

# Does Religion Stave Off the Grave? Religious Affiliation in One's Obituary and Longevity

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## Abstract

Self-reported religious service attendance has been linked with longevity. However, previous work has largely relied on self-report data and volunteer samples. Here, mention of a religious affiliation in obituaries was analyzed as an alternative measure of religiosity. In two samples ( $N = 505$  from Des Moines, IA, and  $N = 1,096$  from 42 U.S. cities), the religiously affiliated lived 9.45 and 5.64 years longer, respectively, than the nonreligiously affiliated. Additionally, social integration and volunteerism partially mediated the religion–longevity relation. In Study 2, exploratory analyses suggested that the religion–longevity association was moderated by city-level religiosity and city-level personality. In cities with low levels of trait openness, the nonreligiously affiliated had reduced longevity in highly religious cities relative to less religious cities, consistent with the religion-as-social-value hypothesis. Conversely, in cities with high levels of openness, the opposite trend was observed, suggesting a spillover effect of religion. The religiously affiliated were less influenced by these cultural factors.

## Keywords

longevity, religion, health, volunteering, social integration, personality

Some think of religion as a matter of life and death on a spiritual level; might it also be on a physical level? Accumulating evidence indicates that individuals who report regular participation in religious services live longer than those who do not (Kim, Smith, & Kang, 2015; Musick, House, & Williams, 2004; Oman & Reed, 1998; Strawbridge, Cohen, Shema, & Kaplan, 1997). Two meta-analyses have supported this relationship (Chida, Steptoe, & Powell, 2009; McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000), though the field has received blistering criticism on methodological grounds<sup>1</sup> (Sloan, 2007; Sloan, Bagiella, & Powell, 1999; Sloan et al., 2000). A chief methodological criticism has been reliance upon self-report of attendance at religious services. For example, surveys using self-reported frequency of church attendance have been found to exceed actual attendance calculations (Hadaaway, Marler, & Chaves, 1993; Presser & Stinson, 1998). Similarly, time use diaries that ask people to list how they spent their time (e.g., What did you do last Sunday morning?) show lower estimates of attendance (Presser & Stinson, 1998) than self-report questions about frequency of religious attendance, presumably due to the social desirability bias associated with the latter method. Another criticism has been that many studies use volunteer samples that may not be representative of the general population (Sloan & Bagiella, 2002). Therefore, supplementing studies that rely on self-reported psychosocial

factors from volunteer samples with data from another methodology could help to clarify the findings and provide a conceptual replication.

Obituaries provide just such an opportunity to examine the association between religiosity and longevity. Because the activities and organizations listed in an obituary presumably shaped the deceased's experiences, they could have influenced the deceased's health. Although psychologists have occasionally used obituaries as a research method (End, Meinert, Worthman, & Mauntel, 2009; Ergin, 2009; Fowler & Bielsa, 2007), this approach has surprisingly not been applied to the religion or health domains. Because individuals close to the deceased tend to write obituaries, descriptions of the individual are not subject to typical self-reporting biases, although they

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may be subject to different biases (addressed further in the Discussion section). Compared to how an individual describes himself or herself, third-person descriptions of that individual's personality or emotionality can actually be better predictors of relevant health outcomes such as coronary artery disease or job performance (Ketterer & Smith, 2011; Oh, Wang, & Mount, 2011). Therefore, information derived from obituaries might provide a different perspective on the relation between religion and longevity than that derived from explicit questions about religious attendance.

Several explanations have been offered for the association between affiliation with a religious organization and longevity, most of them suggesting that religiosity affects health rather than that mental or physical health affects religiosity. One common explanation is that religious affiliation is associated with social support, which is one of the most robust predictors of mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Holt-Lunstad, Smith, & Layton, 2010). Attendance at religious services is associated with greater social support (Sørensen, Danbolt, Lien, Koenig, & Holmen, 2011; Strawbridge et al., 1997) and a larger number of close friends (Idler & Kasl, 1997) in cross-sectional studies. Longitudinally, attendance at religious services has also been found to predict increases in social relationships over a 30-year span (Strawbridge, Shema, Cohen, & Kaplan, 2001).

Another potential explanation for the association between religion and longevity is increased involvement in volunteering among the religious. A core teaching of most religious traditions is caring for others. Membership in a religious organization is associated with greater volunteering both in the United States (Wilson & Janoski, 1995) and globally (Smith & Stark, 2009; Wilson, 2012; but see Galen, 2012). A meta-analysis of five studies showed that volunteers had a 22% reduction in mortality compared to nonvolunteers (Jenkinson et al., 2013). Therefore, the link between religious affiliation and longevity may occur because religions encourage volunteering and service of others, which provide health benefits. Thus, beyond reexploring the link between religion and longevity with a novel methodology, we test whether religious affiliation may be associated with longevity through increased opportunities for social integration and volunteerism.

Finally, because one of our samples used obituaries from different cultural regions of the United States, we considered an exploratory moderator for the association between religious affiliation and longevity: the local culture. An emerging literature has suggested that the positive relationship between religious service attendance and self-esteem (Gebauer et al., 2016), subjective well-being (Diener, Tay, & Myers, 2011), and self-reported health (Stavrova, 2015; but see Huijts & Kraaykamp, 2011) is greater in regions for which there is greater religious affiliation. According to the religion-as-social-value hypothesis (Gebauer, Sedikides, & Neberich, 2012), in highly religious regions, religious affiliation is socially valued and adhering to religious norms confers psychological benefits that may reduce stress and improve health (Smyth, Zawadzki, Juth, & Sciamanna, 2016; Zilioli et al., 2016).

An alternative model is that the effects of organizational religious behavior spill over and affect others in the community. In other words, nonreligious people are positively influenced by being in a highly religious environment, reducing the difference in longevity between religiously affiliated and nonreligious individuals in highly religious areas. Such "spillover" effects of the current or historical proportion of individuals involved with a religious organization in a region have been associated with effects on the attitudes (Moore & Vanneman, 2003), values (e.g., social trust; Traummüller, 2010), and health-relevant behaviors (suicide: Van Tubergen, Te Grotenhuis, & Ultee, 2005; substance use: Adamczyk & Palmer, 2008; volunteerism: Ruiter & De Graaf, 2006, 2010) of secular individuals in these regions. Thus, because religious spillover effects have been seen for values, norms, and beliefs that influence health, we reasoned that there may be spillover effects on longevity as well.

A final possibility is that additional cultural features of regions may influence whether a particular region demonstrates a religion-as-social-value or spillover effect. In particular, recent research has suggested that regions vary in personality (e.g., Bleidorn et al., 2016; Rentfrow et al., 2013) and that the fit between an individual's personality type and the personality composition of this individual's cultural milieu can influence health. Importantly for our predictions here, people who are less open to experience (or more conscientious) tend to be more concerned with social norms and conformity (Harrington & Gelfand, 2014). We reasoned that the religion-as-social-value hypothesis might be more likely to occur in these cities lower in openness to experience, where being discrepant from others (i.e., nonreligious individuals in a city with high religious involvement) could be stressful and have negative health consequences. However, in cities that value conformity but are low in religious identification, there could be less of a difference between religiously and nonreligious individuals because identifying with a religion is less socially valued.

