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Does Devoutness Delay Death? Psychological Investment in Religion and Its Association With Longevity in the Terman Sample

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Religious people tend to live slightly longer lives (M. E. McCullough, W. T. Hoyt, D. B. Larson, H. G. Koenig, & C. E. Thoresen, 2000). On the basis of the principle of social investment (J. Lodi-Smith & B. W. Roberts, 2007), the authors sought to clarify this phenomenon with a study of religion and longevity that (a) incorporated measures of psychological religious commitment; (b) considered religious change over the life course; and (c) examined 19 measures of personality traits, social ties, health behaviors, and mental and physical health that might help to explain the religion–longevity association. Discrete-time survival growth mixture models revealed that women (but not men) with the lowest degrees of religiousness through adulthood had shorter lives than did women who were more religious. Survival differences were largely attributable to cross-sectional and prospective between-class differences in personality traits, social ties, health behaviors, and mental and physical health.

Keywords: religion, longevity, personality, development

The association of social ties and social activity with physical health and longevity is one of the best established facts of human social life (House, Landis, & Umberson, 1988; Kawachi, Kennedy, & Glass, 1999; Uchino, 2006). Study after study has shown that people with strong social ties and high levels of social engagement live longer and with better health on many metrics—from alcohol use (Peirce, Frone, Russell, Cooper, & Mudar, 2000) to wound healing (DeVries, Craft, Glasper, Neigh, & Alexander, 2007).

Religious involvement is one form of social engagement that has been linked with physical health—most notably, with longevity. In a meta-analytic review of data from 42 tests of the religion–mortality association, McCullough, Hoyt, Larson, Koenig, and

Thoresen (2000) found that highly religious people were 29% more likely to be alive at any given follow-up point than were less religious people (odds ratio [OR] = 1.29; 95% confidence interval = 1.20–1.39). When those 42 effect sizes were statistically adjusted to estimate the association of religiosity and survival in a study that controlled for a large suite of potential confounds and mediators (e.g., demographic variables; social variables, including nonreligious social activities, social support, and marital status; baseline physical health; and health behaviors, such as alcohol use and smoking), the religion–mortality association dropped to an OR of 1.23. Powell, Shahabi, and Thoresen (2003) likewise concluded that religious service attendance predicts a 25% reduction in mortality risk in “high-quality” studies (i.e., those that do a good job of controlling for potential confounds).

Subsequent studies have replicated the association of religiousness with longevity, including studies with representative samples of U.S. adults (Gillum, King, Obisesan, & Koenig, 2008; Musick, House, & Williams, 2004); older Mexican Americans (Hill, Angel, Ellison, & Angel, 2005); and adults in Denmark (la Cour, Avlund, & Schultz-Larsen, 2006), Finland (Teinonen, Vahlberg, Isoaho, & Kivela, 2005), Taiwan (Yeager et al., 2006), and China (Zhang, 2008). As would be expected from McCullough et al.’s (2000) meta-analytic results, most (but not all) studies continue to show 25%–30% reductions in mortality for religiously active people, even after controlling for potential confounds and explanatory variables (cf. Bagiella, Hong, & Sloan, 2005). With more than 50

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independent tests of the religion–mortality association now in hand, it therefore seems safe to conclude that religious people do, on average and in most places, enjoy slightly longer lives.

Religion as a Health-Relevant Social Investment Over the Life Course

Nonetheless, important questions remain about how the association of religious involvement and longevity emerges over the life course. What causes people to be religious? Do those causes of religion also cause the religion–longevity association? What does religion cause? And are those effects of religion the mechanisms through which religion obtains its associations with longevity? The variety of models available for conceptualizing the links of individual differences and social processes to health is quite overwhelming, but many researchers concur that the best models incorporate the fact that many of the personality, social, and behavioral factors that influence health change over the life course (as does health itself) and influence each other reciprocally (Hampson & Friedman, 2008).

We think that the social investment principle from personality psychology (Bogg & Roberts, 2004; Lodi-Smith & Roberts, 2007) provides a useful starting point for a model of religion and longevity that incorporates the dynamic interplay over the life course of religiousness with (a) health-relevant personality traits, (b) commitment to other social institutions and social relationships, (c) health-relevant behaviors, and (d) intermediate measures of mental and physical health (see Figure 1).

Religion's Bidirectional Associations With Health-Relevant Personality Traits

The social investment principle states simply that psychological investment in normative, age-graded social institutions (e.g., work,

marriage, parenthood, religion, and community) causes—and is caused by—the psychological endowments that enable people to successfully fulfill the demands that those social commitments impose (Lodi-Smith & Roberts, 2007; Roberts & Bogg, 2004). For instance, highly conscientious and agreeable people have an easier time adjusting their behavior in response to (a) the demands that social roles place upon them (e.g., showing up to work, or worship services, or one's child's basketball game, on time) and (b) the needs, feelings, and wishes of the people with whom they interact in those roles. Conscientiousness and agreeableness reflect an ability to regulate one's behavior in response to task demands and to the wishes, feelings, and needs of others, respectively (Cumberland-Li, Eisenberg, & Reiser, 2004; Jensen-Campbell et al., 2002). It is perhaps not surprising, therefore, that religiosity is positively associated with conscientiousness, agreeableness (Lodi-Smith & Roberts, 2007; Saroglou, 2002), and self-control (McCullough & Willoughby, 2009).

But sustained commitment to social roles might also build psychological resources for doing a good job at fulfilling those roles (Bogg & Roberts, 2004; Lodi-Smith & Roberts, 2007; Roberts & Bogg, 2004). Therefore, commitment to social institutions, such as marriage, family, community, work, and religion, might lead, over the life course, to increases in self-control and self-regulation—or, at the level of the Big Five, conscientiousness and agreeableness (Lodi-Smith & Roberts, 2007; McCullough & Willoughby, 2009). The potentially reciprocal associations of religiosity with traits such as conscientiousness, agreeableness, and self-control are crucial here, because these same personality traits are related to better behavioral health and longevity (Bogg & Roberts, 2004; Martin, Friedman, & Schwartz, 2007). Thus, religion's associations with health and longevity might reflect the superordinate effects of personality traits on both religious com-

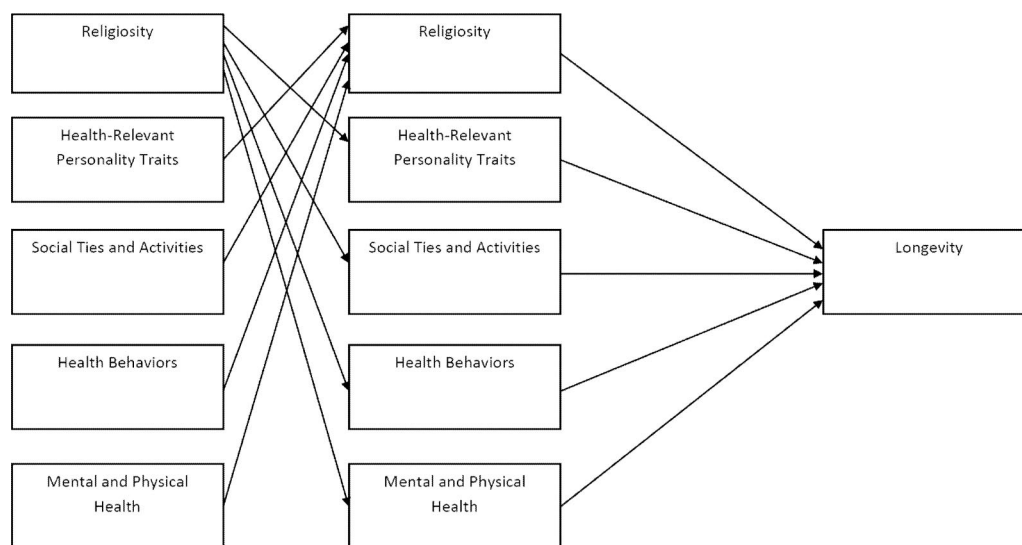


Figure 1. A model of religion's associations with health-relevant personality traits, social ties and activities, health behaviors, and mental and physical health over the life course. We presume that these relations are dynamic; thus, we include discrete "waves" of data merely to simplify the figure. For simplicity, we also have specified only religiosity's presumed effects on other variables and other variables' presumed effects on religiosity. Causal paths not modeled here are presumed to be important as well.

mitment and health, the effects of religious commitment on the development of health-relevant personality traits, or both.

Religion's Bidirectional Associations With Other Social Commitments

Likewise, the psychological resources that enable people to commit to a social institution such as religion should also suit them well to sustaining their commitments to other social institutions and social relationships (McCullough, Enders, Brion, & Jain, 2005). If this is true, then religiously committed people should also be more committed to other social institutions and social relationships, and they are (Putnam, 2000). The fact that investment in social activities and social relationships of all kinds tends to be health-promotive (House et al., 1988; Uchino, 2006) may therefore help, in part, to explain how religion acquires its associations with physical health and longevity. Specifically, three causal scenarios seem plausible: (a) religious commitment may cause people to make salutary commitments to other relationships and social institutions, such as family, marriage, and community; (b) strong social ties may encourage people to invest also in religion; or (c) both.

