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J Health Psychol 2007 12: 580
DOI: 10.1177/1359105307078164

The online version of this article can be found at:
http://hpq.sagepub.com/content/12/4/580

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The Role of Optimism and Acute Distress

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ACKNOWLEDGEMENTS. Amy L. Ai, PhD, was supported by National Institute on Aging Grant 1 RO3 AGO 15686–01, National Center for Complementary and Alternative Medicine Grant P50 AT00011, a grant from the John Templeton Foundation and the Hartford Geriatric Faculty Scholar's Program. The opinions expressed in this article are those of the authors and do not necessarily reflect the views of the National Institutes of Health and these organizations.

COMPETING INTERESTS: None declared.

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JHP

Journal of Health Psychology

Los Angeles, London, New Delhi
and Singapore
www.sagepublications.com
Vol 12(4) 580–596
DOI: 10.1177/1359105307078164

Abstract

To address the inconsistent findings and based on Hegel's dialectic contradictive principle, this study tested a parallel mediation model that may underlie the association of using prayer for coping with cardiac surgery outcomes. Three sequential interviews were conducted with 310 patients who underwent open-heart surgery. A structural equation model demonstrated that optimism mediated the favorable effect of prayer coping. Prayer coping was also related to preoperative stress symptoms, which had a counterbalance effect on outcomes. Age was associated with better preoperative mental health, but age-related chronic conditions were associated with poor outcomes; both of these were mediated through the same mediators.

Keywords

- *acute stress disorder*
- *anxiety*
- *cardiovascular disease*
- *depression*
- *open-heart surgery*
- *optimism*
- *prayer coping*
- *preoperative PTSD symptoms*

CARDIAC EVENTS are on the rise due to the aging of the Baby Boom generation, longer life expectancies and the presence of traditional risk factors that increase with age (e.g. obesity, diabetes, smoking, lack of exercise). More than 70 million Americans are affected by cardiovascular disease (CVD; American Heart Association, 2005). It is the leading cause of death among all Americans aged 35 and older and cost $393.5 billion in 2005 alone. From 1979 to 2000, the number of cardiac procedures increased by 470 percent, making this a common crisis in middle and late life. In the course of open-heart surgery, mental health comorbidities (e.g. depression, anxiety) play a crucial role and are predictive of poorer quality of life, new cardiac events and mortality postoperatively (Pignay-Demaria, Lesperance, Demaria, Frasure-Smith, & Perrault, 2003). These facts spotlight the importance of identifying at-risk patients preoperatively and identifying new protective factors for cardiac health.

Growing empirical evidence has supported the effect of faith factors (e.g. those pertaining to spirituality, religion) on physical and psychological health (Koenig, McCullough, & Larson, 2001; McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000). Scholars postulate that these influences are usually indirect (George, Ellison, & Larson, 2002; Miller & Thoresen, 2003; Powell, Shahabi, & Thoresen, 2003). A rigorous analysis of popular hypotheses and evidence in this area shows that the effect of faith factors is better established for CVD than for cancer (Powell et al., 2003). How these factors may affect the postoperative mental health of cardiac patients, that is their underlying mechanisms, remains under-investigated.

This theory-driven study thus examined an explanatory model of how the preoperative use of personal prayer for coping influences the short-term postoperative mental health (e.g. absence of depression and anxiety) of middle-aged and older patients undergoing open-heart surgery. In following the sample, we focused on the complex way that a faith-based means might allay concerns and fears about the operation and increase optimistic expectations about the future. However, we also examined the potentially undesirable link of this usage with distress in the face of a life-altering open-heart surgery. In particular, we explored the mechanism underlying the influence of using prayer for coping by testing its parallel pathways to mental health: (1) optimism, on the positive side, and (2) acute stress symptoms, on the negative side. To justify these hypotheses, we first summarize the inconsistent findings in the cardiac literature and introduce Hegel's dialectic contradictive principle to support our analysis. We then clarify theories and evidence underlying (1) and (2) and describe the hypothetical model.

Inconsistent findings in the cardiac literature and Hegel's contradictive view

Only a few prospective studies have explored the role of faith factors in cardiac surgery (Contrada et al., 2004). Oxman, Freeman and Manheimer (1995) found a lower rate of 12-month mortality in those who perceived religious comfort and strength preoperatively. Ai, Saunders, Peterson, Dunkle and Bolling (1997) showed better adjustment one year after surgery among those who practiced prayer in a retrospective study, controlling for noncardiac chronic conditions. However, findings on the association between faith factors and adjustment are not always consistent (Alferi, Culver, Carver, Arena, & Antoni, 1999; McCullough & Larson, 1999). Contrada and colleagues (2004) reported fewer complications and shorter hospital stays right after surgery among those with stronger religious beliefs. Prayer frequency was not related to recovery index, whereas religious attendance frequency was associated with worse outcomes. These mixed results suggest that the effect of faith factors on cardiac outcomes is more complicated than generally thought.

The inconsistent findings on faith-based coping in the cardiac literature could be attributable to two possibilities: differences resulting from varied instruments used or from the temporal nature of assessment times. For instance, a previous report showed that the preoperative use of prayer for coping, as a measure of faith-based effort intention, predicted optimism immediately prior to cardiac surgery, but prayer frequency, as a measure of general religiosity, did not (Ai, Peterson, Bolling, & Koenig, 2002). A current analysis, however, found that prayer coping, assessed cross-sectionally with the postoperative outcomes, was positively related to poor short-term postoperative global functioning (SPGF), but preoperatively assessed positive religious coping styles predicted better SPGF after open-heart surgery (Ai, Peterson, Bolling, & Rodgers, 2006). This new outcome differentiated an over time protective effect of faith-based coping in patients' general lives from a crisis-mobilized usage of faith-based state coping, namely seeking spiritual support from a higher power in a time of adversity.

Based on these seeming conflicting findings concerning prayer in cardiac patients, we speculated a third possibility for interpreting the mixed findings in the literature. That is, under critical, uncertain conditions, the use of prayer coping could be tied to outcomes through both positive and negative psychological pathways, that is, the positive attitude about the future and the negative emotional experience, namely distress, in relation to its mobilizer. But, how could this paradox be true? In the early19th century, Georg Wilhelm Friedrich Hegel (1770–1831), a 'German Idealist', proposed an epistemological perspective in which contradictions are seen as a universal law that underlies all realities, including consciousness (Hegel, 1807/1977). Hegelianism implies that conflicts between and dialectic integration of the two opposite, but dynamically interrelated, sides are not only common but necessary for forward movement in uncertainty.

