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Long-term Adjustment After Surviving Open Heart Surgery: The Effect of Using Prayer for Coping Replicated in a Prospective Design

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Purpose: Despite the growing evidence for effects of religious factors on cardiac health in general populations, findings are not always consistent in sicker and older populations. We previously demonstrated that short-term negative outcomes (depression and anxiety) among older adults following open heart surgery are partially alleviated when patients employ prayer as part of their coping strategy. The present study examines multifaceted effects of religious factors on long-term postoperative adjustment, extending our previous findings concerning prayer and coping with cardiac disease. ***Design and Methods:*** Analyses capitalized on a preoperative survey and medical variables from the Society of Thoracic Surgeons' National Database of patients undergoing open heart surgery. The current participants completed a mailed survey 30 months after surgery. Two hierarchical regressions were performed to evaluate the extent to which religious factors predicted depression and anxiety, after controlling for key demographics, medical indices, and mental health. ***Results:*** Predicting lower levels of depression at the follow-up were preoperative use of prayer for coping, optimism, and hope. Predicting lower levels of anxiety at the follow-up were subjective religiousness, marital status, and hope. Predicting poorer adjustment were reverence in religious contexts, preoperative mental health symptoms, and medical comorbidity. Including optimism and hope in the model did not eliminate effects of religious factors. Several other religious factors had no long-term influences. ***Implications:*** The influence of religious factors on the long-term postoperative adjustment is independent and complex, with mediating factors yet to be determined. Future research should investigate mechanisms underlying religion–health relations.

Key Words: Depression, Anxiety, Cardiovascular diseases and surgery, Religion, faith, and spirituality, Intended use of private prayer for coping, Reverence, Optimism and hope

Open heart surgery is a highly stressful event in middle age and late life, which has life-altering effects linked with negative emotions, such as prolonged depression and anxiety predicting worse clinical prognoses (Pignay-Demaria, Lesperance, Demaria, Frasure-Smith, & Perrault, 2003). Combating mental health comorbidity in cardiac surgery patients is of considerable clinical and public interest. The prevalence of comorbid depression, anxiety, and distress in coronary heart disease (CHD) has been well documented (Carroll, Phillips, & Der, 2007; Lichtman et al., 2008). To date, more than

100 studies have evaluated the link between depression and CHD and have reported a prevalence of 20%–35% in various samples (Lett, Blumenthal, & Babyak, 2004; Lichtman et al., 2008; Rumsfeld & Ho, 2005). In 1,052 German cardiac patients, symptoms of anxiety were a strong predictor for subsequent adverse cardiovascular events (Rothenbacher, Hahmann, Wusten, Koenig, & Brenner, 2007). These facts underscore the need to learn more about patients' coping and protective factors with respect to their impact on long-term adjustment in order to inform interdisciplinary preoperative intervention.

Evidence from longitudinal data documented the high level of individual stability in religious involvement over the course of adult life and the well-grounded roles of spirituality maintained in the United States, alongside its population aging (Dillon & Wink, 2007). In large-sample studies, church attendance predicted lower mortality for at-risk cardiac populations (Miller & Thoresen, 2003). Behavioral investigation in more advanced clinical conditions (e.g., open heart surgery), however, has seldom investigated the long-term effect of multifaceted religious factors. To fill the gap, this study examined the complicated influences of preoperative religious factors on the adjustment of middle-aged and older patients 30 months after open heart surgery. In particular, an earlier finding concerning the protective role of prayer in adjustment 1 year after coronary artery bypass graft (CABG) surgery (Ai, Dunkle, Peterson, & Bolling, 1998), which has not been replicated over a decade, was examined.

Mental Health Comorbidity in Open Heart Surgery Patients and Complex Effects of Religious Factors

The review of psychosocial outcomes following cardiac surgery by Duits and colleagues (1997) and Pignay-Demaria and colleagues (2003) indicated that anxiety and depressive symptoms predict postoperative maladjustment, including new cardiac events and rehospitalization. For patients undergoing open heart surgery, the incidence of depression varies considerably among studies between 7.5%–47% and 19%–61% postoperatively (Duits, Boeke, Taamms, Passchier, & Erdman, 1997), yet, depressive symptom levels remained stable before and after surgery (Andrew, Baker, Kneebone, & Knight, 2000; Duits et al., 1997). Even after 1 year postoperation (Boudrez & De Backer, 2001), such symptoms have been found to predict postoperative cardiac events (unstable angina, acute myocardial infarction, repeat CABG, and angioplasty) and death. Recent studies documented perioperative depressive symptoms in up to 25% of 963 CABG patients, which contributed to impaired function 1 year after surgery (Mallik et al., 2005).

Among patients undergoing open heart surgery, however, better postoperative short-term outcomes have been associated with intrinsic and inner experience-related religious factors (e.g., strong beliefs, private prayer) but not church attendance (Ai, Park, Huang, Rodgers, & Tice, 2007; Contrada et al., 2004; Oxman, Freeman, & Manheimer, 1995). This may be because severe illnesses restrict old and/or sick adults' capacity to attend a place of worship, leaving them to depend more on private religious coping. Prayer use in CABG patients, regardless of church attendance, appeared to ameliorate distress 1 year postoperatively (Ai et al., 1998) and reduce postoperative complications (Ai, Wink, Tice, et al., 2009). Rather than this being an issue of underrepresentation, it also may simply be that factors of intrinsic religiosity are better predictors of recovery than are extrinsic factors. These findings call attention to the need for additional investigation of the role of multifaceted religious factors in the long-term adjustment of cardiac patients.

