

Prayer and Health: Review, Meta-Analysis, and Research Agenda

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Abstract This article reviews the empirical research on prayer and health and offers a research agenda to guide future studies. Though many people practice prayer and believe it affects their health, scientific evidence is limited. In keeping with a general increase in interest in spirituality and complementary and alternative treatments, prayer has garnered attention among a growing number of behavioral scientists. The effects of distant intercessory prayer are examined by meta-analysis and it is concluded that no discernable effects can be found. The literature regarding frequency of prayer, content of prayer, and prayer as a coping strategy is subsequently reviewed. Suggestions for future research include the conduct of experimental studies based on conceptual models that include precise operationally defined constructs, longitudinal investigations with proper measure of control variables, and increased use of ecological momentary assessment techniques.

Keywords Prayer · Health · Spirituality · Complementary and alternative treatment

In the last decade there has been a tremendous increase in scientific interest regarding the relations between religion/spirituality and health. This trend may be viewed as part of a larger movement to examine “grass-roots medicine” or what is commonly identified in the medical and

scientific communities as complementary and alternative medicine. A 1993 study determined that Americans made an estimated 425 million visits to providers of unconventional therapy, a number that was greater than the number of visits to primary care physicians (388 million), and that they paid nearly as much out of pocket for these therapies as they did for all hospitalizations (\$10.3 billion vs. \$12.8 billion; Eisenberg et al. 1993). Recognizing both the popularity of these treatments and the lack of scientific evidence evaluating their effects, the U.S. Congress in 1991 passed legislation authorizing the establishment of an office within the U.S. National Institutes of Health to study what were called “unconventional medical practices” (U.S. Department of Health and Human Services 1991). The following year the National Center for Complementary and Alternative Medicine was formed.

Barnes et al. (2002) revealed that 62% of Americans reported using some type of alternative medicine. Individuals who use these treatments tend to be young to middle age adults who are well educated, have higher incomes, and use the treatments primarily because they are closely aligned with their personal values, beliefs, and philosophical orientations rather than because they are dissatisfied with conventional medicine (Astin 1998; Eisenberg et al. 1993). Of the 10 most often utilized alternative treatments in the U.S., prayer for self (43%) and prayer for others (24.4%) are the two most commonly named therapies and being in a prayer group (9.6%) ranks fifth (Barnes et al. 2002). A 2002 national survey on the use of alternative medicine found similar rates of prayer utilization among individuals diagnosed with diabetes (46%) though, interestingly, only 28% of the diabetic sample indicated that they used prayer specifically for their diabetes (Yeh et al. 2002).

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Whether prayer should be conceptualized as an alternative medical intervention has itself become a topic of discussion. From certain vantage points, prayer clearly fits under this umbrella. To begin, prayer is central to the value and philosophic systems of many individuals across a variety of faiths and cultures. Prayers for health are common in, for example, Christianity, Judaism, and Islam. There is evidence from several countries outside the U.S. that prayer is their most commonly used health intervention (e.g., Edman and Koon 2000; Samana et al. 2004). Even among certain health care workers in the U.S., prayer is commonly used. Tracy et al. (2005) conducted a national survey of critical care nurses and determined that 73% used prayer in their practices, 81% had recommended it to patients, and 79% had been requested by patients and their families to pray on their behalf. Given that prayer is not part of conventional medical training, but is consistent with the philosophic systems of its users and is widely employed as a health intervention (sometimes to the exclusion of other treatments), it seems to fall within the domain of a complementary and alternative medical treatment that is worthy of study.¹

However, a typical part of the definition of a complementary and alternative medical treatment, at least as it concerns acceptability for funding by the National Center for Complementary and Alternative Medicine, pertains to the lack of an accepted biomedical explanation for the intervention's effects. Regarding prayer this criterion may be more easily applied to some types of prayer than others. Distant intercessory prayer, one of the types of prayer most studied, seems congruent with this requirement in that there is no commonly accepted biomedical explanation for how individuals who are not present with the patient could alter that patient's course of disease or physical condition by offering prayers for healing on the patient's behalf. On the other hand, prayers said by others in the presence or with the knowledge of the patient, or prayers said for oneself, *may* have as their mechanism of action psychological processes that are at least recognized, if not commonly accepted, by the biomedical community. (This is not meant to deny or criticize the fact that believers may attribute the outcomes of prayer to supernatural or divine intervention). These could involve, to name a few, social support, increased hope, or decreased anxiety; all of which are psychological phenomena that likely influence biological processes via recognized psychoneuroimmunological

pathways (e.g., Cohen et al. 2003; Kiecolt-Glaser et al. 2002; Koenig 2001).