Nonetheless, Hegel's dialectic contradictive principle has not been used as a foundation upon which scientific investigations tend to be built. Rather, empirical research often follows classic logic, which facilitates a linear way of thinking, leaving ambiguities to the topics of wisdom and philosophy. Psychologists in faith research, however, have recognized the complexity of faith phenomena and have dealt with a paradoxical aspect of religion through assessing positive and negative styles of spiritual/religious coping (Pargament, 1997, 2002). This approach, however, does not always reconcile all the inconsistencies in the faith literature. In a recent meta-analysis of religious coping and adjustment, for example, Ano and Vasconcelles (2005) gathered 105 effect sizes, mostly cross-sectional studies, with 13,512 participants. Although the overall results suggest mostly positive effects of positive religious coping styles and negative effects of negative styles, there were considerable mixed findings concerning the two styles across studies in this analysis.

We therefore believe that researchers of faith matters should confront this challenge, rather than ignore it by focusing on what outcomes constitute the majority, and provide empirical evidence on the complexity inherent in faith as a part of human nature. Accordingly, it is warranted to test Hegel's principle in a novel approach that could simultaneously demonstrate two sides of the same coin, prayer coping, when a life-or-death issue was put on the operation table. The possible coexisting two sides in our case are discussed in the literature below.

Prayer coping, optimism and cardiac surgery

Could prayer have a positive effect on health outcomes? Pargament (2002) discussed the circumstances under which coping with faith is most likely to have salutary effects: (a) internalized religion and intrinsic motivation; (b) social marginalization; and (c) stressful situations that push individuals to their limits. Circumstance (a), the intrinsic nature of using prayer in crisis for coping, may best be described by the two following statements. First, William James claimed one century ago: 'wherever …prayer rises and stirs the soul, even in the absence of forms or of doctrines, we have a living religion' (1902/1958, p. 352). Second, more contemporarily, Allport and Ross noted: 'the intrinsically motivated *lives* his religion' (1967, p. 434, emphasis in original). Accordingly, the prayer act used by middle-aged and older cardiac patients to cope could embrace a component of intrinsic motivation.

Based on research evidence, Pargament, Magyar-Russell and Murray-Swank (2005) argued about the uniqueness of religion in contribution to good outcomes, or in other words, why such involvements as prayer coping may promote physical and mental health in its own right. They suggested that in the search for the sacred, faith may offer motivation, a source of value and significance, and coping. In general, for religious adherents these actions function beyond just mystical experiences (Leuba, 1933), illusion and child-like wishes (Freud, 1928/1953), or the ideas of society (Durkheim, 1973/1912). Particularly in crisis, when situations are perceived as unpredictable and incontrollable, to users, prayer coping is meant as more than merely a ritual. Rather, it indicates their intention of survival, in the case of a life-altering operation (Ai et al., 2002), or their seeking of spiritual support through a profound connection in their faiths, in the case of other incomprehensible crises (Ai, Tice, Peterson, & Huang, 2005c), or the combination of both.

With respect to circumstance (b), social marginalization tends to refer to disadvantaged strata (the poor, the less educated, minorities or the disabled). Older persons are socially marginalized in a youth-oriented society, even without medical crises. Major disabling chronic conditions, such as cardiac diseases, may further jeopardize their socio-demographic disadvantages and mobilize the use of prayer for coping in crisis. As for circumstance (c), about half a century ago Welford's (1947) study

showed the importance of tension-related arousal and frustration in prayer as a response to situations in which human action may lose its efficacy. His study highlighted the use of prayer in a stressful context. Faith-based actions, such as prayer coping, may offer comfort or transcend the meaning of suffering in relation to these disadvantages. Under highly uncertain circumstances, such as open-heart surgery, the divine tends to be called for as a spiritual resource to ease distress (Ai, Peterson, Rodgers, & Tice, 2005a; Cole & Pargament, 1999; Hood, Spilka, Hunsberger, & Gorsuch, 1996; Pargament, 1997; Wrosch, Schulz, & Heckhausen, 2002). Indeed, Saudia, Kinney, Brown and Young-Ward (1991) indicated that 96 percent of cardiac surgery patients prayed and 70 percent gave it the highest rating on coping effectiveness.

An analysis of preoperative data also found prayer to be a common coping practice prior to open-heart surgery (Ai et al., 2002). To reflect the mental processes underlying the use of prayer for coping, in that study we developed a new assessment of prayer that focused on coping and went beyond general religiosity measures based only on behavioral frequency (Poloma & Pendleton, 1991). This consciousness-based assessment included three items: a prayer user's (1) appraisal of its importance, (2) belief in its efficacy based on his or her past experiences and (3) intention to use it to cope with crisis, in this case, cardiac surgery. Yet, this measure did not focus on the exact content or quantity of prayer, on expected or desirable outcomes (e.g. a favorable surgical outcome), or on divine providence. Rather, in linking past experience with present coping intention, we considered that such prayer coping may indicate an internalized and conscious involvement in one's general faith-based life, and a survival intention in collaboration with a higher power in the face of a particular stressor.

Despite research linking faith factors with surgery outcomes (Ai et al., 1997; Contrada et al., 2004; Oxman et al., 1995), a question remains: how might certain faith factors influence outcomes? In the *American Psychologist* special issue on faith and health, Miller and Thoresen (2003) especially recommended the use of more sophisticated designs (e.g. longitudinal studies) and advanced statistics (e.g. structural equation modeling (SEM)) to specify the indirect effect of faith factors, that is, mechanisms. Considerable assumptions have been made on such possible pathways as emotional and cognitive factors, behavioral and lifestyle factors, immunological factors, and interpersonal and social factors (George et al., 2002; Powell et al., 2003). Theoretically, researchers in religion and positive psychology have postulated on the possible mediation of positive attitudes (e.g. optimism) in the role of faith factors, especially in life-threatening crises (Hood et al., 1996; Myer, 2000; Peterson, 2000). Empirically, not much evidence has been provided based on the recommended methods.