Prayer and the Health-Related Coping Experience

In the face of life-altering operations that frequently accompany advanced stages of cardiac disease, private prayer can be a unique coping resource for patients. Practicing prayer is common according to both national surveys (Levin & Taylor, 1997; Poloma & Pendleton, 1991) and clinical research on coping with health crises (Ai, Peterson, Bolling, & Koenig, 2002; Ai et al., 1998; Contrada et al., 2004). From a psychological perspective, one important definition of prayer dates back to James (1901–1958) who did not view it simply as a quantifiable act. James asserted that the idiosyncratic event of prayer is a perceived "inward communion or conversation with the power recognized as divine" and is "the very soul and essence of religion" (p. 352). As such, in using prayer, the practitioner could find comfort from a sacred interconnectedness in one's faith or a sense of meaning in the midst of distress (Ai, Tice, & Kelsey, 2009). Such experiences may help improve health-related well-being (Levin, 2004) or increase the likelihood of long-term adjustment in this case. It should be noted that this characterization of prayer encompasses not only Judeo–Christian prayers but also prayers of other faith traditions.

Pargament (2002) proposed that faith-based coping is most likely to have salutary effects if it creates intrinsic motivation. Allport and Ross (1967, p. 434) once claimed, " . . . . the intrinsically motivated *lives* his religion." Stated differently, intrinsic religiousness offers meaning, guiding principles, and motivations for one's life. The use of prayer to cope may reflect a survival intention in patients who were motivated to strive in combating severe heart disease (Ai et al., 1998, 2002). The "inward communion or conversation with the power recognized as divine" (James, 1901–1958, p. 352), via prayer, could provide meaning, which might lessen depression, thereby paving a way to better long-term adjustment. This hypothesis is yet to be tested.

Gaps to be Addressed

Certain design weaknesses, however, existed in the earlier study concerning prayer among CABG patients (Ai et al., 1998), including the simple measure of prayer, a partial retrospective design, the lack of control for objective medical indices, a shorter "follow-up" (1 year), and not examining potential mechanisms underlying the prayer effect. To address the major assessment gap and the consistent criticism on faith–health research (i.e., using single-item frequency measures; Hill & Pargament, 2003; Levin, 2004), we developed a consciousness-oriented (experience, appraisal, and intentionality) scale. It was designed to assess the precrisis intent to use prayer for coping in the month prior to open heart surgery based on an individual's experiences with and appraisal of its efficacy (Ai et al., 2002).

Another gap in this research area concerns the mechanism underlying the faith–health effect (Hill & Pargament, 2003). Regarding how the use of prayer for coping affects health, sociologists and epidemiologists speculated that prayer may exert salutary impacts through its distress-deterrent effect (for a review, see Levin, 2004). Even so, experts note that the faith–health connection is more complicated than generally expected (Miller & Thoresen, 2003). For example, the role of pursuing prayer for coping may manifest over time, whereas its short-term effect during health crises could be well confronted by the salient use of the act itself in severe crises (Ai, Peterson, Bolling, & Rodgers, 2006; Ai, Tice, Peterson, Huang, & Bolling, 2009). Positive attitudes (e.g., optimism and hope) may serve as another explanation for the effects of prayer on health (Ai et al., 2002).

As assessed by the Life Orientation Test (LOT), dispositional optimism is defined as the global expectation that good things will be plentiful in the future (Hirsch, Britton, & Conner, 2009; Scheier & Carver, 1992). As assessed by the Hope Scale, hope is defined as the belief that one has the determination to realize one's desired expectations and the ability to sustain movement along those selected pathways (Snyder et al., 1991; Snyder, 2000). Compared with optimism, the latter evaluates state-specific feelings of hope (Kortte, Veiel, Batten, & Wegener, 2009) and more hope is seen to be more outcome oriented (Ai, Peterson, Tice, Bolling, & Koenig, 2004). Therefore, as defined by our measures, optimism is a more enduring characteristic and hope is more dependent on the current situation or state. Research evidence has accumulated to prospectively link these measures with good health outcomes, including cardiovascular health (Giltay, Geleijnse, Zitman, Hoekstra, & Schouten, 2004; Maruta, Colligan, Malinchoc, & Offord, 2000; Peterson & Bossio, 1991; Peterson, Seligman, & Vaillant, 1988; Peterson, Seligman, Yurko, Martin, & Friedman, 1998; Tindel et al., 2009). Thus far, not many investigators have yet evaluated the social and spiritual sources of such attitudes (Ladd & McIntosh, 2008; Peterson, 2000).