Prayers for health are attested to in ancient writings including, for example, the Bible and Qur'an, have been offered by the faithful through the ages, are commonly practiced today, and gained the attention of such noted scholars and scientists as Sir Francis Galton and William James over 100 years ago. Nevertheless, from the perspective of science, prayer remains a scarcely studied phenomenon. The purposes of this paper are to: (1) review the scientific literature on prayers for health, and (2) offer a research agenda to guide future investigators. Based on the discussion above, the review of the prayer literature will be divided into two sections: (1) meta-analysis of distant intercessory prayer, an example of a type of prayer lacking a biomedical explanation, and (2) narrative review of other forms of prayer, i.e., prayers whose effects could be understood on the basis of known psychological and biological processes. Following the review we will offer suggestions for areas of research on prayer that we believe have merit and provide cautions regarding areas that appear less promising. This discussion will include a brief examination of methodological and ethical problems that one may encounter while scientifically addressing prayer.

Distant Intercessory Prayer

Intercessory prayer is simply defined as prayer said on behalf of someone else. It could occur in the presence of the other person, as often happens during religious ceremonies such as the laying on of hands, or could be said from a distance, i.e., without the presence of the person who is the object of the prayer. The scientific literature has focused on distant intercessory prayer and has utilized methodologies specifically designed to rule out the possible influence of psychological variables or placebo effects. Consequently, all of these studies used patient blinding procedures and the body of studies is characterized by the use of double-blinding that left the subjects/patients, treating physicians, and other health care workers unaware of what condition (prayer vs. no-prayer) the patients were in. Some of the studies were actually designed so that neither the patients nor their treatment team even knew that a study of any kind was taking place. Clearly at least one intention of the researchers contributing to this body of literature is to test the specific and isolated effects of prayer on health (please see Masters et al. 2006 for a list of these studies).

In 2006 Masters, Spielmans, and Goodson published a comprehensive meta-analysis of this literature that was designed to determine: (1) the size of the overall effect of prayer on health; and (2) the influence of moderator

¹ In considering prayer as a form of alternative medicine it is useful to distinguish between voluntary prayer initiated by patients and their families or friends versus prayer used by a health care provider as an active intervention. The ethics of the latter are a contentious topic that lie beyond the scope of this paper but others, most notably Richard Sloan (Sloan n.d.; Sloan et al. 1999) who argues for separation of prayer and medicine, have written extensively on this subject.

variables on this effect. What follows is an update of this meta-analysis. Interested readers are referred to the original article for a complete description of the research methods. Since the first meta-analysis appeared in press, a large, multi-center study (the second in the literature) on distant intercessory prayer was published by Benson et al. (2006). The study included 1,802 patients undergoing non-emergent coronary artery bypass graft who were randomized to three groups (i.e., uncertain if they were receiving prayer and actually received it, uncertain if they were receiving prayer and did not receive it, certain they were receiving prayer). With the addition of this important study we recalculated our statistics in the meta-analysis and the results are reported below. To remain consistent with the purposes and criteria of our original meta-analysis only patients in the two groups that were uncertain if they would receive prayer ($n = 1201$) were included in the new calculations.

Table 1 depicts the effects for distant intercessory prayer summarized across the 15 studies. Using a random effects model, the mean effect size was $g = .082$; $p = .26$ (see Table 1 throughout). The findings for each individual study and the overall result are graphically portrayed in Fig. 1. When only studies examining medically ill or mentally distressed patients were considered, the mean effect size, while small, achieved borderline statistical significance ($p = .09$), whereas healthy participants showed no benefit from intercessory prayer ($p = .57$). A moderator analysis, however, based upon whether patients were ill or well indicated that the effects of prayer were not significantly different between groups ($Q = 2.21$, $p = .14$), though it is important to consider the small sample of studies (which limits the power of the Q -test to detect between group differences) when interpreting this result.