In a secondary analysis of preoperative data, we found that preoperative prayer coping was indeed related to optimism as one of these assumed pathways, consistent with an assumption of positive psychologists that religion may nurture general positive attitudes (Ai, Peterson, Tice, Bolling, & Koenig, 2004). Dispositional optimism has been defined as the 'global expectation' that good things will be plentiful in the future and bad things scarce (Scheier & Carver, 1992). Previous research has linked optimism to well-being, including better postoperative recovery, on the one hand (Carver, Spencer, & Scheier, 1998; Scheier et al., 1989, 1999) and to faith factors, on the other (Sethi & Seligman, 1993). Cross-sectional studies of healthier populations have demonstrated the mediation of optimistic expectations in the positive effect of faith factors on well-being (Ai et al., 2005c; Krause, 2002). Our preoperative studies have linked prayer coping to optimism prior to open-heart surgery, which included the evident protection of optimism on cardiac health and in-depth discussions on the link between faith factors and positive attitudes (Ai et al., 2002, 2004). However, whether this beneficial pathway holds prospectively to affect postoperative mental health remains to be determined in further investigation.

Prayer coping, acute stress disorder and cardiac surgery

According to Hegel's dialectical contradictive principle, the presence of positive attitudes may not mean the absence of negative psychological experiences, especially under uncontrollable situations such as open-heart surgery. Therefore, a question rises for this study: As a consciousness-based action, could prayer coping also be related to distress? Conceptually, the relation between prayer and stress with negative implications in crisis has been implied both in the statements indicated above (Hood et al., 1996; Pargament, 2002; Welford, 1947) and in James' notion of prayer as 'the very soul and essence of religion … an intercourse, a

conscious and voluntary relation, entered into by a soul in distress' (1902/1958, p. 352). Practically, those who pray could be anxious in their devastating needs for answers from a higher power. A current large-scale clinical trial on intercessory prayer may suggest this possible anxiety in a group of open-heart surgery patients who were aware of others' prayer for them (Benson et al., 2006). Compared with two 'no-awareness' groups, received prayer or not, the 'awareness' group had greater levels of complications that were due almost entirely to atrial fibrillation. This is a cardiac arrhythmia attributable to increased adrenaline secretion in distress.

Based on empirical evidence, Pargament et al. (2005) argued about the idea that faith-based coping can itself be a source of distress. In the face of the great uncertainty under life-related tests, users of such coping means could themselves worry about abandonment or punishment from their higher powers. They could also perceive their God as powerless, unresponsive, angry or vengeful, when they fail to perceive help in crisis. Indeed, Trenholm, Trent and Compton (1998) found that religious conflict predicted panic disorder, even after controlling for other psychosocial confounders. Several studies have also related use of prayer to higher levels of pain and distress (Haley, Koenig, & Bruchett, 2001; Rippentrop, Altamaier, Chen, Found, & Keffala, 2005), which could mean mutual influence between the two factors (Koenig et al., 2001).

Furthermore, many other studies have also pointed to additional possibilities. As noted earlier, coping by faith can be mobilized to pursue spiritual support in adversity (Ai et al., 2005c, 2006; Ai, Tice, Huang, & Ishisaka, 2005b; Schaefer & Gorsuch, 1993; Pargament, 1997; Welford, 1947). Also, patients with poorer health may have greater dependence on faith-based coping and other private involvement (Ai et al., 1997; Hays et al., 1998; Rippentrop et al., 2005). Finally, there could be some ongoing interactions between faith-based coping and negative emotional responses to contextually harmful triggers (Ai et al., 2005c; Pargament et al., 1994; Pargament, Smith, Koenig, & Perez, 1998). In these cases, a prayer–stress association may well counteract a prayer–optimism link, supporting the net lack of any effect of prayer on the short-term postoperative outcomes in Contrada et al.'s (2004) study.

Accordingly, we assessed the hypothetical association between prayer coping and distress in the form of 'acute stress' disorder, a concept attracting increasing attention in the literature. This mood state is considered to be a peritraumatic form of negative emotions associated with panic attack, distressing anticipatory anxiety and acute PTSD (posttraumatic stress disorder) symptoms (Jaycox, Marshall, & Orlando, 2003; Pollack & Marzol, 2000; Thabet, Abed, & Vostanis, 2002). Ten years ago, Cardena, Lewis-Fernandez, Bear, Pakianathan and Speigel (1996) recommended adding acute stress to the psychiatric diagnostic armamentarium. In fact, PTSD was earlier considered as acute stress disorder in a revised version (Ehrenreich, 2003). Without an agreed-upon definition, researchers on noncardiac samples have assessed its clinical symptoms using a PTSD checklist (Jaycox et al., 2003) or a scale for autonomic activation (Bracha et al., 2004).

In women following prenatal diagnosis, acute stress contributed to poor long-term outcomes (Leithner et al., 2004). In cardiac research, stress, including acute stress, has been known to be a risk factor in CVD prognosis (Krantz, Sheps, Carney, & Natelson, 2000; Rozanski, Blumenthal, & Kaplan, 1999), and there have been a few reports linking acute stress (e.g. bereavement, earthquake, missile attack) with coronary heart disease (CHD) incidence (Leor, Poole, & Kloner, 1996; Meisel et al., 1991; Rozanski et al., 1999). Experimentally manipulated panic attack, a form of acute anxiety, can cause cardiac ischemia detectable by myocardial perfusion scintigraphy (Fleet et al., 2001). Hyperventilation, often seen in acute anxiety, can promote coronary artery spasm or arrhythmia that may trigger fatal cardiac events (Tennant & McLean, 2001). Psychiatric disorders after combat exposure predicted abnormal electrocardiographic indicators of CHD, including infarctions, 20 years later (Boscarino & Change, 1999). Conceptually and methodologically, acute stress remains underinvestigated in cardiac surgery patients.

Particularly worth noting is the recent report on PTSD symptoms in patients undergoing cardiac surgery by German psychiatrists (Schelling et al., 2004). Postoperative PTSD symptoms were related to the lowest mental health scores and poor life satisfaction (Stoll et al., 2000). These findings have led to a randomized controlled trial on hormonal treatment of PTSD in cardiac surgery patients (Schelling et al., 2004). Because patients with PTSD identified postoperatively had considerable traumatic memories of an intensive care unit (ICU) even at six months afterward, these symptoms were attributable

to the ICU care. Yet, based on a surgeon's observation, we believed that some patients might have developed these symptoms prior to this life-altering surgical event because of its critical impacts on themselves and their families.