Conversely, in more open cities with less emphasis on conformity and social norms, identifying with a religion may not be as valued culturally. Nonetheless, the degree of religious involvement in the city may impact behavioral norms or other factors that influence health. Thus, there may be an opportunity for the benefits of religion to spillover, allowing the nonreligious individuals to live longer in more rather than less religious cities.

We tested our hypotheses in two sets of obituaries. The first contains obituaries published within Des Moines, IA, over the course of 2 months, which we collected to do an initial investigation of the link between religion and longevity in a sample of obituaries. The second was derived from the online newspapers of 42 metropolitan areas in the United States to increase external validity. In addition to religious affiliation, we measured other variables mentioned in the obituary associated with longevity, such as social integration, volunteerism, marital status, and gender. We predicted that religious affiliation within obituaries would be associated with increased longevity beyond marital status and gender.

After examining the effects of affiliation with a religious institution in each sample independently, we combined the two studies to conduct a mediation analysis to determine whether social integration and volunteerism mediate the relation between religion and longevity. Additionally, we conducted exploratory analyses to examine possible moderation of the religion–longevity link by city religiosity. These analyses provided a preliminary examination of whether the association is more consistent with the religion-as-social-value or the spillover hypothesis or whether the regional personality might determine which effect would occur.

## Study 1 Method

### Sample

The first study used the obituaries posted on the Des Moines Register from January 1, 2012, to February 29, 2012. Basic death announcements that did not contain the person's age at the time of death or any information about what they did while they were alive were not included in our sample, resulting in 505 obituaries for analysis. Our stop rule for sampling was the end of 2 months, which we estimated would give us between 500 and 1,500 obituaries, which would have been consistent with the sample size in epidemiological studies on religion and health (Chida et al., 2009).

### Coding

Researchers coded for sex (0 = *male*, 1 = *female*), age, marital status, religious affiliation, and number of social and volunteer activities. Religious affiliation was coded as a binary variable, indicating mention of religious activities or not. Additional details about coding and interrater reliability are available in the Online Supplemental Material for both studies.

## Results

Table 1 contains zero-order correlations among the primary measures: longevity ( $M = 75.98$ ,  $SD = 17.35$ ), religion (38% religious), social integration ( $M = 0.47$ ,  $SD = 0.86$ ), volunteerism ( $M = 0.30$ ,  $SD = 0.70$ ), gender (49.1% female), and marital status (82% married).

We ran a linear regression analysis to examine the relation between religious affiliation and longevity (Table 2). Religious affiliation was significantly associated with longevity, with those mentioning affiliation with a religious organization living almost

**Table 1.** Zero-Order Correlations Between Longevity, Religion, Social Integration, Volunteerism, Gender, and Marital Status.

Variable	1	2	3	4	5
1. Longevity					
2. Religious affiliation	.265**				
3. Social integration	.190**	.263**			
4. Volunteerism	.216**	.331**	.428**		
5. Gender	.218**	.145**	-.080	.002	
6. Marital status	.381**	.176**	.097*	.059	.079

\* $p < .05$ . \*\* $p < .01$ .

10 years longer than those who did not (Figure 1a). In a second model, we controlled for the effects of gender and marital status. Even controlling for these variables, religious affiliation was significantly associated with longevity, though the effect size was reduced to 6.48 years. Further, gender and marital status had significant effects on longevity above and beyond each other.

## Introduction Study 2

Study 1 used obituaries coded by research assistants to conceptually replicate previous work that used self-reported religious involvement to demonstrate that there is a relation between religious affiliation and longevity. However, because this relationship could be unique to the Des Moines area, Study 2 examined this relationship in 42 other cities across the United States using data that were originally collected for another purpose (Maley et al., 2012; Wallace, Padin, & Hartman, 2012). There is extensive variability in religious affiliation and personality in different regions of the United States (Bleidorn et al., 2016; Pew Forum on Religion & Public Life & Pew Research Center, 2008), and the relationship between religious affiliation and health may depend on the religiosity of the region (e.g., Stravrova, 2015), as well as the regional personality. As such, this national sample provides the opportunity to explore whether the religious affiliation–mortality link is consistent across regions.

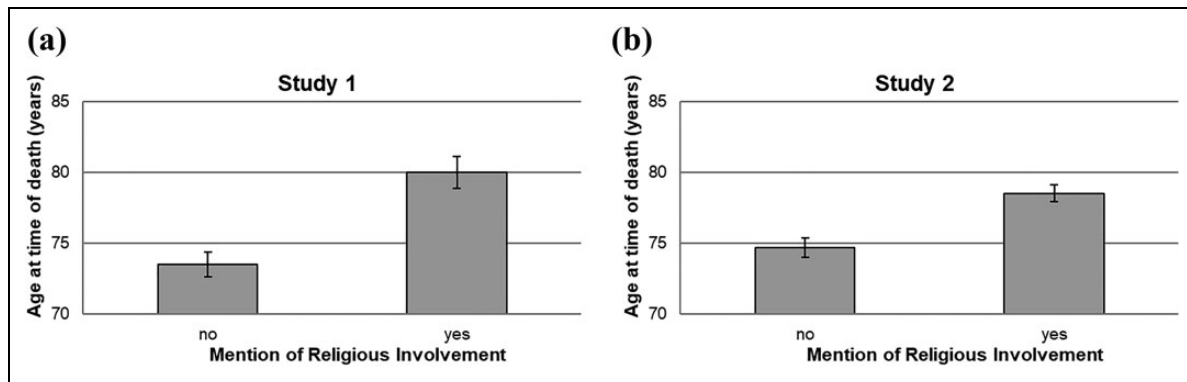
## Method Study 2

### Sample

Obituaries were analyzed from a previously collected data set that had randomly selected 19–30 obituaries from newspaper websites of 42 major cities in the United States, yielding a total of 1,096 obituaries. On average, the data set had 26 people per city. For most cities sampled, obituaries appeared in

**Table 2.** Summary of Study 1 Regression Analyses for Variables Predicting Longevity.

Predictor	Model 1				Model 2			
	<i>b</i>	<i>p</i>	95% CI	<i>r</i>	<i>b</i>	<i>p</i>	95% CI	<i>r</i>
Religion	9.45	.000000002	[6.43, 12.47]	.27	6.48	.00001	[3.63, 9.33]	.18
Gender					5.74	.00004	[3.00, 8.47]	.16
Marital status					15.14	$8.3 \times 10^{-16}$	[11.57, 18.72]	.33



**Figure 1.** Age at time for death for those mentioning religious affiliation versus not mentioning religious affiliation at mean levels of gender and marital status. (a) Study 1. (b) Study 2. Error bars represent standard errors of mean.

**Table 3.** Zero-Order Correlations Between Longevity, Religion, Social Integration, Volunteerism, Gender, and Marital Status.

