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Association of Religious Participation With Mortality Among Chinese Old Adults

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Abstract

This research examines the association of religious participation with mortality using a longitudinal data set collected from 9,017 oldest-old aged 85+ and 6,956 younger elders aged 65 to 84 in China in 2002 and 2005 and hazard models. Results show that adjusted for demographics, family/social support, and health practices, risk of dying was 24% ($p < 0.001$) and 12% ($p < 0.01$) lower among frequent and infrequent religious participants than among nonparticipants for all elders aged 65+. After baseline health was adjusted, the corresponding risk of dying declined to 21% ($p < 0.001$) and 6% (not significant), respectively. The authors also conducted hazard models analysis for men versus women and for young-old versus oldest-old, respectively, adjusted for single-year age; the authors found that gender differentials of association of religious participation with mortality among all elderly aged 65+ were not significant; association among young-old men was significantly stronger than among oldest-old men, but no such significant young-old versus oldest-old differentials in women were found.

Keywords

China; Chinese Longitudinal Healthy Longevity Survey; elders; gender differentials; level of involvement; mortality; older adults; oldest-old; religious participation

Introduction

Most existing studies on religious participation and mortality have been conducted in Western societies with the exception of a few studies in Japan and Taiwan (Krause et al. 1999; Yeager et al. 2006). Given that Chinese religious networks are weaker and religious activities are much less organized than those in Western countries, one may wonder whether the association of religious participation with a lower risk of mortality found in most other studies is also true among the elderly in Mainland China. There are very few published studies on the association between religious participation (and frequency of participation) and mortality in Mainland China. Almost all previous studies of the association between religious participation and mortality conducted in both Western and Eastern societies had small numbers of the oldest-old (aged 85 and older). Thus, the findings primarily reflected associations between religious involvement and health among the young-old, although the total number of persons aged 85 and older in the world is expected to climb from about 28

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million in 2000 to 86 million in 2030 and 193 million in 2050 (United Nations 2007). The number of oldest-old aged 85+ in China is expected to climb from about 3.5 million in 2000 to 16.5 million in 2030 and 45.1 million in 2050. The worldwide proportion of the oldest-old among those aged 65 and older will increase from 4% in 2000 to 13.5% in 2050 (United Nations 2007). The annual rate of increase of the oldest-old worldwide is about twice as great as that of the entire elderly population aged 65 and older (United Nations 2007). Obviously, inadequate representation of the oldest-old is another major limitation in previous studies of the effects of religious participation on mortality.

We address these limitations by using the unique Chinese Longitudinal Healthy Longevity Survey (CLHLS) data set (2002–2005), which includes the largest sample of the oldest-old ever conducted in the world ($N = 9,017$ age 85–109) and a comparative subsample of 6,956 younger elders age 65 to 84. The present study is also unique in the sense that it fills the information gap about the effects of religious participation (and frequency of participation) on mortality at old ages in Mainland China, an Eastern society and the largest developing country, where the organizational context and practice of religion are fundamentally different from those in Western countries and also differ substantially from those in Japan and Taiwan.

In the rest of this section, we present a brief review of the related literature and the social/cultural context of religious participation in China, followed by the conceptual framework and the hypotheses to be tested. We present the data sources, measurements and method, and the results in the second, third, and fourth sections. Finally, we discuss the implications of the empirical findings.

A Brief Review of the Related Western Studies

U.S. research has consistently shown that those persons who attend religious services once a week or more enjoy longer life than those who never attend religious services; these findings have been observed in both age-heterogeneous samples and samples of older adults (e.g., Dupre, Franzese, and Parrado 2006; Kaplan et al. 1994; Koenig et al. 1999; Strawbridge et al. 1997; Yeager et al. 2006). For example, Koenig et al. (1999) and Strawbridge et al. (1997) reported that frequent religious attendees had a significant survival advantage over infrequent attendees, adjusting for various confounding factors. Using data from the National Health Interview Survey, Hummer et al. (1999) found that people who never attended religious services or who attended less than once a week were 1.87 times more likely to die in the seven-year follow-up period compared to people who attended once a week or more. Dupre et al. (2006) showed that those older women who never attended religious services and those who attended infrequently had 60% and 34% higher mortality risks, respectively, than those who attended frequently after controlling for various confounders including baseline health status. The corresponding figures among older men were 42% and 25%. However, a few studies showed that religious distress may put seriously ill (i.e., hospitalized) patients at increased risk for earlier death by as much as 28% because they felt abandoned by God (Pargament et al. 2001). Nevertheless, the related Western studies published during the past few decades have consistently demonstrated significant associations between religious attendance and reduced risk of mortality in community-dwelling populations and even in some patient populations such as those undergoing surgery (for reviews, see Chida, Steptoe, and Powell 2009; Larson, Larson, and Koenig 2002; McCullough et al. 2000).

Non-Western Studies on the Association of Religious Participation With Mortality

The relevant research suggests that religious involvement improves health and reduces mortality risk at old ages in some Asian countries as well. Based on a national sample of

2,154 old adults interviewed in 1996 in Japan, Krause et al. (1999) confirmed that religious participation was positively associated with health among Japanese elderly, and helping others via religious activities might explain at least part of the reason for this relationship. In a 16-year prospective study among 3,900 men and women aged 35 or older in Israel, Kark et al. (1996) found that the mortality risk of Jewish religious attendants over the period from 1970 to 1985 was only half of the population average, with women benefitting more (63% lower) than men (40% lower), after adjusting for age and the other covariates. In a recent study from Taiwan, Yeager and colleagues (2006) reported that older adults who often or sometimes participated in religious activities had 50% to 60% lower mortality risk over a 4-year follow-up period than those who did not participate in religious activities. The effects were reduced to 32% to 40%, but still significant, when baseline health was taken into consideration. After carefully reviewing the literatures in both the English and Chinese languages, we found very few published studies on the association of religious participation with mortality in Mainland China. Among these few studies, almost all were based on very small sample sizes in local communities and thus could not examine the effects of religious participation on mortality with reasonable statistical power (Holroyd 2002; Huang and Chao 1995; Lui and Mackenzie 1999; Wang and Wang 1998; Xi and Zhou 1996), except a recent article by Zhang (2008). Using data from the CLHLS baseline (1998) and the first follow-up (2000) waves, Zhang (2008) found that religious participation, coded simply as the presence or absence of religious involvement, was significantly associated with mortality among Chinese oldest-old women but not among Chinese oldest-old men. The analysis by Zhang (2008) had two major limitations due to the data constraints of the CLHLS baseline survey: Data on frequency of religious participation were not available and all sample members were age 80 or older. Because the 2002 wave of the CLHLS collected data on frequency of religious participation and included an expanded age range of elderly Chinese age 65 and older, those limitations are avoided in this research.