The Present Study

Following preplanned steps, the current analysis used hierarchical regressions on the long-term follow-up data for a sample of patients who underwent open heart surgery, for whom short-term outcomes had been published (Ai et al., 2006, 2007, Ai, Tice, & Peterson, 2009, Ai, Pargament, Kronfol, Tice, & Appel, 2010). As can be noted, cases involved in the current analysis were those individuals we could locate and who had survived around 30 months after open heart surgery. To inform early intervention, our primary objective was to explore whether intrinsic religious factors, assessed preoperatively, had independent long-term effects, above and beyond that of key confounders and known predictors of surgical outcomes. The sets of factors controlled in the first three steps of hierarchical regression included demographics (Levin & Taylor, 1997), preoperative objective medical factors (left ventricular ejection fraction [LVEF]), subjective health, and mental health indicators (e.g., comorbidity, depression, positive attitudes; Ai et al., 2007, Ai, Tice, & Peterson, 2009, Ai, Pargament, Kronfol, Tice, & Appel, 2010).

Previous findings (Ai et al., 2002, 2007; Oxman & Hull, 1997) suggested optimistic expectations and

perceived social support as potential mediators. Our secondary objective was to test the mediation in the link between religious factors and long-term adjustment (i.e., depression and anxiety), as underlying mechanisms. The three mediators (perioperative social support, optimism, and hope) were thus entered into models in the last step. We also assessed measures of faith-based involvement, such as behavioral frequencies in public, private, and subjective religiousness (Chatters, Levin, & Taylor, 1992); positive and negative religious coping (Pargament, Smith, Koenig, & Perez, 1998); and the sense of reverence, a contextualized sacred emotion (feeling reverence in religious or secular contexts; Ai, Wink, Tice, Bolling, et al., 2010). Similar to the literature on short-term outcomes (Ai et al., 2007, Ai, Wink, Tice, Bolling, et al., 2010; Contrada et al., 2004), mixed religious effects were expected.

Method

Procedure

Participants were a convenience sample of patients who completed a mailed survey 30 months after surviving nonurgent and nontransplant open heart surgery at the University of Michigan's Medical Center. This follow-up study capitalized on the preoperative data collected from middle-aged and older patients who underwent open heart surgery and participated in a two-wave preoperative survey (Ai et al., 2002). The first wave conducted by trained interviewers assessed demographic backgrounds, religious affiliation and all religious factors, medical comorbidities, and mental health symptoms (depression and anxiety) within 2 weeks of surgery. The second wave assessed psychosocial protectors via telephone (optimism, hope, and social support). No statistical differences were found between consenters and nonconsenters. Subject eligibility criteria and the survey information were reported earlier (Ai et al., 2002, 2007). Standardized medical data were obtained from the Society of Thoracic Surgeons' (STS) database. At the 30-month follow-up, depression, anxiety, optimism, and hope were reassessed. All procedures in the initial and follow-up surveys were approved by the University of Michigan's Institutional Review Board.

The Sample

For this long-term follow-up, we were able to reach and gain consent from 262 participants from the initial sample (429 patients), who survived open heart surgery and completed the above two-wave preoperative survey. Eligibility criteria were presented in the earlier report (Ai et al., 2002). The types of surgery included nonemergent CABG, aneurysm repairs, and valve repair or replacement. All these procedures required the use of a heart–lung machine. The majority of the follow-up sample was male (62%), Caucasian (92%), Judeo–Christian (86%), and currently married or living with somebody (77%). The average age was 62 (SD = 11.88). Average education was 14 years (SD = 3.43).

Measures

Among the measures employed, most have demonstrated reliability and validity in multiple samples. The exceptions to this are the using private prayer for coping and sense of reverence indices, which have only been employed in a few publications. Although the extent of their reliability and validity is not yet fully established, they do possess high face validity.

Adjustment was operationalized as depression and anxiety. Depression was measured with the 20-item Center for Epidemiological Studies–Depression Scale (Radloff, 1977) with individual items scored on a 4-level scale (preoperative: M = 12.63, SD = 9.88, α = .88 and postoperative: M = 12.40, SD = 9.69, α = .89). Anxiety was measured with the 20-item Trait Anxiety Inventory (STAI Form X-2), part of the State-Trait Anxiety Inventory (Spielberger, 1983) with individual items scored on a 4-level scale (preoperative: M = 36.57, SD = 10.84, α = .91 and postoperative: M = 35.32, SD = 10.33, α = .88).

Perceived social support was measured with the 12-item Multidimensional Scale of Perceived Social Support (Zimet, Powell, Farley, Werkman, & Berkoff, 1990), measuring perceived support from family, friends, and significant others, with individual items scored on a 4-level scale (M = 62.21, SD = 7.80, α = .89).

Positive attitudes were operationalized as optimism and hope. Optimism (dispositional) was measured with the 12-item LOT (Scheier & Carver, 1985). Patients were asked about the extent to which they agree with each statement in the prior month on a 5-level scale (preoperative: M = 22.38, SD = 4.27, α = .73 and postoperative: M = 21.93, SD = 5.15, α = .83). Hope (situational) was measured with the 12-item Hope Scale (Snyder et al., 1991), which asks participants to report how they felt about each statement in the prior month on a 5-level

scale (preoperative: $M = 31.12$, $SD = 4.10$ $\alpha = .81$ and postoperative: $M = 29.96$, $SD = 5.24$, $\alpha = .88$).

Religiousness was measured with the 11-item Religiosity Scale (Chatters et al., 1992), which measures: public religiosity ($M = 11.22$, $SD = 4.73$, $\alpha = .87$), private religiosity ($M = 10.16$, $SD = 3.84$, $\alpha = .78$), and subjective religiosity ($M = 6.00$, $SD = 1.73$, $\alpha = .88$).

