Spiritual beliefs and practices compared to psychological strengths:

Are they unique or overlapping predictors of health in inflammatory bowel disease?

by

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Abstract

Despite widespread claims that religion benefits physical health, scant research has compared the ability to predict health by different aspects of spirituality and related psychological strengths. 175 Canadians, with the autoimmune-based, chronic illness inflammatory bowel disease (IBD), were surveyed and interviewed. Outcome measures were disease symptoms, physical and mental health. The spiritual variables were attendance at spiritual services, use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life. The psychological constructs were meaning in life, optimism, mastery, peacefulness, social support, and gratitude. Hierarchical linear regression, controlling for health 10 years prior, showed that, as a set, the psychological variables predicted all 3 health outcomes, before and after the influence of the set of spiritual variables was accounted for. The set of spiritual variables did not predict any of the health outcomes, before or after the influence of the psychological variables was accounted for. All psychological variables were positively correlated with mental and physical health. No spiritual variable was correlated with any health measure. There were few correlations between spiritual and psychological variables, but prayer was negatively correlated with mastery and social support. Partial correlations, showing belief in God and belief in an afterlife were negatively correlated with mental health, imply that any religiosity index including beliefs with predictors of positive health may have limited efficacy. In paired squared semipartial correlation, optimism predicted 4 times the variability in mental health, while mastery predicted twice the variability in physical health, therefore, both should be measured routinely in health research. Public health advocates should encourage optimism, mastery, and peacefulness, over spirituality. By bridging the foundations of key health psychology constructs, for the first time directly comparing them and joining them with the spirituality literature, this study builds a new, integrated structure of knowledge.

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and especially

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Thank you for contributing to my

meaning in life, peacefulness, optimism, mastery, & social support,

and for inspiring my gratitude.

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Introduction

After the official research interview was over, the 80-year-old man told me the story of being wheeled in for his heart surgery. He said to the doctor, "Don't worry if you lose me; I know where I'm going." During a different official interview, I asked a 90-year-old for his dis/agreement with the statement, "I am optimistic about my future." When he agreed, his daughter looked at me, pointed toward the ceiling, and started humming "Amazing Grace."

Before interviewing 100 rural elders, I had spent very little time with people who *knew* they were going to heaven. During the months of interviewing, steeped in that experience, I was quite moved by their confidence that life would get unimaginably good, forever, right after they died. Some of them were actually looking forward to dying. I became very curious about how this might influence their physical health.

A few months later, I started my literature review. I found that thousands of studies, reviewed in massive books, were said to link spirituality and health (Koenig, King, & Carson, 2012; Koenig, McCullough, & Larson, 2001). However, I was perplexed by the research instruments, asking for dis/agreement with items such as, "When I am ill my faith gives me optimism that I will recover" (Ironson, et al., 2006) and "My spiritual beliefs give my life a sense of significance and purpose" (Fetzer, 1999). How might those influence wellness differently from a secular sense of purpose, or optimism without faith? If positive states or feelings, such as optimism and purpose, are intertwined with the measures of spirituality, then spirituality would be expected to be associated with health. But, if the good and the godly—behaviors and cognitions—are carefully separated, might atheists receive the same health benefits from the

good as religious people do from the godly? I wondered if the "religious" health benefit did not require God.

For some individuals in contemporary Canada, belief in God may facilitate a sense of mastery or meaning in life. Belief in an afterlife may be the foundation of optimism. Prayer may be the method for expressing gratitude or attaining peacefulness. Attendance at religious services may be how many people meet key social support needs. In this project, I sought greater understanding of the correlations between the spiritual and psychological strengths that help people deal with chronic physical illness.

If feeling meaning in one's life or a sense of gratitude is good for one's health, does it matter if the meaning is a spiritual meaning? Does it matter if the gratitude is to God? Is social support just as good for what ails you if it comes in the form of a neighbor who brings you chicken or miso soup, rather than from a congregation that sings together every week?

Which spiritual beliefs and behaviors are most strongly positively associated with health? Does spirituality offer anything uniquely salubrious, or do its positive influences overlap completely with well-known health-promoting psychological strengths?

If spirituality offers nothing unique, or if spirituality is not as strongly associated with health as psychological strengths are, it could be argued that the privileged place it occupies in secular health care and health education is inappropriate, and a more inclusive focus on psychological strengths would better serve individual and population health. In 2005, 7% of all Canadians, 10% of Canadian men, and 11% of British Columbians identified as atheists (Bibby, 2007). In 2017, when asked, "Do you believe that God or a higher power exists?" 16% of Canadians answered, "No, I don't think so," and an additional 11% answered, "No, I definitely do not believe." (Angus Reid Institute, 2017). Yet the first sentence on Health Canada's (2017)

Healthy Living webpage states, "Healthy living means making positive choices that enhance your personal physical, mental and spiritual health."

In order to clarify the relationships between spiritual variables, psychological strengths, and mental and physical health, I gathered data from 175 people living with one chronic illness, inflammatory bowel disease, who were enrolled in an 11-year longitudinal study. Questions covered social support and attendance at spiritual services, optimism and belief in an afterlife, inner peace and prayer. Unlike the approach taken in many of the spirituality and health research articles I read, where the psychological was intertwined with the spiritual, I asked the questions separately so that I would be able to discern the independent contributions of each, to physical and mental health, 6 months later.

Although this is a basic science proposal, the knowledge gained has the potential to be applied in impactful ways. The Centre for Chronic Disease Prevention (2014) reported that 16% of Canadians over 20 years old were living with a major chronic disease (i.e., cardiovascular disease, diabetes, cancer, or chronic obstructive pulmonary disease). The Public Health Agency of Canada (2011) stated that chronic diseases cost Canadians $190 billion in 2010 alone: $122 billion in lost income and productivity, and $68 billion directly for health care. This means that chronic diseases accounted for 58% of the total health care dollars spent that year. Given these extraordinary numbers, learning more about the strengths, which people bring to their lives with chronic illness, has the potential to improve the quality of life for all Canadians: those with chronic disease, those who care for and about them, and those who pay for the care.

In the pages that follow, I discuss definitions of spirituality and religion, and offer a critique of the empirical literature on spirituality and health. Next, I review the literature on physical health and each of the psychological characteristics highlighted in the analysis. Then, I

comment on the spiritual and health measures I have chosen, before moving on to the detailed methods.

Definitions

In a major review of psychology and religion, Emmons and Paloutzian (2003) said that agreement on terms is good for a field, yet consensus is not compulsory. This is reassuring, given their comment that there was more debate on the definitions of religion and spirituality than on any other topic within the field. Little has changed since then (Belzen, 2009; Norenzayan, 2016; Oman, 2013; Park et al., 2017). Emmons and Paloutzian (2003) noted that the meanings of religion and spirituality only diverged in the U.S. with the social transformation of the 1960s and 1970s: Historically, spirituality was just a quality of religious persons.

A 2001 U.S. nationally representative sample showed 61% of the population self-described as spiritual and religious, 20% as spiritual but not religious, 8% as religious but not spiritual, and 11% as neither (Marler & Hadaway, 2002). What did they mean? A survey of a non-representative sample found 39% of U.S. respondents used the term religion to mean a subset of spirituality, 10% used the words in the reverse manner, 42% said the words overlap in a different way, and 7% said there was no overlap (Zinnbauer et al., 1997). Clearly the lack of consensus on terms is not limited to religion researchers.

In the earliest major review of the religion and health literature, in 1993 (as reported in Freedman, Orenstein, Boston, Amour, Seely, & Mount, 2002), Larson defined spirituality as thoughts, feelings, and behaviors arising from the search for divinity or ultimate truth. Religion was defined as practices condoned by a group, in search of the spiritual, *or* in pursuit of social and individual needs that might be met in a spiritual context. Freedman and colleagues objected

to these definitions on the grounds that they made religion the broader concept, at odds with the current, conventional use of the words. They also objected to Larson using the terms in ways that prevented the disentanglement of the sacred from the social benefits of religious involvement.

Koenig (2012) defined spirituality as transcendence of the self. He defined religion as tradition dedicated to that transcendence, and he said that there is such a great overlap that he used the terms interchangeably. Egbert, Mickley, and Coeling (2004) defined spirituality (S) as individual and religion (R) as social, but then chose to combine the two concepts into *RS* in their review article. The authors of one meta-analysis did not define religion; they simply searched for any article containing the words *religion, religious, religiosity,* or *religiousness* (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000).

In his role as the president of the American Psychological Association's division dedicated to the psychology of religion, Pargament (1999) acknowledged that the words religion and spirituality are used differently in Europe from the U.S., and that some researchers prefer to define spirituality as encompassing all existential concerns, whether or not they are sacred. He argued that spirituality requires the sacred, which he defined as God or godliness.

In this proposal, when discussing research literature, I generally employ the language used in the source document, unless it conflicts with the following: To differentiate the psychological from the spiritual, I do not use the term *spiritual* to refer to secular concepts; I reserve it for the explicitly metaphysical. I use the term *religion* to mean the subset of spirituality referring to institutionalized practices.

There is no consensus on a psychological taxonomy of spirituality (P. C. Hill et al., 2000; Nasel & Haynes, 2005; Zinnbauer et al., 1997). Rohrbaugh and Jessor (1975) reported that early social psychologists of religion, such as William James (1902), viewed religiosity as a

unidimensional metaphysical belief. This then changed over time. Rohrbaugh and Jessor referred to a 1959 chapter by C. Glock ("The religious revival in America," in J. Zahn (Ed.), *Religion and the Face of America*. Berkeley: University of California Press), which delineated four religious dimensions: beliefs, rituals, emotions, and influence on secular life. Krause (2006) focused on six dimensions for the study of health: attendance, prayer, meaning in life, social support, coping, and forgiveness. There are much more complex conceptualizations. For instance, Zinnbauer and colleagues analyzed 18 dimensions of spirituality in their study.

Yet only a few dimensions of spirituality are used routinely in health studies and have validated measures, uncontaminated with well-being, suitable for people of differing creeds. They are meaning and belief (Emmons & Paloutzian, 2003; Park, 2012), attendance at spiritual services (Levin & Schiller, 1987), and private prayer (e.g., Koenig, 2001; Masters & Spielmans, 2007).

Rather than setting out to define and measure the essence of spirituality, this project will compare the best measures of spirituality, from a health psychology point of view, with the most relevant measures of psychological strengths. Prayer and attendance at spiritual services can be performed for non-metaphysical reasons, such as custom or to please a spouse. Yet these have been used in research frequently as the only measures of spirituality, sometimes defined as private and public religiosity (prayer and attendance, respectively). Therefore, they are included as spiritually-related variables, along with beliefs in God and an afterlife, and spiritual meaning in life.

Empirical Studies of Religion and Physical Health

Koenig's review. Koenig (2012) conducted a systematic review of 3,300 peer-reviewed, mostly quantitative, empirical articles on spirituality and health published from 1872 to 2010, approximately 660 of them on physical rather than mental health. In what he determined were high quality studies, he saw convincing evidence of spirituality's positive association with meaning in life, gratitude, optimism, and, to a lesser extent, mastery. Those are four of the six key psychological variables used in this proposal.

Koenig, a physician, reported that he alone rated each study's quality from 0 to 10. A second expert in the field rated a subset of 75 of the studies. Interrater reliability, measured with Pearson's *r,* is considered minimally acceptable when equal to .70 or above (Stemler, 2004). Yet Koenig reported agreement between the two raters as only .57. Further, the raters only agreed 75% of the time on whether an article was high quality (7-10) or low quality (0-6).

Examples of what Koenig described as a (religious/spiritual) "R/S intervention" (p. 9), which lowered cholesterol, turned out to be fasting in one case (Sarri, Tzanakis, Linardakis, Mamalakis, & Kafatos, 2003), and 9 days of yoga and vegetarian dietary advice in another (Bijlani et al., 2005).

On page 10, Koenig described 4 studies out of 27 on religion and immunity, of the "highest quality," showing "increased immune functions in response to a R/S intervention." In one of these studies, there were six hypotheses, five of which were rejected for the spiritual intervention group. There was one measure where the spiritual intervention was superior to the control, but, in that case, the relaxation intervention worked even better (McCain et al., 2008).

Although Koenig's definition of spiritual as transcendental could include compassion and love, by the standard research definition, the other three studies mentioned did not have a

spiritual intervention. Pace and colleagues (2009) tested compassion meditation; Davidson's group (2003) used mindfulness meditation, which explicitly avoids the concepts spiritual and religious; and one study looked at "The effect of motivational arousal through films on salivary immunoglobulin A."

The latter immune experiment, by McClelland and Kirshnit (1988), set out to elicit feelings of power, by showing a U.S. propaganda film created to build popular support for the U.S. to enter WWII. A BBC documentary on Mother Teresa was screened, in order to focus attention on giving and receiving loving care. Both films greatly increased negative mood in the undergraduate sample. Apparently, images of dying babies were not more uplifting than film clips of Hitler. The investigators were surprised by the response to the BBC film, but the negative reaction did not keep viewers of Mother Teresa from having a brief increase in the immune molecules that protect against cold and flu. Although it was smaller, viewers of Hitler also had an increase. McClelland and Kirshnit cautioned that those who had the largest gains in salivary immunoglobulin A also reported worse colds in the previous year, opposite to predictions.

Although the above study is inconclusive, it is intriguing, and the presentation by the authors was balanced. They did not describe their data as supporting a link between spirituality and immune health. Yet Koenig presented this as one of the strongest studies showing such a link. I would not describe any of Koenig's highest quality studies as providing evidence of increased immune function in response to a spiritual intervention.

Cardiovascular evidence. Sloan and Bagiella (2002) criticized the cardiovascular section of the *Handbook of Religion and Health* (Koenig, McCullough, & Larson, 2001). After recounting their work, I catalogue the related research.

Sloan and Bagiella's critique. Of the 89 articles on cardiovascular health reviewed in the *Handbook of Religion and Health* (Koenig, McCullough, & Larson, 2001), there were 4 articles Sloan and Bagiella (2002) found convincing, while the handbook's authors saw 39 of the 89 studies as presenting evidence of a religion and health relationship. Sloan and Bagiella disregarded 36 of the 89 studies because they compared the health of people in one denomination to that of those in a second denomination. They pointed out that research of this nature is usually conducted to compare effects of known differences between the groups, in health behaviors or DNA, guaranteeing confounding of religion with other factors. Sloan and Bagiella dismissed two more studies for only using religious affiliation as a measure of assimilation to a new country or city. Another 16 studies were discounted, as abstracts that could not be critically reviewed, as duplicate listings, project descriptions, reviews, or case reports.

After removing eight studies that Koenig, McCullough, and Larson did not claim showed positive results, Sloan and Bagiella found at least one of the following flaws in each of the remaining articles (all said to offer evidence of the spirituality-health link by the handbook's authors): no results with $p < .05$, no reported effect size, no correction for multiple comparisons, picking one item out of a 5-item scale, picking one (post-hoc) subgroup's response to one of several measures, lack of random assignment, lack of a control group for the intervention, no control for 20 years of being cloistered, reporting analyses of only the best responders, reassignment to the control group of those determined to not be meditating enough, correlating parents' religiosity with their children's cholesterol levels, or failing to control for smoking or the need to be physically well enough to attend church.

Oddly, Sloan and Bagiella did not comment on the fact that relaxation is not a spiritual practice. They did object to the inclusion in the handbook of a study by Kumanyika and

Charleston (1992), on weight control, which "qualified as a study of religion and health only because it was conducted in a church" (p. 18). They also pointed out that an intervention consisting of a combination of health education, biofeedback, and yoga make it impossible to determine the effect of any aspect separately. I would add that yoga, as practiced in the West, is generally not religious.

Of the four *Handbook* studies that Sloan and Bagiella stated did support a link between religion and cardiovascular health, it is unclear why they considered two of these convincing, when they noted that the articles demonstrated weaknesses similar to those they dismissed as problematic or misrepresented. The sole religious variable in one was religious affiliation used as a measure of social integration. Two others were meditation interventions. One of these, on transcendental meditation and heart disease, did not mention random assignment, and did mention removing data from 5 of 21 participants because they became too ill to complete the study (Zamarra, Schneider, Besseghini, Robinson, & Salerno, 1996). One withdrawn participant required bypass surgery.

When a relaxation intervention is described as not requiring a change in belief or philosophy, when it includes 10 hours of socially-based instruction over 7 months, when the control condition is asking volunteers to wait 8 months for a training that they believe could improve health (Zamarra et al., 1996), one might wonder why it is classified as having anything to do with religion. It could be seen as a study in social support, positive expectancy (Bishop, 2002), or the Hawthorne effect (Levitt & List, 2009).

None of the studies mentioned above offer convincing evidence of a religious health benefit. However, there was an Israeli research program with compelling results.

Israeli cardiovascular evidence. In the last of the four studies that Sloan and Bagiella (2002) described as providing the best evidence, Jewish, Israeli heart attack cases and controls were compared on identification as secular, traditional, or orthodox (Friedlander, Kark, & Stein, 1986). The odds ratio for being a case rather than a control, for male smokers versus nonsmokers, was 3.0, 95% CI [2.1, 4.2]. For female smokers, the odds ratio was 2.6, 95% CI [1.1, 6.1]. The odds ratios for secular versus orthodox men, 4.2, 95% CI [2.6, 6.6], and secular versus orthodox women, 7.3, 95% CI [2.3, 23.0], compare impressively.

While one might think that measuring different levels of one religion in one country would yield easily interpretable results, this may be more of a multi-ethnic study than it seems. The religious groupings also separated people into subcultures with differing educational backgrounds, immigration histories, and health behaviors, including diet (Shmueli & Tamir, 2007). In the case-control study (Friedlander et al., 1986), there was no control for the heart protective effect of much higher levels of fish in the orthodox diet.

In the decades since, have the results been replicated? The same research group continued its efforts. Kark and colleagues (1996), contrasting death rates among 3,900 members of religious versus secular *kibbutzim* (Israeli communal settlements) from 1970 through 1985, found higher mortality in the secular communities, in spite of similar social structures. The overall hazard ratio was 1.9, 95% CI [1.4, 2.6]. The effect was so large that religious men lived as long as secular women. The authors speculated that reduced stress could be the mechanism for the differences, due to Orthodox Judaism minimizing uncertainty about how to act and how the world works, divorce rates among the orthodox being 11 times lower, and there being weekly ritual rest periods on religious kibbutzim.

In order to clarify the potential mechanisms, Kark's group analyzed psychosocial risk and protective factors in randomly selected subgroups of the above kibbutz members (Kark, Carmel, Sinnreich, Goldberger, & Friedlander, 1995). Of 600 invited to participate, 76% agreed. Social contact, social support, sense of coherence, and work-related stress did not differ between the groups. Self-reported hostility did, perhaps due to greater socially desirable responding in the religious people. Thirty-five yes-no hostility questions garnered about 11 *yes* points for religious people and 12 for secular ones, with a standard deviation of approximately 5. Could one extra point on a hostility scale really be responsible for an almost doubling of relative risk of mortality? The authors declared the question of mechanism unresolved.

In 1999, Kark and colleagues took a different approach (Friedlander, Lapidos, Sinnreich, & Kark, 1999). A subset, of the psychosocial study just mentioned, was selected where at least two members, of different generations of one biological family, were willing to participate. Over 400 individuals representing 80 families provided blood samples, for DNA analysis, and electrocardiograms, to evaluate the QT interval, which represents electrical activity in the large chambers of the heart. The study found one genetic influence, one environmental influence, and a third factor with insufficient data to classify it as genetic or environmental. The first two factors alone accounted for over 50% of the variation in a QT interval that is associated with cardiac mortality.

Kark and colleagues' high quality research program found a religious health benefit, but some of their best evidence for the mechanism turned out to be genetic. A DNA-driven health benefit is not a religious health benefit at all.

Several other studies, conducted within Israel by unrelated research groups, provided varied results. Shmueli (2007), investigating self-reported health and religiosity in over 4,500

midlife and older Jews, in the 1990s and the year 2000, found worse health in those with greater religiosity. A 12-year longitudinal study of all-cause mortality among over 3,500 Jewish, male industrial workers, found that religion (the same orthodox, traditional, and secular groupings used in the heart attack study) was protective of younger workers, while it predicted greater mortality in older men (Kraut, Melamed, Gofer, & Froom, 2004). A similar 23-year study of 10,000 men showed a 20% reduction in mortality among the more religious, controlling for age, smoking, hypertension, cholesterol, diabetes, and body mass index (Goldbourt, Yaari, & Medalie, 1993).

All of these Israeli studies were of high quality. Most showed a religious health benefit. However, the mechanisms appeared to have little to do with religious beliefs or behaviors. Genetic and nutritional influences may explain the bulk of the benefit.

Cardiovascular evidence from other countries. In the U.S., a multicenter, multi-ethnic investigation found that better health behavior among religious people completely explained the apparent religious health benefit (Feinstein, Liu, Ning, Fitchett, & Lloyd-Jones, 2010). Nearly 7,000 U.S. residents, aged 45 to 84 and free of clinical cardiovascular disease at baseline, enrolled in a longitudinal study. Only 8% of participants who attended religious services daily or weekly were smokers, compared to 12-15% of those who attended services monthly to never. After controlling for smoking, there was no protective effect of public or private religiosity on subclinical cardiovascular disease at baseline, or on the 152 cardiovascular events or deaths that occurred over 4 years.

Kark, involved with most of the Israeli studies showing a religious benefit to heart health, coauthored a more recent study in Albania. Over 400 people admitted to the hospital for acute coronary syndrome were matched with population-based controls (Burazeri, Goda, & Kark,

2008). Acute coronary syndrome is the result of reduced blood flow to the heart, sometimes due to heart attack. The article described Albania as an atypical setting for an investigation of religion and health: Religion was outlawed, under communist rule, from 1967 to 1991, leaving 24 years without religion, and 12 to 15 years with religion, before data collection.

The authors estimated that 70% of the Albanian population identified as Muslim, 20% as Orthodox Christian, and 10% as Roman Catholic, but they noted that this was primarily a cultural identification. Religiosity was measured with self-report of frequency of attendance, frequency of prayer, and observance of ritual fasting. Only 2% of Muslims and 1% of Christians attended weekly, only 2% of Muslims and 3% of Christians reported praying several times a day, and only 5% of Muslims and 6% of Christians regularly observed food proscriptions for Ramadan or Lent (Burazeri, Goda, & Kark, 2008).

Controlling for age, sex, socioeconomic status, exercise, smoking, personal and family health history—religiosity was negatively associated with acute coronary syndrome, with odds ratios, for observance scores above the median compared with no observance, of 0.45, 95% CI [0.26, 0.77] in Muslims and a statistically insignificant 0.58, 95% CI [0.25, 1.31] in Christians. Associations with acute coronary syndrome were strongest for prayer and food proscription, with attendance not showing a linear relationship (Burazeri, Goda, & Kark, 2008).

In sum, while there is a body of impressive and well-conducted research, almost all of the convincing cardiovascular studies involve one researcher and religious food restrictions. It is not clear that there is a religious heart health benefit beyond the effects of diet and DNA.

All-cause mortality. The three authors of the *Handbook of Religion and Health* (Koenig, McCullough, & Larson, 2001) were joined by two others in conducting a meta-analysis (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000). They found 29 independent

investigations of religious involvement as a predictor of all-cause mortality. The studies included 125,000 persons. What the authors characterized as a small—according to Jacob Cohen (1988)—positive association between religiosity and survival was found: an odds ratio of 1.29, 95% CI [1.21, 1.39]. The uncontrolled odds ratio for high (versus low) public religiosity (frequency of attendance was the usual measure of this) was 1.43, while high (versus low) private religiosity (e.g., beliefs) had an odds ratio of 1.04. (An odds ratio of 1 represents no effect at all.)

Controlling for gender, social support, health behaviors, and socioeconomic status brought the odds ratio down to 1.23. In a letter to the editor concerning this study, Sloan and Bagiella (2001) noted that the 1.23 odds ratio had a *p*-value of .31, and that 30 of the 42 studies presented in the McCullough meta-analysis had odds ratios with the lower end of the confidence interval below 1.1, before controlling for confounds.

Checking for publication bias, McCullough and colleagues calculated the fail-safe *N* for the odds ratio of 1.29. This showed that over 1,400 unpublished studies with odds ratios of 1 would have to exist to reverse the statistical significance of the results from the published studies that they analyzed. This is odd reassurance, when all that was needed to reach statistical insignificance was to control for known confounders. These data, when properly controlled, do not support a religious mortality benefit.

A model analysis review. Powell, Shahabi, and Thoresen (2003), noting five reviews from 1998 to 2002 that touted the religion and physical health connection, and two reviews criticizing serious methodological flaws in the studies, sought to clarify the issues, not with a meta-analysis, but with a review using epidemiological standards and by grouping sets of data into models. They excluded studies on suicide and other mental health outcomes, and on biomarkers, such as blood pressure, which are predictors of but not actual states of disease. They

also excluded cross-sectional studies and those that did not control for any confounders. Within the studies in the analysis, they looked for confounders that could result in underestimation of the religion-health association: age and non-European ethnicity, where both religiosity and health risk are higher. They also looked for confounders that could result in overestimation of benefits: health conditions, socioeconomic status, and gender. One has to be healthy and wealthy enough to get to services, they pointed out, and women are more religious and live longer.

Powell and colleagues sought evidence in support of *mediational* models, where religion is associated with factors known to impact health: exercise, alcohol consumption, social support, and depression. They also looked for support for what they called *independent* models, where religion provides a benefit to physical health after controlling for the known risk factors.