One study included in the meta-analysis (Cha and Wirth 2001) was fraught with questions regarding its legitimacy (see Masters et al. 2006) and thus Table 1 presents analyses both with and without this study included. When Cha and Wirth was removed from the analysis, the omnibus effect size across studies diminished to nearly zero

Table 1 Effects of IP summarized across studies

Condition	N of Comp. ^a	g^b	Z	p
Overall	15	.082	1.18	.26
Patient	12	.139	1.68	.09
Healthy	3	-.061	.58	.57
Patient (without Cha and Wirth 2001)	11	.044	.52	.61
Overall (without Cha and Wirth 2001)	14	.003	.04	.97

^a = number of comparisons; ^b = positive value for g represents a positive effect for IP

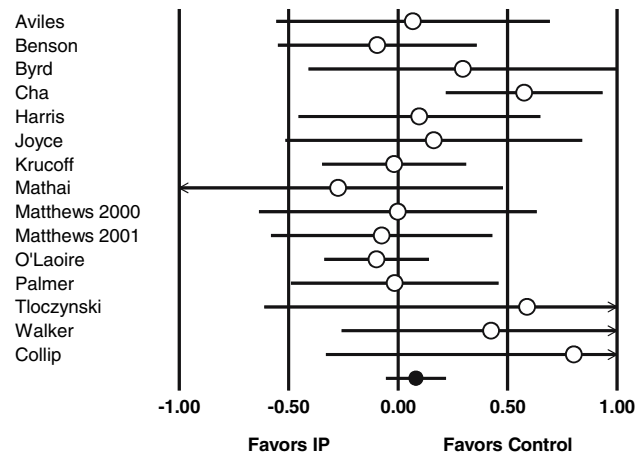


Fig. 1 Forest plot of effect sizes and confidence intervals for individual studies and overall

($g = .003$) and the small effect size that marginally supported the efficacy of distant intercessory prayer among sick patients when this study was included no longer achieved even borderline statistical significance ($p = .61$) without it.

Like the original, the updated meta-analysis also found that none of the following potential moderator variables actually influenced the findings: (1) random assignment to conditions, $Q = .062$, $p = .80$; 2) daily versus less frequent prayer, $Q = .25$, $p = .62$; and 3) duration of the prayer intervention, $\beta = -.002$, $p = .83$. Finally, a test of homogeneity yielded nonsignificant results ($Q = 15.61$, $p = .34$), indicating that the studies were likely clustered around a common mean that is reasonably representative of each study in the set, thus increasing confidence in the generality of these findings.

The updated findings continue to support our conclusion that there is no scientifically discernable effect for distant intercessory prayer on health and that several potential moderating variables, in fact, do not moderate the results. The intercessory prayer line of research has also been criticized on the basis of methodological, ethical, theoretical, and theological considerations (Chibnall et al. 2001; Masters in press, 2005; Sloan, n.d.). Readers are referred to the original articles for detailed discussion of these criticisms as to do them justice in the present context would require more space than is available. Two concerns, however, will be highlighted. From a methodological perspective, the impossibility of a true control group presents a formidable barrier in distant intercessory prayer research. In these studies it is only possible to have subjects that are not prayed for by the research team, but this is far different from having subjects who are not prayed for. How can a researcher assure that patients are not prayed for by family and friends? If control subjects receive the treatment

(prayer) there is no control and the body of literature simply becomes a comparison of those who receive prayer from a select group of research interventionists versus those who do not receive this prayer. Findings from such studies are trivial at best in terms of addressing the relationship between prayer and health. Second, Masters (2005) argued that despite claims to the contrary, the existing body of distant intercessory prayer studies was designed with the assumption that God is the mechanism of change working through prayer. But God's actions are not amenable to scientific study. God as a being lies within the realm of the metaphysical; science is firmly planted in the physical. The scientific method is based on epistemological assumptions that render it inappropriately matched for questions regarding the behaviors of God (see Masters 2005 for more a more detailed argument). Thus, we again conclude that scientists interested in the effects of prayer on health should turn their attention away from studies of distant intercessory prayer and instead should focus on those areas where the effects of prayer may be conceptualized in terms of naturally occurring mechanisms that are within the domain of study of several branches of science, including psychology, biology, physiology, and medicine. We now turn our attention to these areas.

