Religion and survival in a secular region. A twenty year follow-up of 734 Danish adults born in 1914

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Abstract

The aim of the study was to analyse associations of religiosity and mortality in a secular region. The sample consisted of 734 Danish, community dwelling elderly persons, living in a secular culture, and all aged 70 when primary data were collected. Secondary data consisted of a 20 year follow-up on vital status or exact age of death. The study was designed to be highly comparable to studies conducted in more religious environments in order to compare results. Three variables of religion were investigated in relation to survival: importance of affiliation, church attendance and listening to religious media. Relative hazards (RH) of dying were controlled in models including gender, education, medical and mental health, social relations, help given and received, and health behaviour. The results showed significant and positive associations between claiming religious affiliation important and survival (relative hazard of dying = RH .70; 95% CI .58–.85) and church attendance and survival (RH .73; 95% CI .64–.87). Results decreased and only stayed significant regarding church attendance when controlled for covariates. Nearly all significant effects were seen in women, but not in men. The effect size of the full sample is less than in more religious environments in United States samples. Although the positive overall RHs are comparable to those of other studies, the mediating variables and pathways of effects seem dissimilar in this sample from a secular environment. Receiving and especially giving help to others are suggested as variables of explanatory value.
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Introduction

During the last decade, evidence of positive associations of religiosity and survival has occurred in several studies (Koenig et al., 1999; Strawbridge, Cohen, Shema, & Kaplan, 1997; Helm, Hays, Flint, Koenig, & Blazer, 2000; Oman & Reed, 1998; Hummer, Rogers, Nam, & Ellison, 1999). Results are interpreted as positive and robust (Koenig, McCullough, & Larson, 2001; McCullough, Hoyt, Larson, Koenig, & Thoresen,

2000), although the findings are mixed with a few studies showing no or weak associations (Idler & Kasl, 1991; Oxman, Freeman, & Manheimer, 1995). Recently, three large and methodologically comparable studies have demonstrated robust associations in two areas of the United States. In a 28 year follow-up of a sample of 5286 adult Californians, Strawbridge et al. (1997) found that persons attending church services at least once a week had significantly lower risk of dying also after controlling for demographic variables, social connections and health practices (RH .77; 95%CI .64–.93). The association was not significant for men when adjusted for health conditions. Koenig et al. (1999) replicated this study, using a data set from North Carolina (the Bible

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Belt), consisting of 3968 elderly persons followed for six years. The effects were larger and stayed significant for both sexes even when controlled for demographics, health conditions, social connections, and health practices (RH .72; 95% CI: .64–.81). The third methodologically comparable study was reported by Helm et al. (2000), using the same North Carolina sample but analysing private religious activities (prayer, meditation, Bible study) instead of church attendance. They stratified the analyses by disability and found significant effects only in the non-disabled group, when they controlled for demographics, health conditions and practices, social support and church attendance/religious media (RH 1.47; 95% CI: 1.07–2.03).

A limitation to the three methodologically similar studies has been the locations of the samples. Although they represent religious activity above and below American average, they are based in the religious American culture. The greatest effects are found in the very religious Bible Belt, where persons not demonstrating religious behaviour might be of a special kind in respects other than religious behaviour. Whether such findings from areas of high religiosity can be replicated in predominantly secular cultures and areas has not yet been investigated. The present study presents data from a sample residing in a non-religious atmosphere; a suburb of Copenhagen, Denmark. According to the Inglehart World Values Survey (Inglehart et al., 2000), only 10.5% attended a church service once a month or more in Denmark in 1981, while the same count was 59.0% for the United States. Weekly attendance was 2.8% in Denmark, and 43.8% in the US. In Denmark, 36.7% said that they "did not believe in God", while the corresponding percentage was 3.3% in the US.

We tested the following hypotheses: (a) claiming importance in religious affiliation would predict longer survival; (b) frequency of church attendance would predict longer survival, and (c) attending services on radio and TV would predict longer survival. Furthermore, a gender difference would be expected with possibly larger effects in women than in men. It was also hypothesised from previous studies that covariates would explain some, but not all effects.

Methods

Sample

Data were collected as part of a longitudinal study of a 1914 birth cohort group in Glostrup, Denmark. The data presented here are derived from a sample survey of 1119 70-year old former or present residents of Glostrup, conducted in 1984 (Avlund, Kreiner, & Schultz-Larsen, 1993; Schultz-Larsen, Avlund, & Kreiner, 1992). Seventy-two percent of the total sample

participated in a comprehensive medical survey at the Copenhagen County Hospital in Glostrup. During a home visit conducted by an occupational therapist 1–2 weeks later, the participants were interviewed about socio-demographics, self-reported functional abilities, habits, and attitudes. Three hundred and sixty-six men and 368 women participated in all phases of the study and constitute the sample here investigated. A register-based study showed that non-participants did not differ significantly from participants on a set of health parameters. The sample has been demonstrated as suitable for generalisation in previous studies on other topics (Avlund, Damsgaard, & Holstein, 1998).