Their findings, based on studies published between 1982 and 2003, were as follows: Religious devotion, as an inner state, definitely did not protect against death, and spirituality in general did not slow cancer. These hypotheses consistently failed in studies of reasonable quality. Further, religion did not speed recovery from acute illness, and there was some evidence, for both the mediated and the independent models, that religiosity slowed such recovery. There was inadequate evidence to make a determination on whether religious coping led to a longer life, or whether spirituality in general reduced mortality from cancer. There was also inadequate evidence for a mediated protective effect of religion against disability, while it was clear that there was no independent effect.

There was some evidence (*some* defined as support from one high quality or two moderately strong studies) of a protective effect of religion against cardiovascular disease, and that being prayed for sped recovery, in both the mediated and independent models. The strongest evidence, which they called persuasive, was that attendance at religious services protected

against death. They found 11 high quality studies, with combined participants numbering over 52,000, in support of the mediated model and, to a lesser extent, the independent model.

Their strongest evidence was that two-thirds of the attendance-health studies found an association even after controlling for health behaviors, social support, depression, demographics, and health conditions, resulting in 25% reduced mortality. Yet, when I looked at what they called the strongest two studies, I found one that considered 65 covariates, cycled in and out of models repeatedly, with additional interaction terms (Oman & Reed, 1998). Although this may seem like wonderfully thorough research, with their alpha level set at .1, twenty statistically significant results would be expected by chance, even before considering interactions, with their coding and recoding of religious service attendance. This is extremely common research practice, but it is not statistically sound (Babyak, 2004).

The other strongest study used 22 variables and followed almost 4,000 elders for 6 years (Koenig, Hays, et al., 1999). When all covariates were controlled, the relative hazard ratio, 0.83, for men had a 95% confidence interval of 0.69 to 1.0. (A 1 in a hazard ratio is the same non-effect as in an odds ratio.) For women, it was 0.55 to 0.76, which is impressive, except when considered in the context of this being possibly the strongest study in support of the strongest effect, in a field of over 600 investigations.

An additional consideration is that the above study (Koenig, Hays, et al., 1999) took place in North Carolina, the seventh most religious state in the U.S. (Gallup, 2009). When asked, "Is religion an important part of your daily life?" 76% of respondents in North Carolina said *yes*, compared to 65% in the U.S. as a whole. When the social norm is so strongly religious, there may be different causes and meanings for individuals' identification as religious. In communities that are organized around church attendance, many healthy, extraverted people may affiliate and

attend, not because they are spiritual (Makros & McCabe, 2003), but because they are gregarious and that is the way to socialize and volunteer (Chatters, 2000). In some settings, those who are not part of church communities may be stigmatized (Cragun, Kosmin, Keysar, Hammer, & Nielsen, 2012).

In sum, there is a body of evidence that attendance at spiritual services is correlated with health, but that association usually becomes statistically insignificant after controlling for known secular predictors of health. When a few studies, out of hundreds, show statistically significant results, a conservative assumption is that they are the expected occasional false positive results due to chance.

Chronic illness. Life threatening illnesses, especially cancer and HIV/AIDS, have inspired a number of investigations on the impact of religion on well-being (e.g., Bowman, Beitman, Palesh, Perez, & Koopman, 2009; Ironson et al., 2002; Peterman, Fitchett, Brady, & Cella, 2002). There is a dearth of research on spirituality in the type of chronic illness where disability is a much greater concern than death. A discussion of the limited literature follows.

Multiple sclerosis (MS) is a serious chronic disease with an unpredictable course. Makros and McCabe (2003) expected to find various measures of spirituality positively correlated with well-being, in a study of 101 Australian adults who had lived with MS for 3 to 48 years. Similar to the Australian population as a whole, 74% were affiliated with a Christian denomination, 5% with another religion, and the rest were unaffiliated. Of the total participants, 32% said they were not religious or spiritual.

Makros and McCabe found that most aspects of spirituality did not significantly predict wellness. Attendance was correlated with health, but it was not a statistically significant predictor of health in regression analysis, in this relatively small study. Both the positive and

negative religious coping scales of the Brief Measure of Religious Coping (Pargament, 1997) were statistically significant predictors, and they were negatively correlated with health. This means that those who endorsed positive items, such as "I sought God's love and care," reported doing poorly, as did those who said they "questioned the power of God." The authors were left wondering if people with MS sought divine help especially when they were feeling worse. The cross-sectional study could not answer that question.

In a Midwestern U.S. study, of 122 adults living with chronic musculoskeletal pain, another negative association was found for religiosity and health. No aspect of spirituality was correlated with pain, but private religious practice was negatively correlated with general physical health, $r = -.28$ (Rippentrop, Altmaier, Chen, Found, & Keffala, 2005). Private religious practice (e.g., prayer, reading and listening to religious media) explained 3% of the variance in physical health, after controlling for the contributions of demographics (including unemployment due to pain), which explained 10% of the variance in physical health, and after controlling for pain itself, which explained 28% of the variance. None of the other dozen dimensions of spirituality were correlated with general physical health.

Koenig conducted a systematic review in 2001 and found 10 investigations of religion and pain. Most cross-sectional studies found pain and prayer were positively correlated. Based on a few interventions, and one prospective study where pain diminished over time, he interpreted the data to mean that people turn to prayer when they are in pain, not that prayer causes physical pain.

Another study recruited 25 people, without serious illness or injury, from a primary care clinic in Missouri, and other participants from nearby university medical clinics (25 with cancer, 32 post-stroke, 25 with spinal cord injury, and 61 with traumatic brain injury), all without

obvious cognitive impairment (Campbell, Yoon, & Johnstone, 2010). The participants dealing with serious health conditions were not more religious than the others. The only statistically significant correlation with general physical health was attendance at religious services, $r = .16$, perhaps because the more disabled people were less able to attend.

In a population-based Canadian study, four conditions characterized by chronic pain and fatigue were analyzed (Baetz & Bowen, 2008). Data from 37,000 people were collected during the 2002 Canadian Community Health Survey, cycle 1.2. Inappropriate analytic methods were used in this investigation (orthogonal rather than oblique rotation—discussed by Fabrigar, Wegener, MacCallum, and Strahan in 1999—and MANCOVA without meeting the independence assumption, as discussed by Kenny and Judd in 1986), therefore the results are likely overstated, although the general conclusions should be accurate.

Canadians attending religious services at least monthly reported fewer diagnoses of back pain, migraines, fibromyalgia, and chronic fatigue syndrome than those who were spiritual but attended services less than monthly. The authors pointed out that cross-sectional data cannot rule out that pain and fatigue reduced attendance rather than religion was protective of health. It appears that the former was the case: In each group, 29% reported being neither spiritual nor religious. Spirituality was important to only 35% of those without fatigue or pain, but to 38% of those with fatigue or pain. Yet 36% of those without fatigue or pain attended at least monthly, while only 33% of those with fatigue or pain attended at least monthly.

The article stated that the 28% of the population living with these four conditions (10,479 individuals), after social support was statistically controlled, coped with prayer and spiritual support, drugs and alcohol, and avoidance and self-blame, to a greater degree than did the general population. However, the differences, between those with pain and fatigue, and those

without, were only 2 to 3.5%. The use of positive coping (e.g., problem solving, looking on the

bright side) was similar in the pain/fatigue and comparison groups, except that exercise was used

for coping 1% more by those without pain and fatigue.

Within the pain/fatigue group, religious attenders used drugs and alcohol less than non-

spiritual people. Spiritual people, including those who did and did not attend services at least

monthly, used positive- and exercise-coping more than non-spiritual people.

In the Canadian study, differences between groups were minimal, except that individuals

living with pain or fatigue attended services less frequently, even though they were more

spiritual. Overall, in the above studies, only attendance at religious services was consistently

correlated with better physical health, probably because disabled people are not as able to attend.

Prayer usually was correlated with pain, probably because prayer is a resource used more often

by people struggling with illness. The correlation of religious coping and physical health was

inconsistent.

There are other published articles on spirituality and chronic illness in adults, especially

on spiritual coping and mental health (e.g., Gall, Charbonneau, & Florack, 2011; Park &

Dornelas, 2012), but I am unaware of other articles reporting associations between spirituality

and physical health outcomes.

Summarizing the empirical evidence. Only Koenig has looked at all 660 studies related

to spirituality and physical health, but various, more narrow, critical reviews have found quite

limited evidence of a spiritual benefit. After personally reviewing what others labeled as the best

of the immune, cardiovascular, cancer, disability, mortality, and chronic illness research, it

appears to me that only possession of genetic variants found more commonly in orthodox Jews

(Friedlander et al., 1999), observance of religious dietary laws (e.g., Burazeri, Goda, & Kark, 2008), and attendance at spiritual services (e.g., Koenig, Hays, et al., 1999) are consistently correlated with better health. There is evidence that religious coping and private religious practices are associated with worse health, and that prayer is associated with pain. It is not at all clear that attendance improves health, which would be of much greater interest to health psychologists than determining that only healthier people are well enough to attend.

There are limitations to the literature. Except in the very few studies on chronic illness, a typical investigation only measured spirituality or religiosity in one or two ways, so that it is unclear if other aspects of spirituality are associated with better physical health.

W. R. Miller and Thoresen (2003), introducing a special section in *American Psychologist* on spirituality, religion, and health, commented, "Surprisingly few studies have included adequate measures of potential mediators of relationships between health and spiritual/religious factors." (p. 31). The medical and epidemiological studies that did include mediators did not compare spiritual with psychological factors, even though that is the only way to know what the unique impact of spirituality on health might be. Chatters (2000), in the *Annual Review of Public Health*, argued for measurement of specific aspects of religion and potential mechanisms, including social support and mastery, to allow an increased understanding of how religion impacts physical health.

Theoretical Research on Psychological Strengths and Physical Health

Three of the most studied psychological determinants of health are optimism, mastery, and social support. Less traditional predictors are gratitude, meaning in life, and peacefulness. The latter constructs are often considered in the spirituality and health literature (Emmons &

Kneezel, 2005), even though they are not essentially metaphysical. All have established survey instruments with sound psychometrics.

Optimism. Optimism can be defined as a general expectation that the future will be good (Schueller & Seligman, 2008), with most researchers defining pessimism as the other end of one continuum (Rauch, Schweizer, & Moosbrugger, 2007). Most people are optimistic (Chipperfield, 1993; Isaacowitz & Seligman, 2002). Optimists are happier (Forgeard & Seligman, 2012), healthier (Scheier & Carver, 1992), wealthier (Segerstrom, 2007), and more productive (Schulman, 1999) than pessimists. They have less pain (Achat, Kawachi, Spiro, DeMolles, & Sparrow, 2000), stronger immune responses to viruses, bacteria, and tumors (Scheier & Carver, 1992), heal faster (Carver & Scheier, 2017), and live longer (Chipperfield, 1993; Giltay, Kamphuis, Kalmijn, Zitman, & Kromhout, 2006; E. S. Kim, Hagan, Grodstein, DeMeo, De Vivo, & Kubzansky, 2017; Seligman, 1990; Tindle et al., 2009; Weiss-Faratci, Lurie, Benyamini, G. Cohen, Goldbourt, & Gerber, 2017). Although socioeconomic status is positively associated with both health and optimism, a stratified random sample of 9,501 Australian women in their seventies showed that optimism predicted physical health after controlling for socioeconomic status, access to health care, social support, and even the number of diagnosed conditions, $p < .001$ (N. Smith, Young, & Lee, 2004).

Optimism and motivation. Scheier and Carver (1985, 1992) placed optimism within the context of motivational psychology, seeing the positive expectancies of optimism as a subset of more general outcome expectancies, where people's actions are theorized to be based partly on what they expect will occur as a result of their behaviors. When people expect to succeed, their moods are better and they are more likely to keep trying, even in the face of serious setbacks. This implies that optimism has a direct effect on mental health and an indirect effect on physical

health, the latter by improving health behaviors. Indeed, that is what was found in a path analysis of health in Chinese university students (Ramsay, Yang, Pang, Lai, Ho, & Mak, 2013).

Optimism and coping. Optimists cope with problems in general by facing them directly (Nes & Segerstrom, 2006), rather than trying to make themselves feel better through indirect means, such as avoidance or using mood-altering drugs (Scheier & Carver, 1987). Optimism is positively correlated with the use of religion as a coping strategy, and with acceptance, while it is negatively correlated with denial (Scheier, Carver, & Bridges, 1994).

Optimistic people pay more attention to health threat and act to mitigate it (Aspinwall & Brunhart, 1996), taking better care of themselves when they are in good health (Steptoe, Wright, Kunz-Ebrecht, & Iliffe, 2006), and when they have very serious illnesses such as AIDS (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). A small study on cardiac rehabilitation showed that optimists were more successful in reaching eight individualized goals, including specifics on diet, exercise, and blood levels of biomarkers such as cholesterol (Shepperd, Maroto, & Pbert, 1996). Active, problem-focused coping was the mechanism for those optimists' successes.

Optimism is a reliable resource in the face of profound health threat. Women who had a suspicious mammogram, requiring follow up diagnostics, reported their optimism before and after being told that they did or did not have cancer (Bredal & Ekeberg, 2016). Impressively, women with and without cancer did not differ on optimism.

In a different breast cancer study, Carver and colleagues (1993) reported that optimism, the day before surgery for stage I or II breast cancer, predicted acceptance and the use of humor coping early in treatment. Path analysis showed acceptance and humor then predicted less distress over the following year.

The use of acceptance as a coping mechanism may seem unduly passive. Yet the authors suggested that, because many stressors in life are uncontrollable, the ability to accept a difficult reality—and refocus on what is important in life—may be more relevant in health outcomes than the use of active coping (such as problem solving), which optimists also do more often (Carver et al., 1993).

Scheier and Carver (1992) determined that optimists used positive reinterpretation as a coping mechanism, but only when a stressor was uncontrollable. In general, longitudinal college studies show pessimism leading to avoidance and withdrawal, while optimism leads to engagement and acceptance (Scheier & Carver, 1992).

Optimism and health. Optimism, measured before coronary artery bypass surgery, predicted health 5 years later, independently of the extent of the disease and the surgery (Scheier & Carver, 1985). This could be because optimists know more about health risks and take more actions to mitigate them (Segerstrom, Carver, & Scheier, 2017). Yet, we also know that the use of health-promoting behaviors increases optimism about health (Ingledew & Brunning, 1999). Rather than being competing models, these appear to be aspects of the complete picture, where optimism is increased by good health and health behaviors, and optimism also increases positive health behaviors and health.

Optimism is protective for people dealing with chronic illness in a variety of ways (Schiavon, Marchetti, Gurgel, Busnello, & Reppold, 2017). The moods of more optimistic women with rheumatoid arthritis are less impacted by pain (Kwissa-Gajewska, & Gruszczyńska, 2017). Pessimists are more likely to experience side effects from placebo, under certain circumstances (Geers, Helfer, Kosbab, Weiland, & Landry, 2005), which could be a factor in adherence to difficult medication regimes. Optimists are more likely to engage with treatment

than pessimists, for instance, attending more sessions, when goals are important to them (Geers, Wellman, Seligman, Wuyekm, & Neff, 2010).

Optimism is a stable trait, with one medical investigation showing test-retest reliability of $r = .78$ over 15 years (Giltay, et al., 2006). Two different studies used a validated analysis technique on letters and diary entries, from late adolescence or early adulthood, as baseline data. In the first of these, Burns and Seligman (1989) reported a test-retest reliability of pessimism of $r = .54$ over 52 years. The second writing-based analysis, of 99 Harvard students, showed correlations of pessimism and poor physical health, $r = .37$, at age 45, after partialing out health at 25 years of age (Peterson, Seligman, & Vaillant, 1988).

In general, correlations have been larger for optimism and self-reported health than for optimism and more objective measures of physical health (Rasmussen, Scheier, & Greenhouse, 2009). However, a study of more than 3,000 Australian twins, aged 50-94, found that 36% of the variance in optimism could be explained by genetics (Mosing, Zietsch, Shekar, Wright, & Martin, 2009). Forgeard and Seligman (2012) pointed out that this may be an indirect effect, with genes being one foundation of intelligence, attractiveness, and talent, which might lead to experiences supporting optimism.

Optimism is broad. In describing how optimism differs from Bandura's (1986) self-efficacy, which is more predictive of behavior the more specific it is, Scheier and Carver (1992) stated that optimism encompasses more than self-efficacy. Optimists may expect positive outcomes based on their own abilities (self-efficacy), but also based on help from friends or gods, a climate where good things happen, or resources such as medical treatments. Empirical studies show that general dispositional optimism predicts physical health even after taking into account specific health expectancies (Scheier & Carver, 1992).

Mastery. Mastery, or perceived control, is the perception that one can control important aspects of one's life (Pearlin & Schooler, 1978). Skinner (2007) posited that the psychological need for control is as fundamental as the physical need for food, because survival is based on successful manipulation of the environment. Functioning similarly to optimism (Lachman & Weaver, 1998), it is a primary motivation (Burger, 1989; Rodin & Salovey, 1989) that inspires people to try harder, to keep trying longer, and to perform better (Skinner, 2007). Like optimism, it is associated with better mental and physical health outcomes (Thompson, Sobolew-Shubin, Galbraith, Schwankovsky, & Cruzen, 1993).

Mastery perceptions. It is the sense of mastery, or perceived control, not actual control, that is experienced by the human body. In classic experiments, male undergraduates, who believed that their reaction times successfully shortened an electric shock, had smaller physiological responses than those, receiving the same short shock, who knew that they had no control (Geer, Davison, & Gatchel, 1970). Similarly, college students, who were told falsely that pressing a button would stop noise, reported fewer physical symptoms, such as racing heart and dizziness, than students who knew they had no control over the same noise (Pennebaker, Burnam, Schaeffer, & Harper, 1977). These studies show that perceived control, even when it has no basis in reality, can reduce physiological reactivity to stress.

Helgeson (1992) tested whether a personal sense of control over serious illness is adaptive even when it has no basis in reality. Three months after a first cardiac hospitalization, 80 people, who either had invasive treatment (bypass surgery or angioplasty) or non-invasive care (testing and medication), were interviewed about adjustment to the illness. At hospital discharge they had been asked questions about control over their illnesses. *Some* or *a lot* of personal control was felt by 92%, while 65% agreed that "someone or something other than you"

had *some* or *a lot* of control. Among the individuals who believed that someone else had control over their illnesses, those who had invasive treatment actually were better adjusted than those who had not had invasive treatment. These patterns were strongest when the prognosis was poor. A sense of personal control, on the other hand, was positively correlated, $r = .25$, with adjustment for everyone.

   Mastery and health. People higher in mastery are more likely to take action to prevent and treat health conditions (Jenkins & Pargament, 1988), including taking medication as prescribed (Rodin, 1986). This may be due, partly, to the fact that perceived control reduces reactivity to stressors (Alloy & Tabachnik, 1984; S. M. Miller, 1979), including hospitalization (Thompson & Spacapan, 1991), pain (Thompson & Schlehofer, 2008), and worries about upcoming medical procedures (Taylor & Brown, 1994).

   Yet physiological states also influence perceived control, with pain and fatigue in particular reducing specific self-efficacies (Wallston, Wallston, S. Smith, & Dobbins, 1987). For instance, in a cancer symptom study, mastery and optimism were correlated $r = .37$. Mastery and optimism were similarly correlated with pain (mastery: $r = -.18$; optimism: $r = -.17$), but mastery had a much larger negative correlation with fatigue (mastery: $r = - 26$; optimism: $r = -.11$; Kurtz, Kurtz, Given, & Given, 2008).

   Mastery is associated with reduced rates of disability (Taylor & Brown, 1994) and death (Chipperfield, Hamm, Perry, & Ruthig, 2017). An investigation of over 1,500 adults in the Netherlands, 57 years old and older, found that mastery was negatively correlated ($r_s = -.31$) with impairment in daily activities 8 years later (Kempen et al., 2005). A study in the U.K., with 20,000 adults aged 40-75, showed that mastery was higher for men, middle-aged compared to older adults, and those with greater socioeconomic status (Surtees, Wainwright, Luben, Khaw, &

Day, 2006). Longitudinally, controlling for gender, age, and disease, over a period of up to 6 years, the addition of one standard deviation in a mastery scale score was associated with a 15% reduction in all-cause mortality (Surtees et al., 2006).

Perceived control, with both trait and state aspects, can be taught, although not as easily in the health arena as in other realms (Wallston, Wallston, S. Smith, & Dobbins, 1987). Wallston and colleagues, in their review, said that, when offered a choice between one good and one bad—or two good—options, people tend to perceive that they have control. But when offered two bad alternatives, which is often the case with health care, people do not experience mastery when making the choice (Wallston, et al., 1987). Outcomes occurring only long after the decision also reduce perceived control based on choices (Wallston, et al., 1987). For instance, in the treatment of inflammatory bowel disease, a person may not feel in charge of important outcomes in her life when choosing between (a) surgery to remove her entire colon and (b) injections that cost $38,000 per year, especially given that each carries a small risk of death. It could take months to heal from surgery and to get used to a colostomy bag, before she would even know if the outcome included the desired reduction in symptoms that drove the decision.

Mastery of chronic illness. Perceived control is a key aspect of adjustment to chronic illness (Taylor, 1983). It is challenging, but important, to nurture a feeling of mastery when dealing with certain diseases: An extended period of time with the sense that one's world is uncontrollable can lead to increased blood pressure, stress hormones, and inflammation (Skinner, 2016).

Rheumatoid arthritis, like the disease this proposal focuses on, is an unpredictable, incurable, chronic, inflammatory, autoimmune illness with sometimes severe pain, fatigue, and

disability. Also similar are the available medications, some of which have potentially serious side effects (Bartlett, Piedmont, Bilderback, Matsumoto, & Bathon, 2003).

In a study of adjustment to rheumatoid arthritis (Affleck, Tennen, Pfeiffer, & Fifield, 1987), comparisons were made on perceived physician control and personal control over daily symptoms, such as pain and stiffness, and disease course, such as joint damage. The 92 patients had lived with their disease for an average of 10 years. Adjustment was not associated with perceptions of physician control over symptoms or disease. Patients believed they could exert some personal control over their *symptoms* by regulating their activities, using medical treatments, choosing where to focus their attention, and, for approximately 3% of them, praying. But adjustment was not associated with perceived personal control over symptoms. Perceived personal control over actual *disease* had a significant correlation with adjustment only for those with severe disease, and the correlation was negative. In other words, where disease was more extreme, believing that one could control the disease was associated with poor adjustment, presumably because the disease is not easy for even the most highly trained physicians to control (Affleck et al., 1987).

Mastery of uncontrollable illness. Skinner (2007) said that when a primary goal, such as curing disease, is accepted as unattainable, other goals emerge, for instance, minimizing the effect of the disease on loved ones. She claimed that, outside of an experimental psychology lab, researchers have been unable to find any situation that people experience as completely uncontrollable.

Positive adaptation has been correlated with perceiving control over just the emotions associated with an uncontrollable illness (Jenkins & Pargament, 1988) and with simply being able to predict when symptoms will get worse (Rothbaum, Weisz, & Snyder, 1982). Mastery can

come from choosing new goals when previous ones become impossible to meet, preventing disabling helplessness (Burger, 1989).

Humans are remarkably resilient. In a study of approximately 200 people using chemotherapy, 86% of them with late stage cancer, and 60% of them with at least two additional health conditions, the average score of sense of mastery over their cancer care was 26 on a 7 to 35 scale. There was little difference between those with early rather than late stage cancer, or those with zero versus more than two other health problems (Kurtz et al., 2008).

Mastery through faith. Kay, Gaucher, McGregor, and Nash's (2010) compensatory control theory states that, when a personal sense of mastery is low, a feeling of control in another area in life can offer stability. Believing that God is in control is one way to reach equilibrium (Kay et al., 2010).

In a study of 71 adults with cancer, positive adjustment was more highly correlated with a sense of control over emotions and symptoms than with control over treatment (Thompson et al., 1993). Adjustment was more strongly correlated with control than any other variable, including physical functioning, educational level, income, or financial strain. Those with the worst physical functioning benefitted the most from feeling in control of their emotions. The most common approach to feeling in control of emotions was faith or religion, which was utilized by 22% of the sample. Other approaches mentioned, in response to the open-ended question, were staying in control by keeping active, used by 21%, and having a positive attitude, used by 16%.

God-mediated control was explored in Krause's (2005) population-based interviews of 1,500 U.S. residents over 66 years old, who were not current or former practitioners of any religion other than Christianity. One question created for the study, "All things are possible when I work together with God," was added to two from Berrenberg's (1987) measure, which asked

for agreement or disagreement with: "I rely on God to help me control my life," and "I can succeed with God's help." African Americans endorsed God-mediated control to a much greater extent than European Americans did. Church attendance was not as strong a predictor as private prayer was, of the three-item God-mediated control scale. God-mediated control was better than prayer or attendance, at predicting optimism and lack of death anxiety.

Mastery and optimism. Mastery functions in health similarly to optimism, but it is not as broad a concept. Few health studies have measured both, perhaps because there is so much overlap in the constructs, yet each has a rich health research literature. Does spirituality, which transcends the self, have a smaller correlation with belief in the personal ability to control outcomes, and a larger correlation with optimistic belief in the goodness of outcomes in general? Spiritual beliefs may be how some people justify optimism beyond personal mastery. This could disadvantage secular people, but the literature does not make that clear.

Social Support. In the year 2000, an estimated 162,000 individuals died in the U.S. due to inadequate social support, tens of thousands more than the 133,000 who were estimated to have died due to poverty (Galea, Tracy, Hoggatt, DiMaggio, & Karpati, 2011). Social support reduced all-cause mortality by 19%, after controlling for covariates, among over 12,000 individuals who were evaluated at a clinic in Texas and then followed for 13 years (Becofsky, Shook, Sui, Wilcox, Lavie, & Blair, 2015). A meta-analysis, covering studies published in the years 1900 through 2006, found an overall odds ratio of 1.50, 95% CI [1.42, 1.59], a 50% increase in survival associated with more social connection (Holt-Lunstad, T. B. Smith, & Layton, 2010). Put another way, lack of social support is as serious a health risk as smoking (House, Landis, & Umberson, 1988).