Prayer coping was assessed with the three-item Using Private Prayer for Coping index (Ai et al., 2002). Patients were asked the extent to which they agreed with each of the following statements: (a) "Prayer is important in my life"; (b) "Prayer does not help me to cope with difficulties and stress in my life" (reverse scored); and (c) "I will use private prayer to cope with difficulties and stress associated with my cardiac surgery." All questions were scored on a 4-level scale ($M = 3.35$, $SD = 0.80$, $\alpha = .89$).

Religious and spiritual coping styles were measured with the 14-item Brief Religious/Spiritual Coping scale (R-cope; Pargament et al., 1998), scored on a 4-point scale with two factors: positive styles (e.g., spiritual connection, seeking spiritual support, forgiveness; $M = 11.90$, $SD = 6.44$, $\alpha = .94$) and negative styles (e.g., spiritual discontent, punishing God reappraisals, spiritual discontent collaborative; $M = 1.23$, $SD = 2.59$, $\alpha = .86$).

The sense of reverence was assessed with the sum of yes or no answers to a checklist of eight circumstances in response to one question ("Under what conditions do you feel reverent?") developed by the investigators to reflect main contexts in which individuals experienced sacred feelings (Ai, Wink, Tice, Bolling, et al., 2010) with two factors (four item each): religious reverence (attending religious services, reading the Bible or watching religious programs, private prayer, meditation; $M = 2.71$, $SD = 1.32$, $\alpha = .72$) and secular reverence (sight seeing or being in nature, enjoying music or art, being loved or supported, and serving others; $M = 2.79$, $SD = 1.28$, $\alpha = .68$).

Medical comorbidities were measured with the sum of yes or no answers to a checklist of 17 chronic conditions, commonly seen in geriatric clinics (e.g., diabetes, arthritis; $M = 2.65$, $SD = 2.63$).

Key cardiac indices were two cardiac function indicators, assessed 2–4 weeks preoperatively, in the STS National Database. LVEF indicates the percentage of blood emptied from ventricle at the end of cardiac contraction, obtained from angiography (lower rates indicating poor function; $M = 52.58$, $SD = 12.95$). New York Heart Association Classification (Class NYHA) is the highest association level leading to episode of hospitalization and/or procedure (lower levels indicating better function; Level 1 = 39.3%, 2 = 34.7%, 3 = 23.7%, and 4 = 1.5%).

Demographics included age (years), gender (0 = *male*, 1 = *female*), race (0 = *others*, 1 = *White*), and marital status (0 = *all other status*, 1 = *married with spouse present or live with significant others*).

Statistical Analysis

Survey data were entered using computerized double-entry system to ensure quality. Before multivariate analyses, log transformation was used to remove the positive skewness of depression and anxiety in order to synchronize their distributions to those of other measures. Bivariate analysis was employed to detect correlations among predictors of major interest and controls. To demonstrate the direct religious effects above and beyond that of existing predictors, two hierarchical regression analyses were performed on depression and anxiety at the follow-up period. The main effects of preoperative predictors were estimated following the preplanned steps: (1) demographics; (2) two key medical indices; (3) self-reported medical comorbidity, psychological symptoms (depression or anxiety), and protectors (optimism, hope, and social support); (4) major religious factors (three-factor religiousness, tendency to use prayer for coping, sense of reverence, and positive or negative R-cope); and (5) mediators (follow-up optimism and hope). All tests were two tailed with significance level set at $p < .05$. Collinearity statistics were inspected, using a conservative value of variance inflation factors (VIF) of 4.

Results

Descriptive Data and Bivariate Correlations Among Major Predictors

Descriptive data of factors involved in this study are shown in Table 1. Of note is the fact that the scores for this particular sample fall below the objective midpoint for illness measures as well as depression and anxiety both preoperatively and postoperatively. The respondents are also well above the objective midpoint for hope, optimism, and most of the religious indices.

Bivariate correlations are presented in Table 2. Concerning the outcome measures, postoperative depression and anxiety are highly correlated ($r = .75$, $p < .001$) and both related to the same set of non–religious-based bivariate correlates (Table 2). These included non-White ($r = -.15$, $p < .05$), no living partners ($rs = -.14$ to $-.17$, $ps < .01$), medical

Table 1. Descriptive Data

	M	*SD*
Age	62.15	11.87
LVEF	52.58	12.94
Medical comorbidity	2.65	2.63
Preoperative anxiety	36.57	10.84
Preoperative optimism	22.38	4.27
Preoperative hope	31.12	4.10
Perceived social support	62.21	7.80
Prayer coping	3.35	0.82
Public religiousness	11.22	4.73
Private religiousness	10.16	3.84
Subjective religiousness	6.00	1.73
Religious reverence	2.71	1.32
Secular reverence	2.79	1.28
Positive religious coping	11.90	6.44
Negative religious coping	1.23	2.59

comorbidity (*r*s = –.27 to –.32, *p*s < .01), and preoperative symptoms (*r*s = –.49 to –.65, *p*s < .01) of pessimism, hopelessness, and lack of social support (*r*s = –.18 to –.45, *p*s < .01). As for religious-based correlates, however, depression was linked with two forms of reverence and two forms of religious coping (*r*s = .15–.19, *p*s < .05–. 01), whereas anxiety was related only to negative religious coping (*r* = .23, *p* < .01). Positive religious coping was correlated with the intent to use prayer for coping and subjective and nonorganizational religiousness at moderately high levels (*r*s = .70–.73, *p*s < .01), whereas other religious measures were moderately correlated (*r*s = .13–.69).