Religion's Bidirectional Associations With Health Behaviors, Mental Health, and Physical Health

According to Lodi-Smith and Roberts (2007), people who invest in a social role become subject to the "set of expectations and subsequent behavioral contingencies corresponding to the social role" (p. 71). Some of the expectations and behavioral contingencies that correspond to religious commitment are likely to be fairly neutral with respect to health and longevity (e.g., whether one should grow a beard, whether it's OK to listen to AC/DC, or what translation of the Bible to read), but others might actually promote health and longevity. For example, if someone commits to a religion, they should be more likely to adopt and adhere to that religion's proscriptions against excessive alcohol use, which are pervasive in the major world religions (Michalak, Trocki, & Bond, 2007). Given the deleterious effects of excessive alcohol use on longevity (Di Castelnuovo et al., 2006), one might reasonably expect that some of religion's associations with health and longevity result from the fact that religious people tend to adopt the behavioral standards of their religious traditions, including some behavioral standards that are relevant for health and longevity.

It is also worthwhile to contemplate the possibility that the psychological resources that sustained religious commitment might help to build (e.g., conscientiousness, agreeableness, and self-control) might also equip people to adopt health-relevant behaviors later in life, even if those health-related behaviors receive no particular normative support from within their religious system. For example, Strawbridge, Shema, Cohen, and Kaplan (2001) found that people who, in 1965, were smokers, heavy drinkers, depressed, physically inactive, or socially isolated were more likely to improve their standing on these health behaviors by 1994 if they were frequent religious attenders in 1965 than if they were not. The data for physical activity are particularly interesting here: There is no requirement for regular anaerobic exercise in either the Hebrew or Christian Bible. Likewise, religious people

more regularly visit their physicians and dentists, eat their vegetables, and take their vitamins (Hill, Burdette, Ellison, & Musick, 2006; Islam & Johnson, 2003; Shmueli & Tamir, 2007; Wallace & Forman, 1998), even though their religions are largely silent regarding such behaviors.

Religion's Bidirectional Associations With Mental and Physical Health

Of course, as Figure 1 implies, one should also be mindful of the possibility that difficulties with mental and physical health can limit people's abilities to invest in religious pursuits to the extent that they might otherwise (Kelley-Moore & Ferraro, 2001). Also, it is worthwhile to keep in mind that religiosity must ultimately influence longevity through more intermediate measures of physical and/or mental health (e.g., physiological functioning, disease processes, depression, suicidality).

In summary, the social investment principle leads us to expect that religion's associations with longevity reflect complex and potentially reciprocal relationships between religious commitment and (a) salutary personality traits, such as conscientiousness and agreeableness; (b) nonreligious social commitments to family, friends, and community institutions that predict longevity; (c) behavioral standards that might be health-promotive (e.g., abstinence from or only moderate use of alcohol, adopting a regime of anaerobic exercise); and (d) mental and physical health.

Modeling the Association of Religious Development over the Life Course and Longevity

Without exception, researchers working on religion and mortality to date have measured religiousness as between-persons differences at a single point in time. Such an approach is perfectly reasonable, but it ignores the fact that religiousness, like many psychological variables, changes and develops over the life course (Argue, Johnson, & White, 1999). Perhaps more important, individuals' religiousness change in different ways as they age (McCullough et al., 2005). And yet, the social investment principle implies that a cross-sectional measurement of individual differences in religiosity cannot provide a complete portrait of the religion-mortality association, because religious investments, like all investments, need time to produce returns: If religiousness causes changes in health-relevant psychological traits, health-relevant investment in other social institutions and relationships, health-relevant behaviors, or intermediate measures of physical and mental health, we would expect for these effects to eventuate in improved longevity only over time. It is thus worthwhile to evaluate the religion-mortality link using research methods that account for intraindividual changes in religiousness.

McCullough et al. (2005) demonstrated that people's patterns of religious development could be estimated as discrete classes of growth trajectories using growth mixture models (Muthén, 2001). Using data from the Terman Life Cycle Study of Children with High Ability (Terman, Sears, Cronbach, & Sears, 1990), McCullough and colleagues identified three basic trajectories of religious development over the adult life course: (a) a trajectory characterized by relatively high levels of religiousness that became slightly higher as people moved through adulthood; (b) a parabolic trajectory class in which people became more religious through mid life

and then less religious in later life; and (c) a pattern of very low religiousness that remained relatively stable throughout adulthood. Using recent extensions of growth mixture modeling, it is now possible to associate trajectory class membership with longevity (Muthén & Masyn, 2005). Such a statistical approach enables researchers not only to examine whether people's patterns of religious engagement over the entire life course accrue to affect longevity but also to estimate the extent to which potential explanatory variables can account for any differences in longevity among the growth trajectory classes that are identified.

The Present Study

In the present study, we evaluated whether people's patterns of religious development over the adult life course were associated with length of life and whether such associations could be explained in terms of personality traits (in this case, conscientiousness, extraversion, agreeableness, and neuroticism), social ties, health behaviors, and intermediate measures of physical and mental health. One distinctive feature of the present study is that we did not rely on a single measure of self-reported public religious activity; instead, we used a series of comprehensive expert ratings of participants' religiosity at several points during the life course, which allowed us to consider religiosity as a trajectory of social investment that unfolds over the life course.

Clark, Friedman, and Martin (1999) conducted a study on religion and mortality, using an earlier version of this data set. Our study differs from theirs in at least four ways. First, whereas Clark et al. estimated the association of longevity with a single-item measure of self-reported religiousness (collected during a 1950 survey), we measured religiousness as membership in discrete developmental trajectory classes, which incorporated data on participants' religiousness across the entire adult life course. Second, our mortality data were updated with a search and collection of death certificates through 2005, whereas Clark et al.'s study incorporated mortality data collected only through 1991. In other words, we incorporate 14 new years of data on the longevity of our participants. Third, newly developed methods for estimating missing data enabled us to include more than 300 more participants than Clark et al. could. Fourth, we evaluated 19 different personality, social, behavioral, and health-related factors (plus gender) in efforts to explain the association of religious development over the life course with longevity. We anticipated that people with high levels of religiosity over the life course would have longer lives than would people with low levels of religiosity over the life course, but we also expected that these trajectory class differences could be explained by taking into account (a) the associations of religious trajectory class membership with other health-relevant personality traits, social ties, health behaviors, and more intermediate measures of physical and mental health that were measured concurrently with the first measurements of religiosity that we used to establish participants' trajectories of religious development and (b) the potential causal effects of religious trajectory class membership on a select set of social ties, health indices, and health behaviors (i.e., whether participants married during their lifetimes, the number of children they had in their lifetimes, self-rated health, psychological maladjustment, and alcohol use) that were measured in the decades following the initial assessments of religiosity.

Method

Participants

We used data from the Terman Life Cycle Study of Children With High Ability, which initially involved 1,528 intellectually bright boys and girls (all had IQs of 135 or greater) living in the state of California. In the present study, we used 1,343 (56% male, 44% female; ages in 1940 ranged from 20–40, M age = 29.59 years, SD = 3.5) of the 1,528 original participants. The 185 participants we excluded either (a) were lost to follow-up or died before 1940 or (b) did not provide enough data to develop at least one indicator of religiousness (see the following details).

As of 1940, the participants in this sample of mostly White, middle-class adults were highly educated (about 99% had high school diplomas, 89% had at least some college experience, 70% had at least a bachelor's degree, 45% had at least a master's degree, and 8% had one or more doctoral degrees). In 1940, approximately 45% of the participants were Protestant, 3% were Catholic, 5% were Jewish, 2% indicated "other," and 45% indicated "no church affiliation." Most (64%) were married (of the remainder, most were single; approximately 3% were divorced).

Measures of Religiousness

As described in McCullough et al. (2005), the measures of religiousness resulted from a systematic review of the religion-relevant materials in participants' study records (Elder, Pavalko, & Clipp, 1993), which were not directly comparable from year to year. For example, in 1940, participants indicated their degree of interest in religion on a 5-point scale (1 = *none*, 5 = *very much*), how much they liked reading the Bible on a 3-point scale (1 = *like*, 2 = *indifferent*, and 3 = *dislike*), their agreement with the idea that giving children religious instruction is essential for a successful marriage on a 5-point scale (1 = *very essential* and 5 = *decidedly not desired*), and the number of religious activities in which they were involved (out of five possible activities). Many participants also wrote qualifications to their survey responses in the margins. In contrast, the 1991 survey included items that instructed respondents to indicate how important nine different aspects of religion and church (e.g., worship and prayer, spiritual reading or radio/TV, and trying to understand religious truths more deeply) were to them (on a 3-point scale ranging from *very* to *not at all*) and a series of items to indicate whether those nine aspects of religion or church had become more or less important to them in recent years.

It is obvious, then, that religious information on our participants was plentiful but not directly comparable across waves of data collection. Such frustrations are not uncommon in archival longitudinal work (Elder et al., 1993), but social scientists have found a productive way to cope with them: We used a "recasting" method (Elder et al., 1993) to develop a 6-point rating scale for measuring participants' religiousness. This measure is conceptually similar to measures that previous longitudinal researchers have used to measure the personal importance that people ascribe to their religious beliefs (Argue et al., 1999; Wink & Dillon, 2002).

To create this measure, a single rater read all information that participants provided regarding their religiousness for the surveys that Terman and his associates administered in six waves of data collection (1940, 1950, 1960, 1977, 1986, and 1991). (For the purposes of evaluating interrater reliability, a second rater also

rated a random subsample of participants' records.) After reading the religious information on a given participant for a given year, the rater then provided a single integer value reflecting her perception of the participant's religiousness at that point in the participant's life.