Variable	1	2	3	4	5
1. Longevity					
2. Religious affiliation	.175**				
3. Social integration	.120**	.049			
4. Volunteerism	.132**	.098**	.269**		
5. Gender	.116**	.101**	.023	.038	
6. Marital status	.317**	.153**	.083**	.130**	.004

\* $p < .05$ . \*\* $p < .01$ .

newspapers from August 2010 to August 2011. Some newspapers limited access to obituaries so for Raleigh and Phoenix, obituaries were selected from January 2011 to August 2011. Memphis and Cincinnati only provided access to obituaries that had been posted in the previous month.

### Coding

We coded obituaries the same as in Study 1. Additionally, the percentage of people identifying as religious in a given city was obtained from the Association of Statisticians of American Religious Bodies (2010), and the personality traits for each city were obtained from Bleidorn et al. (2016). Analyses with an alternative measure of city religiosity as well as a table with the percent religious and the personality values for each city are available in Online Supplemental Material.

## Results Study 2

Table 3 reports zero-order correlations between variables of interest: longevity ( $M = 76.86$ ,  $SD = 15.94$ ), religion (56.5% mentioned religion), social integration ( $M = 0.26$ ,  $SD = 0.64$ ), volunteerism ( $M = 0.25$ ,  $SD = 0.62$ ), gender (42.6% female), and marital status (80.7% married).

Replicating the previous study, mention of a religious organization in the obituary was associated with longevity. Those mentioning religious affiliation lived about 5 years longer than those who did not (Figure 1b). Even when controlling for the

effects of gender and marital status, religious affiliation continued to be associated with longevity (Table 4).

### Mediation Analysis in Both Study 1 and Study 2

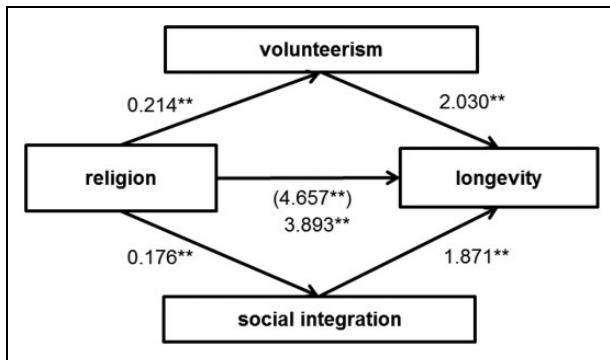
Because we hypothesized that a component of religious affiliation's relation with longevity is due to the opportunities and incentives to volunteer and participate in other social groups provided by religious communities, we conducted a dual mediation analysis controlling for the effects of marital status and gender, which showed that both volunteerism and social integration mediate the relation between religious affiliation and longevity (Figure 2). We combined the data from each study for these analyses and entered study as a factor. Across both studies, religious affiliation was significantly associated with longevity. Further, religious affiliation was related to both volunteerism and social integration. When all three variables were included in a regression model, religious affiliation was still associated with longevity, as was social integration and volunteerism (see Figure 3a and b for the associations of social integration and volunteerism with longevity). Most importantly, bias-corrected bootstrap 95% confidence intervals (CIs) demonstrated that the decreases in the total effect of religious affiliation on longevity from the indirect effects of both volunteerism,  $b = .43$ , 95% CI [0.22, 0.71] and social integration,  $b = .33$ , 95% CI [0.15, 0.56] were significant. However, the relation between religious affiliation and longevity remained significant, suggesting that there are additional pathways influencing the relation between these two variables.

### Exploratory Moderation Analyses of the Religion–Longevity Relationship

Further, having a national sample allowed for exploratory analyses to examine moderation of the association between individual religiosity and longevity by city religiosity. As outlined in the Introduction, we thought that three possibilities could exist. The first possibility is a “religion-as-social-value” effect, in which we would expect religiously affiliated people to live

**Table 4.** Summary of Study 2 Regression Analyses for Variables Predicting Longevity.

Predictor	Model 1				Model 2				
	<i>b</i>	<i>p</i>	95% CI	<i>r</i>	<i>b</i>	<i>p</i>	95% CI	<i>r</i>	
Religious affiliation	5.64	.000000005	[3.76, 7.52]	.18	3.82	.00004	[2.01, 5.63]	.12	
Gender					3.35	.0003	[1.55, 5.14]	.10	
Marital status					12.16	$1.20 \times 10^{-24}$	[9.89, 14.43]	.28	

**Figure 2.** Mediation of the relation between religious affiliation and longevity by volunteerism and social integration controlling for gender and marital status. Values in parentheses indicate the total effect of religion on longevity controlling for gender and marital status. Data for each of the studies are combined. \* $p < .05$ . \*\* $p < .01$ .

longer than nonreligiously affiliated people in highly religious cities. The second possibility is a spillover effect, in which the benefits of religiosity would “spill over” to nonreligiously affiliated people. This possibility predicts that the difference in longevity between the religiously and nonreligiously affiliated would be smaller in highly religious cities than in less religious cities. Finally, we hypothesized that the overall openness of the city could moderate the effect of city-level religiosity on the relationship between individual religiosity and longevity. In an initial exploratory test of this hypothesis, we explored a three-way interaction between individual religiosity, city religiosity, and city openness on longevity controlling for gender, marital status, and average income of the city using a multilevel model. In the current data, the effect of individual religiosity on longevity was moderated by city religiosity and city openness,  $\gamma = -2.19$ ,  $t(1,082.75) = -2.39$ ,  $p = .017$ ,  $r = -.07$ , 95% CI [-3.98, -0.39] (Figure 4; simple two-way interaction and simple slope analyses reported in Online Supplemental Material). Among cities that were less open, the pattern of results was consistent with the religion-as-social-value hypothesis, but among those cities that were more open, the pattern of results was consistent with a spillover effect.

We also examined moderation by city-level conscientiousness because high conscientiousness has also been associated with greater conformity. There was a similar three-way interaction between individual religiosity, city religiosity, and city conscientiousness,  $\gamma = 3.94$ ,  $t(1,080.12) = 1.98$ ,  $p = .048$ ,  $r = .06$ , 95% CI [0.03, 7.85], with cities high in

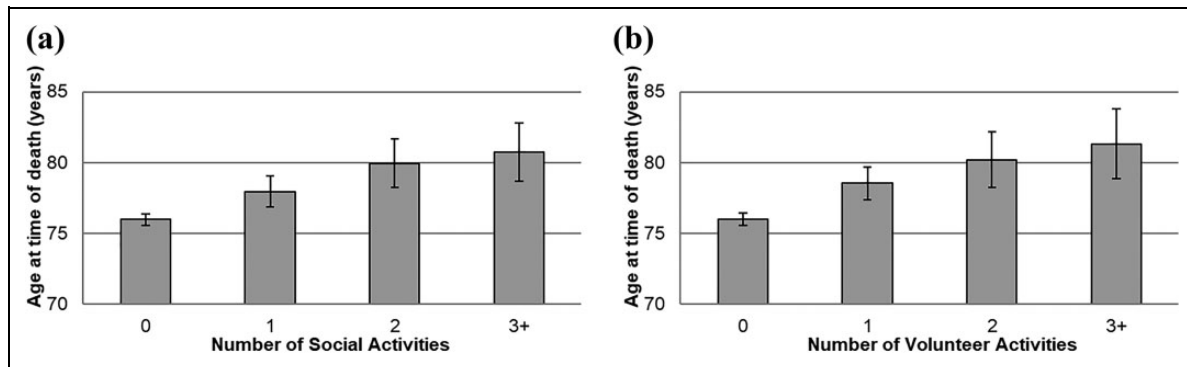
conscientiousness demonstrating a religion-as-social-value pattern and cities low in conscientiousness demonstrating a spillover pattern (see Online Supplemental Material for details). No other personality traits (agreeableness, neuroticism, or extraversion) had a significant interaction with city religiosity and individual religiosity,  $ps > .28$ .