As mediators, optimism and hope were both inversely correlated with negative religious coping (*r*s = .25–.31, *p*s < .01), whereas optimism positively related to prayer-based coping (*r*s = .15, *p* < .05). Religious factors were uncorrelated with medical indices, except that medical comorbidity related to private religiousness and two forms of religious coping (*r*s = .13–.16, *p*s < .05). All religious factors correlated with being female (*r*s = .13–.29, *p*s < .05–.01) and non-White (*r*s = –.14 to –.21, *p*s < .05–.01), except that no relation emerged between race and secular reverence. Older age related to public and subjective religiousness (*r*s = .13–.16, *p*s < .05), whereas no living partners correlated with private religiousness and negative religious coping (*r*s = –.13 to –.18, *p*s < .05). Further analyses showed that being female correlated with no living partners, Class NYHA, medical comorbidity, and preoperative symptoms (*r*s = .15–.29, *p*s < .01). Older age correlated with medical comorbidity (*r* = .13, *p* < .05) but less anxiety (*r*s = .16–.29, *p*s < .01), whereas non-White status related to less of both (*r*s = –.14 to –.15, *p*s < .05). No living partners correlated with less comorbidity, depression, and anxiety (*r*s = –.16 to –.18, *p*s < .05). Among the medical indicators, LVEF inversely correlated with Class NYHA (*r* = –.30, *p* < .01).

Prediction of Depression

Table 3 shows hierarchical regression analyses predicting depression at follow-up. Predictors were entered into the equation following the predetermined five steps. In Step 1, among demographics, only race significantly predicted depression 30 months after surgery, accounting for about 5.5% of the variance. Minority patients were more likely to be at risk of depression than their White counterparts. The race result held on Step 2 after two key medical indices were added to the model. LVEF and Class NYHA were unrelated to depression, and the R-Square change was not significant. In Step 3, addition of the initial self-reported comorbidity and preoperative psychosocial factors reduced the magnitude of the race effect to a marginal level. Preoperative depression and hope related to follow-up propensity for depression, whereas medical comorbidity and optimism had marginal effects. Social support had no influence. Patients with poor self-reported health and at risk of depression preoperatively tended to be more depressed at the follow-up, whereas those with higher hope were less likely to be depressed. The R-Square change, accounting for an additional 23.8% of the variance, was significant.

In Step 4, entry of religious factors did not alter most patterns but eliminated the race effect while enhancing the influence of optimism. Among all new factors, favoring prayer as a coping strategy was inversely associated with depression, whereas religious reverence positively related to depression. Patients who intended to use private prayer for coping with open heart surgery were less depressed, but those who experienced reverence in religious contexts were more likely to report depression at follow-up. The R-Square change, accounting for an additional 6.5% of the variance, was significant. In Step 5, to determine the mediation, follow-up positive attitudes were entered in the final model, accounting for 46% or the variance, $F(21, N = 200) = 7.268$, $p < .001$, $R^2 = .46$. Optimism, but not hope, inversely related to depression. Adding mediators diminished the influence of preoperative attitudes but only slightly reduced that of prayer coping (from $\beta = -.28$, $p < .01$ to $B = -.24$, $p < .05$). The role of religious reverence and other

Table 2. Correlations Among Factors

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Gender	−.00	−.01	−.29**	.20**	.00	.24**	.17**	.15*	−.10	−.09	.01	.24**	.15*	.35**	.29**	.13*	.21**	.29**	.17**	.08	.10
2. Age		.05	−.08	.10	−.03	.13*	−.07	−.14*	.05	.00	.01	.03	.16**	.05	.13*	.11	.07	.13	−.09	.00	−.11
3. Race			.03	−.01	.01	−.15*	−.12	−.14*	.11	.16*	.02	−.11	−.16*	−.21**	−.14*	−.15*	−.11	−.14**	−.21**	−.15*	−.15*
4. Marital status				−.07	−.03	−.16**	−.18**	−.17**	.12	.05	.15*	.01	−.02	−.13*	−.08	−.06	−.11	−.08	−.18**	−.14*	−.17**
5. Class NYHA					−.30**	.12	.09	.00	.01	−.01	.04	.03	−.01	.07	.11	.03	.09	.08	−.05	.12	.08
6. LVEF						−.11	−.10	−.05	.08	.00	.11	.06	−.04	−.10	−.09	−.04	−.05	−.09	−.02	−.10	−.12
7. Medical comorbidity							.36**	.30**	−.17**	−.16*	−.09	.03	.00	.13*	.09	.08	.07	.16*	.15*	.32**	.27**
8. Preoperative depression								.78**	−.42**	−.27**	−.22**	−.01	−.03	.10	.02	.07	.09	.08	.27**	.49**	.57**
9. Preoperative anxiety									−.51**	−.35**	−.18**	.06	.04	.14*	.06	.12*	.03	.12	.32**	.52**	.65**
10. Preoperative optimism										.51**	.36**	.09	.06	.01	.06	.03	.01	.08	−.39**	−.35**	−.44**
11. Preoperative hope											.38**	.00	.06	−.05	.08	.02	.07	.01	−.30**	−.32**	−.44**
12. Preoperative social support												.15*	.17**	.14*	.15*	.12	.10	.20**	−.32**	−.18**	−.27**
13. Preoperative prayer cope													.57**	.66**	.69**	.60**	.29**	.70**	.09	−.01	.04
14. Public religion														.67**	.68*	.66**	.30**	.60**	.12	.03	.03
15. Private religion															.69**	.62**	.41**	.73**	.19**	.12	.12
16. Subjective religion																.68**	.36**	.71**	.11	.04	−.01
17. Religious reverence																	.50**	.65**	.17**	.16*	.11
18. Secular reverence																		.43**	.15*	.15*	.03
19. Positive religion coping																			.13*	.15*	.05
20. Negative religion coping																				.19**	.23**
21. Post-depression																					.75**
22. Post-anxiety																					—