Possible Mechanisms by Which Religious Participation Exerts Its Protective Effects

Previous research also has investigated the possible mechanisms by which religious participation exerts its protective effects on mortality and other health outcomes. Six categories of mediators/mechanisms have been investigated. The positive associations between religious participation and health/survival may be due to one or more of the following: (1) promotion of beneficial health behaviors such as avoidance of tobacco and heavy alcohol use among the attendees (Strawbridge et al. 2001); (2) increased social support (Koenig et al. 1999); (3) enhanced psychosocial resources to cope with life stress and foster self-esteem, efficacy, and mastery (Hill et al. 2005); (4) improved coherence of belief structures that shape individual's positive worldviews (George, Ellison, and Larson 2002); and (5) improved immune function (Koenig et al. 1997). Another potential explanation for the association is (6) endogeneity, which is an inherent problem for any investigation of the association between religious activity and health outcome including mortality. For example, a positive but spurious correlation between religious participation and health may be observed because healthier people are more likely to be able to participate in religious activities.

A majority of previous studies in Western countries and Japan report that older women are more likely than older men to be involved in religious activities (e.g., Koenig et al. 1999; Krause et al. 1999; Strawbridge et al. 1997). Older women also pray more frequently and are more likely than men to say that religion is important in their lives and that they depend on religion to cope with stress (see Princeton Religious Research Center 1996). Accordingly, many studies report that the effects of religious involvement, especially attending religious services, are stronger for women than for men (e.g., Koenig et al. 1999; Strawbridge et al. 1997). Other studies, however, report that the protective effect of religious attendance on

mortality was larger for men than for women (e.g., Bryant and Rakowski 1992), and still others report no gender differences (Musick, House, and Williams 2004, using an age-heterogeneous sample). A recent study examined the effects of age on the relationship between religious attendance and mortality in a sample covering the adult age range (Musick et al. 2004). In that study, the protective effect of religious involvement on mortality risk diminished with increase of age.

The Social/Cultural Context of Religious Participation in China

According to an estimate, about 100 million Chinese are involved in religious activities of various forms (Liu and Yun 1999), and the majority of them are older adults (Li 1997). Buddhism, Daoism, Islam, Catholicism, and Protestantism are five widely recognized institutional religions in contemporary China (Fan 2003). Although the number of Christian churches is increasing, Buddhism and Daoism are the dominant religions among the Han Chinese, who constitute more than 90% of China's population (National Bureau of Statistics China 2003). Chinese religious practitioners may be classified into three groups. The smallest group consists of Buddhist and Daoist monks and nuns, who live in temples and devote their lives to religion. The second group is called *Ju Shi*, who live in the community but are strict adherents and regular participants in one religion. The third and largest group consists of people who believe in Buddhism, Daoism, or another religion; participate regularly or occasionally in religious activities; but do not strictly follow the rules of that religion. Religious activities for the second and the third groups occur in temples and at home. Chinese home-based religious activities include praying at a shrine for protection or good luck/happiness from the Buddha or Bodhisattava (Guanyin) and/or from their loved/deceased relatives, as well as sitting and thinking quietly (*samadhi*). Chinese religious participants also go to temples frequently or infrequently depending on their degree of involvement. Institutional religious activities in China are substantially weaker and the activities are much less organized than those in Western countries (Fowler and Fowler 2008; Melton 2001; Thompson 1996; Weller and Shahar 1996; Yang and Ebaugh 2001).

Chinese and Western religious philosophies differ substantially (Fowler and Fowler 2008; Miller 2006; Overmyer 2003). Western religions teach that God created and rules the world and, for most denominations, determines whether a person's afterlife will be pleasant or painful. Buddhism's teachings vary but include the beliefs that the world has always existed or is only perceived to exist and that the world and everything in it is the Buddha. The Buddha is understood as the human Siddhartha (whose teachings point the way to the correct understanding of the world). By following the teachings of the Buddha, one improves both one's current and next lives. The Dao is generally understood as the natural order. When one attunes one's life to the natural order, one's life will be necessarily improved and lengthened. Confucianism focuses on harmonizing societal relationships, which begins by correcting oneself. While Heaven (Tian) is acknowledged as the creator and ruler of the world and the judge of human actions, Confucianism focuses on human interactions rather than on superhuman issues because the harmonization of human relations is the prerequisite for understanding superhuman issues. Some scholars think that Confucianism is a religion, but many others (including us) believe that Confucianism is an important philosophy but not a religion. It is common for Chinese people to follow Confucianism and also borrow Buddhist and/or Daoist views.

In addition to philosophical/theological differences, religious networks fundamentally differ between Western and Chinese religions. Western religion is characterized by highly organized church-based networks and communal activities. Millions of believers of the Western religions have fairly regularized religious lives, characterized by attending weekly religious services and other activities. Such forms of public religious practices do not exist in China (Fowler and Fowler 2008; Melton 2001; Thompson 1996; Weller and Shahar 1996;

Yang and Ebaugh 2001). Furthermore, although the Chinese constitution guarantees citizens religious freedom, the Chinese government has taken a more regulatory stance toward religious institutions than is true in Western nations, Japan, and Taiwan. This regulatory role has declined somewhat, however, since the reform and opening the door to the outside world (Fowler and Fowler 2008; Kipnis 2001; Miller 2006; Overmyer 2003).