In the present study, we measured this mood state with items asking about PTSD symptoms, tailored to the context of cardiac surgery, and expected an association with postoperative poor mental health symptoms (Krantz et al., 2000; Rozanski et al., 1999). For the present study, the concept was defined as having ever met the symptom criteria for PTSD by this measure at one day prior to cardiac surgery. Consistent with past practice in the literature (Jaycox et al., 2003; Pollack & Marzol, 2000; Thabet et al., 2002), what we assessed is best described as either acute stress disorder or acute PTSD symptoms, but not as formally diagnosed PTSD.

A hypothetical model

The current literature and Hegel's dialectic contradictive principle led us to test a model illustrating simultaneous mediation through two counterbalancing pathways of the prayer effects on postoperative mental health (Fig. 1). They are: a positive pathway, through optimism, running parallel to a negative pathway, through acute PTSD symptoms. Accordingly, we expected that: (a) preoperative optimism would mediate the positive prayer effect on better postoperative mental health (absence of depression and anxiety); and (b) acute PTSD symptoms would increase with preoperative prayer coping and be related to poor outcomes postoperatively.

Because disadvantaged status may contribute to the greater use of prayer (Levin & Taylor, 1997; Miller & Thoresen, 2003; Poloma & Gallup, 1991), the roles of age, education and chronic conditions were also adjusted in the model, consistent with the retrospective study (Ai et al., 1997). Based on cardiac research, we expected age to have a desirable influence on both optimism and acute stress response (Ai et al., 2002; Plach, Napholz, & Kelber, 2003). In contrast to younger counterparts, older patients may have less concern about lives being cut short, having survived more previous struggles and developed greater life-span wisdom. Finally, we anticipated age-related noncardiac chronic conditions to be negatively related to optimism and positively related to acute stress response, whereas education would be related to the two mediators in positive directions, that is, positive attitude and low stress (Ai et al., 1997, 2002).

Method

The sample

The subject eligibility criteria were presented in the earlier report (Ai et al., 2002). Four hundred and eighty-one patients (64% of patients approached) completed the first face-to-face interview. Of these, 426 completed the second telephone interview (89%) and 335 completed the third, postoperative follow-up (70% of the wave-1 respondents). The majority of the sample was male (58%), Caucasian (90%), Judeo-Christian (87%) and married with spouse present (72%). The average age was 62 (range, 35–89). The average level of education was 14 years (range, 0–28). The average annual family income was $56,727.51 (range, $0–$400,000).

Procedure

The study took place in the cardiac clinic at the University of Michigan Medical Center (Ann Arbor). Nurses and trained interviewers recruited subjects for three sequential interviews between 1999 and 2002. Trained interviewers conducted these interviews. Surgical procedures included coronary artery bypass graft, aneurysm repairs and valve repair or replacement; all required the use of a heart–lung machine that enables the bypass of blood through synthetic material circuits and a mechanical heart-bloodless field to facilitate vessel or valve repair.

The first interview took place about two weeks prior to the cardiac surgery at the peak of stress (Eriksson, 1988). The initial interviewer asked about (a) demographic and socioeconomic background, (b) religious affiliation, (c) the use of personal prayer for coping and (d) noncardiac chronic conditions. The second interview was conducted by telephone about two days preoperatively, when acute PTSD symptoms and optimism were assessed. The third interview was conducted approximately 36 days after surgery, when mental health was assessed.

Measures

The latent Construct of *Mental Health* was measured by two indicators. *Depression* was assessed with the *Center for Epidemiologic Studies Depression Scale* (CES-D) (Radloff, 1977). One example is: 'I could not get "going"'. Each of the 20 items was scored on a four-level Likert scale (0 = rarely or none of the time (< 1 day), 3 = most or all of the time (5–7 days)).

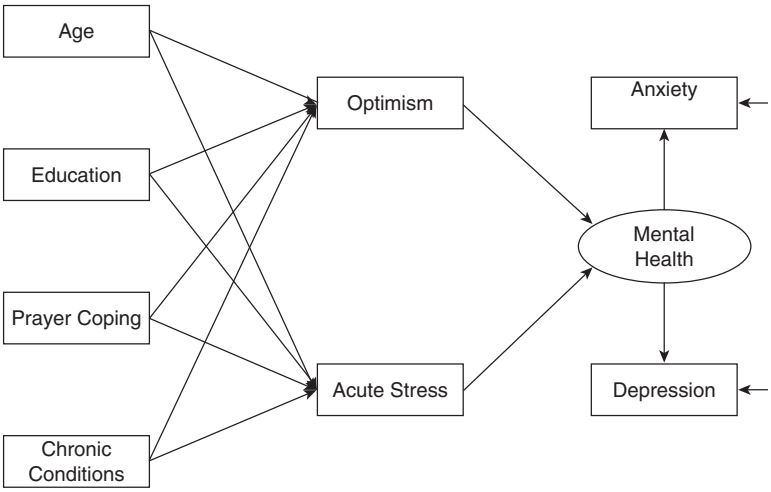

Figure 1. A hypothetical model.

Coefficient alpha was .88. *Anxiety* was assessed with the *Trait Anxiety Inventory* (STAI Form X-2; Spielberger, 1983). One example is: 'I am inclined to take things hard'. Each of the 20 items was scored on a four-level Likert scale (1 = almost never, 4 = almost always). Cronbach's alpha was .91.

Optimism was assessed with the *Life Orientation Test* (LOT; Scheier & Carver, 1985). One example is: 'In uncertain times, I usually expect the best'. Each of the eight items was scored on a five-level Likert scale (0 = strongly disagree, 4 = strongly agree). Cronbach's alpha was .76.

Acute PTSD symptoms was assessed with a nine-item measure of PTSD from the *Diagnostic Interview Schedule (DIS)*, a standardized structured interview based on the *Diagnostic and statistical manual of mental disorders* (3d edn; DSM-III) diagnoses (American Psychiatric Association, 1980; Saunders, 1994). The DIS can be used in clinical and research settings to make specific psychiatric diagnoses in a standardized fashion with good validity (Robins, Helzer, Croughan, & Ratcliff, 1981; Robins, Helzer, Ratcliff, & Seyfried, 1982). It is believed to be a reasonably reliable and valid instrument in the hands of a lay interviewer. For the present study, some items were altered to fit the situation of this medical crisis. On example is: 'Dreams or nightmares about the surgery'. The original format of the DIS requests a 'yes' or 'no' answer. To make it more reliable, a four-point scale (0 = never, 3 = often) was added to the response format. Cronbach's alpha was .76.