LVEF = left ventricular ejection fraction.
*$p < .05$. **$p < .01$.

Table 3. Hierarchical Regression Analysis Predicting Depression at the Follow-up

Variable	Step1 β (*SE*)	Step 2 β (*SE*)	Step 3 β (*SE*)	Step 4 β (*SE*)	Step 5 β (*SE*)
Gender	.022 (0.120)	.004 (0.122)	–.089 (0.110)	–.085 (0.117)	–.040 (0.110)
Age	–.003 (0.005)	–.005 (0.005)	.014 (0.004)	–.020 (0.004)	–.002 (0.004)
Race	–.198 (0.222)**	–.194 (0.222)**	–.116 (0.200)	–.093 (0.202)	–.104 (0.189)
Marital status	–.111 (0.140)	–.111 (0.140)	–.056 (0.125)	–.024 (0.124)	.025 (0.117)
Step 1, $F = 2.844$ ($df = 4$, $p < .05$)					
LVEF		–.030 (0.005)	–.025 (0.004)	.071 (0.004)	.090 (0.004)
Class NYHA		.092 (0.074)	.095 (0.066)	.092 (0.064)	.059 (0.060)
Step 2, $F = 2.279$ ($df = 6$, $p < .05$)					
Medical comorbidity			.118 (0.024)	.112 (0.024)	.138 (0.023)*
Preoperative depression			.303 (0.066)***	.277 (0.066)***	.236 (0.062)**
Preoperative optimism			–.145 (0.114)	–.161 (0.117)*	–.005 (0.120)
Preoperative hope			–.164 (0.117)*	–.168 (0.116)*	–.065 (0.126)
Perceived social support			.041 (0.088)	–.025 (0.090)	–.008 (0.084)
Step 3, $F = 7.495$ ($df = 11$, $p < .001$)					
Prayer coping				–.280 (0.108)**	–.239 (0.101)**
Public religiousness				–.010 (0.016)	–.008 (0.015)
Private religiousness				.131 (0.023)	.105 (0.022)
Subjective religiousness				–.112 (0.051)	–.086 (0.047)
Religious reverence				.204 (0.061)*	.202 (0.058)*
Secular reverence				.067 (0.045)	.052 (0.042)
Positive religious coping				.168 (0.103)	.153 (0.096)
Negative religious coping				–.112 (0.152)	–.109 (0.143)
Step 4, $F = 5.553$ ($df = 19$, $p < .001$)					
Optimism at the follow-up					–.319 (0.105)***
Hope at the follow-up					–.123 (0.108)
Step 5, $F = 7.268$ ($df = 21$, $p < .001$)					

LVEF = left ventricular ejection fraction.
*$p < .05$. **$p < .01$. ***$p < .001$.

patterns remained significant, and comorbidity became significant. The R-Square change, accounting for an additional 9.2% of the variance, was significant. All VIFs are less than 3.2.

Prediction of Anxiety

Table 4 shows hierarchical regression analyses predicting anxiety at follow-up. Predictors were entered into the equation following the same steps. In Step 1, gender, race, and married status significantly predicted at-risk anxiety 30 months after surgery, accounting for about 8.9% of the variance. Minorities, those living without partners and younger patients, tended to be anxious postoperatively, though the age effect was marginal. These patterns remained on Step 2 after two key medical indices were entered; the R-Square change was not significant. In Step 3, entry of the self-reported comorbidity and psychosocial factors decreased the effects of race and age but not of married status. Preoperative anxiety and hope related to the follow-up anxiety in opposite directions, whereas other new factors had no effects. The R-square change was significant, adding 40.1% to the variance.