## Discussion

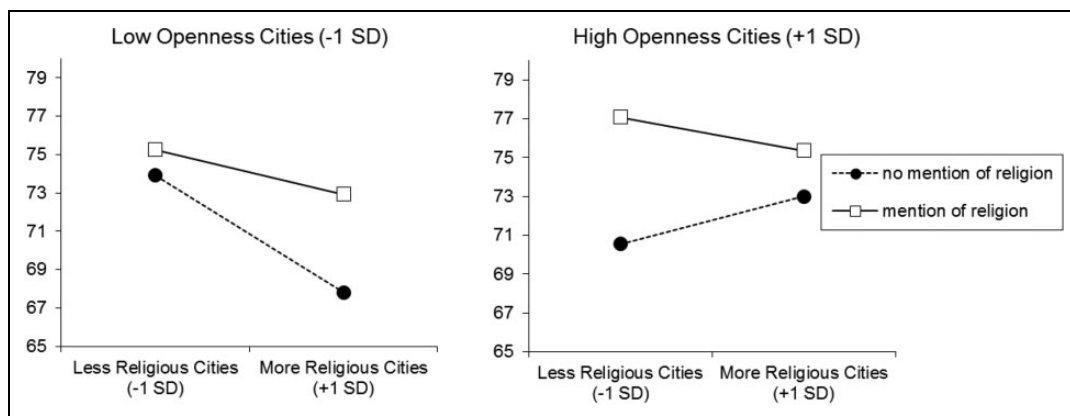
Across two unique samples, individuals identified in their obituaries as involved with a religious institution lived significantly longer lives. This relationship held even when controlling for other social variables known to positively correlate with longevity (e.g., gender and marital status). The difference in life span between those with obituaries mentioning religious affiliation and those not was comparable to the difference in longevity between women and men, which is about 4.8 years (Center for Disease Control and Prevention, 2012). Studying longevity via individuals’ obituaries is a relatively novel approach to examining psychosocial influences on health, and these results are consistent with prior work indicating a positive relation between religiosity and longevity (Kim et al., 2015; Musick et al., 2004; Oman & Reed, 1998; Strawbridge et al., 1997). When viewed in combination with these prior studies using self-report methodology, the present findings suggest that religious affiliation is associated with health.

Mediation analyses in the combined data sets indicate that the religion–longevity link was partially mediated through increased opportunities for social group involvement as well as volunteerism. These effects of social group involvement are consistent with prior work and further validate the methodological approach of using obituaries. Greater social integration has a robust association with greater longevity (e.g., Holt-Lunstad et al., 2015) and greater religious affiliation is associated with greater social contacts (e.g., Strawbridge et al., 2001). Volunteerism as a mediator is a more novel finding but is consistent with both religious affiliation increasing volunteerism (Wilson & Janoski, 1995) and volunteerism having salubrious effects (e.g., Jenkinson et al., 2013).

Volunteerism and involvement in social organizations only accounted for a portion (a little less than 1 year) of the longevity boost that religious affiliation provided. In the mediation model, religious affiliation still had a direct effect of a little less than 4 years on longevity. There are multiple factors not measurable with obituaries through which religious affiliation may relate to longevity. For example, many religions restrict



**Figure 3.** Age at the time of death for each level of social and volunteer activities at mean levels of the other variables. (a) Effect of social activities on longevity for Studies 1 and 2. (b) Effect of volunteer activities on longevity for Studies 1 and 2. Error bars represent standard errors.



**Figure 4.** Interaction between city openness, city religiosity, and individual religiosity. Those cities low in openness demonstrate a pattern consistent with religion-as-social-value whereas those high in openness demonstrate a pattern consistent with spillover.

behaviors related to health, such as drinking, doing drugs, and having sex with many partners (Gardner, Sanborn, & Slattery, 1995; Koenig, George, Meador, Blazer, & Ford, 1994). Further, many religions promote stress reducing practices that may improve health such as gratitude, prayer, or meditation (Belding, Howard, McGuire, Schwartz, & Wilson, 2010; Luhrmann, 2013; Mills et al., 2015; Redwine et al., 2016). Religious belief may also provide people with a sense that the world is predictable, which should make them feel more in control of their outcomes and thus reduce anxiety associated with believing the world is unpredictable (Kay, Gaucher, McGregor, & Nash, 2010). Improving understanding of these other mechanisms is an important future research endeavor.

### Exploratory Moderation Analyses of the Religion–Longevity Relationship

Although future research is needed to draw definitive conclusions, in our sample, city religiosity and city openness moderated the religion–longevity relation. There was suggestive evidence for both the religion-as-social-value (Gebauer et al., 2016) and spillover hypotheses, depending on the level of city openness and conscientiousness. In cities characterized by low

levels of openness, we observed a pattern consistent with the religion-as-social-value hypothesis (Gebauer et al., 2016; Stavorova, 2015). In highly religious cities, people who were not religiously affiliated had shorter life spans than those who were religiously affiliated. However, in less religious cities, nonreligiously affiliated people lived just as long as the religiously affiliated. This pattern of effects is consistent with the theory that religion is a valued social identity, which can influence mental and physical health.

In more open cities, the observed direction of effect is more consistent with the spillover hypothesis, which posits that the benefits of religiosity spill over to the nonreligiously affiliated. In this case, in more religious cities, nonreligiously affiliated people did not differ in longevity compared to religiously affiliated people, but in less religious cities, religiously affiliated people outlived nonreligiously affiliated people. Thus, nonreligiously affiliated people lived longer in more religious cities than less religious cities, which is the opposite pattern to that observed in the less open environment. If the pattern of effects seen here were replicated, it would suggest that the effects of individual and city religiosity on longevity may depend on the city's predominant personality type or other cultural factors. Naturally, it will be interesting to see whether

these exploratory findings replicate using alternative approaches and larger data sets. For a more detailed discussion of these moderation results, see Online Supplemental Material.

## Limitations

Although the main effects of religious affiliation on longevity corroborate work using survey methodologies, these results should be interpreted with caution due to several limitations. First, our data are correlational in nature and only collected at one time point. As such, it is impossible to disentangle the direction of the effect: whether religious involvement increases longevity or healthier people tend to be more religious. Furthermore, the correlational nature of the interactions between individual religiosity and the cultural environment could be influenced by an unmeasured third factor (e.g., civic services such as health care).

Second, although obituaries may not be subject to the same biases as self-report, they may be subject to their own biases such as the obituary writer self-enhancing on behalf of the deceased or those who are well liked or have stronger social connections being more likely to have obituaries.