Prayer coping was assessed with the three items of *Using Private Prayer as a Means for Coping* referring particularly to coping with difficulties and stress associated with cardiac surgery (Ai et al., 2002). One example (faith in its effectiveness) is: 'Prayer does not help me to cope with difficulties and stress in my life'. Each of the three items was scored on a four-level Likert scale (1 = strongly agree, 4 = strongly disagree). Cronbach's alpha was .87. *Content of prayer* was ascertained with a 'yes' or 'no' answer on four major types used by Americans in a national survey (Poloma & Gallup, 1991) and an additional 'other types' option. *The number of chronic conditions* was ascertained with a 'yes' or 'no' answer on 15 noncardiac chronic conditions commonly seen on geriatric units (e.g. hypertension, arthritis, diabetes, back problems, allergies, incontinence of urine, chronic lung disease, cancer; Ai et al., 1997). Age was measured in years. Education was measured with five levels (1 = no formal education, 2 = grades, 3 = high school, 4 = some college, 5 = post college).

Statistical analysis

Both univariate and multivariate normality of the data were examined for the assumption of the SEM estimation. Zero-order correlations were then performed among constructs in the theoretical model. The SEM analysis was conducted to test major hypotheses and to estimate structural relationships among all constructs. The hypothetical model

(Fig. 1) was evaluated using maximum-likelihood estimation using a robust new tool, M-PLUS version 3 (Muthén & Muthén, 2004). SEM allows all structural paths to be estimated simultaneously with measurement models and all path coefficients to be estimated while taking account of measurement errors in observed variables. This analysis included all paths and effects (direct, indirect, and total) in Fig. 1 (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002). The final model includes only statistically significant standardized path coefficients ($p < .05$).

There was one latent factor, postoperative mental health symptoms, indicated by depression and anxiety. Only a few missing values of education levels were imputed corresponding to years of education. No other missing values were imputed. After listwise deletion, the final sample size was 310. This SEM estimation enabled simultaneous estimation of all effects of prayer coping, as well as age, education and chronic conditions, on postoperative mental health, including their mediation through two intermediating factors (optimism and acute PTSD symptoms), along with the measurement model specified for one latent variable. In this process, postoperative mental health symptoms were regressed on optimism and acute stress response. Optimism and acute stress response were regressed on the four exogenous variables.

Several goodness-of-fit indices were used in addition to the chi-square statistic that is sensitive to both assumptions of normality and sample size (Bollen & Long, 1993). These included the standardized root mean square residual (SRMR) index and the residual mean squared error of approximation (RMSEA), with values below 0.05 (the lower bound of the 90% CI under .05) indicating an adequate fit (Browne & Cudeck, 1993). We also used the Comparative Fit Index (CFI; Bentler, 1990) and the Tucker–Lewis Index (TLI; Tucker & Lewis, 1973), with values above .90, or even .95, indicating an adequate fit (Hu & Bentler, 1999).

Results

Mental health and prayer coping

Given the average age and cardiac conditions of the sample, a conservative number, 20, was used as the cutoff CES-D score to identify depression disorder, instead of the standard cutoff point, 16 (Beekman et al., 1997). Postoperatively, 24 percent of the sample met this criterion. Two weeks prior to surgery, 87.7 percent of them expressed belief in the importance of prayer; 74.7 percent had faith in the efficacy of prayer coping from past experiences; and 88.1 percent intended to use personal prayer to cope with surgery-associated difficulties.

The most popular types of prayer used were ‘conversation with God’ (74.2% of the sample), followed by ‘accomplishment of needs’ (51.4%), ‘experiencing the divine’ (40.1%) and ‘memorized prayer’ (39.7%). Only 74 patients (15.4%) checked the ‘other types’ option. Some provided their prayer contents: thanksgiving prayer; praying for others; seeking wisdom or God’s will; asking for help or healing; seeking help for spouse, children and family; visualizing positive outcomes; speaking to deceased father; visiting close persons’ graves; praying with others (family members, relatives, ministers, group); reading the Bible; appreciating nature; and writing. One patient indicated: ‘asked Dr X (cardiac surgeon) to pray before he does surgery’.

Normality analysis and correlation

For univariate normality analyses, the analysis showed that the kurtosis and skewness of factor distributions in Fig. 1 all fell within acceptable range. For multivariate normality analyses, Mahalanobis’ Distance identified no outliers out of the final sample of 310 with complete measures of all factors. Accordingly, raw data were used. Table 1 presents zero-order correlations, means and standard deviations of all constructs estimated in the hypothetical model. Signs of significant coefficients were mostly consistent with our expectations.

Prayer coping was related to optimism but not to acute PTSD symptoms, nor to either of the postoperative mental health indicators. Age was positively correlated with optimism and negatively correlated with acute PTSD symptoms. It was unrelated to postoperative mental health indicators. Education was positively correlated with optimism and both postoperative mental health indicators though not with acute PTSD symptoms. The number of non-cardiac chronic conditions was negatively correlated with optimism but positively correlated with acute PTSD symptoms and postoperative mental health indicators. Optimism was inversely correlated with acute PTSD symptoms. Depression and anxiety were highly correlated postoperatively.

Table 1. Means, standard deviations, and zero-order correlations among estimated constructs (n = 310)

	1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*
1. Prayer coping								
2. Age	.101							
3. Level of education	–.135*	–.248***						
4. Chronic conditions	.069	.145*	–.188***					
5. Optimism	.132*	.161**	.175**	–.123*				
6. Acute distress	.085	–.192***	–.026	.269***	–.307***			
7. Postoperative depression	.088	.041	.142*	.243***	–.419***	.380***		
8. Postoperative anxiety	.027	–.038	.127*	.212***	–.505***	.392***	.795***	
Mean	9.97	62.25	3.74	2.75	22.18	8.71	13.19	34.76
SD	2.393	11.758	.848	2.207	4.495	4.674	9.179	10.122

*p < . 05; ** p < .01; *** p < .001

Counterbalancing pathways

The initial estimation of the hypothetical model (Fig. 1) found a less-than-satisfactory fit to the data. The modification index suggested that the addition of one theoretically reasonable path, from optimism to acute PTSD symptoms, might improve the model fit. The model was revised accordingly, and the final solution with standardized coefficients is shown in Fig. 2.