Social support has been measured as the reality (Holt-Lunstad & Uchino, 2015) or the

perception that practical or emotional help has been or will be available when needed, and as

integration into communities or networks of people (House, et al., 1988). Although correlated

only r = .20 to .30 with each other, each of these aspects of social support has been found to

predict illness and death (House et al., 1988). The mere existence of a spouse or roommate

usually is not predictive of health (Magrin et al., 2015).

Sheldon Cohen (2001), reflecting on the first publication showing the effect of social

support on longevity (Berkman & Syme, 1979), reviewed why people are so good for human

health: The question has not been answered definitively, but social support improves health

behaviors and mood, it may reduce uncertainty or strengthen purpose in life, it may increase

access to health information or to health care itself. As an example, Korean immigrants to the

U.S. sought informational support from their friends and families, about health care providers,

health conditions, and treatments (W. Kim, Kreps, & Shin, 2015). In addition, family members

sometimes translated during medical appointments (Kim et al., 2015).

Social support and health behaviors. Sheldon Cohen (2001) stated that the evidence is

clear that better personal health behaviors, such as avoiding substance use and eating a

wholesome diet, explain only a small part of the social support effect. Cacioppo and colleagues

echoed this but addressed another factor: health care provider behaviors (Cacioppo, Hawkley, &

Berntson, 2003). The random sample of U.S. physicians they surveyed admitted that they

provided more complete medical care to older patients who had involved family members.

DiMatteo (2004) conducted a meta-analysis of social support and adherence to

recommended medical treatment, using data published in 122 studies from 1948 to 2001.

Practical social support had an average correlation of r = .31 with adherence. For emotional

support, the mean correlation was *r* = .15. Simply being married, *r* = .06, or living with anyone else, *r* = .08, was not as influential.

A meta-analysis conducted in 2012, of social support and adherence to hypertension treatment (e.g., taking medication, attending medical appointments, exercising), found that living with a spouse or anyone else was not predictive, but emotional, instrumental, or informational social support was predictive (Magrin et al., 2015). The 33 independent studies, conducted on four continents, included over 13,000 people. Notably, the results were stronger when objective measures of adherence were used rather than self-report.

Social support and inflammation. Inflammation, a necessary part of the acute immune response to pathogens that have gained entry to the body, is itself pathogenic when it becomes chronic, even in people who do not have chronic autoimmune inflammatory diseases such as rheumatoid arthritis or inflammatory bowel disease (Kiecolt-Glaser, Gouin, & Hantsoo, 2010). Chronically lonely people sometimes have been found to have excessive adrenalin and norepinephrine, and too little cortisol, circulating in their blood (Uchino, 2006). These stress-related hormonal imbalances may be the cause of the immune dysregulation that has been found consistently: Persons with low social support have an impaired ability to respond to cortisol with a quieting of the inflammatory molecules interleukin-6 and C-reactive protein (G. Miller, Chen, & Cole, 2009). C-reactive protein and interleukin-6 are typically elevated in inflammatory bowel disease (Lochhead, Khalili, Ananthakrishnan, Richter, & Chan, 2016).

There have been several reviews addressing social support and inflammation. Uchino (2006) found some evidence that social support increases the hormone oxytocin, which reduces stress hormones. Instrumental social support was associated with reduced interleukin-6, in parents caring for children with cancer (G. E. Miller, S. Cohen, & Ritchey, 2002). And Penwell

and Larkin (2010) found support for the hypothesized path from social support to reduced inflammation to reduced cancer and cardiovascular disease. All reviewers cautioned that they were writing in the early days in this area of research; they felt that the evidence was far from conclusive.

Expected relationships were not found in large cross-sectional studies of interleukin-6 and C-reactive protein in the U.S. and Taiwan (Glei, Goldman, Ryff, Lin, & Weinstein, 2012). Perhaps interactions would have been found had they been looked for. Recent experiments with U.S. undergraduates showed that only students who reported low subjective socioeconomic status during childhood reacted to stressful social tasks with elevated interleukin-6 (John-Henderson, Stellar, Mendoza-Denton, & Francis, 2015). This inflammatory response was not seen when confederates provided social support to these students (John-Henderson et al., 2015).

Another piece of the puzzle is that lonely adults, both old and young, have reduced sleep quality (Cacioppo, Hawkley, & Berntson, 2003). Sleep disturbance itself is inflammatory (Kiecolt-Glaser et al., 2010). An interaction was found where poor self-rated sleep was associated with increased interleukin-6 and C-reactive protein, but only in those with lower social support (Tomfohr, Edwards, Madsen, & Mills, 2015).

A more fine-grained portrait of social support and inflammation was produced with a U.S. sample of almost 650 married, midlife people (Yang, Schorpp, & Harris, 2014). Interleukin-6, C-reactive protein, and three other biomarkers of inflammation, measured with blood samples, were combined into an index representing susceptibility toward disease. Social support and social strain, at the time of the blood draw and 10 years prior, were averaged, to represent perceptions over time, and analyzed as predictors of inflammation. After adjusting for demographics, smoking, and medications, and comparing the fit of a variety of models, social

support did not offer a statistically significant benefit. Social strain—friends, spouse, and family being demanding, critical, disappointing, or annoying—did reach statistical significance: The odds ratio for social strain predicting inflammation was 1.7, 95% CI [1.1, 2.7].

The authors had several comments. First, this was not a clinical sample, and social support, rather than social strain, may be much more important when individuals are dealing with acute or chronic illness. Second, what started as a nationally-representative sample became an unusually socially stable sample, when unmarried people and those with any missing data were removed, presumably attenuating the associations. Third, perceived quality of relationships was more important than frequency of contact. Finally, the authors pointed out that children, siblings, and parents cannot be divorced, so perhaps we should not be surprised that, when they looked at the sources of social strain separately, strain with spouses was not as strongly associated with inflammatory biomarkers as social strain with family (Yang et al., 2014).

Two current studies make strong points about the power of social support. First, among over 1,100 older adults, social support predicted lower C-reactive protein 5 years later, while C-reactive protein did not predict social support 5 years later (S. Kim & Thomas, 2017). This was a structural equation model, controlling for a variety of potential confounders, in a population-based U.S. sample. Finally, in China, among 300 people with rheumatoid arthritis, fatigue was more highly correlated with perceived social support than it was with a disease index that included C-reactive protein (Xu et al., 2017).

Overall, social support has been linked with reduced inflammation. There is some evidence for nonlinear influences, for example, depending upon socioeconomic status.

Social support and religion. It was Berkman and Syme's 1979 report that inspired contemporary research on social support and health. Mortality was found to be associated with

social ties over a period of 9 years, in a representative sample of 7,000 Northern Californians. At baseline, in 1965, more than 4,000 of the participants were over 38 years old; 17 years later, 29% of them had died (Seeman, Kaplan, Knudsen, R. Cohen, & Guralnik, 1987). In the 1987 follow up, adjusting for demographics and baseline health, for those over 70 at baseline, minimal contact with friends and family, and lack of church membership, had statistically significant relative hazard ratios: 1.30 for friends and family, and 1.32 for church membership. Not being married and not having membership in a secular group did not have statistically significant hazard ratios.

The type of social connection that mattered to all-cause mortality differed by age group. Membership in a church group was the only type that was statistically significant for almost all of the age groups studied. Only those 50 to 59 years old at baseline did not have an association between church membership and mortality at the level of $p < .05$. Yet, when the analysis was further adjusted, incorporating known causes of death, such as smoking and lack of physical activity, church membership lost statistical significance for all age groups over 50 (Seeman et al., 1987). Does this mean that religion is not a unique contributor to physical health?

In her religion and public health review, Chatters (2000) noted that religious participation increases social support in a number of ways: satisfaction with and frequency of interacting with a larger network, as well as the receipt of additional emotional and instrumental help. She suggested that social support is a promising focus for future study in the religion-health relationship. Indeed, religious participation may be a particularly attractive form of social support for many people, whether it offers unique benefits beyond the standard life-lengthening benefits of secular social support or not.

Religion did not show a unique effect in a surgical study. Longitudinal data, from over 300 people having major cardiac surgery, supported a structural equation model where religiosity indirectly led to reduced post-operative distress, with complete mediation via secular social support and hope (Ai, Park, Huang, Rodgers, & Tice, 2007).

One study claimed to provide evidence that general social support was not as capable as religious social support at predicting a variety of health behaviors (Debnam, Holt, Clark, Roth, & Southward, 2012). However, the general social support scale contained a wide range of items, including, "If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me," and, "If I wanted to have lunch with someone, I could easily find someone to join me" (S. Cohen & Hoberman, 1983). The religious social support items, on the other hand, all referred to deeper support, such as, "How often do the people in your congregation make you feel loved and cared for?" and "How often do the people in your congregation listen to you talk about your private problems and concerns?" (Fetzer Institute, 1999). Note that the religious social support questions were religious only in that they inquired about people attending a religious institution. In any case, it is hard to reach any conclusions about religious versus secular support given how different the scales were.

There was one study where godliness was not confounded. Lee and Sharpe (2007) surveyed 115 African Americans, 65% of them female and all of them over the age of 65, about their sources of support. They were asked to answer yes or no for each question. The percent answering that this was a source of support follows each category: clergy 6%, neighbors 6%, friends 18%, family 54%, God 69%. For health issues in particular, support was received from clergy 5%, friends 6%, family 35%, God 65%, and health care providers 66%. Unfortunately there were no health outcome data included in this study.

Noting that most religion and social support research had been conducted in highly religious cultures, Norwegian investigators invited 3,000 randomly sampled adults from their generally secular culture to answer survey questions (Kvande, Reidunsdatter, Løhre, Nielsen, & Espnes, 2015). Among the 22% who returned the questionnaire, only religious men under age 40 reported more social support than their secular peers, matched on age and gender. Secular women under 40, and all secular adults aged 60 to 75, perceived more social support than their religious age peers. Adults between 40 and 60 did not differ in social support depending on religiosity. The results of this research may have been different if the level of social support had been truly low for any of the participants, or if a different measure of religiosity had been used. The religiosity index in the study included attendance, private prayer, identification as a religious versus nonreligious person, and the use of religious coping. The sample over-represented female, older, less religious, and more educated individuals, but it was representative in other demographic and religious aspects.

In his review of social support and health, Uchino (2006) suggested that social support increases perceived control, which in turn improves health. Carver and Scheier's 2017 review noted that expanding one's social network led to increased optimism. In sum, although the mechanisms have not been definitively established, and the relationship with religiosity is unclear, social support is powerfully protective of health, and it is associated with all of the other key variables discussed so far: optimism, mastery, and spirituality.

Gratitude. Appreciation is both a state and a trait, or disposition. (Even a generally ungrateful person might appreciate a cold drink on a hot day.) McCullough, Emmons, and Tsang (2002) defined the grateful disposition as a tendency to attribute the cause of one's happiness to

the actions of many others. They found that gratitude is related to but distinct from optimism, life satisfaction, and positive affect.

In 2008, McCullough and colleagues posited that gratitude, the positive emotional experience of receiving a gift, is an evolutionary adaptation that reinforces reciprocal altruism, by making it feel good to receive, at the same time that it makes a person more inclined to give (McCullough, Kimeldorf, & A. D. Cohen, 2008). The authors speculated that the relationship between trait gratitude and health may be mediated by this social influence. As fascinating and convincing as their argument is, for the importance of gratitude as a unique emotion in building human societies, theirs is not the only conceptualization of gratefulness that is relevant in a discussion of gratitude and health.

Wood, Froh, and Geraghty (2010) considered gratitude toward a generous someone as only one facet of what they called a *life orientation* of attending to and appreciating positives, including the beauty in nature and what one has. They defined *trait gratitude* as experiencing gratitude intensely and frequently in different situations, which they claimed has a strong, causal association with well-being. In support of this conceptualization, a different research group found that open-ended descriptions of gratitude, offered by children and adults, included a situation where there was no bestower of the gift, for 47% of respondents (Lambert, Graham, & Fincham, 2009). Statistically, gratitude has been determined to be one factor with many facets, including benefit-triggered gratitude and the more generalized appreciation (Lambert et al., 2009).

Gratitude and personality. Wood, Froh, and Geraghty, in 2010, summarized empirical evidence that people who are high in gratitude are low in the neuroticism facets hostility and depression, high in the extraversion facets warmth and gregariousness, high in the agreeable

facets trust and altruism, and high in the conscientiousness facets competence and achievement striving. Impressively, after controlling for the standard 30 facets (Costa & McCrae, 1995) of the Big Five personality factors (neuroticism, extraversion, agreeableness, conscientiousness, and openness to experience), gratitude explained 8% of the variation in satisfaction with life (Wood et al., 2010). Because neuroticism (Lahey, 2009), agreeableness (Hampson, Goldberg, Vogt, & Dubanoski, 2007), and conscientiousness (Friedman, et al., 1995) are associated with physical health, gratitude might be expected to show similar associations.

Gratitude and social support. Gratitude has been linked to stress and social support (Wood et al., 2010), which have established causal relationships with physical health (DeLongis, Folkman, Lazarus, 1988; House, Landis, & Umberson, 1988). Two longitudinal studies, of the first term of college, provide evidence that gratitude directly reduces stress and increases perceived social support.

In the first of the two studies, the paths from Time 1 gratitude to Time 2 stress and social support had standardized coefficients of -.21 and .16 (for verbal-emotional support) for the 156 participants. Reversed, mediated, and reciprocal causation models were tested and rejected (Wood, Maltby, Gillett, Linley, & Joseph, 2008). Study 2, a replication with 87 participants, controlled for the Big Five personality traits. Path coefficients were -.21 for stress and .28 for social support. Based on the correlation matrix, it appears that more cases in Study 2 might have powered support for the reciprocal model, where stress and social support predict gratitude 3 months later, at the same time that baseline gratitude predicts stress and social support 3 months later. However, clearly, there is support in the combined studies for gratitude as increasing social support and reducing stress (Wood, Maltby, et al., 2008).

Gratitude and health. Due to a variety of issues, few conclusions can be drawn from the following set of interesting gratitude and health studies. The first study was conducted in the U.S. with a nationally representative sample of adults, excluding atheists (Krause, Emmons, Ironson, & P. C. Hill, 2017). After controlling for exercise, demographics, religious attendance, and prayer, as well as belief that God intervenes in health, gratitude statistically significantly predicted a biomarker of long-term blood sugar control, hemoglobin A1c (HbA1c). A 10-point difference in gratitude, on the measure with a range of 4 to 20, raised HbA1c on average only 0.3, which could be clinically significant if it were above normal. Elevated HbA1c, the authors pointed out, predicts heart and kidney disease, in addition to diabetes.

In the same study, gratitude to God was predictive only for women, who were more grateful both in general and to God (Krause et al., 2017). However, I am not sure that there is any practical significance to the gratitude to God finding, given that the average HbA1c associated with the highest gratitude was 4.7, and the average HbA1c associated with the lowest gratitude was 5.1, still well below the high end of physiological normal (<5.7).

In the next study, a randomized clinical trial, a 2-week gratitude journaling intervention was piloted for people diagnosed with asymptomatic heart failure, where heart structure is abnormal but function is normal (Redwine et al., 2016). The authors reported that the goal with asymptomatic heart failure is to prevent progression to symptomatic heart failure, where mortality risk increases by a factor of five. C-reactive protein, interleukin-6, and other inflammatory markers rise as heart failure worsens (Redwine et al., 2016). The intervention, versus usual treatment, consisted of writing 3 to 5 things the person was grateful for each day. Fewer than 40 participants were compared. Because randomization resulted in groups that

differed in inflammation at baseline, the inflammation reduction seen, noted the authors, could be from regression to the mean rather than any treatment effect.

The last in this set of inconclusive, recent studies (P. L. Hill, Allemand, & B. W. Roberts, 2013), used a stratified random sample of almost 1,000 Swiss adults, aged 19 to 84, and the classic self-reported health questionnaire, the SF-12 (Ware, Kosinski, & Keller, 1996). Yet, instead of scoring this health survey based on principal components analysis as recommended, or the alternate documented method of factor analysis (Ware, Kosinski, & Keller, 1995), the authors broke the 12 items into two groups, using 6 items to measure physical health and the other 6 items to measure psychological health (P. L. Hill et al., 2013). Their nonstandard analysis may have inflated the correlation and mediation: They reported that gratitude was correlated with physical health, $r = .16$, and that this relationship was mediated by psychological health.

Gratitude experiments. Wood, Froh, and Geraghty, in their 2010 review, summarized 12 gratitude experiments. Regularly thinking about or listing a few things one is grateful for, used in most of the interventions, improved mood in the moment, and was remarkably effective at treating generalized anxiety disorder, even as an online 14-day intervention. But Wood and colleagues cautioned that most of the studies used control groups with individuals who were waitlisted or who wrote about hassles, which hardly proves that gratitude is a unique cause of improved mental health, as they implied that some clinical proponents claim. Further, they pointed out that most of the studies did not analyze whether improvements were due to increases in gratitude.

In 2016, a large research group conducted a series of meta-analyses designed to address the questions left unanswered by the 2010 narrative review (Davis et al., 2016). This meta-analysis included 32 published and unpublished English language studies that used random

assignment. Gratitude interventions did not reduce anxiety or increase gratitude, but they did increase well-being, when compared with what the authors called *measurement-only* control and *activity-matched* controls, such as listing five activities of the day. Gratitude interventions did not increase well-being more than *psychologically-active* controls, such as practicing acts of kindness or progressive muscle relaxation; they were equally effective.

Davis and colleagues noted that interventions may work better in clinical populations, where there is more room for improvement, than in the typical student sample (Davis et al., 2016). They also acknowledged that participants have been happy to complete the gratitude tasks. But the authors suggested that gratitude interventions may work only as well as placebo. It is unclear why they classified the physical relaxation and social action controls as placebo. Furthermore, considering that the placebo response can include a physiological reaction to a psychological state, and that there is remission while on placebo for 8-18% of participants in clinical trials for inflammatory bowel disease, as assessed by objective measures in meta-analyses, that is an odd criticism (Ilnyckyj, Shanahan, Anton, Cheang, & Bernstein, 1997; Su, Lichtenstein, Krok, Brensinger, & Lewis, 2004).

Gratitude and sleep. In the 2010 review, sleep was the only physical health measure empirically associated with gratefulness (Wood et al., 2010). In a large cross-sectional study, gratitude was correlated with more positive thoughts just before sleep, allowing quicker, longer, and better quality sleep (Wood, Joseph, Lloyd, & Atkins, 2009).

One gratitude experiment tested several physical health outcomes, including sleep (Emmons & McCullough, 2003). Adults with neuromuscular diseases, such as post-polio syndrome, were assigned to a control condition versus listing several things they were grateful for, each evening for 3 weeks. The gratitude group reported less negative affect, and more

gratitude, optimism, connection with others, satisfaction with life, and positive affect. The differences in self-reported satisfaction with life and positive affect were confirmed with ratings by significant others. On physical health, the gratitude group reported more refreshing sleep that lasted half an hour longer than the control group's sleep. The groups did not differ on pain or physical functioning.

A more recent sleep experiment (Jackowska, Brown, Ronaldson, & Steptoe, 2016) had 119 healthy women in their 20s, who had moderate sleep disturbances, either write in a gratitude journal six times over 2 weeks, write things they noticed during the day (the active control), or wait 3 weeks for their writing assignment (the passive control). The gratitude practice increased sleep quality and optimism, and reduced diastolic blood pressure and emotional distress. It did not change sleep disturbance, systolic blood pressure, cortisol, heat rate, or satisfaction with life, with or without various adjustments for confounders. The authors wondered if their active control accidentally became an effective mindfulness intervention, reducing the apparent treatment effects.

Gratitude and prayer. With over 90% of U.S. residents reporting praying at least occasionally, prayer was explored as a path to gratitude through two longitudinal studies and one experiment (Lambert, Fincham, Braithwaite, Graham, & Beach, 2009). Controlling for attendance at religious services and baseline gratitude, frequency of prayer predicted gratitude 6 weeks later in a large ($N = 780$), longitudinal study at a southeastern U.S. university. An even larger replication, using a different measure of religiosity and controlling for socially desirable responding, returned similar results.

The same article reported on their month-long experiment with undergraduates in romantic partnerships, comparing the effect on gratitude of (a) a daily prayer for one's partner,

(b) a prayer of one's choosing, (c) thinking positive thoughts about one's partner, or (d) listing daily accomplishments (Lambert, Fincham, Braithwaite, Graham, & Beach, 2009). The two prayer conditions resulted in more gratitude than the other conditions, at the end of the month, after controlling for prior gratitude, prior prayer frequency, and religiosity.

Increasing prayer may be an effective way to increase gratitude, a path that religious people could be very comfortable with. A more direct approach is to list a few things one is grateful for, which has had a high acceptance rate in experiments among religious and nonreligious participants (Emmons & McCullough, 2003; Wood et al., 2010).

Gratitude and religion. Because major religions institutionalize gratitude practices, it is not surprising that religious people are more grateful (Lambert, Fincham, Braithwaite, Graham, & Beach, 2009; McCullough et al., 2002). Two studies, published since the 2010 review by Wood, Froh, and Geraghty, compared religious gratitude with general gratitude.

In Iran, in 256 Muslim university students, religious gratitude explained only about half the variance in mental health, compared with the predictive power of general gratitude (Aghababaei & Tabik, 2013). This was true even though the correlation of the gratitude measures was $r = .78$. Religious gratitude was measured with the four-item Gratitude toward God Questionnaire (Krause, 2006). One of the items is, "As I look back on my life, I feel I have been richly blessed by God." Adding religious gratitude to the regression equation did not significantly increase the variance explained by the validated Farsi version of McCullough, Emmons, and Tsang's 2002 six-item, dispositional Gratitude Questionnaire (GQ-6).

The other study reported similar results, among 405 community and university adults in the U.S., surveying 25% Orthodox and 12% non-Orthodox Jews, 22% Protestants, 9% Catholics, and 32% others (Rosmarin, Pirutinsky, A. B. Cohen, Galler, & Krumrei, 2011). The authors used

the original GQ-6 as well as what they called the RGQ, the Religious Gratitude Questionnaire. The RGQ repeated the GQ-6 questions with the words *to God* inserted. For instance, the original GQ-6 item "I have so much in life to be thankful for" was rewritten "I have so much in life to be thankful to God for." The correlation between the GQ-6 and the RGQ was $r = .66$. The GQ-6 correlation was larger than the RGQ correlation with each health and well-being variable reported. However, the correlation with the SF-12 physical health component score was only $r = .07$ for the GQ-6 and .03 for the RGQ. The correlation $r = .07$ represents gratitude explaining only one-half of one percent of the variation in physical health.

In sum, although religiosity and gratitude are highly correlated, religious gratitude does not contribute as much to predicting physical health as general gratitude does. Even the documented general gratitude-health link is very weak, except for sleep as a health outcome.

Gratitude and optimism. Psychologists only started studying gratitude this century. Wood, Froh, and Geraghty (2010) suggested that merely repacking the same health psychology under a different title, such as gratitude, does not advance the field. Yet, there is little data comparing gratitude and optimism in physical health, in spite of two gratitude experiments reporting an increase in optimism (Emmons & McCullough, 2003; Jackowska, Brown, Ronaldson, & Steptoe, 2016) and other parallel findings.

Grateful people have reduced stress, because they more often reach out for emotional and instrumental help, and are more likely to use approach coping rather than avoidance coping (Wood et al., 2010). This is similar to optimism (Scheier & Carver, 1992). Yet the study which is cited in support of the gratitude-approach-well-being hypothesis (Wood, Joseph, & Linley, 2007) did not report on optimism.

Although McCullough, Emmons, and Tsang (2002) declared that gratitude is related to but distinct from optimism, they did not publish data that rules out the possibility that the part of gratitude that influences health is the part that overlaps with optimism. With gratitude-optimism correlations of $r = .35$ to $.51$ (P. L. Hill & Allemand, 2011; Kleiman, Adams, Kashdan, & Riskind, 2013; McCullough et al., 2002), this is a glaring gap in the literature. Only a study measuring optimism, gratitude, and health can discern if gratitude adds to the established health benefits of optimism.

Recently, such research was conducted (Huffman et al., 2016). The Gratitude Research in Acute Coronary Events (GRACE) Study measured both optimism and gratitude, in people hospitalized for acute coronary syndrome (heart attack or unstable angina). Recruited at admission, 164 people answered psychological questions 2 weeks later. Outcomes were tracked for 6 months. Optimism at baseline predicted the following outcomes 6 months later: steps taken per day (recorded by an accelerometer), unplanned cardiac hospital readmission, C-reactive protein, and one other inflammatory biomarker. These associations were statistically significant when controlled for age and sex, but not necessarily when other covariates were controlled, especially anxiety and depression. The prediction for hospital readmission was impressive: For each point on the standard summed optimism scale used in medical research (the LOT-R, discussed in the measures section below), there was a reduction in readmission of 8%. Gratitude was predictive only of one biomarker, no other outcome. Neither psychological strength predicted interleukin-6 or four other biomarkers. Unfortunately, gratitude and optimism were tested in separate regression equations, therefore it is unclear whether gratitude's predictive power was completely redundant with optimism's predictive power.