Assessment

Vital status and age

From the Danish Central Person Registry (CPR) data on date of eventual death was extracted up to March 11, 2004. The sample was then dichotomised alive/not alive and the exact age for the living and the exact age of death for the dead were computed. The surviving participants were at the age of either 89 or 90 in 2004.

Religiosity

Membership of a religious *denomination* was answered as: (a) Danish folk church, (b) Catholic, (c) Mosaic, (d) Other, and (e) No membership.

The importance of religious affiliation was measured by the question "Does this mean something for you?" yes, no, and I do not know. When required by the statistic procedures, these answers were dichotomised to "yes" "no", excluding the category of "I do not know".

Religious attendance was assessed by the question "Do you attend services at church?" never, rarely (i.e. only religious festivals), and often (i.e. more than just religious festivals). These answers were dichotomised into "never" vs. "rare + often". Participants were also asked if they listened to *religious services on the radio or TV* and answers were handled as above.

Covariates

Demography

Variables of gender and education were included, education was grouped by <12 years vs. ⩾12 years.

Medical and mental health

Functional ability: Measured by the Mob-T Scale which includes the following items: transfer, walk indoors, go outdoors, walk outdoors in nice weather, walk outdoors in poor weather, and climb stairs. We asked whether the participant felt tired after performing the activities. The scale counts the number of items

where the participants reported no tiredness. High scale score thus describes better function. In the present analyses we combine persons who did not feel tired in 4–6 (non-disabled) and 0–3 activities (disabled).

Reliability tests showed agreement percents from 88.9 to 100 and kappa values from 0.55 to 0.96 for the included items on intra-rater and inter-rater tests (Avlund, Thudium, Davidsen, & Fuglsang-Sørensen, 1995). The construct validity of the included items has been tested by the Rasch model of item analysis and showed satisfactory results (Avlund et al., 1993). In addition, functional ability as measured by the scale was strongly associated with diagnosed diseases (Schultz-Larsen et al., 1992).

Self-rated health: Dichotomised in categories "extra-ordinary good" and "good" vs "not quite good" and "bad".

Chronic conditions: The participants were extensively investigated with a medical evaluation including a thorough physical examination, ECG, and laboratory tests including haematological, renal, hepatic, and metabolic function tests. The diagnosis of a chronic condition was based on the presence of one or more of the following diseases: stroke, epilepsy, arteriostenosis in lower limbs, myocardial infarction, bronchitis, hypertension, diabetes mellitus, osteoarthrosis.

Depression: No standard depression scale was used, but a depression score was constructed from the following questions: Do you feel content and cheerful? Are you tired in the mornings? Are you tired all through the day? and On the whole, are you content with your life? We distinguished persons with two or more expressions of tiredness and discontent from persons with less.

Anxiety: From the questions: Do you suffer from anxiety attacks? and Are you afraid to be alone during the daytime? an anxiety score was computed. Answers were coded as any positive answer vs. none.

Social connections

Marital status/living alone: Data was grouped into "unmarried, divorced, or widowed in 1984" vs. "married".

Social contact frequency: Measured by questions about weekly contacts with children, grandchildren, and friends and grouped into "yes" vs. "no".

Help given to others: Measured by questions of whether to have (a) taken care of others, (b) sewed for others, (c) made repair for others, and (d) helped others with house work during the last month. We distinguished those who gave help with one or more of these items from those who did not give help.

Help received: Measured by questions about receiving help from children or friends and grouped into "yes" vs. "no".

Help from the public social system during the last month was grouped into "yes" vs. "no".

Health behaviour

Smoking: Entered as "daily" vs. "more seldom".

Alcohol: Measures of beer, wine and liquor was summed on a weekly basis. The sample was dichotomised in people drinking more than 14 units of alcohol a week vs. people who drank less.

BMI: Recent tables of body mass index BMI, (weight in kilograms divided by height in metres squared) defines BMI over 25 as overweight. Sample was divided in over vs. under BMI 25. This measure was found equal to overweight defined as the highest BMI quintile, as used in some previous studies.

All covariates above were significantly associated with survival except the variables of anxiety, marital status, receiving help from others (while giving help to others was highly significant) and the BMI.