Conceptual Framework and Hypotheses to Be Tested

How can we conceptualize the potential impacts of religious participation on mortality among the Chinese elderly? We present a few preliminary thoughts here. First, we have seen in the Chinese data set (to be presented later in Table 2) and in the literature (Ellison and George 1994; Strawbridge et al. 1997) that religious participants have more social connections and thus receive higher levels of social support than nonparticipants; such a phenomenon may be more profound among younger elderly as they may be more capable of having social contacts than the oldest-old. In the Chinese case, many religious functionaries are familiar with or have expertise in traditional Chinese medicine. If a participant's health problem is identified through religious contacts, she or he might be encouraged or assisted to consult a doctor of either Chinese or Western medicine. Stronger social connections and support may also help the elderly to cope with declining physical and cognitive function and to eliminate loneliness. Satisfaction with social connections and support might have positive effects on the immune system to fend off disease, facilitate recovery, and extend survival (Spiegel 1992; Spiegel et al. 1989).

Second, similar to Western religions, Chinese religions teach and promote kindness (Shan) and discourage fighting and hurting each other. For example, the famous (and perhaps primary) idol among Chinese religious people, especially women, is Bodhisattava Guanyin, an extremely kind and powerful woman who always helps others to overcome life's difficulties. Assistance to other persons based on the philosophy of kindness may earn respect and positive feedback from others, which may increase religious participants' social status and life satisfaction (Krause et al. 1999), especially for women who usually have lower socioeconomic status in China. Kindness might also reduce the risks of physical and mental injuries due to conflict with others.

Third, almost all Chinese religious activities involve sitting and thinking quietly (samadhi), which may help to reduce depression, anxiety, and stress. Chinese religion tends to generate forces of hope, continuity, and connection, and thus may be a form of health-seeking behavior (Holroyd 2002). Lower rates of psychological distress, like social support, result in stronger immune systems and better defenses against disease (Irwin et al. 1990; Leserman et al. 2000).

Fourth, most Chinese religions promote happiness and life satisfaction even under poor living conditions and other difficulties. For example, the most popular Buddhist symbol is a monk with a truly lively smile and a big abdomen. The old Chinese saying, "Knowing satisfaction leads to constant happiness" (Zhi zu chang le) is favored and promoted by Chinese religions.

Building on previous research and our understanding of the Chinese context outlined here, we will test the following hypotheses while controlling for potentially confounding variables, including demographic characteristics, socioeconomic status, social ties, health practices, and prior health status:

Hypothesis 1: Chinese older adults who participate in religious activities frequently are at lower risk of mortality than those who participate infrequently or not at all.

Hypothesis 2: The positive association of religious participation with survival is stronger among Chinese older women than among older men.

Hypothesis 3: The positive association of religious participation with survival is greater for younger Chinese elders than for the oldest-old.

Data Source

The data used in this research are from the 2002 and 2005 follow-up waves of the CLHLS. The CLHLS baseline survey was conducted in 1998; follow-up surveys, with replacement of deceased and lost-to-follow-up elders, were conducted in 2002 and 2005 in a randomly selected half of the counties and cities of 22 Chinese provinces (Liaoning, Jilin, Heilongjiang, Hebei, Beijing, Tianjing, Shanxi, Shaanxi, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Sichuan, and Chongqing). The baseline survey areas include 985 million persons, 85% of China's total population. The intention was to interview all centenarians who agreed to participate in the study in the sampled areas. For each centenarian, one nearby octogenarian (aged 80–89) and one nearby nonagenarian (aged 90–99) of predesignated age and sex based on the last digit of the randomly assigned codes for centenarians was interviewed. Beginning in the 2002 wave, for every two centenarians interviewed, three persons aged 65 to 79 of predesignated age and sex based on the last two digits of the randomly assigned codes of the centenarians were also interviewed. “Nearby” is loosely defined—it could be in the same village or street, or in the same town, or in the same county or city, depending on the availability of respondents. The random codes for the centenarians were used to randomly predefine the age and sex of younger respondents and identified approximately equal numbers of male and female nonagenarians, octogenarians, and younger elders in each age group. The goal was to have representative and comparable numbers of male and female octogenarians, nonagenarians, and younger elderly of each age from 65 to 99, in addition to the centenarians (Zeng et al. 2001).

The extensive questionnaire data collected include family structure, living arrangements and proximity to children, disability status, physical performance, self-rated health, life satisfaction, cognitive function, chronic disease, medical care, social and religious participation, diet, smoking and alcohol consumption, psychological characteristics, economic resources, and caregiving and family support.

In this study, we use the cross-sectional data collected in 2002 from 15,973 participants (6,956 aged 65–84 and 9,017 aged 85 and older) and their follow-up survival/mortality data between 2002 and 2005. The interview refusal rate was 3.0%, and the rate of loss to follow-up in the three-year interval was 13.2%. Those who were lost to follow-up were excluded from this study because we do not know their actual survival status and survival time.

The rate of loss to follow-up in the CLHLS was similar to some studies in the United States (e.g., Mihelic and Crimmins 1997) and lower than that in some other studies (e.g., 17.8% in a Mexican two-year interval survey study reported by Vellas et al. 1998). Respondents who are women, living in urban areas, physically impaired, have low social contacts, and religious attendants are associated with higher loss-to-follow-up rates. The possible reason for the loss included population resettlements due to rapid urbanization, unfavorable weather, and transportation difficulties (Gu 2007). Kempen and Sonderen (2002) showed that the linkage between sample attrition and respondents' characteristics does not necessarily mean that the estimates of the coefficients of predictors for outcomes of interest would be biased. Kempen and Sonderen (2002) also demonstrated that attrition might not always be a serious problem when associations between variables are the focus of a study, particularly when the proportion of dropouts is not too large, although a cross-sectional

descriptive analysis at a later wave may be more affected by attrition. Therefore, we expect that it is unlikely that there would be significant problems in estimations of the associations between religious participation and mortality presented in this article using the CLHLS data sets. To check the validity of this expectation, an alternative approach using the multiple imputation method based on 10 random multiple-imputed replicates was performed with all variables considered in this study as covariates to simulate the survival status and survival days of those who were lost to follow-up (Allison 2002). The results including lost-to-follow-up respondents with their imputed survival status and survival days after the 2002 interview differ very little as compared to those excluding lost-to-follow-up samples (the numerical results are not presented here due to space limitation but are available upon request).