Gratitude and IBD. An online survey, of 144 people with inflammatory bowel disease (IBD) and 163 people with arthritis, showed that gratitude was negatively correlated with depression, measured at the same time and 6 months later, r = -.43 to -.50 (Sirois & Wood, 2017). Baseline gratitude predicted later depression, controlling for demographics, baseline depression, helplessness, pain, perceived stress, social support, self-rated health, time since diagnosis, benefit-finding, illness acceptance, and thriving.

Gratitude is easy. The evidence for gratitude as a predictor of health is not as strong as for the classic health-related psychological strengths optimism, mastery, and social support. On the other hand, the gratitude interventions that have been used, such as listing up to five things one is grateful for before going to sleep, require little time, no training, and no expense. Completion rates in the intervention studies reviewed have been high, implying that people do not mind doing this daily for weeks. Mastery and optimism can be taught, but not as easily as gratitude (Schueller & Seligman, 2008; Schulman, 1999; Sperry, 2009).

Meaning in life. Psychology's study of meaning in life was born when Viktor Frankl was liberated from Auschwitz, convinced that the key to surviving extreme loss was to have meaning in life. In fact, he saw maintenance of a sense of meaning in life as the main motivator of human behavior (Crumbaugh, 1972).

Meaning in life is common. In 2007, 91% of almost 150,000 people from 132 countries answered "yes," when asked if they felt that their life had an important meaning or purpose (Oishi & Diener, 2014). Meaning in life can be based on lofty humanistic or religious worldviews, deep personal relationships, accomplishments or simple pleasures, a good mood, and even mundane visual patterns (Heintzelman & King, 2014b).

Meaning in theory. A variety of psychological theorists have focused on meaning in life, including Ryff and Keyes (1995), who named purpose in life and mastery as two of the six dimensions of psychological well-being. Similarly, Taylor's (1983) theory of cognitive adaptation said that, after a threatening event, humans have a need to regain mastery of their lives and a sense of purpose.

Park (2010) differentiated between global and situational meaning. Global meaning is described as worldview or meaning in life. Situational meaning becomes especially important when the meaning of one's current circumstances is at odds with one's worldview, such as during health crisis. Meaning making is the process of resolving the differences, automatically and/or with effort. When successful, there is a new meaning made (Park, 2010).

For instance, if a man's meaning in life is based on his role as a high school chemistry teacher, it could be devastating to be diagnosed with a disabling chronic illness. If forced to give up work, he might resolve the discrepancy by expanding the global meaning of his life to encompass guiding the next generation toward wonder and knowledge in a variety of ways, and then he might refocus on his role as father.

Park and L. S. George (2013) depicted meaning-making theory as widely accepted, yet they pointed out that this was in spite of a lack of evidence for the theory. They said this was due to imprecise measurement and inadequate design, in the relatively new area of study.

Meaning in three parts. Meaning in life often has been treated in research as if it were synonymous with purpose in life (Steger, 2012), with scales of one name including items with the other wording (P. L. Hill, Burrow, Sumner, & Young, 2015). However, L. S. George and Park (2016) described recent movement within the field toward consensus on a tripartite model of meaning in life, comprising *purpose*, *comprehension*, and *mattering*. (George and Park noted that

no instrument existed to measure the three constructs with any precision, until they published one in 2016.)

Martela and Steger (2016) used the terms *purpose*, *coherence*, and *significance* for the same three facets: Purpose is said to be motivational, reflecting goals; coherence is cognitive, representing a life that makes sense; and significance is the evaluation that life is valuable and worth living. The paths from the concepts purpose and significance to a meaningful life seem straightforward. Coherence as meaning may be less obvious; its biological basis is discussed below. The three aspects of meaning in life, although quite different at face value, typically form one factor in factor analytic studies, perhaps because they all rely on the same physiology (Heintzelman & King, 2014a).

Meaning is biologically based. The coherence aspect of meaning has been described as the experience of expected relationships (Proulx & Inzlicht, 2012). In other words, meaning in life can be simply a sense of order in one's world. The feeling of meaning is hypothesized to have evolved from the survival advantage of the detection of associations, such as the perceived aspects of an environment that are associated with safety or food (Heintzelman & King, 2014a). This feeling directs attention (Heintzelman & King, 2014a), and regulates perceptions, emotions, beliefs, behaviors, and memories, consciously and unconsciously (Paloutzian & Park, 2013).

When environmental relationship expectations are not met, there is an unpleasant physiological arousal (Proulx & Inzlicht, 2012), which encourages the seeking of patterns (Heintzelman & King, 2014a) or a search for the familiar (Proulx & Inzlicht, 2012). The meaning maintenance model (Heine, Proulx, & Vohs, 2006) says that this seeking type of motivation is unconscious, and it guides actions toward resolving the arousal—not toward resolving the disruption in a particular content area of meaning (Proulx & Inzlicht, 2012). For

instance, the disabled chemistry teacher might have resolved the uncomfortable feelings, which were aroused by the discrepancy between his global and situational meanings, by creating meaning in a completely different realm. He could have found himself turning to the pleasures of playing the piano or the clearly delineated worldview of the Catholicism of his youth.

The effects of disorder on meaning in life can be quite concrete, even when the patterning is very abstract. Meaning in life was successfully manipulated experimentally by presenting photographs of trees in seasonal versus random order, and by presenting the same words in groups of related versus unrelated meanings (Heintzelman, Trent, & King, 2013). Pointing to increased meaning in life, after manipulation of experimental relationships, pleasure, and patterns, Heintzelman and King (2014b) noted the survival advantage of each: Friends can protect you, the pleasures of food can nourish you, and a disturbed pattern is a potential sign of danger. (Maybe the birds quieted because a predator lurks.)

Meaning's sources. Outside of the experimental lab, meaning in life has been correlated with various aspects of social support and connectedness (King, Heintzelman, & Ward, 2016; Steger, Mann, Michels, & Cooper, 2009). When young adults were asked to name their primary source of meaning in life, 68% responded with familial relationships (Martela & Steger, 2016). In a different study, the association was reciprocal: Meaning in life predicted adults' connectedness, 10 years later, with community, family, friends, and romantic partners, at the same time that those four levels of connection predicted meaning in life 10 years later (Stavrova & Luhmann, 2016).

A narrative review found family relationships were the most frequently mentioned source of meaning in life for people in the U.S., as well as Israeli Arabs and Jews (O'Donnell, Bentele, Grossman, Le, Jang, & Steger, 2014). Meaning in life also was correlated with perceived and

expected social support; friendships (measured on three continents); and lover, partner, or spousal relationships (O'Donnell et al., 2014).

Priming with words of relatedness, such as *father* and *family*, experimentally increased meaning in life (O'Donnell et al., 2014). In different studies, experimental manipulations of exclusion decreased meaning in life (King, Heintzelman, & Ward, 2016).

Beyond social connection, manipulating positive affect has increased reports of meaning in life (King, Heintzelman, & Ward, 2016). In addition, in a daily diary study, undergraduates rated their meaning in life higher when they were in better moods (Machell, Kashdan, Short, & Nezlek, 2015). After accounting for positive and negative affect, meaning was predicted by positive achievement and social events, while negative social events were not as predictive (Machell et al., 2015).

Meaning in health. Meaning in life was negatively correlated with pain in women with breast cancer in India (Anand, 2014). That finding is in very good company. A meta-analysis of 66 peer-reviewed studies, which included over 70,000 adults, found an average correlation between meaning in life and physical health of $r = .26$, 95% CI [.21, .30], unaffected by the age of the participants, whether the sample was healthy or had cancer or a chronical illness, or whether the research design was cross-sectional, longitudinal, or experimental (Czekierda, Banik, Park, & Luszczynska, 2017). Subjective health measures were stronger predictors of meaning in life than objective measures were. Measures of mortality were the weakest, but they too were significantly predictive. The authors tested two different components of meaning: *purpose*, defined as having personal goals, and what they called *order*, which included coherence and significance. They found no difference in effect between measures of order versus purpose.

Meaning in life and mortality were explored in an investigation using a U.S. sample of over 1,300 older adults. Krause (2009) reported correlations between meaning in life and (a) physical health, $r = .26$, (b) disability, $r = -.28$, and (c) attendance at religious services, $r = .34$. Purpose in life protected against mortality (odds ratio = 0.86, $p < .05$), until measures of health and disability were added to the model.

After Park and colleagues (Park, Moehl, Fenster, Suresh, & Bliss, 2008) found that meaning in life for 155 men with congestive heart failure was correlated, $r = .30$, with physical health 6 months later, L. S. George and Park (2017) looked for a bidirectional relationship between meaning in life and violations of beliefs and goals. They expected that living with a diagnosis of congestive heart failure would disrupt meaning in life, while high meaning in life would protect against disruption from this very serious illness. Over 140 people completed surveys 6 months apart. The four beliefs surveyed were a sense that the world is fair, that God is in control of one's life, that the self is in control of one's life, and that health professionals are in control of one's health. Participants also were asked if their heart disease disrupted 12 specific goals, covering domains including work, health, money, and peacefulness. Controlling for heart function and general physical health, earlier meaning negatively predicted later goal and belief violations, and earlier goal violations negatively predicted later meaning. Earlier belief violations were not a significant predictor of later meaning. The authors wondered if the latter was due to measurement error.

Finally, a systematic narrative review of meaning in life interventions in palliative care included five randomized, controlled, clinical trials, and seven qualitative, exploratory, or reflective articles (Guerrero-Torrelles, Monforte-Royo, Rodríguez-Prat, Porta-Sales, & Balaguer, 2017). Each intervention explored sources of meaning in life, in the context of a supportive

relationship with a therapist. These resulted in increased optimism, mastery, and meaning in life, reduced anxiety and depression, and less desire for a hastened death.

Meaning and other psychological strengths. Some studies have published correlations between meaning in life and mastery or optimism: A measure of purpose in life was correlated with a measure of mastery, $r = .45$, in adults of all ages (Ryff, 1989). Meaning in life was correlated with optimism, .37 among students in psychology courses (Steger, Frazier, Oishi, & Kaler, 2006), .33 in arthritis patients in India (Khan, M. O., & Khan, M. I., 2016), and .63 among almost 500 Dutch adults living with chronic illness (Dezutter, Casalin, Wachholtz, Luyckx, Hekking, & Vandewiele, 2013).

Meaning and religious well-being. Existential well-being, the perception that life is meaningful, and religious well-being, a sense of comfort based on connectedness with a grand, sacred power, have been identified as the two components of spiritual well-being (Edmondson, Park, Blank, Fenster, & Mills, 2008). Edmondson and colleagues found that it was existential well-being, not religious well-being, that predicted physical and mental health-related quality of life in over 200 cancer survivors.

Correlations with physical health were $r = .26$ for existential well-being and -.01 for religious well-being. (For comparison, the correlations with physical health were $r = .18$ for social support and .24 for optimism). Correlations with mental health were .59 for existential well-being and .18 for religious well-being (compared to $r = .46$ for social support and .47 for optimism). Religious and existential well-being were correlated with each other $r = .54$, but, when existential well-being was controlled, religious "well-being" turned out to be negatively associated with mental health (Edmondson et al., 2008).

The same research group (Yanez et al., 2009) reported follow up data on the 2008 Edmondson study participants. Private religious practices (such as prayer) and attendance at religious meetings were both unrelated to mental health.

In the above two studies, religious practice and religious well-being did not fare well compared to existential well-being, the sense of meaning in life. Yet religion may be a powerful way to rebuild the perception of meaning in life, in the wake of a serious health threat.

Meaning in religion. Many people find meaning in life through spirituality. Religious fundamentalism was correlated with meaning in life in a convenience sample of mostly young South Africans (Nell, 2014). Public and private religious practice, in 84 U.S. psychology students, were correlated with their answer to the question, "How meaningful does your life feel today?" (Steger & Frazier, 2005). A 2-week daily journal study of 87 U.S. undergraduates showed that the current day's sense of spirituality predicted the following day's sense of meaning in life, and not the reverse (Kashda & Nezlek, 2012).

Paloutzian and Park (2013) argued that religion is, on one level, at essence an elaborate meaning system. This has implications for health. Fredrickson (2002) suggested that positive meanings drawn from religion could be the most important source of any health benefit bestowed by religion, because positive meanings generate positive emotions, which build personal resources to deal with adversity. Park (2007) suggested that social support from religious gatherings may build meaning in life, and that meaning may motivate positive health behaviors.

Religious meaning can create an orderly world where goodness is always rewarded (Park, 2013), even if one has to die to get the rewards. God's will is a meaning that is accessible to many people (Rothbaum, Weisz, & Snyder, 1982). With God's grand plan, nothing is random, everything is under control, and bad events can be assumed to have occurred to prevent

something worse from happening (Park, 2013). When health fails, suffering can be sanctified (Park & Edmondson, 2011).

Not all religious meaning is positive: People can feel especially confused when bad things happen in what they were sure was a good world; they can feel punished or abandoned by God; they can lose faith (Park, 2013). Yet, post-stress growth is consistently predicted by religiosity (Park, 2013). Indeed, many religious people end up more committed to their beliefs after they have been tested by life challenges (Park, 2013).

Peacefulness. There are almost no published data on peacefulness in relation to physical health or religion, except where peacefulness was measured mixed with another construct (Sims, Nelson, & Puopolo, 2014). Other than measuring peace of mind in contrast to hedonic happiness (Lee, Lin, Huang, & Fredrickson, 2013), there have been only two research paths traveled in pursuit of peacefulness: one measuring serenity and the other measuring peacefulness together with meaning in life.

Serenity can be defined as inner peace that is sustained independently of one's situation (K. T. Roberts & Whall, 1996). K.T. Roberts and Aspy (1993), based on multicultural scholarship, listed what they believed were the 10 essential attributes of serenity, including belonging and beneficence. The resulting Serenity Scale was described as having nine factors, based loosely on principal components analysis. When the scale was tested years later, exploratory factor analysis did not replicate the factors (Kruse, Heinemann, Moody, Beckstead, & Conley, 2005). Next, the 22-item Brief Serenity Scale was developed and tested on 87 adults who had received organ transplants (Kreitzer, Gross, Waleekhachonloet, Reilly-Spong, & Byrd, 2009). Three factors emerged from this sample: acceptance, inner haven, and trust. Acceptance

items included forgiveness. Note that the transplant sample was so small that these factors would not be expected to replicate (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

Floody (2014) used a process similar to Roberts and Aspy's (1993) in developing his serenity inventory. The factor he labeled *harmony* encompassed mindfulness as well as equanimity. The other factors were *positivity* (which included humor, gratitude, and subjective well-being), *lifestyle* (including living a simple life and nature appreciation), and *higher power* (including spirituality and meaning in life).

The developers of the serenity scales were clinicians using inclusive items from multiple sources, which may have met their needs very well. Yet, it is difficult to build theory when serenity is defined including constructs that may be antecedents, such as forgiveness and gratitude, and likely outcomes, such as subjective well-being.

The Meaning/Peace Subscale of the Functional Assessment of Chronic Illness Therapy, Spiritual Well-Being Scale (Peterman, Fitchett, Brady, & Cella, 2002) has four items that measure peacefulness in a simple and direct way, uncontaminated with other constructs. The items are, "I feel peaceful. I have trouble feeling peace of mind. I feel a sense of harmony within myself. I am able to reach deep down into myself for comfort." Most publications have reported only the Meaning/Peace Subscale score, which includes four meaning items, but there is reason to separate the two.

Murphy and colleagues (2010) reported *r*-values between peacefulness and meaning in life of .86 to .94, depending on ethnicity, in 8,800 U.S. residents with a cancer diagnosis 2 to 10 years in the past. European Americans had the lowest correlation, African Americans had the highest. Meaning in life had a slightly higher correlation with the physical health component of the SF-36 health-related quality of life score, $r = .27$ compared to $r = .25$ for peacefulness.

However, for the mental health component, peacefulness's $r = .66$ was quite different from meaning in life's $r = .55$.

Summarizing the literature on psychological strengths. Optimism and mastery are well-established predictors of health, with successful interventions confirming the causal relationships. Social support and meaning in life also are known to predict health. Health research on peacefulness and gratitude is in its early days. Gratitude is not promising as a broad or powerful predictor of health, yet the short, pleasant, low cost interventions, which appear to be effective for sleep, deserve further investigation in the realm of physical health.

Spiritual Dimensions and Health

Researchers wishing to contribute to the field have been asked to investigate which spiritual aspects, beliefs, and behaviors predict health (Oman & Thoresen, 2005; Park et al., 2017; Pearlin, 2002), and to compare them with the non-spiritual constructs that most closely resemble them in function (Belzen, 2009). The five dimensions of spirituality measured in this project are spiritual meaning in life, belief in God, belief in an afterlife, attendance at spiritual services, and private prayer.

Spiritual meaning in life. Park (2007; 2013) lamented the dearth of data needed to understand the complex influences of meaning in life on health, mentioning the need to compare religious and secular meanings, and to correlate meaning with specific religious beliefs. I am unaware of any study meeting those needs. Krause's 2003 publication is a start.

Although his spiritual meaning in life questions were well-crafted and appear to be appropriate for anyone who believes in a God, Krause (2003) surveyed only African and European Americans over the age of 66 who had never been affiliated with a religion other than Christianity. After controlling for frequency of attendance and prayer, religious meaning in life predicted optimism. Because Krause did not measure meaning in life in general, we do not know if it would have been more or less predictive of optimism. As for predictors of religious meaning in life, frequency of prayer was twice as strong as frequency of attendance. There were no physical health outcomes measured in this study.

Belief in God. In spite of the centrality of beliefs to religion (Exline, 2002), there are almost no data on health in relation to beliefs in God or an afterlife, separate from other dimensions of religiosity (Park, 2012). I did locate two articles comparing the health of atheists to that of agnostics and theists.

One study looked at data from a national probability sample of over 3,000 U.S. adults, who were surveyed between 2008 and 2012 (Speed & Fowler, 2016). Three percent of the sample said they did not believe in God. Interestingly, 26% of these atheists were affiliated with a religion. Self-rated health did not differ between atheists, agnostics, individuals who believed in a higher power, and those who believed in God (with or without doubts). Attendance at spiritual services did predict positive health, for the atheists as well as the others.

Interviews, of a different nationally representative sample of 3,010 U.S. adults, revealed that the 83 atheists (again about 3%) and 189 agnostics were physically healthier than interviewees with any religious affiliation, although the atheists smoked and drank more than the affiliated people (Hayward, Krause, Ironson, P. C. Hill, & Emmons, 2016). The non-believers

had less disability and fewer chronic health conditions, even after controlling for age, education, ethnicity, and region of the country. On the other hand, the interviewees who were affiliated with a religion were higher, than atheists and agnostics, in optimism, gratitude, religious gratitude, meaning in life, and receiving and giving emotional social support. This 2016 study, with health outcomes, incorporated most of the predictors used in my project. Unfortunately, no correlation matrix was published for this category-based analysis.

As for theory on belief, I was surprised to see how many researchers of religion and health have suggested that belief in an omnipotent god may act as a powerful placebo, leading to true cures of physical disease (Cacioppo & Brandon, 2002; L. K. George, Ellison, & Larson, 2002; Koenig, Idler, et al., 1999; Levin & Schiller, 1987; Oman & Thoresen, 2005). A recent meta-analysis of placebo response in clinical trials of new drugs for Crohn's disease, the most serious type of inflammatory bowel disease, included over 7,500 patients in 100 studies. Remission occurred in 18% of patients, 95% CI [16, 21], while on placebo treatment (Jairath et al., 2017). In response, an editorial urged gastroenterologists to harness the placebo effect in clinical settings with patients with IBD (Bernstein, 2017).

Belief in an afterlife. The impetus for this project was my curiosity about the health benefits of heaven. I found only one investigation providing data on belief in an afterlife as a predictor of health (Park, Lim, Newlon, Suresh, & Bliss, 2014). A 3-month study of 111 people living with disabling heart failure, in the U.S., also asked about frequency of participation at place of worship. The people in the study were mostly financially secure and Christian. Belief in an afterlife was not predictive of the SF-12 physical health component score, $r = .06, p > .05$. Participation was correlated with the physical health score, but only $r = .14, p > .05$. Belief in an afterlife predicted a worse SF-12 mental health component score, $r = -.21, p < .05$. Participation

had a smaller negative correlation with the mental health score, $r = -.15$, $p > .05$. Gender did not predict either spiritual variable. The correlations between age and the spiritual variables were positive, but with r-values $< .14$, $p > .05$. To be eligible for the study, a person had to experience symptoms of disease with even very mild physical activity, so generalizability may be limited beyond this severely disabled sample.

Attendance at spiritual services. Frequency of attendance at services is the spiritual variable with the strongest empirical support for its association with physical health (L. K. George, Ellison, & Larson, 2002). Various researchers have argued that attendance reinforces positive coping, reducing the dangers of substance use (Oman & Thoresen, 2005; Park et al., 2017), that religious rituals increase mastery (Spilka, 2005), and that merely having a stable routine is health promoting (Masters & Hooker, 2013).

Taking care of the body can be seen as tending God's temple (Oman & Thoresen, 2005; Marks, 2005). Frequent attenders more often started and maintained positive health behaviors, including exercise, in one large longitudinal study (Strawbridge, Shema, R. D. Cohen, & Kaplan, 2001). Other studies have shown religious people accessing more preventative health care (Oman & Thoresen, 2005; Park et al., 2017).

Some fish and non-human primates exhibit physiological changes, including in levels of hormones, neurotransmitters, and immunity, as a result of ritualized, patterned behavior (Alcorta, 2017). Participation in religious rituals may do the same for humans (Idler et al., 2003), especially when music is involved (Alcorta, 2017).

Attendance was weakly negatively correlated with blood pressure not only in the U.S., where weekly attendance at religious services is high, but also in a rural county in Norway, where less than 4% of the population attended weekly (Sørensen, Danbolt, Lien, Koenig, &

Holmen, 2011). The correlation emerged in the data only after adjusting for demographics, given the positive relationship between age and religiosity in the sample. The decrease in blood pressure was only ~1.5 mm Hg for weekly attendance versus no attendance, which is of questionable clinical significance.

There have been many studies on health and attendance and private prayer. One, conducted in the U.S. Midwest, recruited, from an outpatient clinic, 32 adults who had survived a stroke 4 to 180 months earlier (Johnstone, Franklin, Yoon, Burris, & Shigaki, 2008). The participants completed the Brief Multidimensional Measure of Religiousness/Spirituality (Fetzer Institute, 2003). This measure, designed for use in health research by the U.S. National Institute on Aging Working Group, unfortunately asks about religion and well-being together. Therefore, it is unsurprising that almost all dimensions of the questionnaire were correlated with mental health. Five of the eight facets, including private prayer, had mental health correlations twice as large as the physical health correlations. The one exception is informative. The Organizational Religiousness Subscale consists of two questions, about attendance at religious services and other spiritual meetings. In this physically-impaired convenience sample, the attendance dimension had a correlation of $r = .24$ with general physical health, and only $r = .07$ with mental health (Johnstone et al., 2008). This pattern can be seen as evidence that physical ability allowed attendance, rather than spirituality improved health. An unrelated study, with almost 3,000 survivors of stroke, hip fracture, or cancer, found the same pattern with private and public religiosity and disability (Benjamins, Musick, Gold, & L. K. George, 2003). Similarly, a probability sample of over 1,200 Israeli Jews over the age of 50 found attendance was negatively correlated with poor health and disability, while prayer was positively correlated with these measures (Levin, 2012).

Private prayer. In their narrative review of non-meditative prayer, Masters and Spielmans (2007) said that health-related prayer is common in Christianity, Islam, and Judaism, and that, in some countries, prayer is the most frequently used treatment for ill health. Within the U.S., a national survey showed that 79% of critical care nurses had been asked to pray for their patients, by the patients or their families (Masters & Spielmans, 2007).

In one qualitative study, 88 chronically ill Pennsylvanians over 65 years old were asked how spirituality helped them manage their illness (Harvey, 2009). One of the themes that emerged, for 32% of African Americans and 42% of European Americans, was the use of prayer to manage pain.

Masters and Spielmans' review found evidence for frequent prayer as (a) an activity that ill people engage in, (b) an unhelpful coping strategy increasing focus on problems, (c) an empowering, positive coping strategy, (d) an activity that keeps people healthy, and (e) an activity that has no impact on health. They did not suspect prayer as being deadly. However, in a 7-year investigation published after their review, among over 40,000 older women, private prayer and spiritual study were slightly positively associated with fatal and nonfatal cardiovascular events (Salmoirago-Blotcher, et al., 2013).

Park (2007) thought that the usual finding among ill people, of prayer's correlation with pain and disability, is probably due to the use of prayer as a coping mechanism. She noted that meditation has been studied experimentally, and it can be physiologically relaxing, reducing the effects of stress.

When 95 people who were being treated for severe chronic pain were asked, "What do you do for your pain?" the most common response, from 89% of them, was to use medication.

The next most common response, from 61%, was to use prayer. Lying down was used by 53% (Glover-Graf, Marini, Baker, & Buck, 2007).

Among 202 members of a Flemish chronic pain association, prayer was correlated with pain tolerance, $r = .18$, but not pain severity, $r = -.01$ (Dezutter, Wachholtz, & Corveleyn, 2011). Positive cognitive reappraisal, described as the mechanism between prayer and pain, was correlated with prayer, $r = .33$; pain tolerance, $r = .45$; and pain severity, $r = -.12$ ($p > .05$).