Third, obituaries do not include demographic factors (e.g., race) or health behaviors (e.g., smoking) that influence longevity. The data from the first sample reported here were racially homogenous (see Online Supplemental Material), so this would not seem to be the major explanation for these effects, consistent with prior work (Kim et al., 2015; McCullough et al., 2000). Furthermore, several previous studies have demonstrated that the relation between religion and longevity holds when controlling for health behaviors (Chida et al., 2009; Zeng, Gu, & George, 2011).

Fourth, because of the potential costs associated with publishing an obituary, our samples may not be entirely socioeconomically or educationally representative. Although these factors limit the generalizability of our findings, they likely restrict the range of our variables, and thus bias against the results, suggesting that the current sample provided a conservative test of these hypotheses.

Fifth, obituaries fail to reflect the relative degrees of involvement in various activities, so they may overemphasize, underemphasize, or even leave out aspects of a person's life. This issue is particularly relevant for obituaries lacking a mention of involvement with a religious institution. It is not entirely clear who falls into this category. Individuals without religious information in their obituaries might be atheists, agnostics, or a member of an unaffiliated group such as the "spiritual, but not religious." Alternatively, individuals without religious information in their obituaries might be religious, but not as closely associated with the institution as those for whom religious identity is mentioned in the obituary. Given these differing possibilities, it is not clear whether the current data demonstrate that religiosity is associated with increased longevity compared to those who are not religiously affiliated at all or whether strongly identifying with a religion is better than weakly identifying with a religion. Thus, it is not clear whether the "at-risk"

group is the nonreligious, the low identifiers, or both. The bulk of the sample was born before the middle of the 20th century when levels of those identifying as nonreligious were low (Pew Forum on Religion and Public Life, 2015). The increase in atheism and the religiously unaffiliated has shown robust increases only recently. Most likely then, individuals without mention of religious involvement in their obituaries were probably low identifiers. Nonetheless, these findings may not generalize to younger generations where the nature and degree of involvement with religious institutions are changing (Pew Forum on Religion and Public Life, 2010). In other words, because of the cross-sectional nature of our data, we are unable to rule out cohort effects.

In conclusion, we use a novel methodology to corroborate survey data associating religious affiliation with longevity. That both methodologies yield a similar picture provides compelling support for the relationship between religious affiliation and longevity.

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## Supplemental Material

The supplemental material is available in the online version of the article.

## Note

1. Sloan (2007) stated:

Studies examining the association of attendance at religious services and mortality provide, without question, the strongest evidence in the field that attempts to establish a connection between religious characteristics and health outcomes. However, in a field so riddled with poorly conducted studies, this is like complimenting a person for being the healthiest patient in a hospice. (p. 493)

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**Does Religion Stave off the Grave? Religious Affiliation in One's Obituary and Longevity  
Supplemental Materials**

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## **Study 1: Additional Coding Details and Interrater Reliability**

### **Additional Coding Details**

Many obituaries mention a religious facility where funeral or memorial services will be held or where people could send flowers. These mentions of religious facilities were *not* coded as religious affiliation because it is not clear if the deceased individual had any involvement with the institution.

The number of volunteer activities was coded as affiliation with an organization that has a service mission (e.g. Shriners). We coded social integration as the number of formal social organizations mentioned (e.g. country clubs). To reduce the effects of outliers, the volunteerism and social integration variables were turned into semi-continuous measures by grouping three or more activities together.

In addition, because the Des Moines Register provided photos of the deceased, we were able to estimate the individual's racial background. Des Moines was chosen because of its lack of racial diversity, in order to control for the effects of race on longevity. Indeed, only 1.6% ( $N=8$ ) of the sample was non-white. As such, race was not included in analyses.

We also coded for education (1=less than high school, 2=completed high school, 3=trade school, 4=college degree, 5=graduate degree). However, only 327 obituaries reported education. In a model with religion, gender, marital status, and education, religion continued to be associated with longevity,  $F(1, 319)=11.59, p=.0007$ , but education did not,  $F(4, 319)=.95, p=.43$ . Therefore, given the loss of power and the fact that education did not impact the relation between religion and longevity, we chose not to include education in the primary analyses.

### **Interrater reliability**

A single research assistant coded all variables. A second research assistant coded 30 obituaries to check for reliability, and there was 90.3% agreement across all variables (100% on religion, 100% on gender, 90% on marital status, 83% on volunteerism, 80% on social activities) so the original coded variables were used.

## **Study 2: Additional Coding Details and Interrater Reliability**

### **Additional Coding Details**

In Study 2, many of the obituaries did not include photographs so it was impossible to code for race.

Because Bleidorn et al. (2016) collected results by county and occasionally there are multiple counties in each city, there were some cities for which multiple values were available for each personality variable. When this occurred, we used the values from the county that was most central to the city.

We attempted to adjust for socioeconomic status by coding for highest level of education completed (1=less than high school, 2=completed high school, 3=trade school, 4=college degree, 5=graduate degree). However, only 514 obituaries mentioned education. In a model with education, marital status, gender, and religious affiliation predicting age at time of death, religious affiliation continued to be associated with longevity,  $F(1, 506)=10.65, p=.001$ . Education was not associated with longevity,  $F(4, 506)=.67, p=.61$ . Because education does not affect the relation between religion and longevity and limiting our sample to just these participants reduces power, we decided not to include it in the primary analyses.

### **Interrater reliability**

For variables other than volunteerism and social integration, seven dyads of trained research assistants independently coded a set of 30 obituaries. The agreement between the dyads across all variables was 99.6% and 92.6% for the religion variable specifically. Because the interrater agreement was so high, the remaining obituaries were distributed among the research assistants and individually coded. An additional triad coded for volunteerism and social integration. For the 50 obituaries that they all coded, coders 1 and 2 had 74% agreement, coders 1 and 3 agreed 72% of the time, and coders 2 and 3 agreed 77% of the time. Because agreement was high, obituaries were split among the three coders.