Other Conceptualizations of a Link Between Prayer and Health

Please note that the following discussion focuses on non-meditative prayer. The effects of meditation or meditative prayer are worthy of consideration in their own right and have been discussed elsewhere. There are many ways of conceptualizing possible pathways through which prayer may impact health that are separate from any consideration of distant intercessory prayer. For example, individuals may find that when they pray they feel a sense of peace that alters physiological responses resulting in subjectively experienced relaxation and general well-being. If this were true, one might hypothesize that the more one prays the more one will experience these beneficial emotional and physiological states and consequently may also experience improved health as a result. Similarly, prayer might be conceived as a way of coping with threatening or stressful situations, including poor health, especially when these stressors are otherwise uncontrollable. Thus, individuals who pray during times of stress may find strengthened faith and an increased sense of confidence in a positive, or at least manageable, outcome. In addition to the psychological benefits, such confidence may lead to more frequent engagement in healthy behaviors, as a renewed sense of hope could combat the behavioral paralysis that can occur with hopelessness.

A related possibility concerns the content of prayer, i.e., perhaps the words and subject matter of the prayer itself may cause the supplicant's cognitive processes to change in ways that are beneficial. Of course for all of the proposed beneficial outcomes it is also plausible to suggest ways that prayer could lead to increased anxiety, exaggerated autonomic arousal, and perhaps poor health. For example, if individuals in stressful situations concentrate primarily on the stressful aspects of their current circumstances while praying they may simply produce greater fear and arousal. Unfortunately, the current state of the science of prayer is such that most of these ideas are untested or lack sufficient empirical data to render reasonably firm conclusions. Nevertheless, some data exist and in what follows we will briefly examine this literature as it relates to three areas: (1) frequency of prayer, (2) prayer as coping, and (3) content of prayer.

Frequency of Prayer

Several hypotheses concerning the frequency of prayer and health are salient. To name a few: (1) increased prayer could lead to improved psychological and physiological functioning that would be related to better well-being and potentially health outcomes, i.e., a positive relationship between frequency of prayer and beneficial health outcomes; (2) when individuals become ill or suffer declines in their health and functional status they may be more likely to seek divine comfort and help in coping with their illness or even in hopes of healing, i.e., a negative relationship between frequency of prayer and beneficial health outcomes; (3) those who pray during stressful times tend to focus on their stress while praying and thus concentrate more on their problems than ways to overcome them, resulting in a passive and potentially unhealthy coping strategy; i.e., a negative relationship between frequency of prayer and beneficial health outcomes; or (4) those who pray during stressful times tend to focus on how divine purposes and plans will help them through the difficult situation that may lead to a sense of empowerment; i.e., a positive relationship between frequency of prayer and beneficial health outcomes.

The available research evidence supports all of the above in inconsistent ways with a substantial dose of no relation findings mixed in (see McCullough and Larson 1999 for a detailed listing). A sampling of studies will be highlighted here that point to some of the outcomes and difficulties in this line of research.

Ellison et al. (2001) analyzed findings from the 1995 Detroit Area Study, an investigation that included a multistage area probability sample of adult respondents ($N = 1,139$) in the three counties of Michigan that surround Detroit. Their analyses tested several well-reasoned

hypotheses regarding religious involvement, stress, and mental health and included the effects of important demographic, stressor, social resource, and psychological resource variables. They concluded that there was a consistently weak but negative association between frequency of prayer and mental health outcomes that was reduced to being statistically non-significant when social stressors were taken into account. Their evidence indicated that people tend to pray more when they have exhausted other coping resources or when the situation seems desperate and that when these factors are taken into account the apparently negative relation between prayer and mental health dissipates. Other researchers have also found that people tend to engage in prayer more when problems are severe, chronic, or when other coping has not worked (though not all findings are consistent; Bearon and Koenig 1990) and these data extend to specific health related situations as well (McCullough and Larson 1999). Similarly, though not specific to prayer, Ironson et al. (2006) found that subsequent to a diagnosis of being HIV+, 45% of individuals showed an increase in religiousness/spirituality, 42% remained the same, and only 13% decreased.

