lower levels of smoking and drinking, higher levels of exercise, greater use of preventive health care services, and more rigid adherence to medication regimens (Hill et al. 2006; Hill et al. 2011; Koenig et al. 2012). Research concerning the health behaviors of pregnant and postpartum women confirms that regular religious attendance is associated with lower rates of alcohol use, cigarette use, and illicit drug use (Mann et al. 2007; Page et al. 2009).

There are several compelling explanations for why religious individuals might engage in so many healthy behaviors, including exposure to religious messages that discourage specific behaviors (e.g., specific biblical proscriptions against intoxication) and reinforce the religious significance of (a) the body (e.g., the idea that the body is a temple of God), (b) parent-child relationships (e.g., the idea that children are a gift from God), and (c) authority (e.g., the idea that existing authorities are appointed by God) (Mahoney et al. 2003; Page et al. 2009; Regnerus and Burdette 2006).

Specific religious doctrines and general sanctification processes are so important for health behaviors because they add religious and spiritual consequences to the regular pressures that mothers face when caring for their bodies and following the recommendations of health professionals. Religious attendance might also contrib-

ute to healthy behaviors by reducing motivations to behave in risky ways, for example, by satisfying the need for supportive social ties and reducing negative emotions and the likelihood of self-medication (Page et al. 2009).

Risky maternal health behaviors like cigarette smoking, poor diet, heavy alcohol use, and illicit drug use are important because they are associated with fetal growth restriction, preterm birth, and low birth weight (McCormick et al. 1990; Peacock et al. 1995; Valero de Bernabé et al. 2004). There is also evidence to suggest that prenatal care is associated with positive infant health outcomes (Alexander and Kotelchuck 2001). Cigarette smoking may be an especially important mechanism because it is one of the most common negative health practices and one of the most consistent predictors of low birth weight (Valero de Bernabé et al. 2004).

Given that few studies have examined the relationship between maternal religious involvement and birth outcomes, it should come as no surprise that only a few of the proposed theoretical linkages have been examined empirically. Nevertheless, Burdette et al. (2012) tested a number of mechanisms linking maternal church attendance and low birth weight, including mental health, cigarette use, alcohol use, illicit drug use, poor nutrition, and late prenatal care. Although lower rates of cigarette use partially mediate or explain the association between maternal religious attendance and low birth weight, the authors found no evidence to substantiate the mediating influence of the other proposed mechanisms.

Allostatic Load

For most people, acute or short-term stress is normally and efficiently managed by the stress response or allostatic systems of the human body. In the first major stage of the stress response (the sympathetic response), the hypothalamus (in the brain) signals the adrenal glands to release a stress hormone called adrenaline (or epinephrine) to ready the body for fight-or-flight. In the second major stage (the parasympathetic response), the

hypothalamus signals the adrenal glands to release another stress hormone called cortisol to switch off and compensate for the sympathetic response. When stress is acute or short-term, allostatic systems can efficiently manage the physiological consequences of stress. When stress is chronic or long-term, the result is allostatic load. According to Bruce McEwen (1998, p. 171), allostatic load is “the wear and tear that results from chronic overactivity or underactivity of allostatic systems.”

Allostatic load is typically measured by biomarkers or objective biological indicators (derived from independent assessments like blood, saliva, and urine, not self-reports) of physiological functioning (e.g., cardiovascular and immune functioning) that are known to predict health and mortality risks (Crimmins and Seeman 2001). The most common measures of allostatic load indicate “chronic overactivity or underactivity” of the autonomic nervous system (e.g., epinephrine), the hypothalamic–pituitary–adrenal (HPA) axis (e.g., cortisol and DHEA), and the cardiovascular (e.g., blood pressure and heart rate), metabolic (e.g., glycosylated hemoglobin or blood glucose, body mass, and waist circumference), and immune systems (e.g., c-reactive protein, interleukin-6, white blood cells, and Epstein-Barr virus).