The points on the rating scale were defined as -1 = *actively antireligious, noted by lack of personal religious interest/inclination, total lack of life satisfaction gained from religion, and some degree of hostility/suspicion regarding religion or religious beliefs*; 0 = *religion has no importance in subject's life, as noted by no religious interest, no religious inclinations, and total lack of life satisfaction gained from religion*; 1 = *religion has slight importance in subject's life, as noted by slight interest in religion, slight religious inclination, or a slight degree of life satisfaction gained from religion*; 2 = *religion has moderate importance in subject's life, as noted by average interest in religion, moderate religious inclination, or a moderate degree of life satisfaction gained from religion*; 3 = *religion has above-average importance in subject's life, as noted by above-average interest in religion, above average religious inclination, or a high degree of life satisfaction gained from religion*; and 4 = *religion has very high importance in subject's life, as noted by very high interest in religion, very high religious inclination, or very high degree of life satisfaction gained from religion*. Very few participants received scores of -1 , so to ease computational difficulties (McCullough & Boker, 2007), we combined scores of -1 with scores of 0 , which resulted in a 5-point scale ranging from 0 to 4 . As reported in McCullough et al. (2005), these measures had high interrater reliability (i.e., 95% of the variance was attributable to substantive sources) and validity: They were correlated both within persons, $r = .34$ ($N = 1,139$), $p < .001$, and between persons, $r = .64$ ($N = 1,356$), $p < .001$, with a similar rating measure of people's involvement in public religious institutions and activities. For the years 1940, 1950, 1960, 1977, 1986, and 1991, we had nonmissing religion values for approximately 92%, 81%, 74%, 54%, 51%, and 34% of the sample, respectively.

Measures of Mortality

The years in which participants died as of 2005 were ascertained from death records, which were obtained through state bureaus (Clark et al., 1999). Through 2005, 1,271 of the 1,528 original study participants were confirmed dead, leaving 257 potentially still alive, although only 136 had responded at all since 1991.

Other Measures From 1940

Personality traits. We measured conscientiousness, extraversion, agreeableness, and neuroticism, using measures previously developed for use with the Terman data (Martin & Friedman, 2000). These scales were based on participants' responses in 1940 to a series of self-report items, including 53 items that Terman drew from an existing inventory (Bernreuter, 1933). On the basis of extensive psychometric analyses, including structural equation models confirming that the psychometric properties of the individual items were essentially the same in the Terman sample as in a contemporary sample of adults, Martin and Friedman (2000) developed measures of conscientiousness (7 items; $\alpha = .65$), extraversion (7 items; $\alpha = .65$), agreeableness (11 items; $\alpha = .72$)

and neuroticism (17 items; $\alpha = .85$). In Martin and Friedman's contemporary validation sample, these scales were highly correlated with the target scales from the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992; heteromethod-monotrait r s ranged from .63 to .81) and only modestly correlated with the off-target scales (heterotrait-heteromethod r s ranged from .101 to .136).

Social ties and activities in 1940. We included measures of whether participants were married in 1940 (0 = *no*; 1 = *yes*) and measures of the number of professional/business organizations in which they were involved in 1940, the number of offices they held in organizations in 1940, the number of avocational activities in which they participated in 1940, the number of service activities in which they participated in 1940, and whether they lived with someone in 1940 (0 = *no*; 1 = *yes*).

Health behaviors in 1940. We used self-reported height and weight data from 1940 to calculate the Quetelet index, also known as the body mass index (BMI): $703 \times \text{weight (pounds)}/\text{height (inches)}^2$. In the 1940 survey, participants also described their alcohol use by choosing one of five options (1 = *I have never used liquor*; 2 = *I take a drink occasionally for social reasons*; 3 = *I am an occasional drinker, I have not been drunk more than a few times*; 4 = *I am a moderate drinker, have been drunk occasionally, but have never felt it necessary to stop*; 5 = *Alcohol is a problem, I drink periodically or steadily, am drunk fairly often, and attempts to stop have been unsuccessful*). On the basis of data from similar items in the 1950 and 1960 surveys, high alcohol use has been found to predict early death in this sample (Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995).

Self-rated health and psychological maladjustment in 1940. In 1940, participants completed a 5-point Likert-type item ("General health since 1940") to indicate their perceptions of their health (1 = *very poor*, 2 = *poor*, 3 = *fair*, 4 = *good*, and 5 = *very good*). To measure psychological maladjustment, we combined participants' standard scores on three items. The first item was a rating of global maladjustment. To create this item, Terman's research staff read a series of items related to participants' psychological adjustment from the 1940 survey and then assigned each subject a score to indicate their "general adjustment" (0 = *satisfactory*, 1 = *some difficulty*, and 2 = *considerable difficulty*). A similar measure of psychological adjustment from 1950 was a significant predictor of early death (Friedman, Tucker, Schwartz, Martin, et al., 1995). The second item was a 4-point rating of the seriousness of any stressful life events that participants reported having recently experienced (1 = *slight* to 4 = *very high*). The third item was a 4-point rating of the extent of nervous symptoms that the participant suffered as a result of the recent life event (0 = *none* to 3 = *nervous breakdown*). The mean of these three items had an internal consistency of $\alpha = .82$, and the mean performed better than any of the items individually as a predictor of other variables in the study, so we used the mean of the three standard scores as a measure of psychological maladjustment.

Measures in the Decades Beyond 1940

Marriage and number of children during lifetime. We measured whether participants married in their lifetimes (0 = *no*; 1 = *yes*) and the number of children they had in their lifetimes.

Alcohol use beyond 1940. The extent of participants' alcohol use in the decades beyond 1940 was measured on single-item rating scales in interviews or self-report questionnaires in four different waves (1950, 1960, 1986, and 1991). Although these four measures were on different response scales (e.g., 1 = *never/rarely drinks* to 4 = *serious alcohol use*), they were moderately intercorrelated ($r_s = .38$ to $.73$), and the estimated internal consistency of a composite based on standard scores of the four scales was $\alpha = .81$. The association of the four-item composite and the single-item measure of alcohol use in 1940 was $r = .59$ ($N = 1,171$), $p < .001$.

Psychological maladjustment beyond 1940. Psychological maladjustment was measured on single-item rating scales in interviews or self-report questionnaires in 1945, 1950, and 1960. These three measures had different response scales (e.g., 1 = *satisfactory* to 3 = *much difficulty*), but they were moderately intercorrelated ($r_s = .48$ to $.87$), and the estimated internal consistency of a composite based on standard scores for the three scales was $\alpha = .82$. Thus, we used the mean of these three measures to represent participants' average psychological maladjustment in the years following 1940. The association of this composite and the single-item measure of maladjustment from 1940 was $r = .58$ ($N = 1,343$), $p < .001$.

Self-rated health beyond 1940. Between 1945 and 1999, participants completed single-item measures of their self-rated health in 10 different waves. The 10 items were weakly to moderately intercorrelated (r_s ranging from $.14$ to $.62$), but a composite based on all 10 measures had an estimated internal consistency reliability of $\alpha = .86$. The association of the 10-item composite and the single-item measure of self-rated health in 1940 was $r = .42$ ($N = 1,215$), $p < .001$. We used this composite to capture individual differences in average self-rated health in the decades following 1940.

Analyses

Missing data. For the main statistical analyses, we used the Mplus 5.2 statistical program (Muthén & Muthén, 1998–2004). Mplus implements maximum likelihood missing data handling for missing outcomes, but it does not allow covariates to have missing values in the mixture modeling framework. Consequently, we imputed the missing predictor variable scores, using the multiple imputation procedure in SAS (Schafer, 1997). To do so, we first estimated an unconditional three-class mixture model using maximum likelihood and saved the posterior probabilities for each case. Next, we specified an imputation model that included two of the three posterior probabilities (the probabilities sum to one, so the third is redundant) and the set of 20 predictor variables (see Table 1). Including the posterior probabilities in the imputation process preserves the associations between the predictors and the latent class model during imputation. Finally, we used a data-augmentation algorithm to create $m = 10$ imputed data sets, each of which contained different estimates of the missing predictor variable scores. The multiple imputation procedure produced complete data on the predictor variables, but the religiousness scores were still missing (the cohort-sequential data-collection design makes imputation impossible). Consequently, we used maximum-likelihood missing data handling to estimate the conditional mixture model on each of the 10 imputed data files and subsequently

Table 1

Means and Standard Deviations of Predictors of Trajectory Class Membership and Within-Class Survival Functions

Predictor	<i>M</i>	<i>SD</i>
Gender (0 = <i>female</i> , 1 = <i>male</i>)	56.20%	—
Conscientiousness (1940)	−0.08	3.88
Extraversion (1940)	−0.11	3.95
Agreeableness (1940)	0.05	5.62
Neuroticism (1940)	0.36	9.12
Participant married (1940)	64.10%	—
No. of professional memberships (1940)	0.73	1.26
No. of offices held (1940)	0.17	0.54
No. of avocational activities (1940)	2.28	2.11
No. of service activities (1940)	0.61	1.05
Does participant live with someone? (1940)	88.00%	—
Body mass index (1940)	21.89	2.46
Alcohol use (1940)	2.58	0.94
Self-rated health (1940)	4.3	0.78
Psychological maladjustment (1940)	0.01	0.86
Did participant ever marry?	90.30%	—
No. of children (lifetime)	1.84	1.4
<i>M</i> alcohol use (1950–1991)	0.04	0.91
<i>M</i> psychological maladjustment (1945–1960)	0.04	0.91
<i>M</i> self-rated health (1945–1999)	4.22	0.63

Note. Variables expressed in percentages were binary predictors.

combined the parameter estimates using standard pooling formulas (Rubin, 1987).