A careful data quality evaluation (i.e., reliability coefficients, factor analysis, rates of logically inconsistent answers, and mortality follow-up) and assessment of the self-reported ages of participants have shown that the CLHLS is of generally good quality (see Gu 2007, 2008; Zeng and Gu 2008).

Measurements and Method

Religious Participation

The independent variable is frequency of religious participation. Respondents were asked: “At present time, do you participate in religious activities regularly?” As explained in the interviewers’ handbook, religious activities include organized religious services in temples or churches and private practice at home. Response categories were almost everyday, not everyday but at least once per week, not once per week but at least once per month, not once per month but sometimes, and do not participate. Responses are grouped into three categories: at least once per week, less than once per week, and do not participate, comprising 6.4%, 11.1%, and 82.5% of the total sample, respectively.

Covariates

The frequency distributions of the covariates included in our statistical models are listed in Table 1. We choose these variables as relevant covariates based on reviews of previous studies in this field and our understanding of the Chinese social context.

Demographic variables—Demographic variables include age, gender, residence (rural vs. urban), ethnicity (Han vs. minorities), education (no schooling vs. ≥ 1 year of schooling; two-thirds of the Chinese oldest-old had no schooling), and economic independence (having his or her own retirement wage and/or earnings vs. no income).

Social/family support and connections—Marital status was a dichotomous measure (currently married vs. unmarried). Proximity to children also was measured dichotomously (participants who lived with their children or had at least one child nearby, i.e., in the same village or on the same street, vs. those who had neither coresident children nor children living nearby). We also examined whether the study participant lived alone (coded 1) or with others (coded 2).

Instrumental social support was measured by a question that asked participants whether their spouse or other family members took care of them when they were sick.

Leisure activities—The leisure activities score is based on frequency of participation in seven activities: personal outdoor activities, gardening, raising domestic poultry/pets, playing cards or mah-jongg, participating in organized social activities other than religion,

reading newspaper/books, and watching TV/listening to the radio. Respondents who reported engaging in the activity once or more per week were coded 1; otherwise, 0. We then summed the seven scores; the resulting scale has a range from 0 to 7.

Accessibility of medication—Those elders who could obtain adequate medication when they were sick were compared with those who could not.

Health practices—Cigarette smoking was assessed by the following question: “Do you smoke regularly at the present time?” Response options were no (coded 0) and yes (coded 1). Based on relatively detailed information concerning the frequency, quantities, and types of alcohol consumed, we coded participants as heavy alcohol drinker (defined as having at least 200 grams of liquor or 400 grams of beer per day; code = 1) versus not heavy alcohol drinker or never alcohol drinker (code = 0). Exercise was assessed by the following question: “Do you exercise regularly at the present time?” Response options were yes and no, coded 1 and 0, respectively.

Deficits index—We constructed an index of overall health status, known as the Deficits Index (DI, Kulminski et al. 2008; also called frailty index), which has been validated and widely applied as a proxy for biological age; as a predictor of death, health change, and utilization of health services; and as an important factor for public health monitoring and intervention (Goggins et al. 2005; Kulminski et al. 2008; Mitnitski, Mogilner, and Rockwood 2001). DI is defined as the proportion of observed deficits divided by the total number of possible deficits for a given individual and is posited to capture the cumulative deficits of the sampled persons (Rockwood 2005). Following the general practice in constructing the DI (Goggins et al. 2005; Rockwood 2005), we estimated the Deficits Index for each elderly interviewee based on 39 variables that include cognitive function, instrumental activities of daily living (IADL), activities of daily living (ADL), physical performance functional limitations, self-reported health, self-reported changes in health during the past year, interviewer-reported health, hearing loss and vision loss, heart rhythm, psychological distress, any serious illness in the past two years, and reports of specific chronic diseases. Each variable is coded 1 when the deficit is present and 0 otherwise, with the exception of number of times hospitalized (which was coded as 2 if the interviewee was hospitalized more than two times in the past year). We then summed up these 39 variables and divided by 40 to obtain the DI. The possible range of the DI is 0 to 1. A detailed list of variables use to construct the DI is available elsewhere (Gu et al. 2009).

Analytical Strategies

The association between religious participation and survival among the Chinese elderly is examined using a Weibull parametric hazard model. A Cox semi-parametric proportional hazard model was estimated first, but several variables in the model failed to meet the proportionality requirement. Therefore, we applied the parametric model. After comparison with the log normal, log logistic, exponential, and Gompertz models, the Weibull model yielded the lowest Akaike Information Criterion (AIC) Index (Akaike 1974). Survival time was entered as days counted from the date of the interview in 2002 to the date of the interview in 2005 for survivors and to the date at death for the deceased, while we used age in 2002 as a control variable.

Demographic characteristics, social connections, family support, health practices, and current health status are included in the Weibull parametric proportional hazards regression model as covariates. Results based on sequential models will be presented to show how the effects of religious participation on survival were mediated by different confounders.

To investigate possible differentials in the association of religious participation with survival between the oldest-old and young-old and between men and women, we ran separate analyses for the oldest-old men, oldest-old women, young-old men, and young-old women, while including single year of age as a control variable in each of these four models (McCullough et al. 2000), followed by tests to determine whether the observed differences are statistically significant (Weesie 1999).

The rates of missing values for the independent variables and covariates are quite low in the data set (the highest missing value rate was around 1.4% for the variable of proximity to children). To reduce the influence of missing values on the modeling outcomes, we used a multiple imputation approach based on 10 random multiple-imputed replicates to fill in missing values (Allison 2002). An alternative approach, which used the mode of the corresponding missing variables to impute the missing values as suggested by Landerman, Land, and Pieper (1997), was applied; it did not alter the results at all.