The most recent systematic review of prayer and health did not look at outcomes, but instead examined the content of prayers made by people living with chronical illness (Jors, Büssing, Hvidt, & Baumann, 2015). They operationalized praying as consciously relating to a higher being. Most of the 16 studies were conducted in the U.S., among cancer patients, with an average age of 50. One study included only Muslims; the other studies were predominantly Christian. The total number of participants was 1,545. The authors found that the most frequently made prayers requested relief from suffering, through reduction of disease or symptoms, or from transformation of their illness experiences. Prayers included requests for help with decision-making and meaning making, for strength or protection, and for forgiveness. Less common were (a) prayers focused on God, such as worshipping or receiving God's presence, (b) prayers for important others, such as their family, friends, and physicians, and (c) what the authors called prayers of lamentation, expressing fears and complaints.

Summarizing the literature on spirituality. Belief in God, belief in an afterlife, and use of prayer have been correlated with worse health, but the scant literature is far from conclusive. Attendance at spiritual services has the most evidence for a correlation with positive health.

Summarizing the Literature as a Whole

Despite hundreds of publications, there is minimal evidence of a positive correlation between health and any aspect of spirituality other than attendance at services, although most studies measured only one dimension of spirituality. There is some tendency for uncontrolled studies to show a relationship between spirituality and health, while well-controlled studies report no association.

Very few studies have examined spirituality and chronic illness. Most religion and physical health research has involved life-threatening illness, older adults, or community samples.

Optimism, social support, and mastery have well-established associations with physical well-being. The potential overlap—between optimism and belief in an afterlife, social support and attendance at spiritual services, mastery and belief in God—raises the question of why there is so little data aligning spiritual and psychological predictors of health. Additionally, despite meaning in life being a key construct in spirituality and health psychology, there have been no studies contrasting the health influences of general meaning in life with spiritual meaning in life.

Almost no research has examined any psychological variable, other than social support, as a mediator of spiritual influence on health. I am unaware of any research that has compared more than one spiritual variable with an analogous psychological factor.

There have been several studies incorporating the majority of the psychological variables represented in this project, but none addressed the same questions. Several research groups used all or most of the variables, but only one (Hayward, Krause, Ironson, P. C. Hill, & Emmons, 2016) used them as predictors of physical health. In other studies, the measures of psychological strength were used to predict post traumatic growth in breast cancer survivors (Danhauer et al.,

2013; Perkins et al., 2007), and the perception that life was better, worse, or the same as before an HIV diagnosis (Tsevat et al., 2009). Without even one investigation testing aligned psychological and spiritual variables, it is difficult to find a cohesive context to interpret the literature.

In 2008, Levin and Chatters urged researchers to conduct longitudinal studies measuring attendance, private religious practice, and other dimensions of religiosity, as predictors of multiple aspects of health. They noted that this same suggestion had been published in 1988 and 1968.

Oman and Thoresen (2005) suggested that religion could increase optimism, mastery, social support, and meaning, influencing mental health directly and physical health indirectly, through a reduction in the physical burden of stress. They were not the only researchers within the field to point out that not everyone will think or behave religiously, even if their lives depend on it (L. K. George, Ellison, & Larson, 2002; Seybold & P. C. Hill, 2001). Therefore, separating the active medicinal ingredients of religion (Snibbe & Markus, 2002), from the inactive ingredients, has the potential to inform the health promotion practices of everyone, no matter where they find themselves on any religiosity spectrum (L. K. George, Ellison, & Larson, 2002).

This Project

This research project used hierarchical regression and correlation analysis to examine the contributions of spiritual and psychological strengths, to particular symptoms and general physical and mental health, in people living with one serious chronic illness. Specific spiritual variables allowed separate analyses of the influences of attendance at spiritual services, the use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life. Those were compared

with specific psychological variables with no spiritual language in the measures: optimism, mastery, social support, gratitude, meaning in life, and peacefulness. The research used data from a population-based, 11-year longitudinal study of Manitobans living with inflammatory bowel disease.

Inflammatory bowel disease. One in 200 Canadians has Crohn's disease or ulcerative colitis, together known as inflammatory bowel disease (IBD). The prevalence of IBD in Canada is the highest in the world, with 144,000 Canadians currently living with the disease (Bernstein, et al., 2006). IBD is a chronic condition, with unpredictable flares and remissions, sometimes disabling abdominal pain, bloody diarrhea, nausea and vomiting, fatigue, joint pain, and fever (Bernstein, 2015).

IBD often is diagnosed in people in their twenties. It can be treated with medication and surgery, but there is no clear cause of this autoimmune disease (Wen & Fiocchi, 2004). The most powerful medication costs each person $38,000 a year and is not without side-effects, which, in rare cases, may be fatal (Blackhouse et al., 2012). Crohn's disease, which involves the small and large intestines, is incurable. Ulcerative colitis, limited to the colon, can be cured only by removing the entire colon and rectum. When done on an emergency basis, the procedure has a 30-day mortality rate of 5% (Bernstein, Ng, Lakatos, Moum, & Loftus, 2013).

The best predictor of symptoms, rather than remission, in a year-long, population-based study of over 700 Manitobans living with IBD, was higher perceived stress (Bernstein, Singh, Graff, Walker, N. Miller, & Cheang, 2010). The results of the study, which collected self-reports every 3 months, suggested that the psychological and spiritual strengths in the current investigation could have an important influence on inflammatory bowel disease, an effect that would not require years to discern.

Covariates and outcome measures. In this study, three variables were controlled in the regression analysis: gender, age, and prior health. Women and older people are more religious (Bibby, 2007; Idler et al., 2003; Powell, Shahabi, & Thoresen, 2003), and women use a greater variety of coping strategies than men do (Chipperfield, Perry, Bailis, Ruthig, & Chuchmach, 2007; Tamres, Janicki, & Helgeson, 2002). Further, in one IBD study, previous bowel symptoms were the strongest predictor of later bowel symptoms (Sexton et al., 2013). Therefore, health at year 1 of the parent longitudinal study was controlled for. Specifically, for the mental health outcome at year 11, mental health at year 1 was controlled. For the general physical health outcome, year 1 physical health was controlled. For the bowel symptoms outcome, year 1 bowel symptoms were controlled. Details about these outcome measures follow in the method section.

Hypothesis and research questions. While hypothesis testing shows the big picture, the correlation analyses in this project show important details: the relationships of each of the spiritual and psychological measures with each other and with each of the outcomes. The relative contributions of the psychological constructs alone add to our understanding: No physical health outcome of any kind had been correlated with all six of these psychological variables.

*Hypothesis***:** Controlling for gender, age, and prior health, the set of spiritual variables—attendance at spiritual services, use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life—will predict mental health, general physical health, and bowel symptoms, in people living with inflammatory bowel disease, both before and after the set of psychological variables—optimism, mastery, social support, gratitude, meaning in life, and peacefulness—are included in the hierarchical regression equations.

*Research questions***:** Which psychological and spiritual variables are the best predictors of health? Do their predictive capacities overlap, or are there unique contributions from each?

Method

Participants

The participants in this study were the enrollees of the longitudinal Manitoba Inflammatory Bowel Disease Cohort Study who stayed in the study for the entire 11 years, ending in March 2015. The cohort study participants were recruited from the population-based University of Manitoba Inflammatory Bowel Disease Research Registry, which was formed in 1995 and updated in 2000. Residents of the province of Manitoba, Canada were invited to join the registry if they had an outpatient or inpatient health care visit that was coded as involving ulcerative colitis or Crohn's disease. This coding was found in the provincial health care database covering all permanent residents of Manitoba (Graff et al., 2006).

In 2002, 56% of the 5,720 Manitobans who had an IBD diagnosis signed on with the registry, agreeing to be contacted about research projects seeking participants. The 606 registrants listed as over 18 years old, and diagnosed in the last 7 years, were invited into the cohort study. Five percent were no longer in the province, had died, or were in fact under 18; 12% were not located; and only 14% decided not to enroll. After 4 withdrawals and some cases determined to be ineligible, 388 started the study, 64% of the short list of 606 (Graff et al., 2006). Study participants who were enrolled from the registry did not differ from non-participants on demographic variables or disease type.

A medical chart review confirmed Crohn's disease for 187 individuals and ulcerative colitis for 169. Another 18 people were confirmed as having indeterminate colitis, an early diagnosis that generally is differentiated, with time, into either Crohn's disease or ulcerative colitis (Guindi & Riddell, 2004). The other 14 did not have confirmed IBD (Graff et al., 2006).

These individuals were allowed to remain in the study until a diagnosis was confirmed. Throughout the investigation, when an IBD diagnosis was disconfirmed (e.g., with an alternate diagnosis of tumor, ulcer, or irritable bowel syndrome), that person was removed from the study (personal communication with Linda Rogala, RN, original study staff member, November 2014).

Recruited initially for a 5-year study, then invited to enroll for another 5 years, and finally asked a third time if they would like to participate in a continuation, 45% of the original cohort, 175 cases, had acceptably complete data for inclusion in this study, which used data points across the full span of 11 years.

At baseline, the 175 participants ranged in age from 18 to 83, $M = 40.8$, $SD = 14.3$. They were asked about their educational background only at baseline, when 20% of them were 25 years old or younger, so the educational level was likely higher by year 9 when the last employment and income data were collected. See Table 1 for other demographic information, from the baseline survey unless otherwise noted, and see Table 2 for information on socioeconomic status.

Almost a quarter of the participants were not affiliated with a religion at year 10.5, but only 10% said that they had no religion *and* that they were not religious at all and not spiritual at all. Forty-one percent identified their religion as some type of Protestant, 27% as Catholic, 4% as Jewish, 1% as Hindu. I categorized as *secular* those who identified a religion when asked, "What, if any, is your religion?" but then completed the sentence, "In general, would you say that you are:" by choosing the answers "not religious at all" *and* "not spiritual at all." Put another way, 8% of the total seemed to identify with a religion for cultural or social rather than religious or spiritual reasons. Including the 10% secular people with no religion, 18% of the total said they were not at all spiritual or religious. See Table 3 for more detail.

Table 1. Demographics

Age in years at Year 11

    29 to 94 $M = 52$ $SD = 14$

Age in years at diagnosis

    12 to 71 $M = 36$ $SD = 14$

Diagnosis at Year 11

Crohn's disease	50%
Ulcerative colitis	50%

Gender

Female	60%
Male	40%

Married or living as married

Yes	66%
No	34%

Ethnicity

European	88%
Jewish	4%
Indigenous	4%
Asian	2%
Latino	1%
African	1%

Table 2. Socioeconomic Status

Education completed, Year 0

< Grade 11	10%
Grade 11-13	28%
Certificate	34%
Bachelor's	16%
> Bachelor's	12%

Employed, Year 9

Yes	76%
No	24%

Household income from all sources, before taxes, Year 9

< $20,000	5%
$20,000 to < $40,000	11%
$40,000 to < $60,000	11%
$60,000 to < $80,000	13%
> $80,000	43%
Don't know	4%
Prefer not to answer	10%

Table 3. Religion / Spirituality at Year 10.5

"No religion" but religious &/or spiritual	13%
No religion, not religious, not spiritual	10%
Roman Catholic (including 1% secular*)	22%
Ukrainian Catholic (including 1% secular*)	5%
United Church (including 2% secular*)	17%
Anglican (including 1% secular*)	7%
Lutheran	5%
Pentecostal	2%
Anabaptist / Mennonite	2%
Other Protestant (including 1% secular*)	8%
Jewish (including 2% secular*)	4%
Hindu	1%
"Other"	5%

Secular = *identified a religion, but were "not religious at all" and "not spiritual at all."*
Secular % = of total, not individual religion.

Procedures

The University of Manitoba Health Research Ethics Board approved the original Manitoba IBD Cohort Study, as well as the continuations after 5 and 10 years. Paper surveys were mailed to participants every 6 months, returned during in-person interviews annually, and mailed back at the half-year marks. An honorarium of $30 was paid for each survey.

By the 10-year mark, 19% of the cohort lived too far away (some moved out of the province) or were not available for in-person interviews for other reasons (poor health, work or family obligations), and instead filled out the interview questions as an additional survey. Some were interviewed in their homes. Most participants were interviewed at a regional health care facility in the city of Winnipeg, including some who came from a distance but coordinated the interview with their annual visit to a physician specializing in IBD. Annual visits by the study nurses to Brandon and Dauphin, small cities 3 and 5 hours' drive from Winnipeg, allowed in-person interviews with dozens more participants (31 in year 10).

The paper surveys, filled out by the participants, and interview forms, filled out by the study nurses, were scanned using TELEform software version 8. A research assistant checked every handwritten answer visually. All forms starting with the year 10 survey and interview were designed and scanned by the author, who checked baseline and year 1 data for accuracy.

TELEform scanning software exports data to SPSS statistical software. SPSS version 24, with the RLM macro version 1.01 (Hayes, 2017), was used for the analysis.

Measures

Six psychological and five spiritual constructs were measured as predictors. They and the three health outcome measures are described below. Appendix A contains more detail on the psychological and health outcome measures, as well as complete wording for each psychological measure.

Number of variables. Linear regression, with a variable-to-case ratio larger than 1 variable per 10 cases, results in unstable solutions unlikely to replicate (Babyak, 2004). With 175

cases, there should be a maximum of 17 variables. Dummy coding two levels of an ordinal variable yields 1 regression variable, because the reference or 0 value does not require its own variable. Dummy coding three levels yields 2 variables. This project had a total of 17 variables: 6 psychological, 8 spiritual (3 of the 5 constructs have three levels and therefore 2 variables each), and 3 covariates.

Psychological constructs. The six psychological constructs that were analyzed include four survey measures collected at the year 10.5 time point. The two interview measures collected at years 10 and 11 are noted below.

Cronbach's alpha is reported for each scale in Table 4 in the results section. Each inter-item correlation matrix was examined, showing acceptable scale reliability. After reversing items as necessary, the scale score for each participant was computed as a mean. These average scores were used in the predictive analyses, because interpretations are more intuitive when looking at the answer choices and an average rather than a sum. I provide summed scale scores in Appendix A, for measures where the sums are usually published.

Optimism. The Life Orientation Test (LOT) measures dispositional optimism, on a 5-point scale (Scheier & Carver, 1985). The 1994 revision (LOT-R) eliminated items confounded with similar constructs, including mastery, leaving three optimistic and three pessimistic statements, along with four filler questions used to disguise the exact realm being measured (Scheier, Carver, & Bridges, 1994). These are the classic optimism scales used in health research (Rasmussen, Scheier, & Greenhouse, 2009). The optimistic items include, "Overall, I expect more good things to happen to me than bad." The pessimistic items include, "If something can go wrong for me, it will." Response choices are *strongly agree, agree, neutral, disagree, strongly disagree.*

Mastery. These data came from the year 10 interview rather than the year 10.5 survey. Pearlin and Schooler's 1978 classic Mastery Scale consists of seven items, including, "I have little control over the things that happen to me." Although the scale is generally administered without a neutral response option, the five answer choices used in this study were *strongly agree, agree, neither agree nor disagree, disagree,* and *strongly disagree.* I reversed the items as needed so that a higher mastery score means greater mastery.

Social support. These interview data, unavailable at the 10-year point, came from the year 11 interview. This classic Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991) was designed, as a self-report paper survey, for people living with chronic conditions. However, it was used in the Canadian Community Health Survey (Statistics Canada, 2003) as part of an in-person interview, and it has been used only as an interview measure within the Manitoba IBD Cohort Study.

Nineteen questions are asked with the introduction: "People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it?" The answer choices are *none of the time, a little of the time, some of the time, most of the time, all of the time.* Items include, "Someone you can count on to listen to you when you need to talk." "Someone to take you to the doctor if you needed it." "Someone to do something enjoyable with."

Gratitude. The Gratitude Questionnaire-6 (McCullough, Emmons, & Tsang, 2002) is a six-item scale with answer choices coded 1 to 7: *strongly disagree, disagree, slightly disagree, neutral, slightly agree, agree, strongly agree.* Items include, "I have so much in life to be thankful for," and, reverse scored, "When I look at the world, I don't see much to be grateful for." Although the scale was created to measure benefit-triggered gratitude to others, these items

clearly include the broader concept of gratitude orientation (Lambert, Graham, & Fincham, 2009). Only one of the six items refers exclusively to people: "I am grateful to a wide variety of people."

Meaning in life. Meaning in life was measured with the four items from the Meaning Subscale of the Functional Assessment of Chronic Illness Therapy, Spiritual Well-Being Scale (FACIT-Sp), by Peterman, Fitchett, Brady, and Cella (2002). Note that, although they come from a "spiritual" scale, the items used in this research do not refer to spirituality or religion in any way.

Unfortunately, at the time the data were collected, the field had not yet settled on the tripartite concept of meaning in life, comprising purpose, coherence, and significance. While the treatment of the three aspects is not equal, each is touched upon. Purpose is surveyed with the questions, "I feel a sense of purpose in my life," and "My life lacks meaning and purpose." The latter question also should tap coherence, a life that makes sense. Significance, the evaluation that life is valuable and worth living, is represented with, "I have a reason for living."

Participants had a choice of five responses (*not at all, a little bit, somewhat, quite a bit, very much*), with the following instruction: "Below are statements that some people living with chronic illness have said are important. Please indicate how true each statement has been for you during the past 7 days."

Peacefulness. Peacefulness was measured with the four items from the FACIT-Sp Peace Subscale (Peterman, Fitchett, Brady, & Cella, 2002). The response choices and instructions are the same as described directly above. An example item is, "I feel peaceful."

Spiritual constructs. Five spiritual constructs were analyzed. All were survey measures collected at the year 10.5 time point. Each variable consists of a single item. One is a continuous variable, and the others are ordinal variables. Gorsuch (1984) found that single item questionnaires on religion had high correlations with longer measures—more so than single questions on other topics. He thought this might be because people more often answer questions about religion than other psychological realms.

The levels of dummy coding were based on a priori logic. As part of data analysis, I examined each answer's correlation with each outcome to check for problematic groupings of answers into levels. Bootstrapped ANOVAs showed no statistically significant differences between answers, and visual inspection of groupings were acceptable.

The first four questions are from Rohrbaugh and Jessor's 1975 composite religiosity instrument. They used wording that would apply equally to adherents of any religion or no religion, measuring what would be considered spirituality in current language. I used their two ritual dimension questions to measure attendance and prayer, and their two ideological dimension questions to measure belief in God and an afterlife.

Before choosing these questions, I reviewed 425 articles with dozens of different measures of spirituality. Almost all of the alternatives either used language inappropriate for accurate measurement of both Christian and non-Christian spirituality, or failed to ask about spirituality separate from psychological strengths and well-being.

In order to be as inclusive as possible, using current language, I made three changes from Rohrbaugh and Jessor's 1975 version. I replaced the word *religious* with the word *spiritual*, I substituted *God* for *He* and *His*, and I removed the word *religious*, from the phrase *religious meditation*. Reference values have been ***underlined and bolded*** for each of the ordinal questions

below. When there are three levels of dummy coding, the last category is *underlined*. As response values, all are *italicized.*

Attendance at spiritual services. The question, "How often have you attended spiritual services during the past year?" was followed on the survey by a box with space for three numerals.

Use of prayer. "Which of the following best describes your practice of prayer or meditation? *a)* ***Prayer is a regular part of my daily life.*** *b) I usually pray in times of stress or need but rarely at any other time. c) I pray only during formal ceremonies. d) Prayer has little importance in my life. e) I never pray.*"

Belief in God. "Which of the following statements comes closest to your belief about God? *a)* ***I am sure that God really exists and that God is active in my life.*** *b) Although I sometimes question God's existence, I do believe in God and believe God knows of me as a person. c) I don't know if there is a personal God, but I do believe in a higher power of some kind. d) I don't know if there is a personal God or a higher power of some kind, and I don't know if I ever will. e) I don't believe in a personal God or in a higher power.*"

Belief in afterlife. "Which one of the following statements comes closest to your belief about life after death (immortality)? *a)* ***I believe in a personal life after death, a soul existing as a specific individual spirit.*** *b)* ***I believe in a soul existing after death as a part of a universal spirit.*** *c) I believe in a life after death of some kind, but I really don't know what it will be like. d) I don't know whether there is any kind of life after death, and I don't know if I will ever know. e) I don't believe in any kind of life after death.*"

Spiritual meaning in life. "To what extent do your spiritual values help you to find meaning in your life? ***A lot****, some, a little, not at all.*"

This question comes from the 2002 Canadian Community Health Survey, which included seven questions concerning spirituality (Statistics Canada, 2003). A national probability sample of 30,000 residents of the 10 Canadian provinces who were over 15 years old was asked the questions, 85% in face-to-face interviews (Gravel & Béland, 2005). The same questions were used in later Canadian Community Health Survey data collections, as recently as 2012 (Statistics Canada, 2012).

Health outcome measures. The three dependent variables are described next. Each was calculated from data collected from the year 11 survey. Corresponding year 1 data was used as a control for each year 11 outcome.

Mental health and general physical health. The SF-36 is associated with the RAND Corporation Medical Outcomes Study (MOS). The MOS survey, which started as a 108-item, health-related quality of life measure, was trimmed to a short form, or SF, with 36 questions (Stewart, Hays, & Ware, 1988). An example item is, "During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?"

One physical health and one mental health component score were extracted from the data, using software provided by QualityMetric (2016), which licenses the form. These component scores are calculated to represent a mean of 50 and a standard deviation of 10 in the general population of U.S. adults (Ware & Kosinski, 2001). The software automatically imputes missing values.

A systematic review of Crohn's disease reported that the most commonly used measures of health, in research on this type of IBD, were the SF-36 and the Inflammatory Bowel Disease Questionnaire, which is described next (Van der Have et al., 2014).

IBD symptoms. Disease symptoms were measured with the mean of the IBD Questionnaire (IBDQ) bowel symptoms subscale (Mitchell et al., 1988). Use of the Inflammatory Bowel Disease Questionnaire, authored by Jan Irvine, M.D. (1994), was made under license from McMaster University, Hamilton, Canada. The IBDQ is the most frequently used IBD health-related quality of life measure (Cheung, Garratt, Russell, & Williams, 2000). It shows responsiveness to small, clinically relevant changes, along with validity and reliability (Guyatt, Deyo, Charlson, Levine, & Mitchell, 1989). The 10-item bowel symptom subscale uses a variety of 7-point answer choices. Questions include, "How often during the last 2 weeks have you been troubled by pain in the abdomen?"

Data Analysis

Data preparation. I performed a variety of diagnostic tests. Multivariate collinearity was acceptable, with all tolerance values > .1, meaning that each predictor has at least 10% of its variance unexplained by other predictors (Meyers, Gamst, & Guarino, 2013). Bivariate scatterplots showed no nonlinear associations between any predictor variable and outcome. Scatterplots of residuals showed that heteroscedasticity was an issue, therefore, for the regression analyses, I used the HC3 estimator to determine statistical significance (Hayes & Cai, 2007). Other diagnostic details follow.

Missing data. Missing data were rare enough that all questions had far above the recommended minimum of 95% of answers (Meyers, Gamst, & Guarino, 2013). When one item was missing from a scale (other than the SF-36, where the software automatically imputed missing values), the scale mean for that individual was substituted for the missing item. When

more items in a scale were missing, substitutions were made from other time points when possible.

Five participants did not complete the 11-year survey, which means that their health outcome data are missing. I used the five cases in all analyses where that was possible. One participant skipped more than half the psychological strengths questions, and more than half of the spirituality questions, and therefore was dropped from all analyses. Otherwise, no participant had a problematic amount of missing data. All other missing items and substitutions are detailed in Appendix B.

Outliers. Univariate outliers, defined as scores more than 3 standard deviations from the mean, were replaced with the next lowest or highest recorded score for five variables (Kline, 2011). Five gratitude scores, three meaning scores, three social support scores, and two mastery scores were replaced with the next lowest score. Three high attendance scores (365, 365, and 156) were replaced with 100.

Mahalanobis distance—how far a point is from the standardized, multivariate mean— identified one multivariate outlier via a chi-square test score of $p < .001$ (Meyers, Gamst, & Guarino, 2013). This participant also was a univariate outlier due to a low gratitude score. There was no other obvious aberration, so the case was retained.

Normality. Univariate normality is acceptable if the Shapiro-Wilk test returns a p-value of at least .001 (Meyers, Gamst, & Guarino, 2013). Kurtosis, a measure of density of scores in the center versus the edges of the distribution, influences standard errors and parametric significance tests (DeCarlo, 1997). Skewness, how far off center the bulk of the scores fall, impacts means. Accepting all kurtosis and skewness values between -1 and 1 is considered liberal (Meyers et al., 2013). Only optimism, mastery and peacefulness passed the Shapiro-Wilk

test of normality. Kurtosis was unacceptable for all spiritual variables except belief in God, and was acceptable for all psychological strengths except gratitude. Skewness was unacceptable for social support, gratitude, meaning, and attendance. (Medians for social support, gratitude, and meaning were approximately 0.2 higher than the means. The median of attendance was 0.) Therefore, I used Spearman's correlations for bivariate analysis and partial correlation (Vargha, Bergman, & Delaney, 2013).

Hypothesis testing. Hierarchical regression tested the hypothesis that the set of spiritual constructs (frequency of attendance at spiritual services, use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life) predicts mental health, physical health, and bowel symptoms, controlling for prior health, gender, and age, both before and after the set of psychological variables (optimism, mastery, social support, gratitude, meaning in life, and peacefulness) are included in the regression equations.

The first model in each hierarchical regression considered only the covariates: gender, age, and, in order to control for prior level of disease, health at year 1. The second model tested whether the spiritual variables increased the variance explained by the covariates, by adding, in one block, all spiritual variables. The third model tested whether the psychological variables increased the variance explained by the covariates and spiritual variables, by adding, in one block, all psychological variables. (The third model is not part of the hypothesis testing, but is included for descriptive purposes.) The fourth model tested whether the psychological variables increased the variance explained by the covariates, by adding, to the covariates, in one block, all psychological variables. The fifth model tested whether the spiritual variables increased the variance explained by the covariates and psychological variables, by adding, in one block, all spiritual variables.