In a rare longitudinal study, Helm et al. (2000) assessed level of “private religious activity” (prayer, meditation, or Bible study) during baseline evaluation in a probability sample of 3,851 community-dwelling adults over the age of 65 who resided in North Carolina. They were followed for a median of 6.3 years during which time 29.5% of the sample died. The results demonstrated that private religious activity provided a protective effect against mortality for those in the sample who were free of functional impairment at baseline, even after controlling for numerous covariates with demonstrated relations with mortality such as demographics, health variables, health practices, social support, and other religious practices. No effect was found for those who displayed functional impairment at the outset. Interestingly, the major difference in mortality benefit was found between those in the lowest frequency group (“rarely or never”) and all other groups. In other words, engagement in private religious activity as little as “a few times a month” was enough to confer mortality benefits on this older adult, mostly Protestant (97.3%), sample. We should highlight that private religious activity included more than prayer; thus, the results cannot be interpreted to indicate that prayer alone was the effective variable.

Meisenhelder and Chandler (2001) studied frequency of prayer and functional health as measured by the SF-36 Health Survey in a sample of 1,412 Presbyterian pastors (age range 20–80, median 50 years). The study is notable because its sample presented restricted ranges on both frequency of prayer (72% reported praying two or more times per day) and health status (also high). Nevertheless, after controlling for age and gender frequent prayer

predicted better scores on three SF-36 scales: General Health, Vitality, and Mental Health.

Maltby et al. (1999) used a cross-sectional design to determine the relationships between religion variables (frequency of prayer, religious orientation, church attendance) and elements of well-being (depression, trait anxiety, self-esteem) in a sample of 474 college students in the United Kingdom. In separate regression analyses that included the religion variables as predictors and the three well-being measures as outcomes, the most consistent findings were obtained for frequency of prayer which predicted lower depression, lower anxiety, and greater self-esteem. Regressions conducted separately for men and women were consistent with the overall analyses.

This sampling of studies is representative of the literature and shows that research in this area of prayer consists almost exclusively of cross-sectional assessments of self-report variables with the frequency of prayer variable typically being a single item. The more impressive observation, however, pertains to what the studies do not have in common. They vary widely in terms of the populations sampled, outcomes assessed, and variables included in analyses as controls or moderators. There are few replications of previous findings. Consequently it is not possible to draw firm conclusions regarding relations between frequency of prayer and health outcomes. It is, however, clear that longitudinal studies that extensively measure health, personality, demographic, and situational variables at baseline and include relevant control and moderator variables throughout are badly needed. It is also likely that there is not one simple relationship between frequency of prayer and health, but that whatever relationships may exist are likely to be modified by important factors such as the content of prayer, spiritual maturity and understanding of prayer by the supplicant, type of prayer offered (see Poloma and Pendleton 1991), other coping resources available, and aspect of health or illness that is measured. Ultimately the frequency of prayer variable, like frequency of church attendance, provides only a starting point for further investigation into understanding how prayer may relate to health. Study of this variable raises important questions, yet answers few.

Content of Prayer

Does the verbal content of prayer influence any possible relations between prayer and health? If prayer is conceptualized as at least in part an act of cognition it would seem probable that it would function like other cognitive processes and therefore be capable of relating to varying outcomes dependent upon the particular cognitive content and processes undertaken.

A starting point in this discussion is the work of Poloma and Pendleton (1991). Based on a factor analysis of responses to an interview survey with 560 residents of Akron, Ohio four types of prayer, primarily based on content, were identified. These are: (1) petitionary prayer—requesting that specific material needs are met for self and friends; (2) colloquial prayer—a conversational style of prayer that incorporates petitionary elements but is less concrete and specific (e.g., asking for personal guidance, forgiveness, blessings, or lessening of world suffering); (3) ritual prayer—a recitation of prepared prayers available through readings or memory; and (4) meditative prayer—concerned with intimacy and personal relationship with the divine described by words such as adoring, reflecting, and communicating. The investigators determined that the different prayer types had different relations with general well-being. Meditative prayer was significantly related with existential well-being and religious satisfaction whereas colloquial prayer predicted happiness and ritual prayer actually predicted greater depression, loneliness, and tension. An interesting finding from this study was that the subjective experiences of individuals while praying were a greater predictor of well-being than were the types of prayer. Specifically, those who felt like they were experiencing an interaction with God or had feelings of increased peace during prayer also reported greater levels of well-being.