All analyses were performed using STATA version 10.0 (STATA Corporation 2007).

Results

Table 1 presents the distributions of the covariates by gender and age groups. Table 2 presents the distributions of the frequencies of religious participation by the covariates considered. The figures in Table 2 demonstrated that the frequent religious participants were more likely to be women, Han, economically independent, married (vs. not married), living alone (vs. living with children, spouse, or others), have more social-leisure activities, and to exercise regularly.

Table 3 presents the estimates of the association of religious participation with survival for the total sample (ages 65+, the last three columns), the oldest-old (ages 85+), and the young-old (ages 65–84). Within each age group, coefficients are presented for both genders combined, as well as for men and women separately. We focus on the effects of religious participation while the estimates of the effects of the other covariates on mortality, which are not the focus of this article, are presented in the appendix but will not be discussed in detail here because of space limitations.

With single year of age, gender, rural/urban residence, education, and ethnicity controlled, the relative mortality risks of frequent and infrequent religious participants aged 65 and older for both sexes combined were 33% ($p < 0.001$) and 18% ($p < 0.001$) lower than that of the nonparticipants (Model 1 in column 7 of sections b and a in Table 3). Controlling for family, social support/connections, leisure activities, and access to medication when sick notably reduced the magnitude of the degree of association of religious participation with survival (Model 2), although religious participation remained significant for the total sample and for every subgroup except the oldest-old men. Inclusion of health practices (smoking, heavy drinking, and exercise) had very little effect (Model 3). After adding the DI to the model, the relative risk of death among infrequent religious participants was 6% lower than that of the nonparticipants but was not statistically significant. The relative risk of death among frequent religious participants of both sexes combined was 21% lower than that of nonparticipants and was statistically significant ($p < 0.001$, Model 4, column 7 of section b in Table 3). As compared to the oldest-old male nonparticipants, the reduction of mortality risk among the oldest-old male frequent participants were 41%, 28%, 28%, and 27% in the sequential Models 1, 2, 3, and 4 (see column 3 of section b in Table 3); the effects among the oldest-old male infrequent participants were not statistically significant in any of the four models (see column 3 of section a in Table 3).

In general, after the health conditions were adjusted (Model 4) in addition to other confounding factors, only one of nine estimates of the association among the infrequent participants (vs. nonparticipants) remained statistically significant (see columns 1–9 of Model 4 of section a in Table 3). However, all but one estimate of the association among frequent participants remained significant even after all the confounding factors, including health conditions, were controlled (see columns 1–9 of Model 4 of section b in Table 3). The estimates in Table 3 clearly indicate that the association of religious attendance with survival among the Chinese oldest-old and young-old who frequently participate in religious activities is significantly stronger than among those who participated infrequently. These findings support Hypothesis 1.

Table 4 presents the *P* values of statistical tests comparing the survival association of religious participation (i.e., the estimates of RH in Table 3) between young-old and oldest-old and between men and women (adjusted for single year of age and other potential confounders). Results in the left panel of Table 4 show that there are no statistically significant differences in the effects of religious participation on the relative hazards of mortality between men and women. Thus, Hypothesis 2 is not supported.

In all, 32 of the 36 relative hazards of mortality of religious participants (either frequent or infrequent) versus nonparticipants among the young-old (aged 65–84) are smaller than those for the oldest-old (aged 85 and older); namely, the survival association among the young-old is stronger than that among the oldest-old (see columns 1–6 of sections a–b in Table 3). For example, compared to nonparticipants, the reductions in mortality risk were 40% to 44% among the young-old frequent participants (see column 4 of section b in Table 3), in contrast to 17% to 31% among the oldest-old frequent participants in the sequential Models 1, 2, 3, and 4 (see column 1 of section b in Table 3). Results of the statistical tests presented in the right panel of Table 4 show that there are statistically significant differences in the association of religious participation with the relative hazards of mortality between oldest-old men and young-old men. The differences between oldest-old women and young-old women, however, are not statistically significant. Thus, our third hypothesis is partially supported.

Discussion

Our results indicated that the positive association of religious participation with survival among both the Chinese oldest-old and young-old who participated in religious activities at least once per week (frequent participants) was relatively stronger than for those who participated less than once per week (infrequent participants). This finding is generally consistent with previous longitudinal studies in the United States (Hummer et al. 1999; Koenig et al. 1999; Strawbridge et al. 1997) and a recent study in Taiwan (Yeager et al. 2006).

After health conditions were adjusted in addition to other confounding factors, most of the survival association among the infrequent participants became nonsignificant, but the effects remained statistically significant among the frequent participants for both male and female oldest-old and young-old in China. This finding is again generally consistent with previous studies. For example, Koenig and colleagues (1999) found that the protective effects of frequent religious involvement (once per week or more) on mortality among older adults in North Carolina were significant both in men and women, with prior health status and other covariates statistically controlled. In the Alameda County Study in the United States by Strawbridge et al. (1997), frequent religious participation (once per week or more) remained a very strong and significant predictor of 28-year mortality for older women but not for older men when health conditions and various other factors were statistically controlled.

We found that Chinese women, both the young-old and the oldest-old, were much more likely to participate in religious activities than their male counterparts, which is consistent with the findings from a majority of previous studies in Western countries and Japan (e.g., Koenig et al. 1999; Krause et al. 1999; Strawbridge et al. 1997). The much higher proportion of elderly women who are widowed might result in them being more involved in religious activities to fill otherwise unmet social needs for interchange and support (Strawbridge et al. 1997), although American women report higher levels of religious involvement than men at all ages. The fact that older Chinese women are seriously disadvantaged in socioeconomic and health status, as demonstrated by a previous study using the CLHLS data (Zeng, Liu, and George 2003), may also contribute to their much higher rate of religious participation. However, no statistically significant clear-cut pattern of gender differentials of the association of frequent religious participation with survival, as compared to infrequent or nonparticipation, was observed in this study. Musick et al. (1998) also found a nonsignificant gender effect in moderating the association of religious involvement and mortality in an age-heterogeneous sample. Both Koenig et al. (1999) and Strawbridge et al. (1997) reported numerically higher reductions in mortality among women than men, but they did not test the statistical significance of the gender difference.