For the hypothesis to be accepted for each of the three health outcomes, firstly, the second model must increase the R^2 beyond that of the first model, with $p < .05$ for the change, confirming that the outcome was predicted, after the covariates and *before* the psychological variables were entered into the equation. Secondly, the fifth model must increase the R^2 beyond that of the fourth model, with $p < .05$ for the change, confirming that the outcome was predicted *after* the psychological variables were entered into the equation. According to Soper's (2015) sample size calculator for hierarchical multiple regression, a sample of 173 with 17 predictors, and an alpha level of .05, has a power of .8 to detect an R^2 or f^2 value of .10, explaining 1% of the variance.

Correlation analysis. The research questions ask: Which psychological and spiritual variables are the best predictors of health? Do their predictive capacities overlap, or are there unique contributions from each? These exploratory questions were answered by examining the bivariate Spearman correlation matrix of all predictor and outcome variables. Partial correlations were examined, separately controlling for age, gender, optimism, mastery, social support, meaning in life, and peacefulness. Semipartial correlation analysis also was conducted.

Results

Descriptive Results

Means and standard deviations. Table 4 shows the means of the outcome measures, and the remarkably similar scores on the same measures 10 years before. The Spearman correlations for the year 1 to year 11 measures were .53 for mental health, .59 for physical health, and .50 for bowel symptoms. All means and standard deviations in Table 4 are similar to published statistics. For instance, the SF-36 physical and mental health component scores were developed to have a mean of 50 and a standard deviation of 10 (Ware and Kosinski 2001). Published IBDQ bowel symptoms subscale scores have means equivalent to 2.0 to 3.6, with standard deviations of 1 to 1.3 (Guyatt et al., 1989; Irvine et al., 1994). Or, framed as the reversed, summed mean, as in the above published studies, the current study's IBDQ bowel symptom subscale results are $M = 57$ ($SD = 10$). Other comparisons with published means can be found in Appendix A.

Ranges. Most variables in Table 4 did not receive scores throughout their entire ranges. Mental and physical health were slightly truncated at both ends of the range. Bowel symptoms were not as severe as the scale measures. As this was a community-dwelling sample living with a chronic disease, those ranges seem appropriate. The lowest scores on optimism and mastery were not quite at the bottom of their scales. Gratitude had the most truncated scale, with no one scoring very low. Spearman correlations are unaffected by this.

Table 4. Descriptive Statistics for Continuous Variables

Variable	Mean	Standard deviation	Potential range	Lowest score	Highest score	Cronbach's alpha
Mental health	49	9.8	8 to 70	19	66	
Mental health year 1	49	9.1	8 to 70	23	62	
Physical health	48	9.5	10 to 67	15	64	
Physical health year 1	49	8.0	10 to 67	27	64	
Bowel symptoms	2.3	1.0	1 to 7	1.0	5.2	
Bowel symptoms year 1	2.5	1.1	1 to 7	1.0	5.3**	
Optimism	2.7	0.7	0 to 4	0.5	4.0	.88
Mastery	3.8	0.7	1 to 5	1.9*	5.0	.82
Social support	4.3	0.7	1 to 5	2.4*	5.0	.97
Gratitude	6.0	1.0	1 to 7	3.2*	7.0	.83
Peacefulness	2.4	0.9	0 to 4	0.0	4.0	.88
Meaning	3.3	0.7	0 to 4	1.0*	4.0	.88
Attendance	13	24	0 to 365	0	100*	

These scores, before outlier score replacement, were Mastery 1.4, Social support 1.0, Gratitude 2.8, Meaning 0.0, and Attendance 365.
**The person with the highest score, 6.5, did not provide outcome data, therefore, the highest score used in analysis was 5.3.*

Scale reliability. Table 4 shows that Cronbach's alphas—ranging from .82 for mastery to .97 for social support—are acceptable. These are similar to published Cronbach's alphas: .82 for gratitude (McCullough et al., 2002), .87 for mastery (Chen, Hsiung, Chung, Chen, & Pan,

2013), and .97 for social support (Sherbourne & Stewart, 1991). There was only one item that would have raised the alpha if removed, the mastery item, "Sometimes I feel that I am being pushed around in life." I examined the mastery response patterns person by person, as well as the coding, and no aberrations were found.

Frequencies of spiritual variables. The frequency of attendance at spiritual services is shown in Figure 1, after outlier score replacement. Table 5 shows the percentage of the total received by each categorical response, for each of the other spiritual variables.

Figure 1. Frequency of Attendance at Spiritual Services.
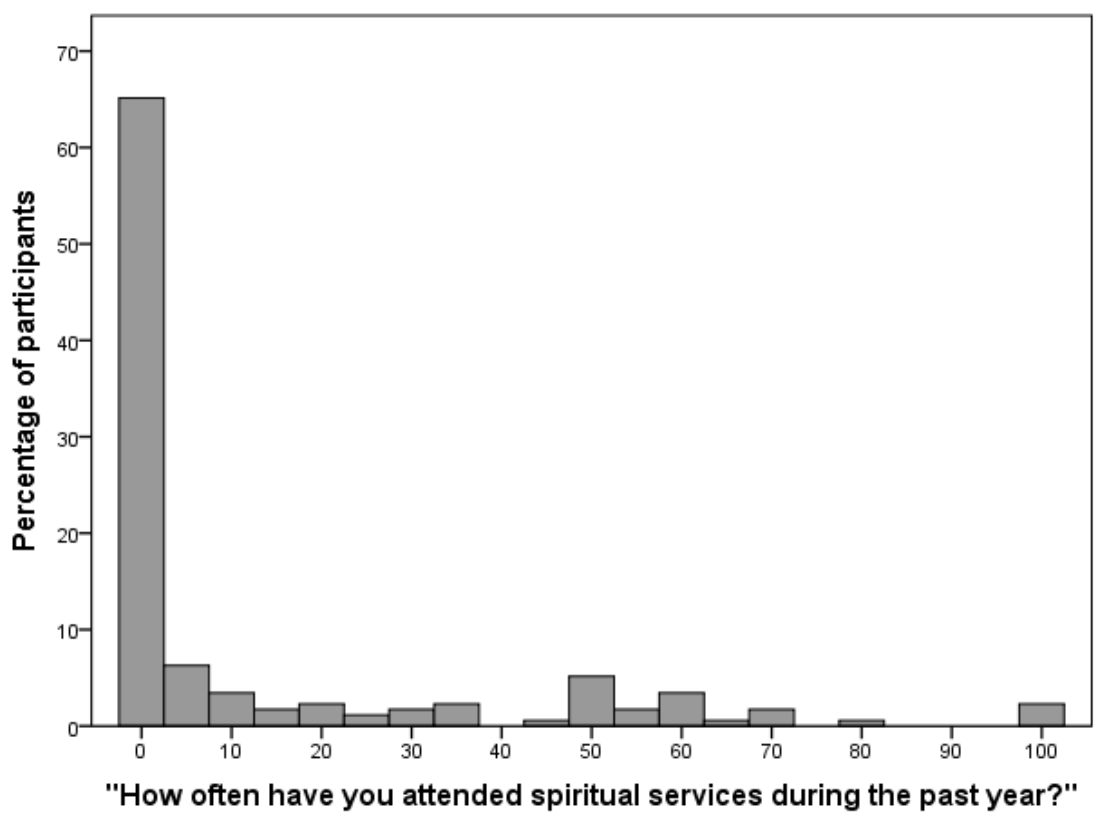
Table 5. Descriptive Statistics for Categorical Variables

Prayer.

"Which of the following best describes your practice of prayer or meditation?"

Code	Level	Wording	%
0	A	I never pray.	21
1	A	Prayer has little importance in my life.	11
2	A	I pray only during formal ceremonies.	11
3	B	I usually pray in times of stress or need but rarely at any other time.	21
4	Ref*	Prayer is a regular part of my daily life.	35

Spiritual meaning in life.

"To what extent do your spiritual values help you to find meaning in your life?"

Code	Level	Wording	%
1	A	Not at all	27
2	A	A little	20
3	A	Some	26
4	Ref*	A lot	26

Ref = reference value. Level A variables were grouped into one dummy code, level B into another.

Table 5. Descriptive Statistics for Categorical Statistics (continued)

Belief in God.

"Which of the following statements comes closest to your belief about God?"

Code	Level	Wording	%
0	A	I don't believe in a personal God or in a higher power.	10
1	A	I don't know if there is a personal God or a higher power of some kind, and I don't know if I ever will.	10
2	B	I don't know if there is a personal God, but I do believe in a higher power of some kind.	27
3	B	Although I sometimes question God's existence, I do believe in God and believe God knows of me as a person.	20
4	Ref*	I am sure that God really exists and that God is active in my life.	33

Belief in afterlife.

"Which one of the following statements comes closest to your belief about life after death (immortality)?"

Code	Level	Wording	%
0	A	I don't believe in any kind of life after death.	12
1	A	I don't know whether there is any kind of life after death, and I don't know if I will ever know.	19
2	B	I believe in a life after death of some kind, but I really don't know what it will be like.	33
3	Ref*	I believe in a soul existing after death as a part of a universal spirit.	11
4	Ref*	I believe in a personal life after death, a soul existing as a specific individual spirit.	24

*****Ref** = reference value. Level A variables were grouped into 1 dummy code, level B into another.*

Hypothesis Testing

Hierarchical regression tested the hypothesis that the set of spiritual constructs (frequency of attendance at spiritual services, use of prayer, spiritual meaning in life, belief in God, and belief in an afterlife) predicted bowel symptoms, physical health, and mental health, controlling for prior health, gender, and age, both before and after the set of psychological variables (optimism, mastery, social support, gratitude, meaning in life, and peacefulness) were included in the regression equations. There is no support for the hypothesis that spiritual variables predict any of the three health outcomes, in this sample of people living with inflammatory bowel disease.

Modeling the influence of the covariates. In tables 6, 7, and 8, the last column in the first row shows that all three outcomes were predicted, $p < .001$, by the first model with the three covariates: gender, age, and—in order to control for prior level of disease—health at year 1.

Testing the influence of spirituality before psychological strengths. In tables 6, 7, and 8, the last column of the second row, or second model in each table, shows that adding all of the spiritual variables, as a block to the covariates, did not increase the predictive ability of the model with a p-value < .05 for the change, for any of the three outcomes. The last column of the third row, or third model in each table, shows that adding all of the psychological variables, as a block, did increase the variance explained, over the variance explained by the covariates and spiritual variables, with p-values < .03 for the change.

Testing the influence of spirituality after psychological strengths. In tables 6, 7, and 8, the last column of the fourth row shows the fourth model, adding all of the psychological variables as a block to the covariates, increased the predictive ability, $p < .03$ for the change, for all three outcomes. However, the last column of the fifth row shows that the fifth model, adding all of the spiritual variables as a block, did not increase the variance explained by the covariates and psychological variables, for any of the three outcomes, as judged by $p > .05$ for the change. The fifth model is the same as the third model, except for the statistics showing the changes from the model preceding it.

Notes about the models. These five models are a more concise way to present what would ordinarily be described as two hierarchical regression models with three steps each. In the ordinary presentation, one hierarchical regression would contain the first model as Step 1, the second model as Step 2, the third as Step 3. Then, for the next hierarchical regression model, the first model would be repeated as Step 1; Step 2 would be the fourth model, and Step 3 would be the fifth model. The difference is in not presenting Step 1 twice. The actual statistical procedure is the usual hierarchical regression technique. The novel presentation is designed to make the patterns in the data easier to discern. The reduced redundancy is a beneficial byproduct.

Further notes about the models are as follows: Darlington and Hayes (2016) warned that a block of predictors with a greater correlation with the covariates will perform less well in a regression than a block of predictors with a smaller correlation with the covariates, even if they have equal effect on the outcome. I ruled out such a potentially unfair test of competing theories, by checking the regressions with the covariates added last instead of first. This did not change the results. Similarly, I repeated all regression analyses using only cases with no missing values. This did not change a single R^2 value**.**

Table 6. Regression Models Predicting Bowel Symptoms

Model	R	R²	f²	R² change	F change	Standard error	df change	p F change
Covariates	.50	.25	.33	.25	18.60	.86	3, 166	<.001
Spiritual + C	.52	.27	.37	.02	0.72	.88	8, 154	.67
Psych + Spirit + C	.58	.34	.52	.07	2.48	.85	6, 148	.03
Psychological + C	.56	.31	.45	.06	2.34	.84	6, 160	.03
Spirit + Psych + C	.58	.34	.52	.03	0.83	.85	8, 148	.58

C = covariates, Psych = psychological variables, Spirit = spiritual variables

Table 7. Regression Models Predicting Physical Health

Model	R	R²	f²	R² change	F change	Standard error	df change	p F change
Covariates	.60	.37	.59	.37	25.10	7.60	3, 166	<.001
Spiritual + C	.63	.40	.67	.03	1.01	7.70	8, 154	.43
Psych + Spirit + C	.69	.48	.92	.08	3.22	7.30	6, 148	.005
Psychological + C	.66	.44	.79	.07	3.55	7.28	6, 160	.002
Spirit + Psych + C	.69	.48	.92	.04	1.17	7.30	8, 148	.32

C = covariates, Psych = psychological variables, Spirit = spiritual variables

Table 8. Regression Models Predicting Mental Health

Model	R	R²	f ²	R² change	F change	Standard error	df change	p F change
Covariates	.53	.29	.41	.29	14.70	8.35	3, 166	<.001
Spiritual + C	.57	.32	.47	.03	0.90	8.40	8, 154	.52
Psych + Spirit + C	.70	.48	.92	.16	7.74	7.48	6, 148	<.001
Psychological + C	.67	.45	.82	.16	9.01	7.45	6, 160	<.001
Spirit + Psych + C	.70	.48	.92	.03	1.09	7.48	8, 148	.37

C = covariates, Psych = psychological variables, Spirit = spiritual variables

Effect sizes. Jacob Cohen (1992) recommended calculating effect sizes in multiple regression as $f^2 = R^2$ divided by $(1-R^2)$, which shows the explained variance divided by the unexplained variance. The covariates alone had a large influence on all three outcomes, with f^2 values of .33 to .59, explaining 25% to 37% of the variance. The spiritual variables, with f^2 change values of .04 to .13, explained another 2% to 4% of the variance in each equation, not enough to reach statistical significance in this sample. Although explaining 4% of an outcome could have practical significance, requiring 8 variables to add that 4% does not make a parsimonious model. In contrast, the psychological variables, with f^2 change values of .12 to .45, explained an additional 6 to 16% of the variance, with 6 variables.

Correlation Analysis

Table 9 presents the Spearman correlation matrix of all outcome variables, predictors, and the age and gender covariates. Note that the table should be read across the rows, primarily,

because the first and last columns, which are redundant with the first and last rows, have been removed to save space.

Within the first two rows, the first two columns show that bowel symptoms have Spearman correlations (r_s) of -.56 with general physical health and -.42 with mental health. General physical health has a much lower correlation with mental health, $r_s = .22$.

Table 9. Spearman Correlations of All Variables

	Physical	Mental	Optimism	Mastery	Social	Gratitude	Peaceful	Meaning	Spirit	Attend	Pray	God	After	Age
Bowel	**-.56**	**-.42**	**-.32**	**-.29**	**-.18**	-.10	**-.33**	**-.23**	-.01	-.09	.00	.02	.07	-.04
Physical		.22	.38	.43	.19	.17	.27	.33	-.04	.04	-.02	-.03	-.04	-.13
Mental	.22		.51	.43	.39	.29	.50	.44	.01	.04	-.03	-.10	-.12	**.17**
Optimism	.38	.51		.65	.34	.56	.57	.69	.11	.09	.06	.06	.02	.07
Mastery	.43	.43	.65		.34	.41	.45	.47	-.14	-.08	**-.15**	-.11	**-.13**	-.13
Social	.19	.39	.34	.34		.25	.32	.37	-.14	-.07	**-.15**	-.08	-.02	-.11
Gratitude	.17	.29	.56	.41	.25		.37	.60	.23	.20	.14	.11	.10	-.04
Peacefulness	.27	.50	.57	.45	.32	.37		.61	.14	.11	.01	.01	-.06	.09
Meaning	.33	.44	.69	.47	.37	.60	.61		.16	.13	.04	.03	-.01	.02
Spirit MiL	-.04	.01	.11	-.14	-.14	**.23**	.14	**.16**		.59	.77	.73	.53	.21
Attendance	.04	.04	.09	-.08	-.07	.20	.11	.13	.59		.53	.56	.43	.15
Prayer	-.02	-.03	.06	**-.15**	**-.15**	.14	.01	.04	.77	.53		.76	.62	.25
God	-.03	-.10	.06	-.11	-.08	.11	.01	.03	.73	.56	.76		.79	.14
Afterlife	-.04	-.12	.02	-.13	-.02	.10	-.06	-01	.53	.43	.62	.79		.07
Age	-.13	**.17**	.07	-.13	-.11	-.04	.09	.02	**.21**	.15	**.25**	.14	.07	
Gender	-.02	.09	-.08	.03	.00	**-.25**	.02	-.11	**-.19**	-.11	**-.18**	**-.17**	**-.19**	.14

Bold = p < *.05.*
Bowel = *bowel symptoms,* **Physical** = *physical health,* **Mental** = *mental health,*
Social = *social support,* **Spirit MiL** = *spiritual meaning in life.*
Gender *is coded so that negative correlations are higher in women.*

In the second to last row, the correlations with age are shown: $r_s = .17$ with mental health, and r_s ranging from .14 to .25 with all spiritual variables, except belief in an afterlife, which has $r_s = .07$. (The $r_s = .14$ for belief in God has a *p*-value just over .05.)

In the last row, we see that the women in this study are more grateful, and more spiritual. The spiritual variables have r_s ranging from -.11 to -.19, $p < .05$ for all except attendance.

Tables 10 and 12 through 15 describe smaller subsets of the correlation matrix. They follow.

Table 10. All Correlations with Health, $p < .05$

Bowel symptoms	Physical health	Mental health
-.33 Peaceful	.43 Mastery	.51 Optimism
-.32 Optimism	.38 Optimism	.50 Peaceful
-.29 Mastery	.33 Meaning	.44 Meaning
-.23 Meaning	.27 Peaceful	.43 Mastery
-.18 Support	.19 Support	.39 Support
	.17 Gratitude	.29 Gratitude
		.17 Age

Table 10 shows correlations with $p < .05$ between health outcomes, and age, gender, and all predictors, in order of size of correlation. Each predictor has its own color, making it easy to see that optimism is in first or second place with each of the three outcomes, meaning is third or fourth, and peacefulness and mastery fill in each of the remaining top four slots. Social support is always fifth, with gratitude the weakest of the six psychological predictors. Age was correlated only with mental health. No spiritual variable reached statistical significance for any health outcome.

Note that the difference in correlations between adjacent variables within each outcome list is generally much less than .10, which represents a difference in variance explained of less than 1%. Therefore, the exact order within each list should not be over-interpreted. A different sample likely would yield a reshuffling, especially in the top four positions.

A complementary way to analyze the relative importance of variables to an outcome is with semipartial correlation. The squared semipartial correlation equals the change in R^2 when a variable is added to a regression (Darlington & Hayes, 2016). Table 11 compares the relative importance of optimism and gratitude, and then optimism and mastery, when they are the only two variables predicting the three health outcomes. The squared semipartial correlations in the top half of Table 11 show gratitude raising the variance, beyond that already explained by optimism, by less than .01 for each outcome. This is not statistically or practically significant. With only optimism and mastery as predictors, in the bottom half of Table 11, mastery significantly predicts all three outcomes. Optimism significantly predicts physical and mental health, but is just under statistical significance in explaining variability in bowel symptoms.

Table 11. Optimism's Paired Squared Semipartial Correlations

Bowel symptoms	Physical health	Mental health
.07 Optimism	.13 Optimism	.13 Optimism
.001 Gratitude	.002 Gratitude	.009 Gratitude
.02 Mastery	.07 Mastery	.09 Optimism
.019 Optimism	.03 Optimism	.02 Mastery

Table 12 explores the correlations between health and spirituality, none of them statistically significant. The largest Spearman correlation, -.12, explains only 1.4% of the variance, which means that statistical and practical significance in this study are well aligned. It is interesting to note that attendance is the only variable positively associated with health on all three outcomes, and belief in God and belief in an afterlife are the only variables negatively associated with all health outcomes.

Table 12. Spiritual Correlations with Health, *p* > .05

Bowel symptoms	Physical health	Mental health
-.09 Attendance	*-.04 Spirit meaning*	*-.12 Afterlife*
.07 Afterlife	*-.04 Afterlife*	*-.10 God*
.02 God	.04 Attendance	.04 Attendance
-.01 Spirit meaning	*-.03 God*	*-.03 Prayer*
.00 Prayer	*-.02 Prayer*	.01 Spirit meaning

Italics *emphasize correlations with worse health.*
Spirit meaning = spiritual meaning in life

Table 13 shows how few statistically significant correlations there were between spiritual and psychological variables. Prayer was negatively correlated with mastery and social support. Attendance was correlated, not with social support, but with gratitude. Gratitude also was correlated with spiritual meaning in life. Spiritual meaning in life had a smaller correlation with meaning in life.

Table 13. All Correlations Between Spiritual and Psychological Variables, *p* < .05

Prayer	Attendance	Spiritual meaning
-.15 Mastery	.20 Gratitude	.23 Gratitude
-.15 Social Support		.16 Meaning

Italics *emphasize negative correlations.*

Table 14 shows correlations among the psychological variables. The highest correlation for most of the variables is with meaning in life, although meaning in life and mastery have their highest correlations with optimism. The lowest correlation for each variable is with social support.

Table 14. Correlations Among Psychological Variables, all *p* < .05

	Optimism	Mastery	Social Support	Gratitude	Peaceful	Meaning
Optimism		.65	.34	.56	.57	.69
Mastery	.65		.34	.41	.45	.47
Support	.34	.34		.25	.32	.37
Gratitude	.56	.41	.25		.37	.60
Peaceful	.57	.45	.32	.37		.61
Meaning	.69	.47	.37	.60	.61	

Table 15 shows correlations among spiritual variables. Spiritual meaning in life has the highest correlations for attendance and prayer, and strong correlations with the others. Belief in God and belief in an afterlife are most correlated with each other. The lowest correlation for each variable is with attendance, except that spiritual meaning in life has its lowest correlation with belief in an afterlife.

Table 15. Correlations Among Spiritual Variables, all *p* < .05

	Attendance	Prayer	Belief in God	Belief in Afterlife	Spiritual Meaning
Attendance		.53	.56	.43	.59
Prayer	.53		.76	.62	.77
God	.56	.76		.79	.73
Afterlife	.43	.62	.79		.53
Spirit Meaning	.59	.77	.73	.53	

Figure 2 shows the patterns in correlations with the three health outcomes when age, gender, social support, and the four strongest predictors of health are controlled, one at a time, using partial correlation. (Listwise deletion was used in these correlations, to meet the needs of statistical procedures, as opposed to the pairwise deletion used for the uncontrolled correlations above, so there are slight differences between Table 10 and the table with no controls below.)

There are few differences among the tables on the left of Figure 2, comparing the uncontrolled correlations with those controlling for age, gender, and social support. The patterns for the four strongest predictors of health are quite different, as seen on the right of Figure 2. The

only notable outcome is in the mental health correlations when optimism is controlled, seen at

the top right: Belief in God and belief in an afterlife were negatively correlated with mental

health. These were the only negative correlations with health in all of Figure 2. These negative

correlations with health were present in the uncontrolled bivariate relationships, seen in Table 12

above, where the correlations were too small to reach statistical significance.

Figure 2. Partial Correlations of Predictors with Health, *p* < .05

All Correlations, No Controls

Bowel symptoms	Physical health	Mental health
-.32 Peaceful	.43 Mastery	.52 Optimism
-.32 Optimism	.39 Optimism	.50 Peaceful
-.30 Mastery	.34 Meaning	.44 Mastery
-.23 Meaning	.27 Peaceful	.44 Meaning
-.17 Support	.19 Support	.38 Support
	.18 Gratitude	.29 Gratitude
		.19 Age

All Correlations, Controlling for Optimism

Bowel symptoms	Physical health	Mental health
-.18 Peaceful	.24 Mastery	.29 Peaceful
-.16 Gender	-.16 Age	.25 Support
		.18 Age
		-.17 God
		-.16 Afterlife
		.15 Mastery

All Correlations, Controlling for Age

Bowel symptoms	Physical health	Mental health
-.32 Peaceful	.42 Mastery	.51 Optimism
-.32 Optimism	.40 Optimism	.49 Peaceful
-.31 Mastery	.34 Meaning	.48 Mastery
-.23 Meaning	.29 Peaceful	.44 Meaning
-.18 Support	.18 Support	.40 Support
		.18 Gratitude	.31 Gratitude

All Correlations, Controlling for Mastery

Bowel symptoms	Physical health	Mental health
-.22 Peaceful	.17 Meaning	.37 Peaceful
-.17 Optimism	.16 Optimism	.33 Optimism
		.29 Meaning
		.28 Age
		.27 Support

All Correlations, Controlling for Gender

Bowel symptoms	Physical health	Mental health
-.32 Peaceful	.43 Mastery	.53 Optimism
-.33 Optimism	.39 Optimism	.50 Peaceful
-.30 Mastery	.33 Meaning	.45 Meaning
-.25 Meaning	.27 Peaceful	.44 Mastery
-.17 Support	.19 Support	.38 Support
	.18 Gratitude	.33 Gratitude
		.18 Age

All Correlations, Controlling for Peacefulness

Bowel symptoms	Physical health	Mental health
-.18 Mastery	.35 Mastery	.33 Optimism
-.18 Optimism	.30 Optimism	.27 Mastery
	.23 Meaning	.26 Support
	-.16 Age	.20 Meaning
		.16 Age

All Correlations, Controlling for Social Support

Bowel symptoms	Physical health	Mental health
-.29 Peaceful	.39 Mastery	.44 Optimism
-.29 Optimism	.35 Optimism	.43 Peaceful
-.26 Mastery	.29 Meaning	.35 Meaning
-.18 Meaning	.22 Peaceful	.35 Mastery
		.23 Gratitude
		.25 Age

All Correlations, Controlling for Meaning in Life

Bowel symptoms	Physical health	Mental health
-.24 Peaceful	.32 Mastery	.33 Optimism
-.24 Optimism	.23 Optimism	.33 Peaceful
-.23 Mastery		.29 Mastery
-.17 Gender		.26 Support
		.20 Age
		.16 Gender

Discussion

Hypothesis Test of Spiritual Versus Psychological Variables

In Manitobans with inflammatory bowel disease—after controlling for age, gender, and prior health—the set of variables representing five spiritual constructs (frequency of attendance at spiritual services, use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life) explained only an additional 2% to 4% of the variance in health in hierarchical regression analysis. In this study, this was not enough to reach statistical significance as a predictor of specific disease symptoms, general physical health, or mental health, which means that the hypothesis was not supported.