In general, research shows that various indicators of religious involvement are favorably associated with a number of biomarkers across autonomic nervous, HPA, cardiovascular, and immune systems (Seeman et al. 2003; Seybold 2007). More specifically, there is evidence that religious involvement is associated with lower levels of blood pressure (Das and Nairn 2016; Hill et al. 2014; Koenig et al. 1998; Krause et al. 2002; Maselko et al. 2007), c-reactive protein (Das and Nairn 2016; Ferraro and Kim 2014; Gillum et al. 2008; Hill et al. 2014; King et al. 2001, 2002), interleukin-6 (Koenig et al. 1997; Lutgendorf et al. 2004), white blood cells (King et al. 2001), Epstein-Barr virus (Das and Nairn 2016; Hill et al. 2014), epinephrine (Maselko et al. 2007), cortisol (Ironson et al. 2002), and overall allostatic load (Hill et al. 2014; Maselko et al. 2007). Evidence concerning the metabolic

system is weak and mixed. Some research suggests that religious involvement is unrelated to glycosylated hemoglobin (Das and Nairn 2016; Hill et al. 2014). Several other studies demonstrate that religious adults tend to weigh more, not less, than their less religious counterparts (Idler and Kasl 1997a; Kim et al. 2003; Oman and Reed 1998; Strawbridge et al. 1997).

We know very little about how religious involvement gets “under the skin” to contribute to favorable biomarker profiles. However, previous research has proposed (but not tested) several social (e.g., social integration and social support), psychological (e.g., meaning and control beliefs), behavioral (e.g., drinking and smoking), and biological (e.g., stress) mechanisms (Hill 2010; Hill et al. 2011; Koenig et al. 2012; Seybold 2007). Figure 2.3 presents our conceptual model of religious involvement and allostatic load. According to this model, religious involvement and religious meaning systems may help to buffer appraisals of stressful life conditions and, by extension, their physiological consequences. Instrumental support, the sense of control, and moderate drinking practices could help adults to avoid stressful life situations (both events and appraisals) and chronic activation of the physiological stress response. In the event of stressful life conditions (and the activation of sympathetic systems), religious beliefs and practices, supportive relationships, strong self-concepts, and healthy lifestyles may also favor healthy coping strategies (and efficient activation of parasympathetic systems and various growth responses).

Because stress, mental health, and unhealthy behaviors are reliably linked to religious involvement and the activation of nervous, HPA, cardiovascular, immune, and metabolic systems (McEwen 1998, 2002), these factors (among others) may function as general mechanisms across markers of allostatic systems. We should note that these mechanisms cannot explain the anomalous positive association between religious attendance and body mass (a marker of the metabolic system). Explanations for why religious adults tend to weigh more than less religious adults are not firmly established in the literature. However, there is some speculation that poor eating habits,

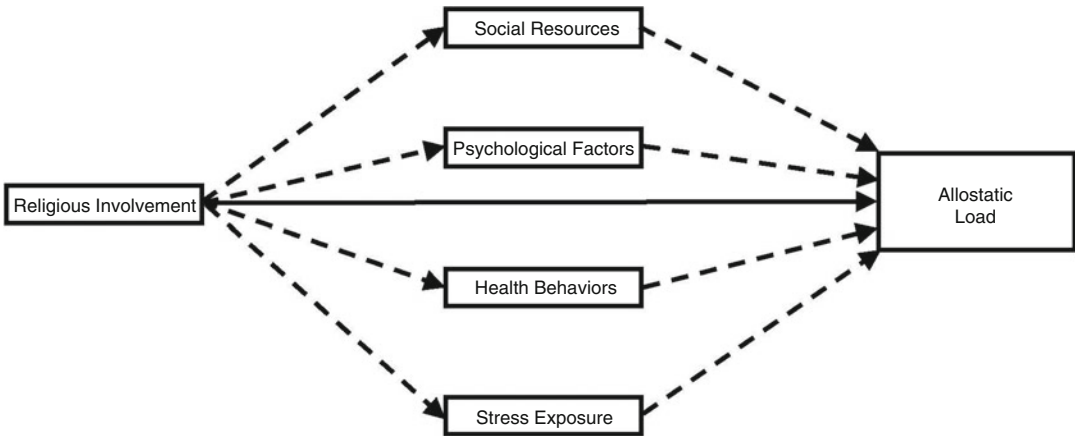


Fig. 2.3 Conceptual model linking religious involvement and allostatic load *Solid lines indicate that the corresponding pathway has some empirical support. Dashed lines indicate limited empirical support or no empirical support

lower rates of smoking, and the sedentary practice of religious media consumption may play a role (Cline and Ferraro 2006; Kim et al. 2003).