Growth mixture model for the religion data. We used growth mixture models to examine whether the heterogeneity in people's religiousness scores resulted from membership in distinct trajectory classes, rather than from parametric differences among people drawn from a single trajectory class. We first used Mplus to conduct a single-class growth model (Hedeker, 2004), in which we specified that the individual differences in religious development resulted from interindividual differences in (a) intercepts, centered on age 53.5 years, which was the midpoint age for the sample; (b) rates of linear change in religiousness over the life course; and (c) rates of quadratic change, or curvature, in religiousness. The within-person models were of the form:

$$R_{ij} = \beta_{0j} + \beta_{1j}(\text{year}_{ij}) + \beta_{2j}(\text{year}_{ij})^2 + r_{ij}, \quad (1)$$

where R_{ij} = person j 's religiousness at time i ; β_{0j} = person j 's religiousness at the intercept, or midpoint, of the age range that we investigated (age 53.5 years), which can also be interpreted as person j 's mean religiousness over the life course (controlling for higher order effects for age); $\beta_{1j}(\text{year}_{ij})$ = person j 's constant rate of linear change in religiousness between ages 27 and 80; $\beta_{2j}(\text{year}_{ij})^2$ = curvature in person j 's longitudinal trajectory; and r_{ij} = an occasion-specific residual in person j 's religiosity at time i that cannot be predicted on the basis of his or her intercept, constant rate of change, and curvature. Participants' observations prior to age 27, and after age 80, had to be trimmed from the data set to facilitate convergence. To minimize collinearity among the intercept, linear change, and quadratic change components, we used orthogonal polynomial series to represent the loadings of the measures of religiousness on the latent growth parameters (for an extensive explanation, see Hedeker, 2004), which were centered on age 53.5. We also tried to run models including parameters for

cubic-order change, but they did not converge, suggesting that it was unproductive to posit growth forms more complex than a quadratic change model could accommodate.

The optimal number of latent classes was determined using the sample-size adjusted Bayesian Information Criterion (SSBIC) and the Lo-Mendell-Rubin likelihood ratio test (LRT; Lo, Mendell, & Rubin, 2001). The SSBIC is based on the log likelihood and contains an adjustment term that effectively penalizes models for overparameterization. Mplus scales the SSBIC such that lower values (closer to zero) reflect better fit. The LRT is a nested model test that compares the fit of a k -class model to that of a model with $k - 1$ classes. Tofighi and Enders (2007), whose simulation study examined a growth mixture model similar to ours, recommended both of these measures.

The SSBIC for the one-class model provided a baseline measure of goodness of fit with which we were able to compare models positing multiple trajectory classes. Having evaluated a one-class growth curve model, we then used Mplus to specify a growth mixture model in which the interindividual differences in religious development were posited to result from two qualitatively distinct trajectory classes. This model also yielded an SSBIC value, along with a measure of entropy, which is a measure of classification quality (values range from 0 to 1, with values closer to 1 indicating that individuals are classified into individual trajectory classes with good precision). The two-class model also produced an LRT that provided a significance test of whether the model with two trajectory classes provided a better fit to the data than did the one-class model. In the two-class model and successive growth mixture models, we allowed the trajectory components within classes to vary (i.e., variance components for the growth factors were freely estimated), and we allowed the Level 1 residual variances to vary across classes (Enders & Tofighi, 2008). Having computed a two-class model, we proceeded to estimate models with three and four latent trajectory classes, respectively.

Predicting religious trajectory class membership. Following an initial assessment of the number of classes, we added 20 covariates (see Table 1) as predictors of religious trajectory class membership, in keeping with Figure 1. The portion of the model that contained these covariates was a multinomial logistic regression in which the regression coefficients reflected the change in the log-odds of belonging to class k relative to a reference class. As described below, there was a class of individuals who were defined by relatively low levels of religiousness throughout the lifespan. This class was defined as the reference class, so the logistic regression coefficients captured the change in the log-odds of belonging to one of the other two classes relative to this least religious class. Consistent with standard logistic regression analyses, these coefficients can be exponentiated to derive ORs that reflect the change in odds of membership in a given trajectory class, relative to the reference class, for every one-unit change in the covariate. Although including covariates can alter the composition of mixtures, such was not the case in our analyses.

Discrete-time survival mixture model. Having established the religious trajectory classes and the covariates that could be used to predict class membership, we added a discrete-time survival model to the model (Muthén & Masyn, 2005). A survival analysis models the probability of an event (in this case, death) over time. In effect, this portion of the model quantifies the progression of the probability of death across the age span and does so separately within

each of the religious trajectory classes. Although time (i.e., age) is naturally a continuous metric, we used a discrete-time survival analysis in which the probability of death was estimated within discrete 5-year time intervals (which improved computational efficiency; because of the multicohort nature of the sample, expression of survival in a continuous metric prevented model convergence). Our main question here was whether the religious trajectory classes differed with respect to longevity. The survival mixture model addressed this by allowing the survival model parameters to vary across classes. In the data that Muthén and Masyn (2005) explored in their exposition of the technique, the measures used to classify individuals into trajectory classes (i.e., repeated measures of students' aggressiveness in first and second grades) were collected in total before the beginning of the observation period for the survival process (probability of school removal between third and seventh grades), whereas the survival process and the religious development process in the present study unfolded concurrently.

Because the religion and survival data were modeled jointly, it was possible for the addition of the survival data to alter the composition of the latent trajectory classes (Muthén & Masyn, 2005). However, this was not the case here: The growth model parameters and the mixture proportions for the three classes were virtually identical, regardless of whether the survival data were included in the model. The event data (i.e., deaths) were coded within 5-year age bins (e.g., 30–34, 35–39).

In a single-class survival model (with no covariates predicting survival), the hazard probability (i.e., the probability of being dead during a particular time interval, given that an individual was alive in the previous interval) varies across time as a function of time-specific logit (or, equivalently, threshold) parameters. When moving to a k -class survival model, these logit parameters are held invariant across classes, and class differences in the hazard functions are determined by a latent variable intercept (i.e., logit) that captures the overall increase or decrease in the hazard function for class k relative to that of the reference class (the intercept is standardized to zero in the reference class). For example, a positive value of this intercept parameter implies that individuals in class k have a higher probability of death at any given age interval than do individuals in the reference class. Similarly, a negative logit parameter means that people in class k have a lower probability of death than do people in the reference class. When exponentiated, these latent variable intercepts represent hazard-ORs that quantify the relative magnitude of the hazard-odds (the ratio of the probability of dying relative to surviving) for class k versus the hazard-odds of the reference class. For example, an exponentiated intercept (i.e., hazard-OR) of .80 means that the hazard-odds of death at any given age interval is 80% as high for people in class k as for people in the reference class.

Explaining religious trajectory class differences in survival with covariates. In another set of models, we sought to determine whether the hazard function within any given class changed as a function of (a) a suite of 14 personality, social, behavioral, and health-related variables measured in 1940, plus gender, or (b) the five measures of lifetime marital history; lifetime number of children; and measures of alcohol use, psychological adjustment problems, and self-rated health following 1940. In effect, these analyses enabled us to examine whether the between-class differences in survival could be accounted for by covariates measured in 1940 or by a limited number of health-relevant variables that unfolded in the years and decades

following 1940. This portion of the model is also a logistic regression, but unlike the multinomial logistic regression described above, this portion of the model can be viewed as a set of within-class regressions in which the within-class coefficients quantify the change in the hazard probability for class k specifically (i.e., what factors influence survival in class k ?). We examined two sets of models: a set in which the coefficients for each covariate were invariant across latent classes (e.g., the impact of gender on survival was the same across classes) and a set in which the magnitudes of the within-class regression coefficients were allowed to vary (e.g., the impact of gender on survival was free to vary across classes). Note that all of the covariates except gender were centered at the grand mean, so the latent variable intercepts (the parameters that describe the hazard differences across classes) essentially quantify the difference in the hazards for two trajectory classes that have been “equated” on the covariates (i.e., the difference in hazards for two religious trajectory classes that have zero values on all covariates). Conceptually, this portion of the analysis resembles an analysis of covariance inasmuch as it evaluates group differences in the hazard function (quantified by the latent variable intercept) after controlling for a set of covariates.

The overall model is depicted graphically in Figure 2, which is similar to the path diagram given in Muthén and Masyn (2005). The growth mixture modeling of the religiosity data, the discrete-time survival part of the model, and the multinomial logistic regressions can all be executed within a single model in Mplus, obviating the need for multistage analyses. Muthén and Masyn (2005) provided additional technical details of this model.