The association between religious participation and survival was significantly stronger among the Chinese young-old men than among the oldest-old men, which is generally consistent with previous studies (Dupre et al. 2006; Musick et al. 2004; Seeman et al. 1987). However, we provide stronger evidence concerning the age effect because our study is based on the largest sample of the oldest-old in the world so far and also includes a comparable sample of the young-old while using single year of age as a control variable in the separate analyses for the oldest-old and the young-old. It is plausible that the health-enhancing effects of religious involvement achieved by altering health practices and lifestyles may be more pronounced among the young-old, who have greater potential for preventing deaths, than among the oldest-old (Musick et al. 2004). Given the limited evidence that religious beliefs/philosophy and attitudes are relatively stable across the life course (see Archer, Brathwaite, and Fraser 2005; Courtenay et al. 1992; Markides, Levin, and Ray 1987), it is also possible that at very advanced ages, when life span limits are approached, social factors including religious involvement cannot exert as powerful effects on prolonging life as they can earlier in the life course. Moreover, frail individuals may be more sensitive to and gain stronger benefits from religious participation than robust ones (Dupre et al. 2006). That is, a higher proportion of robust older adults may survive to advanced ages, and thus, the effects of religious participation on survival may be smaller among the oldest-old.

In summary, our first hypothesis that frequent religious participation has a larger survival association than infrequent participation and nonparticipation was supported. Our third hypothesis that religious involvement yields a greater association among young-old than among the oldest-old was partially supported (i.e., for men but not women). However, we do not find sufficient evidence to support the second hypothesis that women would benefit more than men from religious participation.

To our knowledge, this is the first study using a nationwide longitudinal data set with large sample size to investigate the relationship between frequency of religious participation and survival among both oldest-old and younger elderly in Mainland China. An important contribution of this study is the evidence that religious participation is positively associated with survival among older adults in a cultural and political setting where religious networks and activities are largely individualized in contrast to the well-organized religions in the West.

Although this study makes a unique contribution to research on the effects of religious participation on mortality, we also recognize its several weaknesses. First, although we discussed theoretically the conceptual framework of the impacts of religious participation on mortality in the Chinese context in the introduction section, the mechanisms by which Chinese elderly people's survival is associated with religious involvement are not fully investigated due mainly to limitations of the data, which were designed for research on determinants of healthy longevity rather than focusing on religion and its impact. We could not distinguish Buddhist from Daoist (or other) religious activities and had no information on whether the attendance was organized services or private practices at home in our data set, and thus could not identify the different types of motivations for and pathways of influence of religious participation. Second, while we controlled for the baseline health status measured by the widely used summary indicator of health (Deficits Index), which may substantially reduce the effects of endogeneity, the problem may still exist. Future causality studies using new data and other methodology (e.g., instrumental variables) may need to be considered. Third, given that the theme of this research was to test the hypotheses concerning differentials of association of religious participation with mortality at old ages between frequent, infrequent, and nonparticipants of religious activities; between young-old and oldest-old; and between men and women, we did not attempt to quantitatively decompose the effects of religious participation into direct and indirect pathways. Fourth, the three-year follow-up period in our data set might not be long enough to fully capture the spectrum of association of religious involvement with longevity. These facts all indicate that more in-depth studies are needed to deepen our knowledge about the associations of religious participation with survival and the mechanisms that cause and explain these associations in China.

Appendix

The Estimated Relative Hazards of All of the Covariates (Including Variables of Religious Participation and Potential Confounders) on Three-Year Mortality, Chinese Longitudinal Healthy Longevity Survey (CLHLS) 2002–2005

	Men				Women			
	1	2	3	4	1	2	3	4
Ages 65 to 84								
Infrequent religious participation (nonparticipation)	0.72 [*]	0.73 [*]	0.72 [*]	0.81	0.77 [*]	0.80 [#]	0.81	0.86
Frequent religious participation (nonparticipation)	0.59 [#]	0.57 [*]	0.55 [*]	0.53 [*]	0.55 ^{**}	0.75 ^{**}	0.61 ^{**}	0.63 [*]
Age (continuous variable)	1.10 ^{***}	1.09 ^{***}	1.09 ^{***}	1.07 ^{***}	1.10 ^{***}	1.08 ^{***}	1.08 ^{***}	1.07 ^{***}
Han (non-Han)	1.13	1.11	1.12	1.29	0.96	0.93	0.94	0.97
Urban (rural)	0.99	1.04	1.04	0.96	0.92	0.92	0.92	0.88
1+ year of schooling (0)	0.94	1.09	1.09	1.03	1.35 [*]	1.45 ^{**}	1.45 ^{**}	1.39 ^{**}
Economic independence (no)	0.69 ^{***}	0.82 [*]	0.82 [*]	0.83 [*]	0.50 ^{***}	0.58 ^{***}	0.58 ^{***}	0.59 ^{***}
Currently married (no)		0.76 [*]	0.76 [*]	0.73 ^{**}		0.69 ^{**}	0.70 [*]	0.73 [*]
Living alone (no)		0.67 ^{**}	0.67 ^{**}	0.70 [*]		0.64 ^{**}	0.65 ^{**}	0.71 [*]
Close proximity to child (no)		1.15	1.15	1.15		0.80 [#]	0.80 [#]	0.78 [#]
Family member as a caregiver (no)		0.99	0.98	0.99		0.80 [#]	0.80 [#]	0.83
Got adequate medication when sick (no)		0.90	0.90	1.06		0.93	0.94	1.08