**Table of City-Level Characteristics**

City	Percent Religious	Agreeableness	Conscientiousness	Extraversion	Openness	Emotional Stability
Portland	29.00	0.00	-0.04	-0.08	0.15	-0.03
Tampa Bay	34.80	0.01	0.07	0.06	0.01	0.07
Seattle	35.60	-0.04	0.01	-0.09	0.22	0.03
Sacramento	36.50	0.03	-0.03	-0.08	0.04	-0.01
Denver	37.00	-0.23	-0.07	-0.12	0.05	-0.12
Columbus	37.30	-0.06	-0.07	0.01	-0.04	-0.01
Phoenix	37.50	-0.02	-0.01	-0.01	0.00	-0.01
San Francisco	37.80	-0.12	-0.13	-0.06	0.34	-0.06
Miami	38.10	-0.02	0.03	0.07	0.08	0.04
Orlando	40.60	0.05	0.02	0.05	0.06	0.05
Indianapolis	41.80	0.00	0.05	-0.01	-0.03	-0.03
Baltimore	42.10	-0.08	-0.04	-0.11	0.16	-0.07
San Diego	43.90	0.08	-0.03	0.00	0.08	0.01
San Jose	44.20	-0.03	-0.08	-0.05	-0.01	-0.03
Washington DC	44.50	-0.18	-0.06	-0.07	0.12	0.04
Raleigh	44.50	0.06	0.04	-0.04	-0.02	0.02
Detroit	44.60	0.12	0.15	-0.03	0.12	0.15
Cincinnati	44.70	0.02	-0.03	0.03	-0.04	0.00
St. Louis	49.20	-0.01	0.05	-0.01	0.12	0.01
Atlanta	49.70	-0.05	0.05	0.00	0.13	0.10
Kansas City	49.90	-0.02	0.03	-0.01	0.06	0.01
Jacksonville	50.10	-0.05	0.05	-0.03	0.03	0.04
Nashville	50.50	0.04	0.07	-0.02	0.13	-0.01
Cleveland	51.20	0.00	-0.04	-0.05	0.00	-0.07
Los Angeles	51.40	-0.11	-0.09	-0.05	0.25	-0.08
Milwaukee	51.80	0.02	0.00	0.02	0.06	-0.01
Minneapolis	52.20	-0.02	-0.02	-0.04	0.08	0.04
Charlotte	52.60	0.04	0.09	0.08	0.03	0.09
New Orleans	53.90	-0.14	-0.14	-0.05	0.23	-0.08
San Antonio	54.10	0.00	0.01	0.01	0.04	0.01
Buffalo	54.70	-0.01	-0.02	0.05	-0.03	-0.02
Philadelphia	54.70	-0.08	-0.05	-0.04	0.13	-0.09
Houston	55.30	-0.01	0.01	0.01	0.05	-0.01
Dallas	55.30	0.02	-0.02	-0.01	0.14	0.02
New York	55.50	-0.22	-0.10	0.01	0.34	-0.12
Boston	56.80	-0.16	-0.08	0.01	0.21	-0.10
Chicago	57.20	-0.08	-0.02	0.03	0.14	-0.04
Pittsburgh	57.70	-0.05	-0.09	-0.03	0.02	-0.07
Memphis	58.90	0.12	0.11	-0.03	-0.03	0.06
Oklahoma City	60.20	-0.05	-0.02	-0.02	0.01	-0.08
Green Bay	64.90	-0.02	-0.02	-0.03	-0.14	-0.02
Salt Lake City	74.00	-0.06	0.00	-0.07	0.07	-0.01

Note. The percent religious measure comes from the Association of Statisticians of American Religious Bodies. The personality trait measures come from Bleidorn et al. (2016) and are z-scored.

### Full details of the three-way interaction reported in the text

As described in the main text, the national sample provided the opportunity to examine moderation of the association between individual-religiosity and longevity by city-religiosity. As outlined in the introduction of the main text, we thought that three possibilities could exist. The first possibility is a “religion-as-social-value” effect in which we would expect religiously affiliated people to live longer than non-religiously affiliated people in highly religious cities. The second possibility is a “spillover” effect in which the benefits of religiosity would “spill over” to non-religiously affiliated people. This possibility predicts that religiously affiliated people would outlive non-religiously affiliated people in less religious cities. Thus, the religion-as-social-value and spillover perspectives predict opposite two-way interactions between city-religiosity and individual-religiosity. To explore these possibilities, we conducted a two-way interaction between city-religiosity and individual-religiosity on longevity using a multi-level model. In all multi-level models we tested, city-religiosity was mean-centered and individual-religiosity was coded as .5 (mention of religion present) and -.5 (no mention of religion). Additionally, we controlled for the average income in each city, which was grand-mean centered, as well as gender and marital status. In both models we tested, only the intercept was modeled as random. We did not find evidence for either the religion-as-social-value or spillover two-way interaction,  $\gamma = .01$ ,  $t(1083.65) = .12$ ,  $p = .90$ ,  $r = .004$ , 95% CI = [-.18, .21].

As described in the main text, we also thought it possible that the city personality might determine whether a religion-as-social-value or spillover effect would occur. As such, we also explored a three-way interaction between individual-religiosity, city-religiosity, and city-openness on longevity using a multi-level model. The effect of individual-religiosity on longevity was moderated by city-religiosity and city-openness,  $\gamma = -2.19$ ,  $t(1082.75) = -2.39$ ,  $p = .017$ ,  $r = -.07$ , 95% CI = [-3.98, -.39] (Figure 4). We broke this three-way interaction down by examining the two-way interactions between city-religiosity and individual-religiosity at high and low levels of city openness. First, among cities that were less open (-1SD), there was a trending interaction between individual-religiosity and city-religiosity,  $\gamma = .21$ ,  $t(1082.69) = 1.62$ ,  $p = .106$ ,  $r = .05$ , 95% CI = [-.04, .46]. This interaction was consistent with the religion-as-social-value hypothesis such that in religious cities (+1SD), religiously affiliated people significantly out-lived non-religiously affiliated people,  $\gamma = 5.12$ ,  $t(1073.84) = 3.09$ ,  $p = .002$ ,  $r = .09$ , 95% CI = [1.87, 8.37]. Conversely, in less religious cities (-1SD), religiously affiliated people did not significantly outlive non-religiously affiliated people,  $\gamma = 1.35$ ,  $t(1083.06) = .74$ ,  $p = .46$ ,  $r = .02$ , 95% CI = [-2.26, 4.96]. This interaction was driven by non-religiously affiliated people living significantly shorter lives in highly religious cities compared to less religious cities,  $\gamma = -.33$ ,  $t(125.04) = -3.45$ ,  $p = .001$ ,  $r = .29$ , 95% CI = [-.53, -.14]. Conversely, religiously affiliated people did not significantly differ in longevity between highly religious and less religious cities,  $\gamma = -.13$ ,  $t(93.34) = -1.43$ ,  $p = .16$ ,  $r = .15$ , 95% CI = [-.30, .05].