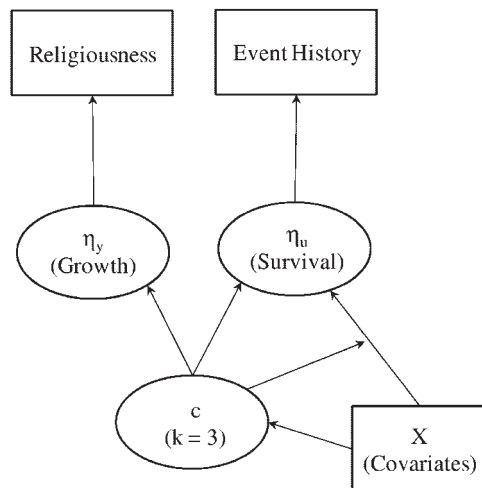


Figure 2. Depiction of the discrete-time survival growth mixture model. The ellipse labeled “c” represents the latent categorical variable that defines the three religious trajectory classes, and the ellipses labeled “ η_y ” and “ η_u ” represent the growth model and survival model, respectively. The arrow connecting c to η_y reflects the fact that the growth model parameters can vary across trajectory classes, and the arrow between c and η_u represents class-specific differences in the survival model parameters. The rectangle “x” represents the set of covariates. The arrow between x and c is the multinomial logistic regression that describes the relationship between the covariates and trajectory class membership, and the arrow between x and η_u represents influence of the covariates on the survival function within each trajectory class.

Results

A mixture solution consisting of three trajectory classes with random effects for the initial status, the linear effect of time, and the quadratic effect of time provided the most efficient description of religious development in the sample (McCullough et al., 2005). As described earlier, this conclusion was based on model comparisons using the SSBIC and the LRT. Classification quality was adequate, as evidenced by an entropy value of 0.76 and average posterior class probabilities given modal class assignment ranging from 0.82 to 0.91 for the three trajectory classes. As in McCullough et al.’s (2005) previous analyses, the smallest class ($N = 211$, or 16% of the sample) was composed of highly religious people whose religiousness increased at a moderate rate until mid life and then gradually reached an asymptote. The next largest class ($N = 521$, or 39%) began adulthood with very low religiousness that stayed low across the life course (and even declined slightly with age). The final class ($N = 608$, or about 45%) had a “parabolic” religious trajectory: moderate religiousness in early adulthood that increased into mid life and then decreased again through the remainder of the life course (see Figure 3).

Trajectory Class Differences in the Covariates

We used the 20 covariates in Table 1 to predict trajectory class membership (i.e., the arrow connecting c with x in Figure 2). This portion of the model was a multinomial logistic regression, and we defined the least religious class as the reference class for these analyses. As such, the regression coefficients reflect the change in the log-odds of belonging to one of the other two classes relative to the least religious trajectory class.

Highly religious trajectory class versus the least religious trajectory class. As Table 2 shows, people in the highly religious trajectory class differed from people in the least religious class on several variables. They were significantly more extraverted, agreeable, and neurotic. They also had less alcohol use, more children, and more engagement in service activities. In the years following 1940, they also went on to have more psychological adjustment problems but also less alcohol use. The regression coefficients in Table 2 are expressed in the logit metric, so exponentiation converts these values to an OR metric that is easier to interpret. For example, the OR of 1.12 for the association of extraversion with membership in the highly religious class suggests that a one-unit increase in extraversion increases the odds of belonging to the highly religious class by 12%.

Parabolic trajectory class versus the least religious trajectory class. The regression coefficients relating membership in the parabolic religious trajectory class versus the least religious trajectory class appear in Table 3. Relative to the people in the least religious class, people in the parabolic class were more agreeable. They also had less self-reported alcohol use, were more likely to have married, had more children, and engaged in more service activities. Finally, women were more likely than men to belong to the parabolic class. The OR of 2.09 for the association of marriage with class membership indicates that the odds of belonging to the parabolic class versus the least religious class were 2.09 times higher for married people than for unmarried people.

Highly religious trajectory class versus the parabolic trajectory class. Finally, the regression coefficients differentiating the highly religious class from the parabolic class appear in Table 4. Relative to the people in the parabolic class, people in the highly religious class

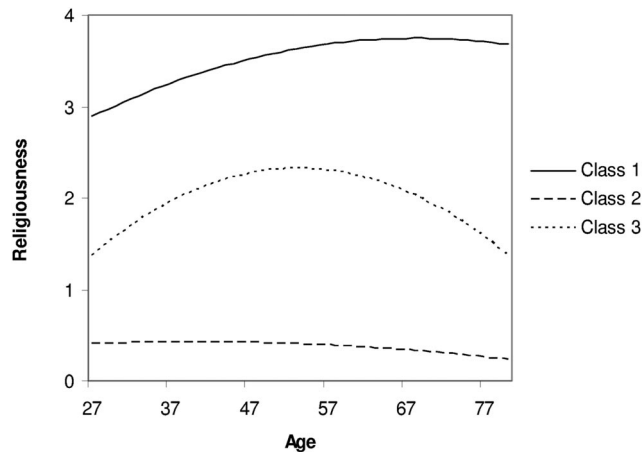


Figure 3. Typical life course trajectories in religiousness for the three religious trajectory classes derived from the growth mixture model.

were more agreeable and more extraverted. They also had less alcohol use in 1940, lower likelihood of ever marrying, and less alcohol use during the years between 1950 and 1991.

Do the Three Religious Trajectory Classes Have Different Mortality Hazards?

Beyond characterizing the health-relevant variables that distinguished among the three religious trajectory classes, the central goal of this project was to determine whether the survival model parameters varied across the religious trajectory classes. In Figure 2, this goal is depicted by the arrow connecting c and η_u . We initially modeled the between-class survival differences as a function of gender (0 = male; 1 = female). This coding of gender

meant that the intercepts of the survival latent variable captured between-class differences in the hazard probabilities for men specifically. In these analyses, the three religious trajectory classes did not manifest significantly different hazard functions. As shown in Table 5, the comparison of men in the high- and low-trajectory classes produced a nonsignificant logit of 0.11 ($SE = 0.19$, $z = 0.59$, two-tailed $p = .55$, hazard-OR = 1.12), as did the comparison of men in the parabolic and low classes (logit = -0.09 , $SE = 0.12$, $z = -0.70$, $p = .48$, OR = 0.91). Thus, there were no significant differences in the hazard functions for the men across the three trajectory classes, replicating Clark et al.'s (1999) finding that men's religiousness in 1950 did not predict longevity.

In another model we re-centered gender on women (0 = female, 1 = male). In this model, we found significant differences in the hazard functions for women in the three trajectory classes. Specifically, the logit comparing the hazard for women in the highly religious class with women in the least religious class was significant and negative, meaning that the highly religious women had a lower probability of death at any given age interval (logit = -0.53 , $SE = 0.19$, $z = -2.85$, $p = .004$). To facilitate interpretation, we exponentiated the logit. The resulting hazard-OR of .59 implies that the hazard-odds of death (i.e., the relative probability of dying versus surviving) for women in the highly religious class was 41% lower than for women in the least religious class. Women in the parabolic class also had a significantly lower hazard function than did women in the least religious class (logit = -0.36 , $SE = 0.14$, $z = -2.50$, $p = .013$). The hazard-OR of .70 means that the hazard-odds of death for women in the parabolic class were approximately 30% lower than for women in the least religious class. Thus, women in the least religious class had a higher hazard of dying at any point in the adult life course than did the women in the other two (more religious) classes. The religion-mortality association for women also replicated results from Clark et al. (1999), who found that religiousness measured in 1950

Table 2

Influence of Covariates on Membership in the Highly Religious Class Relative to the Least Religious Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = female, 1 = male)	-0.22	0.24	-0.90	.37	0.80
Conscientiousness (1940)	0.04	0.03	1.08	.28	1.04
Extraversion (1940)	0.11	0.03	3.40	.00	1.12
Agreeableness (1940)	0.09	0.02	3.80	.00	1.09
Neuroticism (1940)	0.03	0.02	2.03	.04	1.03
Participant married (1940)	-0.02	0.31	-0.05	.96	0.98
No. of professional memberships (1940)	-0.20	0.11	-1.76	.08	0.82
No. of offices held (1940)	0.10	0.21	0.45	.65	1.10
No. of avocational activities (1940)	0.07	0.05	1.40	.16	1.07
No. of service activities (1940)	0.35	0.10	3.51	.00	1.41
Does participant live with someone? (1940)	-0.23	0.41	-0.56	.58	0.80
Body mass index (1940)	-0.02	0.04	-0.36	.72	0.99
Alcohol use (1940)	-1.07	0.21	-5.20	.00	0.34
Self-rated health (1940)	0.07	0.19	0.37	.71	1.07
Psychological maladjustment (1940)	0.00	0.18	0.00	.00	1.00
Did participant ever marry?	-0.53	0.49	-1.07	.28	0.59
No. of children (lifetime)	0.29	0.09	3.12	.00	1.34
M alcohol use (1950–1991)	-0.49	0.20	-2.44	.02	0.61
M psychological maladjustment (1945–1960)	0.41	0.17	2.38	.02	1.50
M self-rated health (1945–1999)	0.23	0.22	1.07	.29	1.26

Note. OR = odds ratio.