	Men				Women			
	1	2	3	4	1	2	3	4
Leisure activities score (continuous variable)		0.78**	0.79**	0.88**		0.77***	0.78***	0.87**
Regular exercise (no)			0.97	1.11			0.90	0.97
Currently smoking (no)			0.91	0.99			1.36*	1.39*
Currently heavy alcohol drinker (no)			0.92	1.02			0.55	0.66
Deficits Index (continuous variable)				1.61***				1.45***
Number of cases	3,077	3,077	3,077	3,077	2,911	2,911	2,911	2,911
–Log likelihood	1,809.7	1,774.6	1,773.8	1,722.0	1,571.3	1,542.0	1,539.0	1,514.0
Ages 85+								
Infrequent religious participation (nonparticipation)	0.93	1.03	1.03	1.10	0.82**	0.87*	0.87*	0.92
Frequent religious participation (nonparticipation)	0.59***	0.72*	0.72*	0.73*	0.72***	0.81*	0.82*	0.87
Age (continuous variable)	1.06***	1.05***	1.05***	1.03***	1.06***	1.05***	1.05***	1.04***
Han (non-Han)	0.88	0.84	0.82#	0.90	0.73***	0.74***	0.74***	0.80**
Urban (rural)	1.10#	1.12*	1.13*	1.12*	0.98	0.98	0.99	0.97
1+ year of schooling (0)	0.99	1.10#	1.09#	1.08	0.98	1.03	1.04	0.99
Economic independence (no)	0.77***	0.87*	0.89#	0.86*	0.84#	0.92	0.93	0.96
Currently married (no)		0.79***	0.78***	0.81**		0.65**	0.65**	0.68**
Living alone (no)		0.97	0.96	1.05		0.83**	0.83**	0.91#
Close proximity to child (no)		0.94	0.95	0.97		0.99	0.99	1.01
Family member as a caregiver (no)		0.91	0.92	0.93		0.85*	0.84*	0.87*
Got adequate medication when sick (no)		0.98	1.00	1.09		1.01	1.01	1.06
Leisure activities score (continuous variable)		0.80**	0.84***	0.92***		0.77***	0.79***	0.88***
Regular exercise (no)			0.75***	0.84**			0.85**	0.94
Currently smoking (no)			0.95	1.00			0.93	0.97
Currently heavy alcohol drinker (no)			0.95	1.02			1.09	1.10
Deficits Index (continuous variable)				1.36***				1.43***
Number of cases	2,885	2,885	2,885	2,885	5,072	5,072	5,072	5,072
–Log likelihood	3,409.2	3,342.8	3,339.3	3,276.1	5,876.9	5,775.5	5,770.2	5,675.9

 $p < 0.10$;*
 $p < 0.05$;**
 $p < 0.01$;***
 $p < 0.001$.

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Table 1

Sample Distributions of the Covariates

	Age 85+		Age 65 to 84	
	Women (N = 5,733)	Men (N = 3,284)	Women (N = 3,420)	Men (N = 3,536)
Frequency of religious participation				
% Never	70.8	86.7	83.0	89.3
% Less than once per week	18.0	9.6	10.3	7.2
% Once per week or more	11.2	3.7	6.7	3.5
Sociodemographic characteristics				
Mean age	92.9	87.9	74.8	74.9
% Urban residence	45.6	45.9	46.3	46.8
% Non-Han ethnicity	5.9	5.2	6.0	4.7
% 1+ years of schooling	12.2	58.4	27.0	72.0
% Economic independence	27.6	19.7	28.1	56.2
Social/family support and connection				
% Married	3.3	26.5	38.9	65.3
% Living alone	13.4	14.0	16.6	10.0
% High proximity to children	82.2	80.2	84.7	80.0
% Spouse/family member as a caregiver	73.9	77.3	68.4	40.0
% Get adequate medication when sick	85.6	89.0	90.2	92.1
Mean of the social-leisure activities score	0.9	1.6	2.2	2.7
Health practices				
% Currently doing regular exercise	36.4	16.7	34.2	45.3
% Current smoker	6.5	25.0	8.6	41.1
% Current heavy alcohol drinker	1.6	6.0	1.1	11.4
Mean of the Deficits Index	0.34	0.26	0.15	0.12
% of deaths during the period 2002–2005	53.3	52.2	14.9	12.6
% lost to follow-up in 2005 wave	11.5	12.2	14.1	13.0

Table 2
Sample Distributions of the Frequencies of Religious Participation by the Covariates Considered

	Women			Men				
	Do not participate (%)	< 1 times per week (%)	≥ 1 times per week (%)	Total N	Do not participate (%)	< 1 times per week (%)	≥ 1 times per week (%)	Total N
Sociodemographic characteristics								
Age groups								
Young-old aged 65 to 84	70.76	18.27	11.26	3,420	86.68	9.62	3.70	3,536
Oldest-old aged 85+	83.03	10.29	6.68	5,733	89.34	7.22	3.44	3,284
Residence								
Rural	78.02	13.86	8.13	4,958	86.43	9.93	3.64	3,656
Urban	78.95	12.35	8.70	4,195	89.73	6.76	3.51	3,164
Ethnicity								
Han	77.87	13.35	8.78	8,608	87.89	8.49	3.63	6,481
Minorities	82.02	10.28	7.71	545	89.38	7.96	2.65	339
Education								
No education	78.86	12.98	8.16	7,537	89.18	7.04	3.78	2,357
1+ years schooling	76.49	14.05	9.47	1,616	87.32	9.21	3.47	4,463
Economic status								
Not independent	78.75	13.16	8.09	7,901	87.39	9.12	3.49	3,926
Independent	76.52	13.18	10.30	1,252	88.74	7.57	3.70	2,894
Social/family support and connection								
Marital status								
Not married	79.62	12.39	7.99	7,636	89.12	7.53	3.35	3,641
Married	72.51	17.07	10.42	1,517	86.63	9.53	3.84	3,179
Living arrangement								
Not living alone	79.73	12.59	7.68	7,813	87.88	8.62	3.50	6,007
Living alone	70.97	16.49	12.54	1,340	88.56	7.26	4.18	813
High proximity to children								
No	79.75	11.19	9.06	1,546	90.49	6.12	3.39	1,357
Yes	78.18	13.57	8.26	7,607	87.33	9.04	3.62	5,463
Caregiver								