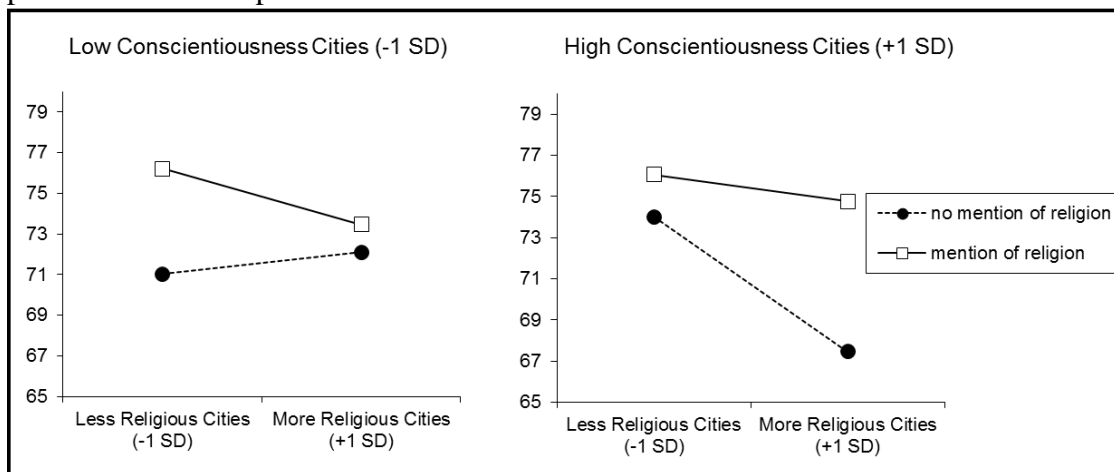
Among those cities that were more open (+1 SD), there was a trending interaction between city-religiosity and individual-religiosity in the opposite direction of the less open cities,  $\gamma = -.23$ ,  $t(1079.45) = -1.61$ ,  $p = .109$ ,  $r = -.05$ , 95% CI = [-.51, .05]. This interaction was consistent with a spillover effect such that in less-religious cities (-1SD), religious people lived significantly longer than those who were not religious,  $\gamma = 6.52$ ,  $t(1081.83) = 3.65$ ,  $p = .0003$ ,  $r = .11$ , 95% CI = [3.02, 10.02]. However, in more religious cities (+1SD), this difference disappeared,  $\gamma = 2.36$ ,  $t(1081.82) = 1.26$ ,  $p = .21$ ,  $r = .04$ , 95% CI = [-1.31, 6.03]. In this case, neither non-religiously affiliated people,  $\gamma = .13$ ,  $t(123.29) = 1.19$ ,  $p = .24$ ,  $r = .11$ , 95% CI = [-.08, .36], nor religiously affiliated people,  $\gamma = -.10$ ,  $t(84.29) = -.94$ ,  $p = .35$ ,  $r = .10$ , 95% CI = [-.30, .11], lived significantly

longer lives in the more religious cities compared to the less religious cities, but the effects went in opposite directions.

### City Conscientiousness X City Religiosity X Individual Religiosity on Longevity

The effect of individual religiosity on longevity was moderated by city-religiosity and city-conscientiousness,  $\gamma = 3.94$ ,  $t(1083.29) = 1.98$ ,  $p = .048$ ,  $r = .06$ , 95% CI = [.03, 7.85] (see Figure below). We broke this three-way interaction down by examining the two-way interactions between city religiosity and individual religious affiliation at high and low levels of city conscientiousness. First, among cities that were more conscientious (+1SD), there was a trending interaction between individual affiliation with a religion and city religiosity,  $\gamma = .28$ ,  $t(1082.64) = 1.67$ ,  $p = .096$ ,  $r = .05$ , 95% CI = [-.05, .60]. This interaction was consistent with the religion-as-social-value hypothesis such that in religious cities (+1SD), those who were affiliated with a religion significantly out-lived those who were not,  $\gamma = 7.15$ ,  $t(1083.07) = 3.52$ ,  $p = .0005$ ,  $r = .11$ , 95% CI = [3.16, 11.13]. Conversely, in less religious cities (-1SD), religiously affiliated people did not significantly outlive non-religiously affiliated people,  $\gamma = 2.13$ ,  $t(1083.94) = 1.12$ ,  $p = .26$ ,  $r = .03$ , 95% CI = [-1.60, 5.86]. This pattern was driven by the non-religiously affiliated, who lived longer lives in less religious cities compared to more religious cities,  $\gamma = -.35$ ,  $t(129.71) = -2.59$ ,  $p = .01$ ,  $r = .22$ , 95% CI = [-.62, -.08]. Conversely, the religiously affiliated did not show a significant difference in their longevity between more and less religious cities,  $\gamma = -.07$ ,  $t(80.81) = -.63$ ,  $p = .53$ ,  $r = .07$ , 95% CI = [-.31, .16].

Among those cities that were less conscientious (-1 SD), there was a non-significant interaction between the percentage of the city that was religious and individual religiosity in the opposite direction of the more conscientious cities,  $\gamma = -.20$ ,  $t(1055.49) = -1.34$ ,  $p = .180$ ,  $r = .04$ , 95% CI = [-.48, .09]. This interaction was consistent with a spillover effect such that in non-religious cities (-1SD), religious people lived significantly longer than those who were not religious,  $\gamma = 5.09$ ,  $t(1083.56) = 2.82$ ,  $p = .005$ ,  $r = .09$ , 95% CI = [1.55, 8.62]. However, in more religious cities (+1SD), this difference disappeared,  $\gamma = 2.13$ ,  $t(1083.94) = 1.12$ ,  $p = .26$ ,  $r = .03$ , 95% CI = [-1.60, 5.60]. Neither the non-religiously affiliated,  $\gamma = .05$ ,  $t(102.73) = .39$ ,  $p = .70$ ,  $r = .04$ , 95% CI = [-.20, .29], nor the religiously affiliated,  $\gamma = -.15$ ,  $t(74.38) = -1.32$ ,  $p = .19$ ,  $r = .15$ , 95% CI = [-.37, .08], lived significantly longer lives in the more religious cities compared to the less religious cities, but their patterns went in opposite directions. Thus, the low conscientiousness cities showed a similar pattern to the high openness cities and the high conscientiousness cities showed a similar pattern to the low openness cities.





### **Three-way interaction between city openness, city religiosity, and individual religiosity with an alternative measure of city religiosity.**

In the analyses reported in the text, we used the measure of city-religiosity collected by the Association of Statisticians of American Religious Bodies (ASARB) because it was collected in 2010, and therefore more likely to correspond with the experiences of people whose obituaries we collected around that time period. However, we were not able to find city-level personality measures from 2010. As such, we used those reported by Bleidorn et al. (2016). Bleidorn et al. (2016) also included a measure of religiosity in their data. Their data was collected from 1998-2009, but excluded people over the age of 60, likely many of the exact people in our studies. Although we did not have a way to avoid this limitation with the personality data, we hoped to avoid this limitation with religiosity data by using the Statisticians of American Religious Bodies data.

We conducted the same analyses with city openness and individual religiosity discussed in the text (and above) using the Bleidorn et al. (2016) measure of city religiosity. The overall three-way interaction demonstrated the same pattern,  $\gamma = -67.61$ ,  $t(1083.91) = -1.61$ ,  $p = .107$ ,  $r = -.05$ , 95% CI = [-149.84, 14.61]. Among cities low in openness, there was a marginal interaction suggestive of the religion-as-social-value hypothesis,  $\gamma = 13.17$ ,  $t(1073.73) = 1.71$ ,  $p = .09$ ,  $r = .05$ , 95% CI = [-1.98, 28.32]. In less religious cities, there was no effect of individual-religiosity on longevity,  $\gamma = .53$ ,  $t(1049.55) = .23$ ,  $p = .82$ ,  $r = .01$ , 95% CI = [-4.06, 5.12]. In more religious cities, religious people significantly outlived the non-religious,  $\gamma = 5.61$ ,  $t(1084.33) = 3.11$ ,  $p = .002$ ,  $r = .09$ , 95% CI = [2.07, 9.15]. Among cities high in openness, there was not a significant individual-religiosity X city-religiosity interaction,  $\gamma = -.35$ ,  $t(1083.94) = -.06$ ,  $p = .954$ ,  $r = -.002$ , 95% CI = [-12.30, 11.60]. However, consistent with general spillover pattern, in the highly religious cities, the effect of individual religiosity did not reach significance,  $\gamma = 3.21$ ,  $t(1084.83) = 1.27$ ,  $p = .21$ ,  $r = .04$ , 95% CI = [-1.77, 8.19]. However, in less religious cities, there was an effect of individual religiosity,  $\gamma = 3.51$ ,  $t(1078.57) = 2.47$ ,  $p = .01$ ,  $r = .07$ , 95% CI = [.72, 6.30]. That this measure demonstrates weaker results than those obtained with the ASARB measure suggests the utility of replicating our results. Nevertheless, that this measure suggests moderation of religion-as-social-value, which has been widely supported thus far, points to city-openness as a particularly important moderator.

