

**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].

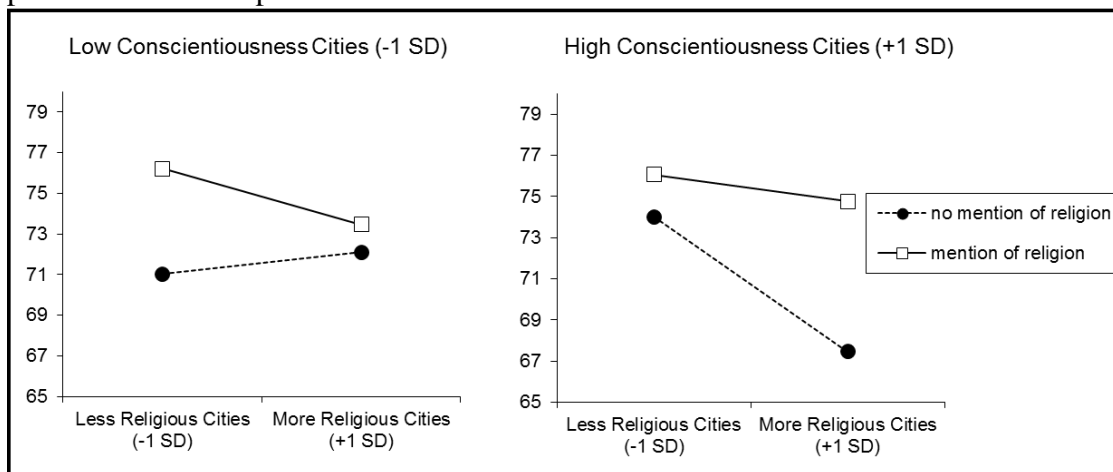
Among those cities that were more open (+1 SD), there was a trending interaction between city-religiosity and individual-religiosity in the opposite direction of the less open cities, $\gamma = -.23$, $t(1079.45) = -1.61$, $p = .109$, $r = -.05$, 95% CI = [-.51, .05]. This interaction was consistent 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 = [-0.18, .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; Stavrova, 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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