Statistical analysis

The basic comparisons and estimations while generating the groups in the dichotomous variables were assessed by means, cross-tabulations and Kaplan–Meier survival analysis. Associations between religious measures, baseline demographics and health variables were done as cross-tabulations with risk estimates (odds ratios) and Pearson Chi-Square (2-sided) indicating significance level. The associations between the religion variables (importance, church attendance, religious media) and survival were made repeating the statistical model used in the three directly comparable studies (Koenig et al., 1999; Strawbridge et al., 1997; Helm et al., 2000), i.e. a five-step Cox proportional hazard regression model for survival analysis. Exact age with two decimals by March 11, 2004 or by death was entered as time measure; death before March 11, 2004 was entered as censoring event. Analyses of the three religion variables were done separately, following the five-step model: First examining the religion variable alone, second adding the gender and education variables as covariates in the model 2. Model 3 added control for the physical and mental health variables (functional abilities, self-reported health, chronic conditions, depression and anxiety); model 4 added the social connections variables (marital status/living alone, frequency of social contact, help given to others, help received, and help from the public social system); and model 5 added the health behaviour variables (smoking, alcohol consumption, and the BMI). The analyses were performed both on the total sample and separately for each gender (excluding the gender covariate in model 2). All analyses were made using SPSS v. 12 statistical software package.

Results

Baseline data and associations

Religion

Members of the Danish Folk Church formed 94.4% and this reflects the special Danish arrangement, where any newborn becomes a member of the Folk Church by baptism, unless active withdrawal procedure is performed. 1.4% were members of the Catholic Church, 1.8% of other religious community and 2.7% declared non-membership of any religious denomination. Religious denomination was not statistically related to gender, but 14 of the 20 non-members were men.

Thirty-nine percent of the sample found religious affiliation to be important, 65% attended church sometimes or often, and 52% listened to religious services on radio or TV.

The measures of religiosity were all significantly, but not very highly, correlated: Importance of religious affiliation and church attendance $r = .43$; importance and TV/radio service-attendance $r = .41$; and TV-attendance and church attendance $r = .22$, all $p < .01$.

The bivariate associations between the religion variables and covariates are shown in Table 1.

People indicating religious affiliation to be important in 1984 were more likely to be female, better educated, to live alone, to have close contact with children and friends, to give help and receive help from others. They were less likely to smoke and to drink alcohol. There were no differences in health parameters. Church attenders (in 1984) were more likely to be female, to have contact with children and friends, to receive and give help to others and to be overweight compared to non attenders. People attending religious services on radio or TV in 1984 were more likely to be female, without a living partner, to have received help from others (not gave help) and to drink less alcohol.

Mortality

People indicating religious affiliation to be important were less likely to die during the 20 years follow-up period (70.0% vs. 83.0%, $\chi^2 = 13.7$, 1 df, $p < .001$).

The unadjusted Kaplan–Meier means of survival time were 83.40 years (SD .37) for the group indicating importance of affiliation and 81.80 (SD .35) for the group not indicating importance (p for difference $< .001$, survival time limited to 90.22). The unadjusted survival curves are shown in Fig. 1. The difference was gender specific with the largest association in women (women, difference in age for religious affiliation important/not important: 1.26 years, $p = .03$, men, difference 0.30 years, ns).

Participants going to church often or sometimes in 1984 were also less likely to die in the 20-year follow-up

period (74.4% vs. 81.6%, $\chi^2 = 4.8$, 1 df, $p = .03$). The expected survival for attenders would be 83.30 (SD .28) in comparison to participants not attending church 81.33 (SD .39), p for difference $< .001$, survival time limited to 90.22. Again the largest associations were seen in women (women, difference in mean age church/non-church 2.19 years, $p = .02$; men, 1.34 years, $p = .04$.

Listening/not listening to religious service in the media in 1984 did not predict differences in survival (75.4% vs. 78.5%, $\chi^2 = 1.0$, 1 df, $p = .32$). Expected mean ages were 82.79 (SD .33) for those who listened, and 82.43 (SD .33) for those who did not listen, difference not significant.

Table 2 presents the hazard ratios on survival of participants claiming religious affiliation to be/not to be important. Participants claiming affiliation to be important had lower relative hazard of dying within the 20 year follow up. When controlled for gender, education, health, social support and health behaviour the hazard ratios were all reduced and results turned insignificant (at borderline level, $p = .055$ in models 3 and 4). Analysing each gender separately, all RHs were positive towards claiming religious affiliation important for both gender, but statistical significance only showed up for women in models 1 and 2, and no significance occurred for men.

Table 3 shows the comparable hazard ratios for church attendance. Church attenders had lower relative hazard of dying within the 20 years than non-attenders. RH was reduced when controlling for covariates, but not as much as above. The relationship stayed significant in all models of control. Again gender differences were important; The hazard ratio stayed significant for women in all models, while significance was only obtained for men without any control of covariates.