The latent factor, postoperative mental health symptoms, was measured appropriately by two indicators, depression and anxiety (Fig. 2). The four indices of model fit were adequate: chi2(d.f. = 9, N = 310) was 20.53; both CFI (.98) and TLI (.95) exceeded the higher criterion of .95; and RMSEA (.064; 90% confidence interval 0.027 to 0.101) and SRMR (.047) were within the range of adequate fit (< .05). The modification index did not suggest any other link. Squared multiple correlations indicated that this model accounted for 35 percent of the variance in postoperative mental health and 20 percent of acute PTSD symptoms. Significant paths in the final model were mostly consistent with our expectations, but not every correlation in the zero-order analysis remained a significant path.

As hypothesized, postoperative mental health symptoms were associated negatively with optimism and positively with acute PTSD symptoms. For optimism, the positive influence of prayer coping as well as of age and education is consistent with preliminary findings (Ai et al., 2002). No direct linkages were found from either prayer or secular factors to postoperative distress; that is, all their effects were accounted for by the two mediators. Prayer coping was related to acute PTSD symptoms. Both age and optimism had inverse relations with acute PTSD symptoms, but education was not influential. Chronic conditions were associated with both optimism and acute PTSD symptoms, and they also correlated negatively with education but positively with age. Education was negatively correlated with both age and prayer, whereas age and prayer were unrelated to each other.

The complete total indirect effects (standardized coefficients) of antecedent variables on postoperative mental health symptoms and acute PTSD symptoms are summarized in Table 2, in which all estimates are significant except that of prayer coping. Both age (–.167, p < .001) and education (–.105, p < .01) had negative indirect effects on postoperative mental health symptoms. Yet, chronic conditions (.138, p < .001) had positive indirect effects on symptoms. Optimism (–.077, p < .001) also had an indirect effect on mental health symptoms through its influence on acute PTSD symptoms.

As anticipated, there was an absent overall indirect effect of prayer coping on postoperative mental health. However, further information on the three specified indirect paths from prayer coping to this outcome provided more details; all of the three were significant but with different directions. On distress, prayer coping had negative influences through both Path 1, optimism (–.065, p < .01), and Path 2,

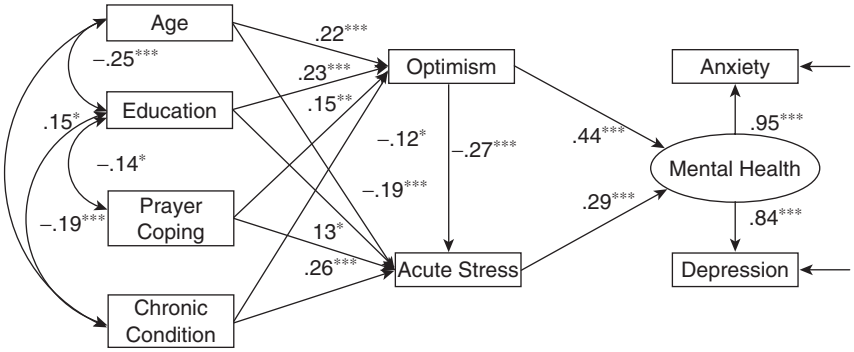

Figure 2. A final structure model with standardized solution.

Table 2. Total indirect effects (standardized coefficient) of postoperative mental health and acute stress response (N = 310)

	Postoperative mental health		*Acute stress response*	
Antecedents	*Coefficients*	*Z (Est. SE)*	*Coefficients*	*Z (Est. SE)*
Age	–0.167	–4.567	–0.059	–3.091
Education	–0.105	–2.978	–0.061	–3.125
Prayer coping	–0.040	–1.214	–0.040	–2.407
Chronic conditions	0.138	3.844	0.033	2.042
Optimism	–0.077	–3.635		

Note: * Total effects differ from indirect effect, which are presented in the text or obvious in the final model

optimism–acute PTSD symptoms linkage (–.011, $p < .05$) and a positive effect (.036, $p < .05$), through Path 3, acute PTSD symptoms.

Additional information concerning the indirect effects on acute PTSD symptoms was also offered by the SEM test, though this construct was not considered to be the endpoint of this study. Through optimism, acute PTSD symptoms were negatively related to prayer (–.040, $p < .05$), age (–.059, $p < .01$) and education (–.061, $p < .01$), and was positively related to chronic conditions (.033, $p < .05$). Clearly, prayer coping had a negative indirect effect on acute PTSD symptoms through optimism, which appeared to counteract its positive direct effect on acute distress. Therefore, the total effect of prayer coping on this mood state was insignificant.

Discussion

Based on Hegel's dialectic contradictive principle, this prospective study provided a conceptual explanatory model concerning the complex effect of preoperative use of prayer coping on short-term postoperative mental health. This model is a good fit to the data, gathered from a sample of middle-aged and older patients undergoing open-heart surgery, a life-altering event with significant public health implications. Consistent with Contrada et al.'s (2004) regression analysis, the bivariate analysis showed no relation of preoperative prayer use with postoperative symptoms (i.e. depression and anxiety). However, as recommended (Miller & Thoresen, 2003), the SEM model showed two potentially counterbalancing pathways that manifest its indirect effects. On the positive side, general positive expectations, or optimism, mediate the likely favorable influence of prayer on postoperative symptoms. On the negative side, acute stress disorder, in the form of acute PTSD symptoms, mediates the undesirable link with prayer. The parallel-pathway model may help to better understand the mixed findings in the role of faith factors in health, provided mostly by cross-sectional studies (Alferi et al., 1999; Ano & Vasconcelles, 2005; McCullough & Larson, 1999).

Several findings should be highlighted in this study. First, on the positive side, the present study supports past findings on both the common use of personal prayer for coping among cardiac surgery patients (Ai et al., 1997; Saudia et al., 1991) and the theoretical assumption on the mediation of optimism in the positive role of faith factors (Hood et al., 1996; Myers, 2000; Peterson, 2000). The benefit of optimism has been discussed extensively (Peterson, 2000). Expanding on past findings in the preoperative report (Ai et al., 2002, 2004), the study notes that the potential desirable influence of prayer coping on postoperative mental health in this sample of cardiac patients may be indirect, mediated through optimism, as was true in other populations (Ai et al., 2005b; Krause, 2002).