Physical Functioning and Mortality Risk in Adulthood

Physical functioning is a general term that refers to indicators of physical impairment (dysfunction in the physical body) and disability (the inability to perform basic roles). The most common indicators of physical functioning include activities of daily living (ADL), instrumental activities of daily living (IADL), and physical mobility. ADLs assess disability or dependence in functioning in bathing, dressing, toileting, transferring from bed to chair, continence, and feeding. IADLs assess disability or dependence in executive functioning in more complex tasks like using the telephone, shopping, preparing food, keeping house, doing one's laundry, traveling, taking one's medications, and handling one's finances. Measures of physical mobility assess physical impairment. For example, the Performance-Oriented Mobility Assessment evaluates performance tasks like standing balance, a timed walk at a normal pace (gait speed), and a timed test of rising from a chair and sitting down.

At this point, there is no consistent empirical evidence concerning the true nature of the association between religious involvement and physical functioning (Benjamins 2004; Fitchett et al. 2013; Powell et al. 2003). According to a recent study by Fitchett et al. (2013, p. 235), "considerable uncertainty remains about the exact influence of religious beliefs and practices on health outcomes in older adults, such as disability, which is a critical marker of overall physical health in late life." Several studies show that higher levels of religious involvement are associated with lower rates of impairment in ADLs (Fitchett et al. 2013; Haley et al. 2001; Hayward and Krause 2013; Hybels et al. 2012, 2014; Idler and Kasl 1992, 1997b; Krause and Hayward 2012; Park et al. 2008), IADLs (Hybels et al. 2012, 2014; Park et al. 2008), and physical mobility (Benjamins 2004; Fitchett et al. 2013; Hill et al. 2016; Hybels et al. 2012, 2014). However, there is also considerable evidence to indicate that there is no association between religious involvement and physical functioning (Fitchett et al. 2013; Hybels et al. 2012; Idler and Kasl 1992, 1997b; Kelley-Moore and Ferraro 2001; Krause and Hayward 2012; Park et al. 2008; Son and Wilson 2011). Some research even suggests that religious involvement is associated with poorer physical functioning (Benjamins 2004; Haley et al. 2001;

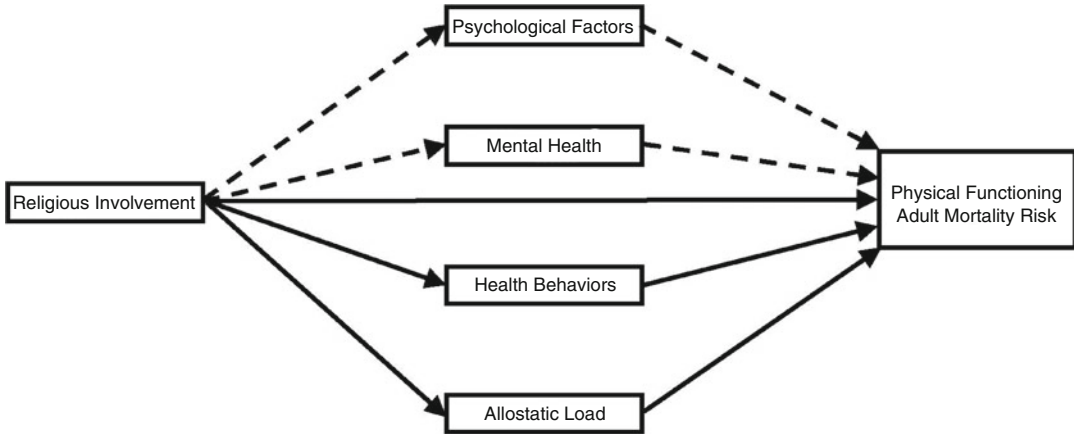


Fig. 2.4 Conceptual model linking religious involvement and physical functioning and adult mortality risk *Solid lines indicate that the corresponding pathway has some

empirical support. Dashed lines indicate limited empirical support or no empirical support

Hayward and Krause 2013; Idler and Kasl 1992; Kelley-Moore and Ferraro 2001; Krause and Hayward 2012).