Conjecturally, if these relationships were found unchanged in a large enough sample, statistical significance would be reached, providing evidence of a small spiritual health benefit. Therefore, this is not conclusive evidence of no health benefit. However, it should be considered in context.

The six psychological strengths (optimism, mastery, social support, gratitude, meaning in life, and peacefulness), as a set, were statistically significantly predictive of each of the three health outcomes, explaining 6% to 16% of the variance in hierarchical regression analysis.

This analysis was a stringent test, requiring prediction of change in health. Over the 10 years between the prior health measurements and the outcome measurements, the sample mean for mental health did not change, general physical health dropped only one percentile, and bowel symptoms dropped from 2.5 to 2.3, on the 1 to 7 scale. Under these strict conditions, the set of psychological strengths showed superiority over the set of spiritual variables, as predictors of health.

Research Question of Unique Versus Overlapping Predictors

Bivariate correlations. In contrast to the stringency of the controlled hypothesis test, uncontrolled bivariate analyses offered a low bar for statistical significance. Yet, in bivariate correlation analysis, not one of the spiritual variables explained even 1.5% of the variability in any outcome. There was not a single predictor of positive health among the spiritual constructs measured.

I conducted exploratory analyses, looking for nonlinear patterns or subsets of participants that might provide more limited evidence of a spiritual benefit to health. There were no major aberrations from the results of the planned analyses. For instance, when I reanalyzed the bivariate correlations of only the 58 individuals (33% of the total) who were sure that God was active in their lives, the variability explained in the three health outcomes shifted less than 2% for each of the psychological predictors, and not one of the spiritual variables became statistically significant. Spiritual meaning in life became statistically significantly correlated with optimism, $r_s = .30$, but not with health. In this much smaller sample, a correlation of .27 was required to reach $p < .05$, leaving only peacefulness, optimism, and mastery as statistically significant predictors of bowel symptoms. Social support became a stronger predictor of each outcome, and gratitude was more highly correlated with mental health, but all of these were small shifts.

Setting aside for the moment the fact that, in this subsample, a Spearman correlation of .15 has a p-value of .26, three spiritual variables were correlated with at least one health outcome to the extent that they explained at least 2% of the variability. Attendance was correlated $r_s = .17$ with mental health. Prayer was correlated $r_s = -.18$ with bowel symptoms and $r_s = .23$ with mental health. Spiritual meaning in life was correlated $r_s = -.15$ with bowel

symptoms—and .24 with meaning in life, the latter explaining 6% of the variability.

Interestingly, belief in an afterlife was still slightly negatively correlated with physical health,

$r_s = -.11$.

Based on the above, and my other similar exploratory findings, it appears that, at least

among some religious people, spirituality may be positively correlated with health. However, the

correlations pale in comparison with psychological strengths.

With only one exception for one outcome, each of the psychological strengths explained

3% to 26% of the variability in each of the three health outcomes for all study participants.

Optimism was the strongest predictor, with correlations explaining 10% to 26% of the variance

in better health 6 months later. Peacefulness performed almost as well, with 8% to 25% of the

variance explained. Mastery and meaning in life were also very strong, with correlations

explaining 8% to 19%, and 5% to 19%, respectively. Social support and gratitude were not as

strong, although their correlations with mental health explained 14% and 8% of the variance.

The minimal overlap between the psychological and spiritual variables was a surprise.

Frequency of attendance at spiritual services was not positively correlated with social support

($r_s = -.07, p > .05$). Spiritual meaning in life was correlated with meaning in life, but, with

$r_s = .16$, it did not have the largest correlation between the sets of variables, in spite of the

similarity of the face values. Gratitude had the largest correlations with spiritual variables,

$r_s = .23$ with spiritual meaning in life and $r_s = .20$ with attendance. This was expected, given the

literature showing that gratitude is higher in religious people (Lambert, Fincham, Braithwaite,

Graham, & Beach, 2009; McCullough, Emmons, & Tsang, 2002). Prayer was negatively

correlated with mastery and social support, implying that prayer may be used to compensate for

deficits in psychological strengths, in alignment with compensatory control theory (Kay,

Gaucher, McGregor, & Nash, 2010). In sum, spirituality not only was not predictive of health in

this study at a statistically significant level, it also was not correlated positively with

psychological strengths, with the exception of spiritual meaning in life and attendance, which

predicted 4% to 5% of the variability in gratitude.

Within the set of psychological strengths, the variable with the largest correlations with

the others was meaning in life, while social support had the smallest correlations. In an

interesting parallel, within the spiritual constructs, spiritual meaning in life had the largest

correlations, and frequency of attendance had the smallest. Attendance was also the only spiritual

variable positively correlated with all three health outcomes, although all correlations were

$p > .05$. Attendance may measure some combination of spirituality, physical ability (e.g.,

Benjamins, Musick, Gold, & L. K. George, 2003), and personality. In a British population-based

study, attendance at age 50 was correlated $r = .17$ with having stated a religion when asked,

"What is your religion, if any?" at age 42 and $r = .16$ with the personality factor agreeableness

(Furnham & Cheng, 2015). Health researchers using attendance as their only measure of

spirituality should not assume that they are capturing a relatively pure measure of religiosity.

Partial correlations. Although women and older people in this study were, as expected,

more spiritual than the others were, controlling for gender and age had no appreciable effect on

the correlations. That was also true when controlling for social support. The only unusual

outcome among the partial correlations was in the mental health correlations when optimism was

controlled: Belief in God and belief in an afterlife were negatively correlated with mental health.

This was not the result of partial correlation reversing an uncontrolled correlation: In the

uncontrolled bivariate analysis, the two beliefs were the only variables that were negatively

associated with all three health outcomes, although these were all $p > .05$.

Belief in God and an afterlife may be a bit more common in those who are suffering more. However, there are limited published correlations between spiritual beliefs and health to compare to. Spiritual beliefs as a set were not predictive of health in people living with cancer (Jim et al., 2015). Other than population-based studies showing atheists to be as healthy (Speed & Fowler, 2016) or healthier than believers (Hayward, Krause, Ironson, P. C. Hill, & Emmons, 2016), the only publication I am aware of on a specific spiritual belief as a predictor of health, belief in an afterlife, was described earlier: Park and colleagues found that belief in an afterlife predicted a worse SF-12 mental health component score, $r = -.21$, $p < .05$, in people with severely disabling heart disease (Park, Lim, Newlon, Suresh, & Bliss, 2014).

The context of the negative correlations found in the literature between health and spiritual beliefs, and between health and prayer, suggest that spirituality may not be a cause of better—or worse—health for anyone, but a helpful resource available to believers when their health fails or is threatened (Idler, 1995). This is a testable moderation hypothesis.

Semipartial correlations. Semipartial correlation tested whether the correlation that gratitude shared with optimism was the only part of gratitude that predicted health. Indeed, gratitude had no significant, unique predictive power for any of the outcomes.

Semipartial correlation also tested the unique ability of mastery against the unique ability of optimism, to predict the three health outcomes. They were equally uniquely correlated with bowel symptoms. However, mastery uniquely explained 7% of the variation in physical health, while optimism uniquely explained only 3%. Yet optimism was much better at predicting the variability in mental health, explaining 9% to mastery's 2%. Bivariate correlations showed that each explained at least 8% of the variability in each outcome.

Despite the large number of health studies examining the influences of optimism and mastery, and the recent investigations of gratitude as a modifiable cause of health, these are the first direct comparisons of the pairs as predictors of health.

Context of Spirituality

Snibbe and Markus (2002) suggested that religiosity may benefit the health of individuals only in cultural contexts where their religious behaviors put them in the mainstream. Stavrova (2015), analyzing data from 59 countries, including over 85,000 people, found that a religious index (i.e., attendance, identification as a religious or nonreligious person, and the importance of religion) predicted positive self-rated health only for people living in countries with a highly religious norm. The correlation between religiosity and health, ranging from $r = -.20$ to $.23$, was negative for 18 countries and positive for only 10 (Stavrova, 2015). Controlling for demographics, the pattern reversed to a positive correlation for 20 of the 22 countries that had statistically significant correlations. There was no significant correlation for 37 countries. A simple regression model showed that neither individual nor country level religiosity predicted self-rated health across all 59 countries, while the interaction of individual and country religiosity did (Stavrova, 2015).

For Canada, the standardized mean individual religiosity score, in the 59-country study, was -0.22 ($SD = .84$) and the country norm was -0.30. The correlation between individual religiosity and health was $r = -.07$, $p < .001$. In the regression with control variables, the beta weight of individual religiosity as a predictor of health was a statistically insignificant -.01 (Stavrova, 2015). That provides a context for the null findings of the influence of spirituality on health in this IBD study: Canada is a slightly non-religious country, and religious Canadians are

slightly less healthy than non-religious Canadians. Controlling for demographics, the ill health is not statistically or practically significant.

For the U.S., the mean individual religiosity was 0.07 ($SD = .77$) and the country norm was 0.02. The correlation between individual religiosity and health was $r = .08$. In regression with control variables, the beta weight of individual religiosity on health was 0.10, $p < .001$ (Stavrova, 2015). Note that, in this IBD study, with its sample size, the positive U.S. correlation would be too small to reach statistical significance.

Stavrova (2015) also analyzed the effect of religious service attendance on mortality, for a probability sample of over 20,000 U.S. residents, according to region. The year of data collection, 1978 to 2002, was controlled, even though it explained very little of the variation, compared with the explanatory power of the region. Attendance was not statistically significantly correlated with mortality in most regions, although there were trends in both directions and some significant negative correlations. Plotting the region-level attendance on the x-axis, and on the y-axis plotting the effect of individual attendance on mortality, yielded a correlation of $r = -.86$, controlling for demographics, explaining 74% of the variance. Clearly, context is very important in the religiosity-health relationship.

When asked if they believe that God or a higher power exists, 40% of Canadians and 39% of Manitobans said that they definitely believe (Angus Reid Institute, 2017). Therefore, Stavrova's Canadian country-level religion and health statistics are directly applicable to this IBD study (Stavrova, 2015). (The phrasing in the above question is not as specific as the answer choice that garnered 33% endorsement in this IBD study, "I am sure that God really exists and that God is active in my life." It is likely that some of the 20% who endorsed, "Although I sometimes question God's existence, I do believe in God and believe God knows of me as a

person," would have described themselves as definitely believing.) According to Stavrova's regional analysis, if this IBD study were replicated in Alabama, Mississippi, Kentucky, or Tennessee, it is possible that the spiritual variables would predict overall health outcomes (Stavrova, 2015).

The only publication I found on chronic illness and spirituality, that was not focused on pain, was the previously discussed Australian multiple sclerosis study (Makros & McCabe, 2003). The Australian statistics, from the 59-country study, included mean individual religiosity of -0.75 (SD = .92) and a country religious norm of -0.68. The correlation between individual religiosity and health was r = -.05. Yet, in regression with control variables, the beta weight of individual religiosity on health was 0.07, p < .05 (Stavrova, 2015). In any case, most aspects of spirituality were not significantly predictive of health in MS in Australia, as was the case in this IBD study.

Context of Psychological Strengths

In general, the strengths of the correlations of health with optimism and mastery, in the current study, are in alignment with their honored places within the classic psychology literatures. The strength of meaning in life is also well grounded in theory. The relative strength of peacefulness is a surprise, because, while it has a brief empirical history, it does not have a theoretical grounding as a predictor of physical health. The relative weakness of social support as a health predictor is unexpected, considering its wealth of empirical support.

In the optimism and health meta-analysis, correlations were largest for the least objective health measures (Rasmussen, Scheier, & Greenhouse, 2009). The same was true for the meta-analysis on meaning in life (Czekierda, Banik, Park, & Luszczynska, 2017). I anticipated finding

a parallel in this IBD study for all psychological strengths, and, with the exception of peacefulness, I did. Optimism had a slightly stronger correlation with mental health than it had with physical health, and optimism's correlation with bowel symptoms was the weakest of the three outcomes. Below, I compare specific correlations found in the literature with those of this study. Most are very similar.

Correlations with optimism. The Spearman correlation in this study, $r_s = .38$, between optimism and physical health, was higher than those in the most similar studies I found: $r = .24$ in cancer survivors (Edmondson, Park, Blank, Fenster, & Mills, 2008) and $r = .18$ in an international convenience sample of people with IBD, 60% from the U.S. and 24% from Canada (Sirois, 2015).

For optimism and mental health, the correlation in this study, $r_s = .51$, is very close to the correlations in other studies: $r = .47$ in cancer survivors (Edmondson et al., 2008), and $r_s = .54$ in people diagnosed with a severe inflammatory disease (Kreis et al., 2015).

This study's correlation of $r_s = .69$, between optimism and meaning in life, is similar to $r = .63$ among Dutch adults living with chronic illness (Dezutter, Casalin, Wachholtz, Luyckx, Hekking, & Vandewiele, 2013) but much higher than $r = .33$ in arthritis patients in India (Khan, M. O., & Khan, M. I., 2016).

Correlations with mastery. Mastery was correlated with physical health, $r_s = .43$, in this study, a bit higher than in a probability sample of over 11,000 Canadians, where women's self-rated health was correlated $r = .36$ with mastery, and men's was $r = .33$ (Bailis, Segall, Mahon, Chipperfield, & Dunn, 2001).

Mastery was correlated with a measure of purpose in life, $r = .45$ (Ryff, 1989), which is quite similar to this study's $r_s = .47$ between mastery and meaning in life.

The negative correlation between mastery and frequency of prayer, in this study, echoes findings in the Washington, D.C. area, in over 1,000 people over 65 years of age (Schieman, Pudrovska, & Milkie, 2005), and in a 2008 representative sample of Canadians (Speed & Fowler, 2017). In addition, the Canadian sample was so large ($N > 12,000$) that the small, negative correlation between mastery and attendance, $r = -.09$, was statistically significant, while the similar correlation in the Manitoba cohort, $r_s = -.08$, had a p-value $> .05$. While this is a small effect in either study, explaining only between half and one percent of the variance, frequency of attendance is the most common measure of spirituality used in health research, and it is not used with an awareness that, at least some of the time, it has a negative correlation with a key psychological correlate of physical health. As context, the categorical attendance measure used in the large Canadian sample, with $M = 2.4$ and $SD = 1.5$, was included in the year 10.5 IBD survey questions, with quite similar statistics: $M = 2.3$ and $SD = 1.6$. These are in alignment with a representative sample of U.S. adults from 1998, whose average attendance was less than once a month (Idler et al., 2003).

Correlations with social support. The correlation in this study, $r_s = .19$, for social support and physical health, was very similar to $r = .18$ in the cancer survivors mentioned above (Edmondson et al., 2008), and, in the Canadian probability sample, $r = .24$ for women and $r = .19$ for men (Bailis et al., 2001).

For social support and mental health, the correlation in this study was $r_s = .38$, not as high as in the cancer survivors, $r = .46$ (Edmondson et al., 2008).

Finally, the correlation between social support and meaning in life in this study, $r_s = .37$, was very similar to the correlation among adults in a smoking-cessation program, $r = .41$ (Steger, Mann, Michels, & Cooper, 2009) and to the correlation among survivors of the 2013 Colorado floods, $r = .39$ (Dursun, Steger, Bentele, & Schulenberg, 2016).

Correlations with meaning in life and peacefulness. In this study, meaning and peacefulness were correlated $r_s = .61$. Among 3,000 people with cancer or HIV, the correlation was $r = .60$ to .88 (Bredle, Salsman, Debb, Arnold, & Cella, 2011).

Among 240 women at least 5 years after a cancer diagnosis, meaning was correlated with physical and mental health, while peacefulness was correlated with mental health only (Bredle et al., 2011). In this IBD study, peacefulness was the more powerful predictor, yet the $r_s = .33$ between meaning and physical health was higher than the average correlation, $r = .26$, in the meaning and physical health meta-analysis (Czekierda, Banik, Park, & Luszczynska, 2017).

Correlations with gratitude. Published gratitude-optimism correlations range from $r = .35$ to .51 (P. L. Hill & Allemand, 2011; Kleiman, Adams, Kashdan, & Riskind, 2013; McCullough et al., 2002). The correlation in this IBD study was similar, with $r_s = .56$.

Implications of This Study

Implications for spirituality and health research. Never before has there been comprehensive testing of spiritual variables against psychological variables as predictors of physical and mental health. The clear superiority of the psychological strengths should call into question the importance of the literature claiming a spiritual health benefit. Where there is a

social norm of religiosity, spiritual variables may predict health at a statistically significant level, but, based on the effect sizes found in the literature, I expect that the psychological strengths will outperform the spiritual in almost any population. Public health promotional activities should reflect this.

Investigating a spurious relationship. If spirituality itself were beneficial to health, the health of a spiritual person would not depend so heavily on the level of religiosity in the surrounding culture. That global pattern, found in Stavrova's (2015) analysis, points to the possibility that a third variable, a causal influence on both health and spirituality, is responsible for a non-causal religion-health correlation. Scientists researching religion as a predictor of health must look deeper or broader to avoid exalting what appears to be a spurious relationship.

One candidate for this third variable is the personality trait conformity. Conformity can be measured by the 10-item International Personality Item Pool (IPIP; Goldberg et al., 2006) Conformity Scale, which is modeled after the Cooperative Scale in the revised Jackson Personality Inventory. (The IPIP website attributes this to D. N. Jackson, 1994, *Jackson Personality Inventory-Revised manual*. Port Huron, MI: Sigma Assessment Systems.) The IPIP Conformity Scale asks for a person to rate the accuracy or inaccuracy of descriptions about the self, such as, "Conform to others' opinions," and "Do what others do," (International Personality Item Pool, n.d.). Conformity may be good for health overall, by keeping one within the mainstream, protected from the stresses of oppression or isolation (Cragun, Kosmin, Keysar, Hammer, & Nielsen, 2012), and away from the dangers of unusual behaviors. In the mainstream, in most religious regions, conformity could make one healthy and religious. In secular regions, conformity could make one healthy and secular.

The conformity-health benefit as the cause of the apparent religion-health benefit is, to my knowledge, an untested hypothesis. I would expect exceptions, under conditions such as religious war or extreme religious oppression of women. However, despite the benefits of eccentric exploration and invention, hewing to the mainstream may be protective of individual health in the majority of places, times, and cases.

While the concept of conformity is parsimonious, an alternative approach is to analyze the Big Five personality factors (neuroticism, agreeableness, openness to experience, extraversion, and conscientiousness; Costa & McCrae, 1995) as causal influences on religion and health. Theorists have suggested using the five factors as the primary map for all personality research, only using other constructs to explain what the five factors have not explained (McCullough & Laurenceau, 2005; Piedmont, 1999; Piedmont, Ciarrochi, Dy-Liacco, & Williams, 2009). Indeed, conformity was correlated, $p < .01$, with neuroticism (.39), agreeableness (.36), openness (-.26), and extraversion (-.12), in a small undergraduate sample (Paunonen & Jackson, 1996).

I am unaware of any publication of correlations between spirituality and all five factors of personality as predictors of health, although four factors were analyzed in the Terman sample of gifted Californian children, who were born in or around the year 1920 (McCullough & Laurenceau, 2005). In that study, an index of religiosity (i.e., interest in religion, involvement in religious activities, liking of reading the Bible, and agreement that giving children religious instruction is essential for the successful marriage) was correlated with agreeableness ($r =.15$), conscientiousness ($r = .14$), and extraversion ($r = .08$). The religiosity index predicted self-rated health for women, even after controlling for health behaviors, social support, and the four personality factors. Religiosity was not predictive for men. McCullough and Laurenceau (2005)

noted that the five personality factors typically only account for 5% to 7% of the variability in religiosity. However, the correlation of religiosity and health also is typically small (McCullough & Laurenceau, 2005).

Among undergraduates in the U.K, attendance at religious services was correlated with personality facets from the Eysenck Personality Profiler (attributed to Eysenck, Barrett, Wilson, & Jackson, 1992)—peaceful, ambitious, guilty, happy, and responsible—each between $r = .13$ and .15, $p < .05$ (Hills, Francis, Argyle, & Jackson, 2004). Higher correlations ($r = .21$ to .25) were found for two other facets, empathic and careful, $p < .001$. Correlations with private prayer and the aforementioned facets were generally similar (Hills et al., 2004). Analyzing correlations of health, religiosity, and all 30 personality facets, of the Big Five personality factors, might be more illuminating than analysis of the five factors or conformity alone.

If five factor or multi-facet personality analysis does not prove to be fruitful, spirituality and health researchers should consider other potential causes of both spirituality and health. In the face of Stavrova's (2015) research, it appears that only searching for causal mechanisms leading from spirituality to health, and even back again, is unlikely to reveal the true source of the spiritual-health association.

Utilizing caution with attendance. While the positive correlation between attendance and health in this study was far from strong enough to reach statistical significance, attendance is the most common single measure in the literature showing such a correlation. Yet, in this study, attendance had the lowest correlations with the other spiritual variables. One population-based British study showed that personality was as important as identification with a religion, as a predictor of attendance at spiritual services (Furnham & Cheng, 2015). This implies that the positive correlation between attendance and health, although frequently found in the literature,

may be spurious. Attendance may be correlated with personality factors that are causal in their relationships with health (e.g., Friedman, et al., 1995; Hampson, Goldberg, Vogt, & Dubanoski, 2007; Lahey, 2009).

Avoiding indices of religiosity. There have been very few published reports of individual spiritual variables, rather than a combination of spiritual variables, tested as health predictors. While there were no statistically significant spiritual predictors of health in the uncontrolled bivariate correlation analysis in this IBD study, integrating the various correlations in this study with the findings in the literature has implications.

In this IBD study, belief in God and belief in an afterlife were slightly negatively correlated with mental health, which was statistically significant when optimism was controlled. This is in alignment with one publication by Park and colleagues (Park, Lim, Newlon, Suresh, & Bliss, 2014). Prayer had almost no relationship with health in this study, but the small correlation was negative, as was the case in a body of published research (Masters & Spielmans, 2007). If these findings are generalizable, it would mean that any index of spirituality that includes prayer, or belief in God or an afterlife, may reduce the ability of the index to find a positive correlation with health.

The impact of any combination of spiritual dimensions should be considered carefully (Park, Sherman, Jim, & Salsman, 2015). In some health studies, frequency of attendance has been combined with beliefs, or the use of prayer, even though the components of the index may have opposite associations with health.

It is important to establish what level of a construct is of scientific interest (Carver, 1989). Many researchers have treated religiosity as a one-dimensional construct, which has impeded progress in understanding the relationship of religiosity to health. As detailed in the introduction,

the suggestion by many researchers has been to investigate spiritual aspects separately (e.g.,

Levin & Chatters, 2008, Oman & Thoresen, 2005; Park et al., 2017; Pearlin, 2002).

However, I do not advocate limiting analysis to bivariate relationships. The influence of a

set of spiritual variables might be greater than the sum of the influence of the separate variables

(VanderWeele, 2017). Synergy could be tested in moderation analysis, but testing interaction

requires a larger sample (Babyak, 2004). Testing sets in regression was the solution in this

project. Testing a set does not require that the set comprises one factor.

Prioritizing applied research. While theorists pursue causes, religious counselors could

investigate the use of spirituality to improve the mental and physical health of persons seeking

their help, taking into account the psychological strengths. Culturally appropriate knowledge

translation could be tested. For instance, using partnership with God as a way to increase mastery

could be tested against a secular intervention designed to increase mastery directly. Gratitude

toward God as a way to increase optimism could be tested against a general gratitude

intervention. Increase in meaning in life, among individuals volunteering to help vulnerable

people as service to God, could be tested against meaning in life among people volunteering to

help vulnerable others as service to humanity.

Public research funding should prioritize increasing mastery and optimism directly.

Sacredness is such a powerful idea, one might assume that a religious intervention would be

more efficacious than a parallel secular intervention. Yet, in this study, meaning in life was more

predictive of health than spiritual meaning in life, and, in another large study, gratitude was more

predictive than gratitude to God (Rosmarin, Pirutinsky, A. B. Cohen, Galler, & Krumrei, 2011).

On the other hand, there is evidence that religious people overall have better health

behaviors than secular people (e.g., Oman & Thoresen, 2005; Park et al., 2017; Strawbridge,

Shema, R. D. Cohen, & Kaplan, 2001). Social scientists could investigate health communication and health behavior norms within the religious environment, looking for aspects that might translate to secular environments.