These patterns remained in Step 4, while the influence of Class NYHA approached significance. Among all religious factors, subjective religiousness inversely related to less anxiety, whereas religious reverence related positively. Negative religious coping marginally related. Nonetheless, the R-Square change was not significant. Patients with stronger religiosity (subjective religiousness) or hope and those living with partners reported less anxiety, whereas those who experienced reverence in religious contexts or had greater preoperative anxiety were more likely to be anxious at the 30-month follow-up. In Step 5, to determine the mediation, follow-up positive attitudes were entered, $F(21, N = 221) = 15.744$, $p < .001$, $R^2 = .623$, and accounted

Table 4. Hierarchical Regression Analysis Predicting Anxiety at the Follow-up

Variable	Step 1 β (*SE*)	Step 2 β (*SE*)	Step 3 β (*SE*)	Step 4 β (*SE*)	Step 5 β (*SE*)
Gender	.061 (0.040)	.053 (0.041)	–.055 (0.032)	–.032 (0.034)	.017 (0.031)
Age	–.122 (0.002)	–.124 (0.002)	–.052 (0.001)	–.065 (0.001)	–.059 (0.001)
Race	–.152 (0.075)*	–.150 (0.075)*	–.056 (0.058)	–.054 (0.060)	–.062 (0.054)
Marital status	–.202 (0.047)**	–.203 (0.047)**	–.115 (0.037)*	–.114 (0.037)*	–.064 (0.033)
Step 1, $F = 5.291$ ($df = 4$, $p < .001$)					
LVEF		–.070 (0.002)	–.026 (0.001)	–.017 (0.001)	.003 (0.001)
Class NYHA		.036 (0.025)	.074 (0.019)	.088 (0.019)	.064 (0.017)
Step 2, $F = 3.826$ ($df = 6$, $p = .001$)					
Medical comorbidity			.042 (0.007)	.053 (0.007)	.084 (0.006)
Preoperative anxiety			.509 (0.065)***	.490 (0.066)***	.424 (0.060)***
Preoperative optimism			–.023 (0.035)	–.054 (0.036)	.116 (0.035)
Preoperative hope			–.211 (0.034)***	–.202 (0.035)**	–.128 (0.036)*
Perceived social support			–.042 (0.025)	.074 (0.026)	–.049 (0.024)
Step 3, $F = 18.898$ ($df = 11$, $p < .001$)					
Prayer coping				–.031 (0.029)	–.001 (0.026)
Public religiousness				.043 (0.005)	.050 (0.004)
Private religiousness				.091 (0.007)	.054 (0.006)
Subjective religiousness				–.191 (0.015)*	–.180 (0.013)*
Religious reverence				.164 (0.018)*	.181 (0.016)*
Secular reverence				.024 (0.013)	.004 (0.012)
Positive religious coping				–.033 (0.027)	–.026 (0.024)
Negative religious coping				–.100 (0.046)	–.093 (0.041)
Step 4, $F = 11.726$ ($df = 19$, $p < .001$)					
Optimism at the follow-up					–.380 (.029)***
Hope at the follow-up					–.065 (.030)
Step 5, $F = 15.744$ ($df = 21$, $p < .001$)					

LVEF = left ventricular ejection fraction.
*$p < .05$. **$p < .01$. ***$p < .001$.

for 62.3% of the variance. Optimism, but not hope, related inversely to follow-up anxiety. Adding optimism reduced the role of preoperative hope and marital status but not of subjective religiousness and reverence. The R-square change, accounting for an additional 9.9% of the variance, was significant. All VIFs are less than 3.7.

Discussion

Addressing the primary question, this study demonstrated the positive role of certain religious factors (e.g., pursuing prayer coping ahead of crisis) on the long-term adjustment after open heart surgery among middle-aged and older patients, consistent with previous findings (Ai et al., 1998). Scale scores indicated a strong intention to use prayer for coping in addition to other forms of positive religious coping but a low tendency to use negative religious coping among middle-aged and older patients. Average levels of depression and anxiety at the follow-up were low and moderate, respectively. Furthermore, bivariate correlates of depression and anxiety were the same on non–religion-related factors but differed across religious factors. The results also imply that greater medical comorbidity may put cardiac patients at risk for depression, whereas lack of a partner's help at home perioperatively could generate anxiety.

The novel finding concerns the link between preoperative attitudes toward prayer and less long-term postoperative depression above and beyond that of powerful clinical indicators (i.e., objectively assessed cardiac indices, previous depression, and hope). Another noteworthy finding is the positive effect of subjective religiousness on less long-term postoperative anxiety, consistent with studies that linked intrinsic religious factors (including beliefs) with better outcomes in this population (Ai et al., 2007; Contrada et al., 2004; Oxman et al., 1995).

Given the lack of effect for quantified public and private religiousness (including prayer), it may be more appropriate to utilize measures of intrinsic religious factors (e.g., intention to pray). Indeed, researchers of faith–health connections should investigate explicitly the phenomenological or experiential aspects of religious and spiritual involvement, as noted by James (1901–1958). An earlier report showed no direct prayer effect on short-term adjustment (depression and anxiety) due to its counteracting associations with both preoperative acute stress and optimism (Ai, Tice, Peterson, et al., 2009). The present findings therefore reinforce the arguable need to assess a temporal nature (cross sectional vs. longitudinal) of multifaceted religious effects on behavioral health in older patients (Ai, et al., 2006, Ai, Tice, Peterson, 2009).

Concerning the secondary question on mediation (Ai et al., 2002, 2007; Oxman & Hull, 1997), pursuing prayer coping related to optimism but not perioperative social support. Adding expected mediators did not eliminate independent effects of religious factors but did, however, slightly reduce its magnitude in the prayer–depression association, indicating only a partial mediation of current optimism. This result supports our earlier hypothesis concerning dispositional optimism as a mechanism underlying the association between religious involvement and health (Ai et al., 2004). It also suggests a direct effect of religious involvement on the long-term adjustment, which might derive from an overtime distress-deterrent effect of intended prayer coping. Firm beliefs in and experiences with prayer could enhance the perceived connection to others and/or eternity, motivation and meaning to life, spiritual love, and transcendence (Levin, 2004).