Krause (2003) analyzed self-report data from a national sample of 1,258 white and African-American adults at least 66 years of age to determine if either praying for other people or praying for material things buffered the negative effects of financial strain on physical health status. Hierarchical regression analysis utilized self-rated health as the outcome variable and age, sex, education, marital status, race, and church attendance as control variables. Financial strain, prayer for others, prayer for material things, financial strain \times prayer for others, and financial strain \times prayer for material things were utilized as predictors. The findings revealed no relationship between prayer for material things and alleviation of the burden of financial strain on physical health. However, individuals who were characterized by often praying for others experienced a 48% reduction in the relationship between financial strain and health problems. To be sure, financial strain still predicted deleterious health outcomes but to a much lesser extent among those who frequently prayed for others.

A subsequent analysis of this same data set (Krause 2004) revealed that attitudes or expectancies toward prayer may also be important variables relating to psychological outcomes, in this case self-esteem. Krause found that feelings of self-esteem were highest when older adults believed that only God knows when and how to best answer prayer. Self-esteem was lower among those who

expected prayers to be answered immediately and believed that they get what they ask for.

This sampling of research suggests that the content of prayer may play an important role in determining the strength and nature of relationships between prayer and health variables. It also suggests that in some cases prayer content may interact with frequency of prayer in determining health relationships. This kind of sophisticated analysis, i.e., assessment of how variables such as frequency of prayer and content of prayer may interact or moderate the effects of each other, is long overdue.

Prayer as Coping Strategy

Implicit within the current discussion of prayer is the concept of prayer used as a way of coping with negative or stressful life events. Again, several hypotheses are plausible. Perhaps individuals who turn to prayer as a way of coping could be characterized as engaging in a passive coping process that fails to utilize more active or direct coping strategies that in many cases could prove more effective at alleviating distress. Alternatively, selective use of prayer as a coping strategy might suggest that prayer is effectively used for coping with relatively uncontrollable stressors and that individuals who pray to God gain relief from the stress associated with these events and at the same time are capable of more directly addressing stressors that are amenable to amelioration.

The information conveyed in the opening paragraphs of this article attests that prayer is an often used practice to cope with illness or physical symptoms and McCullough and Larson (1999) noted that prayer is, in fact, more likely to be used as a coping resource when problems are more severe, chronic, or unresponsive to other treatments or interventions. However, there is evidence of prayer being utilized to cope with even transient stressors. Selim (2001) studied 60 Egyptian patients about to undergo magnetic resonance imaging. The study was designed to test the effects of a set of instructions on anxiety reduction; however, Selim found that 60% of the sample spontaneously used prayer as a way to cope with the anxiety that the procedure engendered. Similarly, Neighbors et al. (1983) found that 44% of a sample of African Americans identified prayer as the one coping response that was most helpful when dealing with a serious personal problem.

Not all the evidence regarding prayer and coping is positive. Lawson et al. (1990) studied prayer among 620 chronic pain patients using the Coping Strategy Questionnaire and found that prayer loaded on a factor characterized by attempts to cope with pain by avoidance through mental distraction, a generally less effective technique. However, later examination of the particular wording of the prayer items revealed that they included phrases that necessarily

linked prayer with wishing or hoping, i.e., less active and generally less effective coping strategies. Recently, Rippentrop et al. (2005) investigated predictors of mental and physical health among 122 chronic musculoskeletal pain patients. Contrary to their expectations, they found that private religious experiences (private prayer, meditation, Bible reading) predicted worse physical health outcome as measured by the SF-36 but were not related to mental health outcomes or pain intensity. Though their data did not afford them the ability to clarify the direction of this relationship, the authors hypothesized that worse health led to increased use of private religious experiences as coping devices.

Finally, Pargament (1997) and others (McIntosh and Spilka 1990) hypothesized that prayer may be part of three different religiously based approaches to coping that likely lead to varying health outcomes depending on the nature of the stressor and corresponding appropriateness and effectiveness of the coping response. The first of these is the deferring style which is characterized by use of prayer as a method of leaving the outcome up to God and thereby eliminating any responsibility for human action. Though this style may be effective in situations in which there is truly no effective human response, it is generally believed to lead to less effective coping. The collaborative style is exemplified when the supplicant continues to pray regarding ways to cope with the stressor and expects that God will aid in this process but the individual offering the prayers also uses them as a way to keep himself or herself motivated and working to find solutions to, or ways to cope with, the problem. Finally, the self-directive approach acknowledges God's relevance but prayer is not needed as the individual is able to personally assume control for remedying or coping with the situation. Research verifying which coping style is most effective is complicated by a variety of factors, notably the different nature of different stressors and the varying ability of individuals to utilize whatever coping approach is implemented. As a broad generalization it appears that better outcomes are associated with the collaborative style followed by the self-directive and finally the deferring (Spilka et al. 2003). Clearly a highly developed model of prayer as coping will include integration of other aspects of the individual's personality, cognitive abilities, physical skills, and socio-environmental context.