Table 3

Influence of Covariates on Membership in the Parabolic Religious Class Relative to the Least Religious Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = <i>female</i> , 1 = <i>male</i>)	−0.50	0.17	−2.93	.00	0.61
Conscientiousness (1940)	0.04	0.02	1.92	.06	1.04
Extraversion (1940)	0.02	0.02	1.17	.24	1.02
Agreeableness (1940)	0.03	0.02	2.13	.03	1.03
Neuroticism (1940)	0.01	0.01	1.38	.17	1.01
Participant married (1940)	−0.19	0.19	−0.99	.32	0.83
No. of professional memberships (1940)	−0.07	0.07	−1.15	.25	0.93
No. of offices held (1940)	−0.01	0.15	−0.09	.93	0.99
No. of avocational activities (1940)	0.00	0.04	−0.07	.94	1.00
No. of service activities (1940)	0.22	0.08	2.63	.01	1.24
Does participant live with someone? (1940)	0.14	0.26	0.55	.58	1.15
Body mass index (1940)	0.03	0.03	0.94	.35	1.03
Alcohol use (1940)	−0.28	0.11	−2.61	.01	0.75
Self-rated health (1940)	0.11	0.11	0.97	.33	1.11
Psychological maladjustment (1940)	−0.01	0.11	−0.12	.91	0.99
Did participant ever marry?	0.74	0.37	1.97	.05	2.09
No. of children (lifetime)	0.14	0.06	2.33	.02	1.15
M alcohol use (1950–1991)	−0.08	0.11	−0.69	.49	0.93
M psychological maladjustment (1945–1960)	0.19	0.11	1.72	.09	1.21
M self-rated health (1945–1999)	0.09	0.14	0.63	.53	1.09

Note. OR = odds ratio.

predicted survival for women in this sample. (We also reparameterized this model with the highly religious trajectory class as the reference class, which enabled us to contrast the hazard functions for the highly religious class and the parabolic religious class. Compared with the highly religious class, the parabolic religious class had a slightly higher (but not statistically significantly so) hazard logit of .18 ($SE = .19$, $z = 0.94$, $p = .35$, hazard-OR = 1.19). The hazard functions for women in the three classes appear in Figure 4.

Accounting for the Hazard Differences Among the Three Trajectory Classes

Adding personality, social, behavioral, and health-related covariates. Next, we estimated a model that predicted the between-class differences in the hazard functions with gender (centering on women) and the 14 measures of personality, social ties and activities, health behaviors, and physical and mental health from 1940. When

Table 4

Influence of Covariates on Membership in the Highly Religious Class Relative to the Parabolic Religious Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = <i>female</i> , 1 = <i>male</i>)	0.28	0.24	1.17	.24	1.33
Conscientiousness (1940)	0.00	0.03	−0.12	.91	1.00
Extraversion (1940)	0.09	0.03	2.76	.01	1.09
Agreeableness (1940)	0.06	0.02	2.58	.01	1.06
Neuroticism (1940)	0.02	0.01	1.16	.25	1.02
Participant married (1940)	0.17	0.32	0.55	.59	1.19
No. of professional memberships (1940)	−0.12	0.11	−1.10	.27	0.88
No. of offices held (1940)	0.11	0.20	0.55	.58	1.11
No. of avocational activities (1940)	0.08	0.05	1.46	.15	1.08
No. of service activities (1940)	0.13	0.09	1.53	.13	1.14
Does participant live with someone? (1940)	−0.37	0.42	−0.89	.38	0.69
Body mass index (1940)	−0.05	0.04	−1.09	.28	0.96
Alcohol use (1940)	−0.79	0.20	−3.89	.00	0.45
Self-rated health (1940)	−0.04	0.20	−0.18	.86	0.97
Psychological maladjustment (1940)	0.01	0.19	0.08	.94	1.01
Did participant ever marry?	−1.26	0.53	−2.39	.02	0.28
No. of children (lifetime)	0.15	0.09	1.63	.10	1.16
M alcohol use (1950–1991)	−0.41	0.20	−2.04	.04	0.66
M psychological maladjustment (1945–1960)	0.22	0.17	1.30	.20	1.24
M self-rated health (1945–1999)	0.14	0.22	0.66	.51	1.15

Note. OR = odds ratio.

Table 5

Mean Hazard Differences Between the Religious Trajectory Classes in Four Different Models in Which Covariates of Trajectory Class Membership Were Systematically Added

Model	Covariates	Trajectory classes compared	Logit	SE	z	p	Hazard-OR equivalent
1	Gender (0 = male)	High vs. low	0.11	0.19	0.59	.55	1.12
		Parabolic vs. low	-0.09	0.12	-0.70	.48	0.91
2	Gender (0 = female)	High vs. low	-0.53	0.19	-2.85	.00	0.59
		Parabolic vs. low	-0.36	0.14	-2.50	.01	0.70
3	Gender (0 = female) + personality, social, behavioral, and health-related variables from 1940	High vs. low	-0.18	0.31	-0.58	.56	0.84
		Parabolic vs. low	-0.33	0.16	-2.08	.04	0.72
4	Gender (0 = female) + personality, social, behavioral, and health-related variables from 1940 + ever married (lifetime), number of children (lifetime), and alcohol, psychological maladjustment, self-rated health beyond 1940	High vs. low	-0.18	0.39	-0.45	.65	0.84
		Parabolic vs. low	-0.21	0.17	-1.29	.20	0.81

Note. OR = odds ratio.

we centered on the women (i.e., by coding women as 0 and men as 1 on the gender variable), the between-class differences in survival (i.e., the hazard intercepts) yielded information about the between-class hazard differences specifically for women in the sample (because the centering strategy one chooses for covariates affects model intercepts), but the effects of other covariates in the models applied equally to men and to women (because the centering strategy one chooses for one covariate does not influence the effects of other covariates). With these 14 variables added, the survival difference between the highly religious and least religious classes became nonsignificant (logit = -0.18, $SE = 0.31$, $z = -0.58$, $p = .56$, hazard-OR = .84). The survival difference between the parabolic and least religious classes remained statistically significant (logit = -0.33, $SE = 0.16$, $z = -2.08$, $p = .04$, hazard-OR = .72).

Adding marriage, number of children, alcohol use, psychological maladjustment, and self-rated health beyond 1940. In a successive model, we added five more covariates: (a) whether

participants married in their lifetimes, (b) the number of children participants had in their lifetimes, (c) alcohol use from 1950 to 1991, (d) psychological maladjustment from 1945 to 1960, and (e) self-rated health from 1945 to 1999. Because the previous model already included as covariates measures of whether participants were married in 1940, as well as alcohol use, psychological adjustment problems, and self-rated health in 1940, these four variables in particular could be conceptualized as measures of residualized change in their respective constructs in the years following 1940. With these five new variables added, the survival difference between the highly religious and least religious trajectory classes fell slightly further (logit = -0.18, $SE = 0.39$, $z = -0.45$, $p = .65$, hazard-OR = .84). The survival difference between the parabolic and least religious classes, on the other hand, went from statistically significant to statistically nonsignificant upon addition of these five covariates (logit = -0.21, $SE = 0.17$, $z = -1.29$, $p = .20$, hazard-OR = .81).

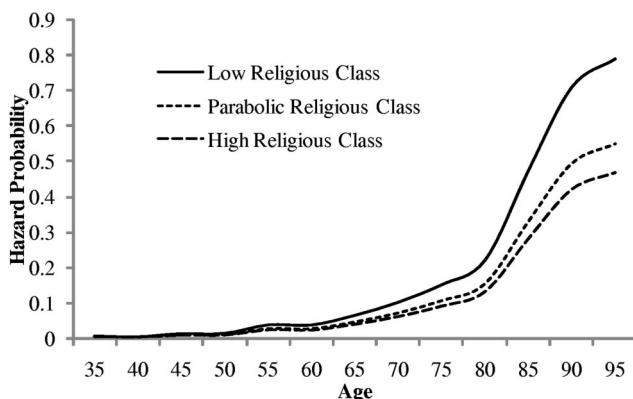


Figure 4. Hazard functions for women in the three religious trajectory classes from the discrete-time survival model. Women in the least religious trajectory class had a higher probability of death at any given age than did women in either of the two more trajectory classes.

Within-Class Predictors of Survival

It was also of interest to examine the influence of the covariates on survival within each of the three classes. We used a nested-model likelihood ratio test to determine whether the influence of the covariates was uniform across classes, and these tests indicated that the model with class-specific covariate effects produced better fit to the data. The logistic regression coefficients associated with predicting the within-class survival functions appear in Tables 6, 7, and 8. As Table 6 shows, gender and marital status were the only variables that predicted survival within the highly religious class: Women and people who eventually married lived longer than did men or people who never married.

As Table 7 shows, several variables predicted survival within the parabolic trajectory class. People high in conscientiousness had lower mortality. People with high levels of alcohol use in 1940 had higher mortality. People who had few children and low levels of involvement in avocational activities also had shorter lives. As in

Table 6
Associations of Covariates With the Hazard Function for the Highly Religious Trajectory Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = female, 1 = male)	0.99	0.27	3.61	.00	2.68
Conscientiousness (1940)	-0.02	0.05	-0.48	.63	0.98
Extraversion (1940)	0.00	0.04	0.00	1.00	1.00
Agreeableness (1940)	-0.05	0.03	-1.49	.14	0.96
Neuroticism (1940)	-0.04	0.02	-1.80	.07	0.96
Participant married (1940)	0.33	0.53	0.63	.53	1.40
No. of professional memberships (1940)	0.00	0.10	0.03	.98	1.00
No. of offices held (1940)	-0.21	0.26	-0.80	.43	0.81
No. of avocational activities (1940)	0.04	0.06	0.70	.48	1.04
No. of service activities (1940)	-0.08	0.09	-0.86	.39	0.93
Does participant live with someone? (1940)	0.44	0.60	0.74	.46	1.55
Body mass index (1940)	0.06	0.07	0.90	.37	1.06
Alcohol use (1940)	0.43	0.38	1.13	.26	1.53
Self-rated health (1940)	-0.12	0.21	-0.55	.58	0.89
Psychological maladjustment (1940)	-0.01	0.22	-0.04	.97	0.99
Did participant ever marry?	-1.51	0.77	-1.96	.05	0.22
No. of children (lifetime)	-0.10	0.10	-0.98	.33	0.91
M alcohol use (1950-1991)	-0.12	0.28	-0.44	.66	0.88
M psychological maladjustment (1945-1960)	-0.07	0.20	-0.36	.72	0.93
M self-rated health (1945-1999)	-0.29	0.30	-0.98	.33	0.75

Note. OR = odds ratio.

the highly religious trajectory class, men's hazard-odds of dying at any point in time were higher than they were for women.