Although several studies show that religious involvement can promote physical functioning, very few have formally tested any potential pathways. Nevertheless, previous research has identified several potential social (e.g., greater social ties and social support), psychological (e.g., greater meaning in life and better mental health), behavioral (e.g., lower levels of drinking and smoking), and biological (e.g., lower levels of stress and better immune function) mechanisms (Benamins 2004; Fitchett et al. 2013; Hayward and Krause 2013; Hybels et al. 2012, 2014; Idler and Kasl 1992, 1997b; Koenig et al. 2012; Krause and Hayward 2012; Son and Wilson 2011). Because these pathways are often associated with indicators of religious involvement and physical functioning, they are highlighted in Fig. 2.4.

Our review of the literature revealed that only a few studies have formally tested any of these processes. Interestingly enough, there is no empirical evidence of mediation for body mass, alcohol consumption, marital status, and contact with friends and children, social well-being, the provision of emotional support, optimism, fatalism, emotional well-being, depression, and psychological well-being (Idler and Kasl 1992, 1997b; Son and Wilson 2011). There is, however, some data to support the

partial mediating influence of physical activity, smoking, contact with family, leisure social activities, meaning in life, and immune function (Benamins 2004; Hybels et al. 2014; Idler and Kasl 1997b; Krause and Hayward 2012). Taken together, these results suggest that religious involvement may actually contribute to better physical functioning through a range of mechanisms.

The concept of adult mortality refers to life expectancy (how long we are expected to live), longevity (how long we actually live), or the timing of death (when we expire).

Several literature reviews and meta-analyses provide convincing evidence that religious involvement is associated with lower mortality risk (Chida et al. 2009; Koenig et al. 2012; McCullough, et al. 2000; Powell, Shahabi, and Thoresen 2003). This general pattern is consistent across outcomes, including all-cause mortality and mortality linked to circulatory diseases, respiratory diseases, infectious diseases, and other specific causes (Dupre et al. 2006; Ellison et al. 2000; Gillum et al. 2008; Helm et al. 2000; Hill et al. 2005; Hummer et al. 1999, 2010; Koenig et al. 1999; Krause 2006; Lutgendorf et al. 2004; Musick et al. 2004; Oman and Reed 1998; Oman et al. 2002; Rogers et al. 2010; Strawbridge et al. 1997).

Numerous articles, chapters, and books have addressed an array of potential pathways through which religious involvement might favor longevity

(e.g., George et al. 2002; Hill et al. 2005; Hill and Cobb 2011; Koenig et al. 2012; Oman et al. 2002). These pathways are very similar to those proposed for physical functioning. They include social resources (greater social ties and social support), mental health (fewer symptoms of psychological distress), health behaviors (lower levels of drinking and smoking), and other biological markers (better immune function).

Some research has confirmed the mediating influences of marital status, social connections, social activity, and the receipt and provision of social support (Ellison et al. 2000; Strawbridge et al. 1997), while others have shown no evidence of mediation for number of confidants, frequency of social contact, and perceived social support (Hill et al. 2005; Koenig et al. 1999; Musick et al. 2004). Although psychological resources are theoretically viable explanations for why religious involvement might favor longevity, we were unable to find any studies to support this class of mechanisms.

Some mortality studies have indicated that smoking (Dupre et al. 2006; Ellison et al. 2000; Hummer et al. 1999; Strawbridge et al. 1997), body mass—especially being underweight (Dupre et al. 2006; Hummer et al. 1999; Musick et al. 2004; Strawbridge et al. 1997), exercise (Musick et al. 2004; Strawbridge et al. 1997), and alcohol consumption (Strawbridge et al. 1997) are important mechanisms, while others have shown little to no mediating influence for smoking (Helm et al. 2000; Koenig et al. 1999), body mass (Helm et al. 2000; Koenig et al. 1999), and alcohol consumption (Dupre et al. 2006; Ellison et al. 2000; Hill et al. 2005; Hummer et al. 1999).