	Women				Men			
	Do not participate (%)	< 1 times per week (%)	≥ 1 times per week (%)	Total N	Do not participate (%)	< 1 times per week (%)	≥ 1 times per week (%)	Total N
Not spouse/family member	77.42	12.70	9.88	1,811	87.94	8.53	3.53	2,977
Spouse/family member	78.70	13.28	8.02	7,342	87.98	8.40	3.62	3,843
Medication when sick								
Inadequate	79.52	12.99	7.49	1,162	88.59	6.72	4.69	640
Adequate	78.29	13.19	8.52	7,991	87.90	8.64	3.46	6,180
Social-leisure activities score								
0 to 2 (lowest 67%)	80.69	11.96	7.35	7,282	89.51	7.29	3.19	3,977
3 to 7 (highest 33%)	69.70	17.85	12.45	1,871	85.79	10.09	4.12	2,843
Health practice								
Current regular exercise								
No	80.23	12.30	7.47	6,908	88.12	8.42	3.45	4,024
Yes	72.96	15.81	11.22	2,245	87.73	8.51	3.76	2,796
Current smoking								
No	78.30	13.30	8.40	8,490	87.91	8.16	3.93	4,549
Yes	83.26	11.46	8.30	663	88.07	9.07	2.86	2,271
Current heavy alcohol drinker								
No	78.45	5.85	8.38	9,025	87.93	8.49	3.59	6,220
Yes	78.13	12.50	9.38	128	88.33	8.17	3.50	600
Deficit Index								
0.0 to 0.1 (lowest 33%)	69.01	18.56	12.43	2,301	85.84	10.58	3.58	2,987
0.1 to 1.0 (highest 67%)	81.61	11.35	7.03	6,852	89.62	6.81	3.57	3,833

Table 3

Relative Hazards (RH) of Religious Participation on Three-Year Mortality, Chinese Longitudinal Healthy Longevity Survey (CLHLS), 2002–2005

Sequential model and covariates	Age 85+ (RH)				Age 65 to 84 (RH)				Age 65+ (RH)			
	Both sexes (N = 7,957)		Women (n = 5,072)		Men (n = 2,885)		Both sexes (N = 5,988)		Women (n = 2,911)		Men (n = 3,077)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(a) Infrequent participants vs. nonparticipants												
1. Religious participation plus sociodemographic variables	0.83***	0.82**	0.93	0.75**	0.77*	0.72*	0.82***	0.80***	0.87#			
2. Model 1 plus family, social support/connections, leisure activities, and accessibility to medication when sick	0.91#	0.87*	1.03	0.76**	0.80#	0.73*	0.88**	0.86**	0.94			
3. Model 2 plus health practices	0.91#	0.87*	1.03	0.76**	0.81	0.72*	0.88**	0.86*	0.93			
4. Model 3 plus health conditions of Deficits Index	0.96	0.92	1.10	0.83#	0.86	0.81	0.94	0.91	1.02			
(b) Frequent participants vs. nonparticipants												
1. Religious participation plus sociodemographic variables	0.69***	0.72***	0.59***	0.56***	0.55***	0.59#	0.67***	0.70***	0.59***			
2. Model 1 plus family, social support/connections, leisure activities, and accessibility to medication when sick	0.79***	0.81*	0.72*	0.58***	0.75**	0.57*	0.75***	0.77**	0.68**			
3. Model 2 plus health practices	0.80**	0.82*	0.72*	0.58***	0.61**	0.55*	0.76***	0.78**	0.67**			
4. Model 3 plus health conditions of Deficits Index	0.83*	0.87	0.73*	0.60**	0.65*	0.53*	0.79***	0.82*	0.69***			
(c) Frequent participants vs. infrequent participants												
1. Religious participation plus sociodemographic variables	0.82*	0.90	0.64**	0.75	0.72	0.82	0.81*	0.87	0.67**			
2. Model 1 plus family, social support/connections, leisure activities, and accessibility to medication when sick	0.87	0.94	0.70*	0.76	0.75	0.78	0.85*	0.90	0.72*			
3. Model 2 plus health practices	0.87	0.94	0.68*	0.76	0.75	0.77	0.86#	0.91	0.72*			
4. Model 3 plus health conditions of Deficits Index	0.86#	0.94	0.66*	0.72#	0.73	0.66	0.84*	0.90	0.67**			

Note: RHs for “both sexes” are estimates for men and women combined with sex as one of the confounding variables. RHs for men and women are estimated from separate models of men and women. All RH estimates are based on the Weibull hazards regression sequential model adjusted for selected covariates listed in Table 1. The degrees of freedom of Model 1, Model 2, Model 3, and Model 4 for men and women separately are 7, 13, 16, and 17, respectively, while the corresponding numbers for both sexes are 8, 14, 17, and 18.

$p < 0.10$;

* $p < 0.05$;

** $p < 0.01$;

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 $p < 0.001$

Table 4

P Values of Statistical Tests of Comparisons on Survival Association With Religious Participation (i.e., the Estimates of Relative Hazards in Table 3) Between Young-Old and Oldest-Old and Between Men and Women

	Men versus women			Ages 85+ versus ages 65 to 84		
	Ages 85+ (N = 7,957)	Ages 65 to 84 (N = 5,988)	Ages 65+ (N = 13,945)	Men (N = 5,962)	Women (N = 7,983)	Both sexes (N = 13,945)
1. Religious participation plus sociodemographic variables	0.5616	0.9778	0.8068	0.2862	0.3658	0.1964
2. Model 1 plus family/social support/connections, leisure activities and accessibility to medication when sick	0.3852	0.7135	0.6773	0.0582	0.2165	0.0341
3. Model 2 plus health practices	0.3972	0.6154	0.7624	0.0488	0.2460	0.0285
4. Model 3 plus health conditions of Deficits Index	0.4533	0.7024	0.7236	0.0716	0.2317	0.0445