Finally, within the least religious class, four variables predicted individual differences in survival (see Table 8). People who reported lower levels of neuroticism, higher levels of alcohol use between 1950 and 1991, and lower levels of self-rated health between 1945 and 1999 and who had fewer children over the life course had shorter lives than did people with higher levels of

neuroticism, lower levels of alcohol use, higher levels of self-rated health, and more children.

Discussion

The religion-mortality association has now been examined in roughly 50 different research samples. The best of the extant studies suggest that religiously active people enjoy a 25% reduction in mor-

Table 7
Associations of Covariates With the Hazard Function for the Parabolic Religious Trajectory Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = female, 1 = male)	0.31	0.13	2.33	.02	1.36
Conscientiousness (1940)	-0.04	0.02	-2.40	.02	0.96
Extraversion (1940)	-0.01	0.02	-0.69	.49	0.99
Agreeableness (1940)	-0.01	0.01	-0.75	.45	0.99
Neuroticism (1940)	0.00	0.01	-0.36	.72	1.00
Participant married (1940)	-0.10	0.16	-0.61	.54	0.90
No. of professional memberships (1940)	0.05	0.05	0.97	.33	1.05
No. of offices held (1940)	-0.20	0.13	-1.53	.13	0.82
No. of avocational activities (1940)	-0.06	0.03	-2.10	.04	0.94
No. of service activities (1940)	0.05	0.05	1.05	.30	1.05
Does participant live with someone? (1940)	0.21	0.21	1.00	.32	1.23
Body mass index (1940)	0.04	0.02	1.69	.09	1.04
Alcohol use (1940)	0.16	0.08	1.95	.05	1.17
Self-rated health (1940)	-0.13	0.10	-1.28	.20	0.88
Psychological maladjustment (1940)	0.00	0.09	-0.05	.96	1.00
Did participant ever marry?	0.49	0.32	1.55	.12	1.64
No. of children (lifetime)	-0.12	0.05	-2.50	.01	0.89
M alcohol use (1950-1991)	0.08	0.10	0.85	.39	1.08
M psychological maladjustment (1945-1960)	0.10	0.09	1.21	.23	1.11
M self-rated health (1945-1999)	-0.21	0.14	-1.54	.12	0.81

Note. OR = odds ratio.

Table 8

Associations of Covariates With the Hazard Function for the Least Religious Trajectory Class

Predictor	Coefficient	SE	z	p	OR equivalent
Gender (0 = female, 1 = male)	0.00	0.17	0.02	.99	1.00
Conscientiousness (1940)	0.01	0.02	0.61	.54	1.01
Extraversion (1940)	−0.01	0.02	−0.38	.70	0.99
Agreeableness (1940)	−0.02	0.01	−1.44	.15	0.98
Neuroticism (1940)	−0.02	0.01	−1.98	.05	0.98
Participant married (1940)	0.11	0.18	0.60	.55	1.11
No. of professional memberships (1940)	0.00	0.06	−0.03	.98	1.00
No. of offices held (1940)	0.05	0.12	0.45	.65	1.06
No. of avocational activities (1940)	−0.06	0.04	−1.70	.09	0.94
No. of service activities (1940)	0.00	0.08	−0.05	.96	1.00
Does participant live with someone? (1940)	0.04	0.22	0.20	.84	1.04
Body mass index (1940)	0.01	0.03	0.24	.81	1.01
Alcohol use (1940)	0.14	0.10	1.38	.17	1.15
Self-rated health (1940)	0.09	0.10	0.91	.36	1.10
Psychological maladjustment (1940)	0.00	0.10	−0.01	.99	1.00
Did participant ever marry?	−0.02	0.31	−0.05	.96	0.98
No. of children (lifetime)	−0.13	0.05	−2.35	.02	0.88
M alcohol use (1950–1991)	0.24	0.12	1.97	.05	1.27
M psychological maladjustment (1945–1960)	0.12	0.09	1.29	.20	1.12
M self-rated health (1945–1999)	−0.26	0.12	−2.15	.03	0.77

Note. OR = odds ratio.

tality relative to their less religious counterparts (McCullough et al., 2000; Powell et al., 2003). However, this literature has been too often limited by (a) inadequate attention to measures of religiousness other than frequency of religious service attendance; (b) inattention to how religiosity might change over the life course and what such changes might mean for the prediction of longevity; and (c) inattention to the dynamic interplay of religion with health-relevant personality traits, social ties, health behaviors, and physical and mental health over the life course (Hampson & Friedman, 2008). On the basis of the principle of social investment (Lodi-Smith & Roberts, 2007), we evaluated whether people's patterns of religious development through adulthood predicted longevity and whether the religion–mortality association could be explained in terms of health-relevant personality traits, social ties, health behaviors, and indicators of mental and physical health that might both cause and be caused by religiosity. It is perhaps worth noting also that (a) the participants in this study were born, on average, in 1910; (b) most of the predictors of mortality were measured in 1940; and (c) we assessed participants' mortality as late as 2005. These features make the present study the longest running study of religiosity and mortality in the scientific literature.

Religious Trajectory Class Differences in Health-Relevant Variables

As in previous work with this data set (McCullough et al., 2005), we identified three distinct trajectories of religious development. Participants in one trajectory class were highly religious in early adulthood and became more so as they aged. Participants in the so-called parabolic trajectory class were moderately religious in early adulthood and became more so through mid life, only to decline again until the end of life. Participants in a third class had very low religiousness throughout life.

With respect to the social investment principle, one of the more interesting features of the three trajectory classes concerns the per-

sonality traits, social ties, health behaviors, and measures of mental and physical health that distinguish among them, especially because previous research has identified many of these variables as important predictors of longevity. People in the highly religious and parabolic religious classes were more agreeable, and people in the highly religious class were more extraverted (and, it is interesting to note, more neurotic), than were people in the least religious class. Relative to people in the least religious class, people in the highly religious class had more children, engaged in more service activities, had fewer alcohol problems (both in 1940 and in the years following 1940), and had worse psychological adjustment in the years following 1940. Likewise, relative to people in the least religious class, people in the parabolic religious class were more likely to marry, had more children, engaged in more service activities, and had fewer alcohol problems in 1940. Thus, it seems evident that people's trajectories of religious development contain a great deal of information about personality traits, social factors, behavioral factors, and health-related factors that are well-known determinants of both social investment and physical health.

Trajectory Class Differences in Survival and Our Efforts to Account for Them

Although men in the three trajectory classes did not differ in length of life—a finding presaged by McCullough et al.'s (2000) meta-analytic finding that the religion–mortality association is weaker for men than for women—membership in the highly religious trajectory class was associated with a 41% reduction in women's mortality relative to women in the least religious class. Likewise, women in the parabolic trajectory class enjoyed a 30% reduction in mortality relative to women in the least religious class. These hazard-ORs convert to tetrachoric correlation coefficients of $-.20$ and $-.14$, respectively (Davidoff & Goheen, 1953), and are

comparable to those in the best studies on this topic (McCullough et al., 2000; Powell et al., 2003).

When we proceeded to use 14 measures of personality, social ties, health behavior, and health collected in 1940 (plus gender) to predict between-class differences in survival, the trajectory class differences in survival between the least religious and the highly religious classes were handily reduced to statistical nonsignificance, suggesting that the survival differences between those two classes could be accounted for by concurrent differences in health-relevant personality traits, social ties, health behaviors, and intermediate measures of health and mental health. In contrast, it was not until we added measures of five health-relevant variables that unfolded in the years *following* 1940—lifetime marital history, lifetime number of children, alcohol use, psychological maladjustment, and self-rated health in the years following 1940—that we could account for the lion's share of the hazard difference between the parabolic and the least religious trajectory classes. This latter finding provides reasonably strong evidence that people in the parabolic religious trajectory class obtained much of their survival advantage by virtue of social and health-related processes that unfolded in the years following 1940—that is, by virtue of health-related social and behavioral changes that their religious trajectories might have helped to put into place. In the end, by taking into account these many elements of the network of associations by which religion might cause, and be caused by, health-relevant personality traits, social ties, health behaviors, and measures of physical and mental health, the survival advantages for women in the highly religious and parabolic religious trajectory classes could be reduced to nonsignificant hazard-ORs of .84 and .81 (or tetrachoric correlation coefficients of $-.07$ and $-.08$, respectively), which were slightly lower than the most stringently controlled mean effect sizes that McCullough et al. (2000) reported in their meta-analytic review of the research on religion and mortality (McCullough, 2001).