Research Agenda for the Study of Prayer and Health

We now turn our attention from an examination of previous research on prayer and health to thoughts on what we think might be promising avenues for future studies. We are excited about the future of prayer-health research

for several reasons. First, it is very clear that prayer is a common practice among a large percentage of the population and many consider it relevant, even important, for their health. Given the long-standing historical traditions in which prayer is embedded and the empirical research showing that prayer activity among the population has changed little over decades, it seems certain that widespread engagement in prayer will continue. Thus, the relevance of studying prayer based on its prevalence among the population is likely to remain high for many years. Second, we are encouraged to continue studying prayer based on the composition of the existing body of literature, both because of what it contains and what it lacks. This research has established a foundation for work in the area, provided reasonable initial investigation of pertinent questions, and demonstrated models of increasing methodological sophistication as studies begin to control or otherwise account for numerous potential confounds and moderating variables. But the research is also quite limited in scope and lacking in depth, leaving open many lines of research to be studied with a variety of methods. Finally, the *zeitgeist* is currently favorable for supporting continued investigation of prayer and health relationships. Whether this remains the case will likely depend on several factors, most importantly, the quality of studies conducted over the next several years. Consequently, this is not only an exciting time to study prayer and health issues, it is also a critical juncture for the future of this area of investigation.

Smith (2001) recently discussed future research pathways for religion and spirituality as related to the science and practice of health psychology. Much of what he discussed remains relevant and is specifically applicable to the prayer and health domain. Interested readers are referred to his comprehensive and excellent discussion. One particularly salient point from Smith's work is the need for empirical studies based on clear conceptual models that include precise operational definitions and psychometrically sufficient measures. In the current prayer literature, the distant intercessory prayer research is notable for its lack of such careful model development whereas work in areas such as prayer content and prayer as coping shows evidence of the emergence of conceptually driven research. We encourage more explicit development of lines of research that are supported by careful theoretical conceptualization. Though atheoretical individual findings linking prayer and particular measures of health can be important, greater research yield and subsequent practical relevance is likely to come from studies that are housed within an integrated nexus of theoretical ideas and empirical data. A starting point is for investigators to provide greater clarity and specification of explicitly hypothesized relationships between independent

and dependent variables. For example, it seems unlikely that effects attributed to particular prayer content are the same across differing health-relevant dependent variables or between differing populations. Thus, prayer reflecting deference to God, for example, may be hypothesized to show better outcomes on measures of coping among terminally ill samples than among those afflicted with a chronic but benign condition (e.g., chronic low back pain). Alternatively, there may be some types of prayer that could be hypothesized as being universally beneficial. Voluntary prayer for the health of others may be one example. This type of prayer could be conceptually linked to the theoretical and empirical literature on volunteerism (e.g., Oman et al. 1999). From a cognitive perspective, mental focus on improving the health of others during prayer may impact the supplicant by enhancing experienced empathy, increasing supportive relationships, and lessening the internal focus on one's own health or social problems. Explanatory models could be developed that depict these relationships and serve as guides for incorporation of measures of moderating and mediating constructs within varying research designs. In this manner, future intercessory prayer studies are warranted, but only within the context of carefully designed investigations based on models that explicate mechanisms describing how prayer for someone else may influence the intercessor's health and functioning.

In addition to the importance of the development of theoretically driven models there is a corresponding need to focus on the fit between research questions and methodologies and for greater diversity of methods. Nearly all of the research that has been conducted to date (with the exception of the intercessory prayer studies) has been observational. This type of research is important in the early stages of inquiry as it provides a relatively economical and efficient way to establish whether hypothesized relationships exist. There is no need to conduct sometimes difficult and expensive studies of potential mechanisms of action if there is no action! Nevertheless, observational studies have their limits, and these limits are particularly noteworthy in the prayer literature. The most basic underlying question that pervades interest in the prayer topic is "does prayer influence health." Observational studies, however, can only inform as to whether prayer (frequency, type, etc.) is *related* to health but they do not allow for the conclusion that prayer actually *influences* health. Not only is the chicken-egg issue problematic in cross-sectional observational studies but the potential influence of third variables such as personality, familial environment, exposure to early role models, etc. cannot be entirely controlled. McCullough (1995), for example, offered the intriguing hypothesis that "spiritual maturity" may be a third variable that

influences prayer frequency, prayer content, and health outcomes. The challenge to define spiritual maturity, develop a measure of it that is complete with evidence of discriminant validity, and then include this measure in studies has yet to be done but this provides an interesting example of a construct worthy of further investigation in this regard.