Implications for health psychology research. Optimism, mastery, social support, and meaning in life predicting health was expected, based on their individual theoretical and empirical literatures. However, there is surprisingly little research comparing these key constructs in health psychology. Gratitude and peacefulness do not have such solid empirical evidence of their roles in health. This study's comparison of the relative strengths of the six psychological variables, in their ability to predict health, brought together separate subfields of research for the first time.

Optimism and mastery. Semipartial correlation tested optimism against mastery, as unique predictors of health. Optimism was twice as good at predicting mental health, while mastery had more than four times the ability to predict physical health. Both were good predictors of mental and physical health, and both have brief validated survey instruments. This implies that both should be measured, which is not common practice.

Psychologists have already demonstrated the effectiveness of interventions to increase optimism (Schueller & Seligman, 2008; Schulman, 1999) and mastery (Christensen, Frostholm, Ørnbøll, & Schröder, 2015; Dennison & Moss-Morris, 2010; von Ranson, Stevenson, Cannon, & Shah, 2010) among a variety of populations, including chronically ill people. Given the high correlation between optimism and mastery, $r_s = .65$ in this study, a novel strategy would be to aim to increase mastery and to check whether optimism increases as well.

Optimism and gratitude. With very little published data comparing gratitude and optimism as predictors of physical health, I wondered if any influence gratitude had on health was due to its shared variance with optimism, rather than unique variance from gratitude. Semipartial correlation determined that gratitude showed no unique positive predictive power for physical health. If these results generalize, it would make sense to stop choosing to measure gratitude as a predictor of health, when measuring optimism instead is an option. On the other hand, gratitude interventions can be so inexpensive, easy, and pleasant, it is worth continuing to explore the use of gratitude in physical and mental health interventions, and to test if optimism rises as a side-effect, as it did in two gratitude experiments (Emmons & McCullough, 2003; Jackowska, Brown, Ronaldson, & Steptoe, 2016).

Social support. The relative weakness of social support as a health predictor was unexpected, considering its centrality in the empirical health psychology literature (e.g., Holt-Lunstad, T. B. Smith, & Layton, 2010). It was not as powerful a predictor of health as optimism or mastery, in this investigation of one chronic illness. The same may be true even in health crisis. Testing perceived stress, as a moderator of the influence of social support on health, could confirm whether the importance of social support depends on the stress level or not.

Meaning in life. Meaning in life may be more important in acute health crisis than as an overall predictor of health in the context of chronic disease. Much of the health research on meaning in life has been in the context of life threatening illness. Testing perceived stress, as a moderator of the influence of meaning in life on health, could confirm this.

Peacefulness. Peacefulness is a relatively new construct in health psychology, at least under that name. Peacefulness may be measuring the personality factor known as emotional stability, or, reversed, neuroticism. Neuroticism is the tendency to feel distress, including fear,

anxiety, sadness, and depression (Carver & Connor-Smith, 2010), and it is known to predict poor physical health (McCrae & Costa, 2008). The performance of peacefulness was so strong in this study, and others mentioned above, that it would be useful to compare it as a predictor with emotional stability in order to bridge the separate literatures.

If peacefulness is found to be a construct distinct from emotional stability, I wonder if its performance in this study will generalize to other distressing illnesses, or if the specific bowel symptoms in IBD make peacefulness particularly relevant. Responses to the IBD Questionnaire showed that, in the previous 2 weeks, 56% of the cohort had been troubled by nausea, and 59% had been troubled by pain. In this longitudinal study, all health outcome measures were very stable over 10 years. Therefore, it is unclear if peacefulness led to relatively peaceful gastrointestinal tracts, or if pain and nausea would be enough to disturb the peace for almost anyone. Measuring peacefulness repeatedly, starting closer to the time of diagnosis, rather than on average 14 years after diagnosis, could clarify the situation in IBD.

Limitations of This Study

There are a number of limitations to keep in mind. Demographically, I had no good measure of socioeconomic status that would have allowed close inspection of that influence on health. In addition, the sample overwhelmingly reported European ethnicity (88%), and Christian (66%) or no (23%) religious affiliation.

Another consideration is that there may be limited generalizability to other regions. In Manitoba, unlike in some areas of the world, religiosity is neither enforced nor proscribed. Also, living with IBD is likely a different experience where the costs of surgery and hospitalization are not covered by the government, as they are in Manitoba, or where the costs of extraordinarily

expensive medications are automatically covered, as they are not in Manitoba. (Many individuals in Manitoba have prescription drug coverage through their employment or a provincial program, but not all do.) In parts of the world where IBD creates more financial stress, mastery may be even more important to health.

One could argue that the psychological variables, as psychological strengths, were confounded with health outcomes in a way that the carefully chosen, neutrally worded spiritual variables were not. There is a positive valence to optimism, mastery, social support, gratitude, meaning in life, and peacefulness. Therefore, the comparison in the hypothesis test may be, at essence, unfair. However, this could not interfere with bivariate relationships between the spiritual variables and health. Attendance at spiritual services, the use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life each failed to show a positive relationship with health, measured several different ways.

Finally, although this study was longitudinal, there was enough stability in the health measures over time that it is not clear that any psychological strength was causal in its relationship with health. On the other hand, experiencing nausea and disabling, painful, frightening, potentially stigmatizing bowel symptoms, in spite of specialist medical care, could realistically reduce most individuals' optimism, mastery, social support, gratitude, meaning in life, and peacefulness. That may be a larger influence than the reverse.

Strengths of This Study

The population-based sample was representative in many ways, with the full range of adult ages and the full range of spiritualty, including individuals who pray daily, who pray only when stressed, and who never pray. There were agnostics and atheists, and people sure of their

personal relationships with God. Some were sure of human mortality, some were sure of immortality, and some were not sure.

While people with only one chronic illness were included in the study, the illness is inflammatory, which is true of the most common killers in Canada—cardiovascular disease and cancer (Diaconu, Ouellette, Camarda, & Bourbeau, 2016)—as well as rheumatoid arthritis, asthma, diabetes, and Parkinson's disease (Laveti et al,. 2013). If physiological effects of inflammation drove any of the results, these may be operative in the most impactful diseases facing industrialized nations today.

The questionnaires used in the study are another strength. Most of the constructs were measured with classic instruments (e.g., LOT-R, MOS Social Support Survey, SF-36, IBDQ), making interpretation in the context of the literature very clear. Where classics did not yet exist, clean measures (i.e., suitable for those of any and no religion, and uncontaminated with well-being) having established psychometrics were used. All scales had good internal consistency in this sample, with most statistics very similar to those in published studies.

The latter is an important point. The existence of so many studies claiming that there is a religious health benefit could raise doubts about the null spiritual findings. Most spirituality research has not been conducted with Canadians, or people with IBD, or any chronic illness. However, with so many of the statistics in line with the various literatures, the null results in this study cannot be dismissed as unusual.

Strengthening Future Studies

Of course, one study, in the context of one chronic illness, in one extreme geographic region, in one health care system, cannot definitively answer any broad research question.

Replications are in order, in similar chronic illnesses, other inflammatory diseases, and representative samples in different regions.

With the exception of the specific disease symptom measure, the same instruments could be employed with most samples. I encourage researchers to use the most precise validated measures available, and to contribute to the collective knowledge base by publishing bivariate correlation matrices and selected semipartial correlations, even if their focus is on a more complex model or specific test.

There are three changes I would suggest in replications. First, additional constructs could be included in the correlation analysis, e.g., the five factors of personality, coping behaviors, adherence to medical treatments, as well as health anxiety and death anxiety.

Second, a more fine-grained approach to religious beliefs could reveal different correlations with health (Park, 2013). Belief in a controlling god may reduce some risky behaviors (Norenzayan, 2016), while belief in a warm, protective god may reduce stress. Similarly, belief in heaven might be more stress-buffering than belief in hell. Perhaps attendance has different influences on health if the service is filled with fear-inducing, angry sermons versus joyful singing and testimonies of the efficacy of love. It seems possible that a regular practice of heartfelt prayer for the well-being of others would have better health effects than begging God for a reduction in one's own suffering.

Third, testing perceived stress as a moderator of the influences of social support and meaning in life, on physical and mental health, could clarify if these two psychological constructs are primarily buffers of stress, while optimism, mastery, and peacefulness may have linear relationships with well-being, in sickness and in health.

Replications to establish generalizability, broaden scope, and clarify are only the beginning. There is a question of causal direction that not every longitudinal study can answer. Repeated measurement of health and key psychological strengths, such as optimism, mastery, and peacefulness, can determine if health is more strongly predicted from prior strengths than strengths are predicted by prior health. Assessment earlier in a chronic illness, before physical condition and psychological reactions have stabilized, may yield more variability (Helgeson & Mickelson, 2000). Clinical medical trials, where individuals with problematic and unstable symptoms are evaluated regularly, could be a fruitful setting as well.

While replication is important to confirm the generalizability of the results, Ryff (2003) urged social scientists to go beyond describing psychological strengths, by testing public health education programs designed to build these qualities. The results of this analysis should contribute to refocusing support for testing interventions that are realistically, empirically likely to increase health in all of God's children, as well as in all atheists and agnostics.

Conclusion

Five spiritual variables—attendance at spiritual services, use of prayer, belief in God, belief in an afterlife, and spiritual meaning in life—were analyzed as predictors of physical and mental health. They were compared with psychological variables with no spiritual language in the measures: optimism, mastery, social support, gratitude, meaning in life, and peacefulness. No physical health outcome of any kind had been correlated with all six of these psychological variables, nor had a set of spiritual variables ever been compared with analogous psychological variables. This comparison synthesized separate subfields of research for the first time.

The five spiritual constructs failed to predict physical or mental health, while the six psychological strengths were predictive of physical and mental health, in a population-based sample of Canadians living with one chronic, inflammatory illness—inflammatory bowel disease. In hierarchical regression analysis, the covariates—health from 10 years prior, age, and gender—explained 25% to 37% of the variance in specific disease symptoms, general physical and mental health. Spiritual variables explained only another 2 to 4% of the variance, not enough to reach statistical significance, while psychological variables explained an additional 6% to 16% of the variance. In bivariate correlation analysis, no spiritual variable explained even 1.5% of the variability in any of the outcomes, while five of the six psychological strengths explained 3% to 26% of the variability in all three health outcomes.

Contrary to expectations, there were very few correlations between psychological and spiritual constructs. Attendance at spiritual services was not positively correlated with social support. Spiritual meaning in life only explained 3% of the variability in meaning in life. Gratitude and spiritual meaning in life had the largest correlation between the psychological and spiritual variables, accounting for 5% of each other's variability. The latter fits well with gratitude theory.

There were small negative correlations between prayer and mastery, and prayer and social support. There were two other negative correlations: Belief in God and belief in an afterlife were negatively correlated with mental health, in partial correlations when optimism was controlled. These were not without precedent, and they highlight the danger in the routine use of combinations of spiritual variables in health research: When some variables predict worse health, and others predict better health, summing them into one index makes a poor tool for revealing true relationships.

Testing just optimism and mastery, using squared semipartial correlation analysis, determined that optimism predicted over four times as much of the variability in mental health, while mastery predicted more than twice as much of the variability in physical health. This implies that both should be measured routinely in the typical health psychology investigation. Although the classic scales have coexisted for over two decades, each serving as the foundation of an impressive body of health psychology research, rarely have both been measured in the same study. Finally, using semipartial correlation, testing optimism against gratitude showed no unique positive predictive power of gratitude for physical health. In bivariate correlation, gratitude did predict 3% of the variance in physical health and 8% in mental health. Given the affordability and high uptake of gratitude interventions, as well as their ability to increase optimism, these should not be discounted.

One study cannot resolve decades of debate on whether there is a religious health benefit. Yet, the context for the study suggests that it will generalize: Individual means, standard deviations, internal consistencies, frequencies, and correlations all are very similar to published statistics. In countries and regions with more religious norms than the Canadian setting for this study, spirituality may be more predictive of health. However, given the extant empirical literature, it is unlikely that any spiritual variable or set of variables will outperform health psychology's best predictors of physical health. Promotors of public health need not wait for confirmation: There are decades of consistent correlations of health with optimism, mastery, and social support to base educational and intervention programs upon. By bridging the solid foundations of key health psychology constructs, and joining them with the large and intriguing spirituality and health literature, this study builds a new, integrated structure of knowledge.

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Appendix A: Additional Details About Measures

Psychological Strengths

Below you will find, for each psychological variable, the full text of the items and response choices. Notes about the scales follow, including published summed means and standard deviations, which are compared with those statistics from this study.

Optimism. The Life Orientation Test-Revised (LOT-R; Scheier, Carver, & Bridges, 1994) has three positive items: "In uncertain times, I usually expect the best. I'm always optimistic about my future. Overall, I expect more good things to happen to me than bad." Reversed items are, "If something can go wrong for me, it will. I hardly ever expect things to go my way. I rarely count on good things happening to me." Response choices are *strongly agree, agree, neutral, disagree, strongly disagree.*

Although Herzberg, Glaesmer, and Hoyer (2006) found that the three pessimistic items as a subscale were not the unipolar opposite of the three optimistic items, and therefore advocated separating them into two subscales, analysis by Rauch, Schweizer, and Moosbrugger (2007) argued that this apparent bidimensionality is due to method effects rather than the capture of two constructs. Glaesmer and colleagues (2012) used a very large (> 2,300), representational sample of German adults and compared subscales with the total score. The differences were so small (only one $r > .01$) that I used the total scale score in this project, which is in line with the vast majority of the over 100 studies using the LOT or LOT-R in physical health research (Rasmussen, Scheier, & Greenhouse, 2009).

Examining my decision, I conducted exploratory factor analysis on this study's LOT-R data. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.87, above the suggested 0.7, and Bartlett's test of sphericity was significant at $p < .0001$ (Fabrigar & Wegener, 2012). Principal axis factoring extracted one factor with an eigenvalue over 1, explaining 56% of the variance. Item loadings ranged from .63 to .85. In this spirituality study, optimism and pessimism were not separate dimensions.

Looking at the summed mean (rather than average mean reported in Table 4), the optimism scale score for the LOT-R had a mean of 16.0 ($SD = 4.5$), similar to the mean (and standard deviation) of $M = 15.2$ ($SD = 3.8$) in a representative sample of Germans who were 18 to 93 years old (Glaesmer et al., 2012). An international convenience sample of people with IBD, 60% from the U.S. and 24% from Canada, had an average mean of 2.2, compared with the Manitoba cohort's 2.7, on the 0 to 4 scale (Sirois, 2015).

Mastery. Pearlin and Schooler's 1978 Mastery Scale consists of seven items: "I have little control over the things that happen to me. There is really no way I can solve some of the problems I have. There is little I can do to change many of the important things in my life. I often feel helpless in dealing with the problems of life. Sometimes I feel that I am being pushed around in life. What happens to me in the future mostly depends on me. I can do just about anything I really set my mind to do." The scale is generally administered without a neutral response option; the five answer choices used in this study were *strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree.*

The Mastery Scale was first tested with a representative sample of 2,300 people in the Chicago area, aged 18 to 65. Their four-year test-retest reliability was $r = .44$ (Pearlin, Menaghan, Lieberman, & Mullan, 1981).

The summed mastery scale score in this spirituality study had a mean of 26.8 (*SD* = 4.6), similar to the statistics in two studies using the same 5-point answer scale: *M* = 25.7 (*SD* = 4.9) in a population-based study of Dutch people over the age of 57 (Kempen et al., 2005), and *M* = 26.6 (*SD* = 3.9) in a large representative sample of Canadians (Speed & Fowler, 2017).

Social support. The Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991) introduces 19 questions with the following: "People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it?" The answer choices are *none of the time, a little of the time, some of the time, most of the time, all of the time.* The items are, "Someone to help you if you were confined to bed. Someone you can count on to listen to you when you need to talk. Someone to give you good advice about a crisis. Someone to take you to the doctor if you needed it. Someone who shows you love and affection. Someone to have a good time with. Someone to give you information to help you understand a situation. Someone to confide in or talk to about yourself or your problems. Someone who hugs you. Someone to get together with for relaxation. Someone to prepare your meals if you were unable to do it yourself. Someone whose advice you really want. Someone to do things with to help you get your mind off things. Someone to help with daily chores if you were sick. Someone to share your most private worries and fears with. Someone to turn to for suggestions about how to deal with a personal problem. Someone to do something enjoyable with. Someone who understands your problems. Someone to love and make you feel wanted."

The psychometric qualities of the survey were established originally in the U.S. with representative sampling of almost 3,000 people diagnosed with hypertension, diabetes, heart disease, or depression, aged 18 to 98 (*M* = 55). Discriminant validity was confirmed: The survey

does not measure loneliness, belonging, marital status, or mental health (Sherbourne & Stewart, 1991).

The summed social support scale score in this spirituality study had a mean of 82 ($SD = 15$). The large sample used to test the measure, composed of individuals diagnosed with hypertension, diabetes, heart disease, or depression (Sherbourne & Stewart, 1991), had $M = 70$ ($SD = 24$).

Gratitude. The Gratitude Questionnaire-6 (McCullough, Emmons, & Tsang, 2002) has answer choices coded 1 to 7: *strongly disagree, disagree, slightly disagree, neutral, slightly agree, agree, strongly agree.* Items are, "I have so much in life to be thankful for. If I had to list everything that I felt grateful for, it would be a very long list. I am grateful to a wide variety of people. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history." The two reversed items are, "Long amounts of time can go by before I feel grateful to something or someone," and "When I look at the world, I don't see much to be grateful for."

McCullough and colleagues (2002) developed the scale with community as well as student samples, over 1,600 participants in total. Internal reliability in initial testing yielded an alpha of .82. When students in a sample asked friends and family members, who knew them well, to answer a (revised, third-person) gratitude questionnaire about the student, interrater reliability among friends and family was .65. The scale has been translated into 10 languages and used with over 4,000 individuals (McCullough, 2011). Work by other research groups has confirmed the discriminant validity of the scale (Wood, Joseph, & Maltby, 2008) as well as the predictive validity (P. L. Hill, Allemand, & B. W. Roberts, 2013).

In this spirituality study, Cronbach's alpha was .83, and the summed scale score had a mean of 35.8 (*SD* = 5.7). These are similar to published statistics: Initial testing of the scale yielded an alpha of .82 (McCullough et al., 2002). The largest adult sample, with over 1,000 people aged 18 to 75, yielded a mean of 36.9 with a standard deviation of 4.9 (McCullough et al., 2002).

Meaning in life. There are four items in the Meaning Subscale of the Functional Assessment of Chronic Illness Therapy, Spiritual Well-Being Scale (FACIT-Sp): "I have a reason for living. I feel a sense of purpose in my life. My life has been productive. My life lacks meaning and purpose." The last item is reversed. The response choices were *not at all, a little bit, somewhat, quite a bit,* and *very much,* coded 0 to 4 (Peterman, Fitchett, Brady, & Cella, 2002).

The FACIT-Sp belongs to the Functional Assessment of Chronic Illness Therapy (FACIT) family of health-related quality of life measures (Peterman et al., 2002). The FACIT-Sp was meant to measure spirituality separate from religion, with the meaning-peace subscale designed to have face validity. A U.S. sample of 131 cancer patients was used to assess the discriminant validity of the subscale against 10 different measures of religiosity. Correlations between .05 and .28 confirmed the minimal overlap (Peterman et al., 2002).

By 2002, the FACIT-Sp had been translated into nine languages from the original English (Peterman et al., 2002). A recent systematic review of 35 spirituality instruments used in clinical research found that the FACIT-Sp was one of the two most frequently used measures, and one of only two with solid psychometrics to recommend it, as a measure of current spiritual state (Monod, Brennan, Rochat, Martin, Rochat, & Büla, 2011).

Based on confirmatory factor analysis conducted with some of the original authors,
several years after the introduction of the measure, meaning and peacefulness were shown to be
separate factors (Canada, Murphy, Fitchett, Peterman, & Schover, 2008). An Arabic translation
confirmed the separation (Lazenby, Khatib, Al-Khair, & Neamat, 2013). This subscale structure
is the form currently recommended by the creators of the measure (Bredle, Salsman, Debb,
Arnold, & Cella, 2011). Exploratory factor analysis in the current spirituality study clearly
showed that the Meaning/Peace Subscale contains two factors, a meaning in life factor and a
separate peacefulness factor.

In this study, the summed mean for meaning in life was 13.1 ($SD = 3.0$). Among 8,800
cancer survivors, 24 to 100 years old ($M = 62$, $SD = 12$), the summed mean was 13.7, with a
standard deviation of 2.8 (Murphy, et al., 2010).

Peacefulness. Peacefulness was measured with the four items in the FACIT-Sp Peace
Subscale: "I feel peaceful. I have trouble feeling peace of mind. I feel a sense of harmony within
myself. I am able to reach deep down into myself for comfort." The second item was reversed.

In this spirituality study, the summed mean was 9.6 ($SD = 3.7$). Among the 8,800 cancer
survivors described above, the summed mean was 12.0, with a standard deviation of 3.4
(Murphy, et al., 2010).

Health Outcome Measures

Mental health and general physical health. The SF-36 evolved from the first SF, which
had 20 questions and was tested with over 11,000 U.S. patients as they waited for health care
appointments. In testing the SF-20, particular attention was paid to samples that traditionally
have not produced high quality data: those over 75 years old, without a high school education,

with depression, or with a serious physical illness. Internal reliability and discrimination between subscales were quite good, even among those subgroups (Stewart, Hays, & Ware, 1988).

The SF-36 was developed to increase the precision in evaluating subtle differences within the same person over time (Ware & Sherbourne, 1992), and a wide range of answer options was observed in testing with over 3,400 patients (McHorney, Ware, Lu, & Sherbourne, 1994). The SF-36 performed well at detecting clinical mental illness, showing convergent validity with much longer instruments. As well, the longer short form corrected floor effects with chronically ill people (Ware & Sherbourne, 1992). Further testing with patients dealing with both psychiatric and physical health issues confirmed the utility of the mental and physical health component scores, which account for 70% of the total variance explained (McHorney, Ware, & Raczek, 1993). SF-36 mental and physical health component scores were used in 120 peer-reviewed journal articles from 1994 to 2000 (Ware & Kosinski, 2001); Google Scholar lists hundreds since then.

This study used the SF-36 United Kingdom version 2. There were some minor wording changes from the U.K. version 1 to version 2 that were not made in the form used by the participants in this study, but all substantive changes that affect coding were made. For instance, "Have you been a happy person" should have been changed to "Have you been happy?" In addition, there were two typographical errors. One response option should have been "a little bit," but instead was "slightly." ("Slightly" is a correct response option for a similar question.) Finally, wording in one question should have been "social activities (like visiting with friends, relatives, etc.)" but was instead "social activities (like visiting friends, etc.)."

IBD symptoms. The 10-item Bowel Symptom Subscale (Mitchell et al., 1988) of the

IBD Questionnaire (IBDQ; Irvine et al., 1994) has good psychometrics: Cronbach's alpha = .82

(Watanabe et al., 2006), a test-retest score of $r = .95$ for stable patients, as well as good

discriminant and convergent validity with a variety of physical health measures (Cheung,

Garratt, Russell, & Williams, 2000). Cronbach's alpha in this spirituality study was .86.

Appendix B: Details About Missing Data

Missing Psychological Data

One participant missed one survey page, with the optimism and gratitude scales. When asked, he promptly completed the page, 3.5 years after the rest of his 10.5 year survey. I used all of his data. Two participants missed one optimism item. Two participants did not complete the 10 year interview, so mastery data from the 9 year interview were substituted. One participant missed one mastery item. Five participants did not complete the 11 year interview, which means that their social support data were missing. The chronologically closest, potential substitute data was from year 1. The Spearman correlations between the social support items from years 1 and 11 were all well below .45, so I did not substitute; I used their other data in bivariate correlation analysis. Five participants missed one social support question. Three participants missed one meaning in life item. Two participants missed one peacefulness item. There were no other missing values in the psychological variables.

Missing Spiritual Data

Among the spiritual variables, one participant missed both the belief in God question and the spiritual meaning in life question. One missed the afterlife question. Two missed the prayer question. I left all of these blank. Five participants did not answer the open-ended question, "How often have you attended spiritual services during the past year?" Yet, in the same 10.5 year survey, all of them answered the following multiple choice question taken from the Canadian Community Health Survey (Statistics Canada, 2003), "Not counting events such as weddings or funerals, during the past 12 months, how often did you participate in religious activities or attend

religious services or meetings? *Once a week or more, Once a month, 3 or 4 times a year, Once a year, Not at all*." I used these data to fill in the missing data as 52, 12, 3, 1, 0. None of the five selected *once a month;* two selected *not at all*; and the other choices were selected once each. No other spirituality data were missing.

Missing Health Data

Three participants skipped one bowel symptom question and six skipped one question in the SF-36. Five participants did not complete the 11-year survey, which means that their health outcome data are missing. Based on $r = .78$ between the IBDQ bowel subscale scores at 10.5 and 11 years, I decided not to substitute the data. I was unwilling to increase error by adding data with almost 40% of the variance unexplained. Later, I realized that one of the cases with the missing year 11 data had the highest score in the sample on the IBDQ bowel subscale at year 1. Then, I checked and saw that the missing data were from cases spread across the range of IBDQ scores. Out of curiosity, I regressed the covariates on the bowel symptoms, and saw that the standard error increased 57%, confirming my decision not to substitute when all outcome data were missing.

At the year 1 time point, of the 10 items in the bowel symptom subscale, there was 1 item missing for four cases, 2 items missing for one case, 4 items missing for one case, and 5 items missing for one case. In addition, two participants did not complete the year 1 survey, so their 6-month survey data were used instead to control for prior health.