At least one study showed no evidence of mediation with separate adjustments for depression and cognitive impairment (Hill et al. 2005). Most studies enter health status variables in a block, so it is difficult to distinguish the mediating influences of mental and physical health. This group of studies provides little (Koenig et al. 1999; Oman et al. 2002) to no (Helm et al. 2000; Strawbridge et al. 1997) evidence to support depression and anxiety as mediators.

Finally, Lutgendorf et al. (2004) demonstrated that the inverse association between religious attendance and all-cause mortality risk in older

adults is fully mediated by lower levels of interleukin-6, a biomarker implicated in the development of heart disease, cancer, osteoporosis, frailty, and functional limitations. Although Gillum et al. (2008) reported a similar pattern for c-reactive protein, these results are unclear because several potential mediators were entered simultaneously.

Directions for Future Research

Due to advances in the biological sciences, it is no longer reasonable to endorse the perspectives of nature-only or nurture-only or nature “versus” nurture. With this in mind, we explored the association between religious involvement and biological functioning across the life course. We defined essential biological concepts and processes. We reviewed religious variations in gene-environment interplay, birth weight, preterm birth, infant mortality, allostatic load, physical functioning, and adult mortality. We reported numerous studies showing that religious involvement tends to favor healthy biological functioning. We also described the central theoretical and empirical explanations for these variations through the development of several biopsychosocial models. These models incorporated pathways related to social resources, psychological resources, healthy behaviors, and various biological processes. In this final section, we discuss several promising directions for future research in the sociological study of religion and biological functioning.

Biological Outcomes

Although this chapter examined a wide range of biological outcomes and processes, numerous outcomes have been understudied or altogether ignored in the religion and biological functioning literature. With this in mind, we would like to highlight the need for research in the areas of epigenetics, infant mortality, and telomeres. Even though individuals inherit their genetic code at conception, environmental factors can actually

regulate the expression of genes (Meaney and Szyf 2005). According to noted biologist Steven Rose (1999, p. 877–878), “the expression of most genes is modified at several levels. It is affected by which other genes are present in the genome of the particular organism, by the cellular environment, the extracellular environment, and, in the case of multicellular organisms, by the extra-organismic environment.” To our knowledge, there is no empirical evidence to suggest that environmental signals related to religious involvement could actually produce epigenetic modifications to affect gene expression. Because religious involvement is associated with environmental factors like diet, exercise, stress, and social support, it is plausible that religious involvement could function to shape health and biological functioning through epigenetic processes. Infant mortality is such an important outcome. It is the ultimate gauge of the intergenerational transmission of biological functioning. Infant mortality is the most logical extension of studies showing an inverse association between maternal religious attendance and low birth weight (a major risk factor for infant mortality). Finally, telomeres are clusters of DNA and protein that serve as protective caps on the ends of chromosomes. Telomere length is an important biological marker of cellular aging that is distinct from chronological aging. The question is whether religious involvement is actually associated with telomere length. Because research suggests that life stress is associated with accelerated telomere shortening (Epel et al. 2004), religious involvement could theoretically slow the rate of cellular aging through typical stress-buffering processes.

Indirect Effects

Previous research is also generally limited by theoretical models that overemphasize the direct effects of religious involvement. Although studies often speculate as to why religious involvement might be associated with biological functioning, empirical support for these explanations is sorely lacking. We have noted limited

empirical support for several classes of potential mediators, especially in the area of allostatic load and related outcomes. It is vital for future research to prioritize the testing of unexplored and understudied mechanisms. While it is important to establish individual pathways, it is also time to focus more on developing and testing elaborate theoretical models with multiple mediators and complex causal chains.

Subgroup Variations

It is often unclear whether the association between religious involvement and biological functioning varies according to theoretically relevant subgroups. Under which social, psychological, and physiological conditions is religious involvement more or less protective? Are the indirect processes linking religious involvement and biological functioning invariant across groups, or do certain causal processes fit certain groups more or less (i.e., moderated mediation)? Although some studies consider subgroup variations in the effects of religious involvement, empirical explanations for these patterns are never formally tested (i.e., mediated moderation). Genetics research aside, it is also uncommon to see religious involvement framed as a moderator of the effects of other biological risk factors. Additional work is needed to confirm the observations of previous studies and to consider new and understudied subgroup variations. We will also need better theoretical explanations *a priori* and formal empirical tests of mediated moderation and moderated mediation.