As noted above, one of the most striking aspects of these results, to us, is the wide range of mortality-relevant factors with which religious trajectory class membership was associated and how effectively those factors eventually accounted for the religious trajectory class differences in survival. The fact that people in the least religious trajectory class were the least agreeable and the least extraverted suggests that religious differences in survival may be due in part to preexisting personality differences in health-relevant personality traits (Weiss & Costa, 2005; Wilson et al., 2005) across the three religious trajectory classes. This possibility seems especially noteworthy given previous research showing that such personality traits predict the development of religiosity over the life course (McCullough et al., 2005; McCullough, Tsang, & Brion, 2003; Wink, Ciciolla, Dillon, & Tracy, 2007). The fact that people in the least religious trajectory class also had more alcohol problems, lower rates of marriage, fewer children, and the lowest rates of community volunteerism also suggests that religiosity may activate social ties or health-related behaviors that eventuate in longer life or, alternatively, that those behavioral and social factors encourage people to invest in religion as they age. Thus, it seems that multiple psychological and behavioral pathways are responsible for the religion–mortality association, just as the social investment principle (Lodi-Smith & Roberts, 2007) and many transactional models of personality and health (Hampson & Friedman, 2008) would suggest. From these results, we have come to conclude that future theorizing that focuses strictly on religion's putative effects on intermediate variables (e.g., health behaviors,

social ties, etc.) that in turn might influence longevity—and not on the possible effects of these variables on religious development over the life course—may lead to conclusions that are incomplete at best and exactly backward at worst.

Between-Class Differences in the Within-Class Predictors of Survival

It is also interesting that the variables that predicted within-class differences in survival were not identical across classes (see Tables 6–8). For example, getting married during one's lifetime predicted longevity for the highly religious class but not for the parabolic class or the least religious class. One possibility is that some of these between-class differences were simply due to between-class differences in the statistical power of the relevant tests: The highly religious trajectory class had 211 participants, whereas the parabolic class had 608, and the least religious class had 521, so it is perhaps unsurprising that, for instance, alcohol use in 1940 predicted mortality for the parabolic trajectory class but not for the other two, even though the coefficients were in the same direction for all three classes.

But aside from statistical power issues, another possibility is that some personality, social, behavioral, and health-related variables do things for people in certain trajectory classes that they do not do for people in other classes. Take marriage as an example. Getting married during one's lifetime predicted longer life for people in the highly religious class, but not for people in the parabolic or least religious class or for the sample overall (Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995). Why might marriage during one's lifetime (relative to staying single) be salutary for highly religious people but not for others? Could it be that highly religious people's spouses were better at providing emotional and instrumental support? Could it be that those marriages were less likely to end in divorce, which itself is a risk factor for early death (Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995)? Meta-analytic research has shown that religiousness is positively related to marital satisfaction and commitment, as well as to lower rates of divorce (Mahoney et al., 1999), so perhaps marriage brings with it different health-relevant affordances for highly religious individuals than it does for less religious individuals. Alternatively, perhaps failure to marry for highly religious people indicates health-relevant social or psychological problems that it does not indicate for less religious people (Friedman, Tucker, Schwartz, Tomlinson-Keasey, et al., 1995), given that marriage is particularly normative for people within religious settings. Such explanations are speculative at this point, but we do find it provocative to consider the ways in which religious social investments might affect the roles that other personality, social, or behavioral processes might play in the promotion of health and longevity.

Why Women but Not Men?

Our finding that the religion–mortality association was stronger for women than for men has also been observed in previous studies (McCullough et al., 2000). Previous work with this sample also revealed that religiousness was associated with higher self-rated health and less age-related decline in self-rated health for women but not for men (McCullough & Laurenceau, 2005). Although no one really seems to know why religiousness is associated with greater health benefits for women than for men, speculation

abounds. For instance, Strawbridge et al. (2001) found that religion was associated with improvements in health behaviors for both men and women but also that the effects were much more pronounced for women than for men. Also, in a study of high-functioning older adults, Maselko, Kubzansky, Kawachi, Seeman, and Berkman (2007) found that religiousness was associated with less cumulative stress-induced physiological wear and tear (called "allostatic load") for women but not for men. Although sex differences in the associations of religiousness with health behaviors or allostatic load might help in part to explain the sex difference in religion's associations with increased longevity, these explanations require explanations themselves. Thus, it remains for future work to uncover the processes that lead religious women, to a greater extent than is true for religious men, to enjoy better health and longer life than do their less religious counterparts. Some of the health behavior variables (e.g., alcohol use) and personality traits (e.g., agreeableness and extraversion) that proved to be important in the present study might be promising targets for future work designed to explain such sex differences.

A final contribution of this work, which is both conceptual and methodological, involved our use of a life course perspective for conceptualizing and measuring individual differences in religiousness. Rather than treating religiousness as something to be measured cross-sectionally, we summarized people's lifelong religious careers in terms of three distinct trajectories of religious development. This approach took into account not only the fact that religiousness changes across the life course (Argue et al., 1999) but also that it changes in different ways for different people (McCullough et al., 2005). By using growth mixture modeling to depict these interindividual differences in intraindividual change, we found religious differences in longevity that were larger (in terms of relative hazards) than those that were found in a previous analysis of a subset of these data that relied on a single-item indicator of religiousness from a single time point (Clark et al., 1999). Moreover, this approach revealed that for one group of people—those who we called the "highly religious"—reduced mortality relative to the least religious class could essentially be explained away by including measures of personality, social ties, health behaviors, and intermediate measures of health that were assessed concurrently (i.e., in 1940) with the first measures of religiosity upon which we established participants' religious trajectories. In contrast, for people in the parabolic religious class, it was only when we controlled for a select set of measures of social ties, health behaviors, and health in the decades beyond 1940 that their survival advantage relative to the least religious class could be reduced to statistical nonsignificance.

Because our models were able to reveal such subtleties, we suggest that, when possible, growth mixture models or other data-analytic approaches that can depict longitudinal trajectories of religiousness might be helpful in clarifying how the risks and protections associated with various social and psychological processes accrue over the life course.

Limitations and Summary

The Terman data set has many virtues but also some limitations. First, it was not designed specifically as a resource for studying psychosocial factors in health over the life course, so many of the variables that we ideally would have examined on repeated occa-

sions (e.g., health-relevant personality traits, social ties, and a broader range of health behaviors) simply were not available beyond the 1940 measurement point in a high-quality form. Nevertheless, we did the best we could to shed light on whether religion's associations with longevity might have been due in part to its prospective effects on a select set of health-related measures, so we made the most of the measures of marriage, childrearing, alcohol use, psychological maladjustment, and self-rated health beyond 1940.

Second, the Terman sample is not representative of the U.S. population, or even of Californians born in the early part of the 20th century. Participants in this study were almost all White and middle-class, and they all were very intelligent. Their nonrepresentativeness probably explains why most of them became less religious after mid life (see Figure 3), even though Americans in the general public tend to become more religious with age (Argue et al., 1999). We do not know whether survival results like these would obtain in a more representative sample.

Religiosity tends to have small but consistent associations with measures of physical health and longevity, particularly among women (McCullough et al., 2000; Powell et al., 2003). The mechanisms that are responsible for these associations are probably numerous. To some extent, religion's associations with longevity appear to be due to the fact that some personality traits (e.g., agreeableness) incline people both to live longer and to become more religious as they age. In the case of other variables, such as alcohol use, family structure, and volunteerism, religion may play a causal role by discouraging excessive alcohol use, providing people with social support, encouraging marriage and parenthood, and offering people opportunities to volunteer in their communities, but those variables might influence people's tendencies to be religious as well. It is likely, therefore, that the religion–health association is partially due to the influences of personality, social ties, health behaviors, and health on religion, as well as religion's effects on personality, social ties, health behaviors, and health. The present work shows that when an adequately broad suite of personality traits, health behaviors, and social factors are taken into account—and when we think of religion in the same way that we might think of any other psychological characteristic that can grow and change over the life course—the seemingly mystical associations of religion with longevity can be demystified considerably. Therefore, it seems to us that a new perspective on religion, personality, and mortality—one that considers religiosity as a lifelong pattern of social investment that can be both a cause and an outcome of other personality, social, behavioral, and health-related processes, rather than simply as an individual difference to be measured in a single snapshot without explicit regard for religion's place in the larger causal network of other health-relevant psychological, social, and behavioral processes—is a perspective that is long overdue.

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Call for Nominations: *Psychology of Men and Masculinity*

The Publications and Communications (P&C) Board of the American Psychological Association has opened nominations for the editorship of *Psychology of Men and Masculinity*. The editorial search is co-chaired by Glenn Good, PhD and Lillian Comas-Diaz, PhD.

Psychology of Men and Masculinity, official journal of APA Division 51 (Society for the Psychological Study of Men and Masculinity), is devoted to the dissemination of research, theory, and clinical scholarship that advances the psychology of men and masculinity. This discipline is defined broadly as the study of how boys' and men's psychology is influenced and shaped by both sex and gender, and encompasses both the study of biological sex differences and similarities as well as of the social construction of gender.

Editorial candidates should be available to start receiving manuscripts in January 2011 to prepare for issues published in 2012. Please note that the P&C Board encourages participation by members of underrepresented groups in the publication process and would particularly welcome such nominees. Self-nominations are also encouraged.

Candidates should be nominated by accessing APA's EditorQuest site on the Web. Using your Web browser, go to <http://editorquest.apa.org>. On the Home menu on the left, find "Guests." Next, click on the link "Submit a Nomination," enter your nominee's information, and click "Submit."

Prepared statements of one page or less in support of a nominee can also be submitted by e-mail to Molly Douglas-Fujimoto, Managing Director, Education Publishing Foundation, at mdouglas-fujimoto@apa.org.

The deadline for accepting nominations is January 31, 2010, when reviews will begin.