Ladd, Ladd, Ashbaugh, et al. (2007) and Ladd, Ladd, Harner, et al. (2007) also found that the content of different actual prayers aligns with positive character and personality traits. Our scale items indicate both belief in the efficacy of prayer and positive experience with its usage, which did "offer *hope* in the face of hopeless situations" (Levin, 2004, p. 85). For individuals who are thoroughly accustomed to engaging in prayer, simply thinking about prayer may be equivalent to doing it, just as perceptions of a welcoming, metaphysical afterlife could be as comforting or appealing as actually acquiring an expanded physical life (Ai et al., in press). This is likely due to the fact that religious interpretations and practices are so thoroughly part of the person's cognitive schema as to provide more or less reflexive information (Ladd, 2007; McIntosh, 1993). In addition, middle-aged and older patients who attempt to cope through religious means by seeking their deity demonstrate a stronger survival intention (Ai et al., 2002) or intrinsic striving motivation (Pargament, 2002) than others, which could counterbalance depression.

Furthermore, an interesting finding is that nonprayer religion measures had no effect at all, and religious reverence predicted poorer adjustment. Previous research has found contradictory results in regard to the relationship between religiosity and cardiac disease and CABG patients (Ai et al., 1998; Chatters et al., 1992; Contrada et al., 2004; Oxman et al., 1995). For the inconsistent findings in the literature, sometimes studies that found a positive relationship between religiousness and cardiac disease could have used samples of healthier people to begin with (Miller & Thoresen, 2003). Another possible explanation is that the protection of religious-related public activities might be more preventive in nature with respect to predisease conditions. Our analyses of the short-term recovery data and other cardiac studies documented mixed findings of religious factors despite moderate correlations among them (Ai et al., 2007, Ai, Wink, Tice, Bolling, et al., 2010; Pargament et al., 1998). Moreover, associations between religious measures and demographic or other predictors may explain the outcome. Contrada and colleagues (2004) linked church attendance with poor outcomes in patients undergoing CABG; yet, attendance was also related to age, a negative predictor of recovery in cardiac patients (Ai et al., 2006).

Age, however, is not correlated with religious reverence that predicts more depression in this follow-up. Alternatively, preoperative depression appears to be its correlate, though this bivariate association is also not very strong (see Table 2). In addition, German theologian Otto (1928) asserted that a sense of the holy in religious contexts might provoke both religious reverence and fear and awe toward a moral–spiritual authority (see Ai, Wink, Tice, Bolling, et al., 2010), whereas the latter attitude could become a part of negative emotion in patients undergoing a life-altering event. Religious reverence is correlated with negative religious coping (r = .17; Table 2), indicating certain religious struggle in the face of a life-altering event (Ai, Pargament, Kronfol, Tice, & Appel, 2010). As can be noted in the correlation table, such negative coping is not associated with either subjective

religiousness or prayer coping attitude despite its correlation with frequencies in private religious coping, including prayer (r = .19). The fact may also suggest the advantage of using the consciousness-based scale in clinical research.

There is also the likelihood that in the current study, the prayer-related items represent a cluster of "cold" cognitive process restricted to the singular evaluation of prayer (its importance, past utility, and future utility). As suggested by Seeman, Dubin, and Seeman (2003), certain religious or spiritual coping attitudes may offer comforting or quieting effects. Especially, this potential may help fend off spiritual struggle over uncontrollable crises. On the other hand, religious reverence may tap into "hot" affective processes (" . . . do you feel . . . " instructions) that include a broad range of religious linked activities (attending, reading, watching, praying, and meditating). Those people who respond most strongly to emotional aspects of religion also respond most strongly to emotional aspects of nonreligious items or events. Thinking about the single practice, prayer, with isolated regard to its practical role as a coping device may, on the other hand, encourage respondents to reply more with their "heads" and less with their "hearts" concerning their spiritual practices (Watts, 2002; Watts & Williams, 1988).

These findings demonstrate the value of employing multiple measures of religion to effectively evaluate its multiple dimensions in all groups, including sicker and older populations. Moving beyond single-item measures of behavioral frequency is critical to advance our understandings of the nuanced relation between religion and health (Hill & Pargament, 2003; Ladd & Spilka, 2002, 2006).

The current study is limited by several features of its sample: convenience of access; racial and religious homogeneity; and age. The attrition of the sample adds selective bias to better-off survivors, given the low psychological symptoms, relatively better preoperative cardiac functioning levels, and relatively low medical comorbidity. In addition, this sample centers on the young–old and the extent to which its findings apply to the old–old or oldest-old is not clear. Nevertheless, this study presents evidence that supporting patients' religious and spiritual practices, with special attention to affective qualities, may enhance their quality of life after surgery, which will enable them to better comply with treatments and rehabilitate more vigorously than if they were depressed and hopeless. To enhance the quality of life in sicker older populations, gerontologists, psychologists, and clinicians should collaborate in understanding and intervening with this critical human dimension.

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