The Dark Side

Although previous research tends to emphasize the salubrious role of religious involvement, we cannot ignore the possibility that religious involvement might also undermine biological functioning. For example, there is some evidence to suggest that religious struggles (wondering whether God has abandoned you, questioning God’s love, and attributing poor health conditions

to the devil) can actually elevate the mortality risk of elderly hospital patients (Pargament et al. 2001). Unfortunately, this “dark side” of religious involvement is generally understudied in the broader religion and health literature. The explanations for these processes are also not as thoroughly developed as explanations for the healthful consequences of religious involvement. More research is needed to explore and explain these processes in the context of biological functioning.

Alternative Explanations

In this chapter, we have suggested that religious involvement contributes to biological functioning. It is important to acknowledge that this is only one of many potential conceptual models. It is also possible to frame the association between religious involvement and biological functioning as an artifact of various alternative explanations, including health selection, personality selection, and genetic selection.

Mortality research aside, most studies of religious involvement and biological functioning are limited to cross-sectional data. Because cross-sectional studies are unable to establish the causal order of any observed associations, it is often unclear why religious people and their offspring appear healthier. We assume that religious involvement predicts health and functioning, but health and functioning might also predict religious involvement. For example, studies show that physical health problems, including broken hips, disability, cancer, and stroke, can undermine or limit public religious activities in old age (Benjamins et al. 2003; Kelley-Moore and Ferraro 2001). In the absence of longitudinal designs and adequate controls for baseline health status, certain indicators of religious involvement (especially indicators of public religious behaviors) can “select” healthier people into religious activities. This pattern can be seen in various mortality studies when associations with religious attendance are noticeably attenuated with comprehensive adjustments for baseline physical health and functioning (e.g., Ellison et al. 2000;

Hill et al. 2005; Hummer et al. 1999; Musick et al. 2004).

Research clearly demonstrates that a significant portion of the association between religion and health is produced by health selection processes. Researchers also argue that individuals with certain personality traits are selected into religious involvement. Some even view religious involvement as a strong indicator of personality. Personalities are patterned ways of thinking, feeling, and behaving. Studies show that religious involvement is reliably associated with several personality characteristics, including lower levels of psychoticism (risk-taking and lack of responsibility) and higher levels of agreeableness (friendly and helpful to others), conscientiousness (dependability and self-discipline), and cooperativeness (Koenig, King, and Carson 2012). Because studies of religion and health rarely (if ever) adjust for personality, there is little to no evidence for personality selection. Psychoticism could reasonably select individuals into risky lifestyle patterns and, as a consequence, out of religious institutions. Agreeableness could even draw individuals into religious communities through various social aspects of public religious activities. If any of these processes are at work, personality selection could account for at least some of the effects of religious involvement through social and behavioral mechanisms.

We have already noted that religious life is at least partially determined by genetic processes. For example, Bradshaw and Ellison’s (2008) analysis of data collected from a national sample of adult twin siblings indicates that genetic factors can explain between 19 and 65 % of the variation in religious involvement. The authors examined several domains of religious involvement, including organizational involvement, personal religiosity and spirituality, conservative theologies, and transformations and commitment. While genetic factors explain 32 % of the variation in religious attendance (the most commonly used indicator of religious involvement), they explain an impressive 65 % of the variation in transformations and commitment (indicated by an item assessing whether the respondent has been born again and committed to Jesus Christ).

Bradshaw and Ellison (2008, p. 540) conclude that the association between religion and health “may be spurious due to the failure to control for important covariates, possibly including genetic confounders.” They speculate that genetic factors could influence religious involvement and health indirectly through personality (which also exhibits significant heritability). Of course genetic factors could also predispose individuals to poorer biological functioning, which could limit religious involvement through health selection.

A generation of research along these lines would effectively dismantle the “nurture fortress” by providing a more comprehensive understanding of how and why religious involvement might contribute to biological functioning across the life course.

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