This positive mediation not only reinforces the postulation about the nature of effects concerning faith factors but also demonstrates the advantage of using SEM to elucidate the secular mechanism of the faith effect in general. Yet, one could question how an event-targeted, faith-based coping could be mediated by a general expectation measure. The high correlation among the three items of prayer coping suggests that the state use of prayer for coping in these patients is based on past life experience and faith in this means of coping. This assessment thus reflects a trait component, or the continuity of prayer use in coping with crisis, based on William James' notion of prayer in distress as a 'living religion' (1902/1958, p. 352). Both use of prayer and optimism thus may have a persistent component in human consciousness.

Second, according to this notion, the potential effect of prayer coping in this study is perceptively based on a trustable relation with some spiritual powers, rather than on merely a utility purpose. Hood et al. believed that individuals in crisis tend to lose control; faith can convey the meaning in adversity and be a source of empowerment: "the more they are uncertain about life after death, the more they pray" (1996, p. 397). In a medical crisis beyond individuals' control, faith-based coping may be one way to seek comfort (Ai et al., 2005a; Pargament, 1997; Wrosch et al., 2002). Through prayer, responsibility for the ultimate solution is placed, as it were, in God's hands, just as regaining control is a hopeful factor in spiritually collaborative coping (Pagament, 1997, p. 183).

The literature shows the protection of faith-based involvement, public and private, in both cardiac patients (Contrada et al., 2004; Oxman et al., 1995; Powell et al., 2003) and noncardiac populations (Helm, Hays, Flint, Koenig, & Blazer, 2000; Meisenhelder & Chandler, 2001). Prayer is also commonly used by the disadvantaged in this cardiac sample and in the general population (Levin & Taylor, 1997). As a source of optimism and potential well-being, this means of coping is far from negligible. Interestingly, optimism not only mediates a potential effect of prayer use, it also has a counteracting role on stress experienced by some cardiac patients, indicated by its negative link with acute PTSD symptoms as suggested by the modification index. In addition, optimism explains the role of education. Positive psychologists stress the need to cultivate character strengths for well-being (Seligman & Csikszentmihalyi, 2000). From this study, the answer to their endorsement may not only lie in individuals, but from outside factors, such as socioeconomic status and cultural-spiritual roots.

Third, on the negative side, the present findings also indicate an undesirable pathway between prayer coping and short-term postoperative mental health, shown as acute PTSD symptoms. Although the study is the first to elicit both sides of this 'coin', it is by no means the first time faith factors have been related to negative outcomes. Earlier, researchers linked pain and panic disorders with faith factors (Haley et al., 2001; Rippentrop et al., 2005; Trenholm et al., 1998). The retrospective study also related depression in the first postoperative month to increased use of prayer, though prayer users showed better adjustment one year after open-heart surgery (Ai et al., 1997). Similarly, Contrada et al. (2004) found that religious attendance predicted longer hospitalization, while prayer frequency had a null effect. Should we then simply make a conclusion that such a faith-based involvement caused harm among cardiac surgery patients? The answer may be multifaceted rather than simply yes or no.

As noted, Pargament et al. (2005) have offered multiple explanations for the undesirable link between faith factors and poor mental health. The research they cited offers the possibility that some faith-based involvement under certain circumstance can be the source of distress. The new evidence in the present study suggests that preoperative acute stress may have a faith-based root, such as religious struggles in the use of prayer, an area that deserves more research investigation (Exline & Rose, 2005). Further, we have also proposed other possibilities that may explain this undesirable pathway. Unexpected open-heart surgery may present an urgent challenge to the meaning of life in their middle- or late-life development among cardiac patients. Some of their remarks on 'other types' of prayer may also reflect

their negative emotions in response to these acute symptoms. Clearly, the association between use of prayer and this mood state echoes Welford's (1947) early study. The current parallel-pathway model may only make it more explicit that seeking support from a higher power through prayer could be accompanied by a stressful mood, especially immediately prior to a life-altering medical crisis.

Yet, given the multiple stressors accumulated during the peri-operative period as noted, the case of a cardiac study (the present one and Ai et al., 1997) could be more complicated, likely one based on an ongoing interplay between serious problems related to a life-altering condition and the multifaceted nature of prayer itself. In Contrada et al.'s (2004) study, the conclusion that church involvement might prolong hospital stay is questionable, because other associated factors, such as female gender, were related to church attendance. The SEM model in the retrospective study associated gender with poor health, less education and low income, which all in turn were related to poor adjustment one year later directly or indirectly through depression in the first month after surgery (Ai et al., 1997). This fact may help explain the undesirable link in Contrada et al.'s (2004) findings. Likewise, our final model also shows that prayer is correlated with less education, which is in turn linked with a greater number of chronic conditions. The latter factor was apparently and understandably related to acute stress disorders.

Fourth, pre- and peri-operative acute stress disorder warrants more practical attention from health professionals, rather than being denied or ignored. Given the risk of mortality, a short notice anticipating open-heart surgery within a few weeks could cause panic response or high rates of distress, especially for self-identified healthy persons (Pirraglia, Peterson, Williams-Russo, Gorkin, & Charlson, 1999). All patients must be informed preoperatively about related side-effects, including the chance of death. The cost of surgery interacts with patients' socioeconomic status, intensifying the crisis (Ai et al., 1997). The waiting period can be a peak of distress, accounting for the variance in recovery indices (Eriksson, 1988; Pirraglia et al., 1999). Clinically, the cardiac surgeon on this interdisciplinary research team observed approximately a quarter to a third of preoperative patients with this under-investigated mood state. With research evidence provided, PTSD symptoms in cardiac patients can be appropriately assessed in practice and the favorable aspect of spiritual coping could then also be addressed.