### **Interactions between City-Religiosity, City-Personality, and Social Integration and Volunteerism on Longevity**

Curious readers may wonder whether city-religiosity and city-personality moderated the effects of social integration or volunteerism on longevity. We did not necessarily predict these interactions as there are likely additional predictors of social integration and volunteerism besides religiosity. Nevertheless, we present these interactions for curious readers.

City-level religiosity did not moderate the effects of social integration,  $\gamma = .03$ ,  $t(1051.81) = .38$ ,  $p = .70$ , or volunteerism,  $\gamma = .007$ ,  $t(1051.81) = .08$ ,  $p = .94$ , on longevity. Also of interest, there was not a Conscientiousness X City Religiosity X Social Integration,  $\gamma = -.73$ ,  $t(1046.89) = -.51$ ,  $p = .61$ , or an Openness X City Religiosity X Social Integration interaction,  $\gamma = .60$ ,  $t(1045.61) = .67$ ,  $p = .51$ . There was also not a Conscientiousness X City Religiosity X Volunteerism,  $\gamma = -1.56$ ,  $t(1047.04) = -1.00$ ,  $p = .32$ , or an Openness X City Religiosity X Volunteerism interaction,  $\gamma = .39$ ,  $t(1045.88) = .43$ ,  $p = .67$ .

### **Moderation Analyses without Income Covariate**

Removing income from the moderation models does not change the interpretation of our primary results. In the model with a two-way interaction between individual-religiosity and city-religiosity, the two-way interaction remains non-significant,  $\gamma = .01$ ,  $t(1085.34) = .13$ ,  $p = .90$ ,  $r = .004$ , 95% CI = [-.18, .21]. As with the two-way interaction model, removing income from the model with the three-way interaction between city-religiosity, city-openness, and individual-religiosity does not change the results. Without income in the model, the three-way interaction with openness,  $\gamma = -2.17$ ,  $t(1083.50) = -2.37$ ,  $p = .018$ ,  $r = -.07$ , 95% CI = [-3.96, -.37] remains largely the same.

## **Complete discussion of exploratory moderation analyses**

As described in the main text, there was evidence for both the religion-as-social-value (Gebauer et al., 2016) and spillover hypotheses, depending on the level of city openness and conscientiousness. That both personality types showed similar effects suggests that the proposed relationship may be influenced by factors that are conceptually overlapping between these two personality constructs, such as cultural tightness (Harrington & Gelfand, 2014). We first discuss the observed interaction between individual and cultural religiousness in cities characterized by low openness and then the cities characterized by high openness.

As mentioned in the text, in cities characterized by low levels of openness, we observed a pattern consistent with the religion-as-social-value hypothesis. In highly religious cities, people who were not religiously affiliated had shorter life spans than those who were religiously affiliated. However, in less religious cities, non-religiously affiliated people lived just as long as the religiously affiliated. This pattern of effects is consistent with the theory that religion is a valued social identity, which can influence mental and physical health (Gebauer et al., 2016; Stavorova, 2015). The lack of fit between the non-religious and the cultural religious environment could be particularly salient in less open cities and lead to negative health effects from processes such as not feeling socially valued or greater experience of stigma (Myers, 2009).

In more open cities, the observed direction of effect is more consistent with the spillover hypothesis, which posits that the benefits of religiosity “spill over” to the non-religiously affiliated. In this case, in more religious cities, non-religiously affiliated people did not differ in longevity compared to religiously-affiliated people, but in less religious cities, religiously affiliated people outlived non-religiously affiliated people. Thus, non-religiously affiliated people lived longer in more religious cities than less religious cities, which is the opposite pattern to that observed in the less open environment. This pattern of results stands in contrast to previous work, which has only found support for the religion-as-social-value hypothesis (e.g. Stavrova, 2015). If replicated and extended, interaction effects such as those seen here would suggest the field of health psychology could potentially benefit from paying greater attention to the interaction between multiple cultural factors and the individual when designing and tailoring interventions.

Although our dataset can't directly speak to the mechanisms by which city-level factors impact the individual (Kuppens & Pollet, 2014), we propose several potential explanations that could account for the spillover pattern whereby there is little difference in longevity between non-religiously affiliated and religiously affiliated individuals in highly religious, culturally open environments. One could be a social network hypothesis, whereby non-religiously affiliated individuals are more likely to interact with those who are religious in highly religious cities. This may lead to greater opportunities for invitations to engage in health promoting activities such as volunteering. Further, non-religiously affiliated individuals with religious friends are less likely to engage in health compromising behaviors such as substance abuse (Adamczyk & Palmer, 2008; Hoffmann, 2014). Another potential explanation that is less reliant on direct social interaction between individuals is the larger cultural heritage of religion in highly religious cities. Religion has been found to have a uniquely enduring influence on the beliefs, attitudes, and norms of individuals in a particular region (Inglehart & Baker, 2000). This cultural heritage becomes implicitly embedded in the minds of all, religious and secular alike. Such effects have been found for Protestantism and social trust (Dingemans & Ingen, 2015; Traunmüller, 2011; Weber, 1930), which can have important health promoting effects at both the individual (Barefoot, et al., 1998) and community level (Subramanian, Kim, & Kawachi, 2002). A third

potential contributor to the spillover pattern could be at the organizational level. Community programs run by religious institutions improve mental health and reduce health risk behaviors among secular participants (Adamczyk & Felson, 2012) and are likely to be more prevalent in more religious communities.

An additional contributor to the spillover effect seen in more open environments could be due to the non-religiously affiliated having worse health in the less religious cities than the more religious cities. These non-religiously affiliated individuals may experience greater anomie due to less influence of cultural norms or a reduced sense of belonging to a community such as a church or synagogue (Durkheim, 1951). This interpretation is consistent with evidence that cultures high in looseness have reduced longevity and higher incidence of diseases such as diabetes and cardiovascular disease than cultures less extreme on an index of cultural looseness (Harrington, Boski, & Gelfand, 2015). These particular diseases can be heavily influenced by stress, including loneliness (e.g. Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016) and lack of social integration (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Holt-Lunstad, Smith, & Layton, 2010), as well as health behaviors (e.g. smoking), suggesting potential pathways to this outcome.

Interestingly, the religiously affiliated appear to be largely unaffected by these cultural differences in either religious involvement or personality. Perhaps this is due to the religious community providing a sense of belonging and identity regardless of the larger cultural context.

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