As we noted earlier, we encourage greater utilization of longitudinal studies that incorporate baseline measures of conceptually important constructs. Though longitudinal studies are observational, they have many characteristics that make them appealing in this field of inquiry. First, they provide greater understanding of the temporal relationships among variables, particularly when measures are obtained at frequent intervals. In the prayer and health literature this feature is potentially quite important in helping sort out the effects of *health on prayer*. Longitudinal studies with frequent assessment may also inform regarding the dynamic practice of prayer and how it changes across time and relates with concurrent life events. For example, there may be identifiable patterns of prayer that may be observed among people across time. Some individuals may consistently demonstrate the same frequency and content of prayer regardless of circumstances whereas the prayer patterns of others may be highly contingent on situational factors. Can such patterns be identified and if so, are there reliable health differences between individuals characterized by these different patterns of prayer? Longitudinal studies based on theoretical models that incorporate carefully chosen measures of control, moderating, and mediating variables may also provide data addressing the potentially complex interactions among these phenomena.

The above paragraph addresses longitudinal studies that cover extended time periods. Studies utilizing ecological momentary assessment techniques can provide a type of naturalistic, longitudinal data that is often, though not necessarily, of shorter duration (usually one month or less) but greater intensity (perhaps recorded several times per day). In these studies participants are asked to record data on hand held computer devices. The frequency and schedule for data recording varies according to the research protocol and may be either time or event contingent. Ecological momentary assessment allows for relatively unobtrusive data collection that can be more sophisticated than is often obtained via paper forms. Due to the use of computer technology, a major advantage of the technique is the capability of the investigator to know *when* the data input actually occurred. This is a valuable tool that, when combined with ambulatory measures of physiological function (e.g., blood pressure, blood glucose), can provide important information on temporal relationships of variables. This research has been introduced in the prayer

literature (Exline et al. 2005) and we see multiple possibilities for its greater utilization.

Finally, though observational studies have their place, a mature research literature on prayer and health must include experimental inquiries. We recognize the practical difficulties of conducting this research and the possible ethical issues that must be considered. Further, we are aware of the epistemological limits of even the best designed experimental investigations. But we believe that many questions in the area of prayer and health will ultimately be best addressed through the use of experimental methods. The difficulties in conducting this research may be analogous to those encountered when designing an exercise intervention study. To begin, the investigator must find a sample of individuals who are not currently exercising or are exercising at less than desirable levels and are willing to engage in a study where they might be asked to increase their regular exercise. The subjects must also be willing to be randomized to various groups and the investigator has to determine the extent to which the subjects exercise during the study and whether they follow the dictates of the interventions. Carefully chosen, non-reactive, outcome measures must be utilized and certain control variables need to be included. The generalizability of findings is, of course, limited to the particular constructs and populations sampled. As pertains to prayer, obviously it can only be studied among those willing to pray. But similarly medicine can only be studied among those willing to ingest it and therapy among those willing to undergo it. Nevertheless, the difficulties of studying prayer in an experimental manner are formidable and require careful attention to the culturally relevant values and practices of those being asked to participate in order to conduct the research in a sensitive and non-trivial manner. It will not be easy, but these studies can also provide important data not obtainable in other ways. For example, a study in which groups are assigned to increased prayer for others versus increased prayer for self conditions would have obvious interpretive power. Conduct of these studies among various samples (e.g., certain denominations, intrinsic versus extrinsic religious orientations, spiritually mature vs. spiritually immature, etc.) would further add to the specificity in the literature.

Space precludes further discussion of the many exciting possibilities in this area but we are confident that thoughtful investigators will conceive of possibilities well beyond those stated here. We encourage the application of increasingly rigorous designs to address specific theoretically driven hypotheses and are optimistic that future research on prayer and health will build on the existing foundation in ways that illuminate, challenge, and stimulate critical thought and research.

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