In fact, our cardiac surgeon believes that this negative pathway is the most interesting finding, given the recent attention to PTSD in patients undergoing cardiac surgery (Schelling et al., 2004). One study reported that 18.2 percent of 148 patients had PTSD at six months after cardiac surgery, and only 4.8 percent of these PTSD patients had preexisting PTSD preoperatively (Schelling et al., 2003). The present findings may be among the first to report the impact of acute PTSD symptoms preoperatively in a large sample. The association of acute PTSD symptoms and postoperative mental health may offer evidence of their persistent impacts, consistent with another postoperative study in Germany (Schelling et al., 2004). Whether this negative pathway will indicate some long-term harm and what physiological mechanisms exist therein should be made evident in the future.

Fifth, the percentage of our patients who met the depression symptom criterion was compatible with major depression in other samples (Pignay-Demaria et al., 2003). Our cutoff point, 20, for the CES-D scale appeared to be reasonable. Despite the prevalence of symptoms, until recently no major attempt has been made to influence routine screening, prevention or treatment of depression among patients with myocardial infarction or undergoing cardiac surgery (Scheidt, 2000). Furthermore, even if symptoms had been identified in these patients, the treatment of depression under a surgical circumstance would be difficult given the complex pathophysiology involved and the interaction of medications (Pignay-Demaria et al., 2003). In recent years, large clinical trials with scientific rigor have failed to support the survival advantage of either antidepressants or cognitive behavioral therapy (CBT) despite their positive effects on depression in myocardial infarction patients (ENRICHD Investigators, 2003). Clearly, identifying new protectors for cardiac patients, such as optimism and its secular and faith-based resources or roots, may have clinical implications.

Confirming previous findings (Plach et al., 2003) and our expectation, older age in this sample was indirectly related to better mental health, explained by their greater optimism and less acute PTSD symptoms. In both retrospective (Ai et al., 1997) and current prospective studies, prayer coping was not associated with older age, contrary to the findings in a population study (Levin & Taylor, 1997). This fact may help restore a positive aspect of aging, a likely source for lifespan wisdom, confidence, and

maturity in crisis. Nonetheless, in both retrospective (Ai et al., 1997) and current studies, age-related chronic conditions are related to poor adjustment through deteriorated optimism and elevated acute PTSD symptoms. Postoperative recovery drains physical strength, and the body has to mobilize all resources for healing surgical trauma. A European study showed that very old patients (age > 75 years) tended to have higher mortality and morbidity, also poor health improvement and quality of life one year after surgery (Jarvinen, Saarinen, Julkunen, Huhtala, & Tarkka, 2003). The comprehensive effect of age on outcome measures could be a fruitful area to explore in clinical studies.

Finally, one major limitation in this study lies in an underdeveloped concept, acute stress, which has not gained consensus on its nature or its assessment. We did not conduct a psychiatric interview, nor did we measure preexisting trauma in these patients' lives. Targeting cardiac surgery, however, these symptoms should be considered as event-specific. Furthermore, the assessment of the endpoints at a short period following open-heart surgery may have contributed to the moderate magnitude of investigated effects, as well as potential counteracting prayer influences in this sample. A longer period of follow-up and replications of this model in other samples are certainly desirable.

The present study is also limited by its convenience sample and the specific context of open-heart surgery. The location of this medical center may contribute to the greater socioeconomic status and majority race of the sample. SEM, as does regression analysis in non-experimental studies, does not eliminate alternative models. Causal modeling has the advantage of testing theoretical models and indirect effects. However, it does not have the advantage of regression models for exploring more alternative predictors. Due to the demanding statistical power in SEM and a relatively small sample, the model leaves open the possibility of impacts by other unmeasured confounders (such as self-efficacy, hostility). The study did not include cardiac data. Yet, Contrada et al. (2004) also found that short-term postoperative outcomes were unrelated to left main stenosis, comorbidity index and number of grafts, but they were associated instead with age, preoperative depressive symptoms and faith factors.

As noted, optimism and acute PTSD symptoms, were measured cross-sectionally. Yet, the suggested direct link from optimism to acute stress seems to be theoretically adjustable, indicating a counterbalancing role of positive attitudes. The link also implies that these two counterbalancing aspects of prayer coping are not completely independent from each other, a fact that supports the interconnectedness of the opposite sides in Hegel's principle. How they lead to forward movement, such as a desirable direction in the long-term postoperative adjustment, will need to be analyzed in the future. In addition, in its aim of testing a parallel-pathway solution with some controversial interpretations, the final model did not address other types of faith-based coping. Likewise, situational optimism was not assessed in this study, although it tends to be correlated with dispositional optimism (Peterson & Vaidya, 2001; Taylor et al., 1992). Our surgeon also suggests that cardiac patients were likely to avoid expressing their expectation for the specific surgical outcome, given their uncontrollable situation (Ai et al., 2004).

Despite these limitations, our data may provide the first empirical evidence for co-existing positive and negative pathways in the seemingly absent effect of prayer coping on short-term postoperative mental health. The potential protection and the complex aspect of prayer coping ought not to be ignored, given that few studies exist related to this topic, especially during the critical period of cardiac surgery. For replication of these complexities, more prospective studies should be conducted regarding other medical conditions, various types of acute crises, and diverse populations. Following Hegelianism, this study suggests that more studies should address the multi-variate and dynamic aspects of faith factors, rather than treat them as lifeless medications with invariable chemicals and mostly constant effects across patient populations.

Earlier, Rotter (1975) cautioned about the misconception of the locus of control construct, namely falling into a simplistic good-or-bad-guy way of thinking (Ai et al., 2005a). Similarly, the parallel-pathway model in this study implies that faith-based involvement in a medical crisis should not be considered as simply a black-or-white solution but rather as an important human phenomenon with the usual attendant controversies. The study also reveals the parallel age influence in this scenario and suggests that aging should not be viewed as an entirely negative factor. Likewise, optimism may also be unrealistic and sometimes even predict undesirable outcomes (Isaacowitz & Seligman, 2001; Norem, 2001). It can sometimes be illusory in nature but can also possess the potential to protect health and well-being (Peterson, 2000; Taylor & Brown, 1988).

Philosophically, this study is the first to present empirical faith-related evidence for Hegel's dialectic contradictive principle. Theoretically, our results may orient the attention of cardiologists and positive psychologists to the social and spiritual contexts of optimal expectations and acute stress response prior to open-heart surgery. Including a positive dimension may enhance professional interventions to build patients' strength traits and resilience. Eventually, this study may hopefully provoke more interdisciplinary, theory-driven research on the mechanisms underlying the effects of faith factors on health.

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