Relations of religious media and survival are shown in Table 4. No significant relations were found, but increased hazards were found for men and decreased hazards for women.

Discussion

We examined the relationship between three variables of religion and survival of participants after 20 years. We found that church attendance significantly lowered the risk of dying for the whole sample after controlling for all covariates. The findings were especially strong among the women. Claming religious affiliation as important also tended to lower the risk of dying 20 years later, but significance was only found for women and before control for health, social support, and health behaviour. Listening to religious media was not associated with mortality.

Table 1
Percent and odds ratios of finding religious affiliation important, attending church, and attending TV/radio service in baseline variables

	Value	Found religious affiliation important 1984 (%)[a]	Odds ratio	Attended church 1984 (%)[b]	Odds ratio	Attended TV/radio service 1984 (%)[b]	Odds ratio
Demographics							
Gender	Male	35.4		61.1		40.5	
	Female	62.3	3.00 (2.14–4.20)[***]	69.2	1.43 (1.05–1.94)[*]	62.7	2.46 (1.83–3.31)[***]
Education	< 12yr	47.0		66.0		53.1	
	⩾ 12yr	61.8	1.84 (1.12–3.02) [*]	60.2	.78 (.50–1.30)	43.0	.67 (.43–1.04)
Medical and mental health							
ADL	Unimpaired	50.5		66.5		50.8	
	Impaired	45.7	.82 (.58–1.17)	62.6	.84 (.61–1.16)	53.5	1.11 (.82–1.51)
Self-rated health	Extraordinary/good	48.9		66.3		51.2	
	Not quite good/bad	49.0%	.99 (.64–1.52)	60.9	.79 (.54–1.17)	53.4	1.09 (.75–1.59)
Chronic conditions	Not present	47.1		68.8		49.0	
	Present	49.9	1.2 (.80–1.57)	63.3	.78 (.57–1.08)	53.0	1.17 (.87–1.59)
Depression	Not present	48.8		65.6		51.3	
	Present	54.2	1.28 (.55–2.83)	55.9	.66 (.33–1.33)	58.8	1.36 (.67–2.73)
Anxiety	Not present	48.4		64.6		51.4	
	Present	56.4	1.38 (.72–2.66)	72.5	1.45 (.77–2.73)	54.9	1.15 (.65–2.04)
Social connections							
Married (living partner)	No	60.2		68.1		61.4	
	Yes	42.7	.50 (.35–.70)[***]	63.6	.82 (.59–1.13)	46.4	.56 (.40–.74)[***]
Frequency of social contact	Less than once a week	43.8		55.6		46.6	
	More than once a week	52.1	1.38 (.99–1.94)[*]	71.3	.1.98 (1.45–2.71)[***]	54.7	1.39 (1.03 -1.87)
Given help to others	No	44.7		58.9		48.6	
	Yes	51.9	1.34 (.96–1.86)	69.3	1.58 (1.16–2.15)[**]	53.6	1.22 (.91–1.64)
Help received	No	40.2		56.1		46.4	
	Yes	55.3	1.85 (1.32–2.57)[***]	72.2	2.03 (1.45–2.76)[***]	55.7	1.45 (1.08 -1.95)[**]
Public help received	No	47.8		66.4		50.7	
	Yes	60.8	1.69 (.94–3.04)	54.8	.61 (.36–1.04)	62.9	1.65 (.97–2.82)
Health behaviour							
Smoke	No	54.6		66.7		54.1	
	Daily	42.5	.61 (.45–.86)[**]	63.2	.86 (.63–1.16)	48.6	.80 (.60–1.08)
Alcohol	Less than 14/week	50.9		65.3		53.4	
	More than 14/week	35.4	.53 (.33–.86)[**]	64.6	.97 (.62–1.51)	40.4	.59 (.38–.91)[*]
BMI	Under 25	47.5		61.5		50.1	
	Over 25	50.7	1.14 (.82–1.58)	69.5	1.43 (1.05–1.94) [*]	53.5	1.14 (.86–1.53)

[*] $p < .05$, [**] $p < .01$, [***] $p < .001$.
   [a]Sample size 587 ("don't know" excluded).
   [b]Sample size 734.

Importance of affiliation

The variable of indicating importance to religious affiliation is not easily comparable to any known study of survival. Usually people are asked about their relation to a God or religious activities such as prayer, meditation or reading of religious texts. The question of importance of religious affiliation might be understood as equivalent to "importance of religion" as such, but the fact that the married participants did not consider affiliation as important as those living alone (43% vs. 56%) may indicate that the responses to a high degree

reflected the importance of the social dimensions of religion and not faith or belief as much. This group was the only group to smoke and drink significantly less, why more clear effects could have been expected in relation to the confounders in US samples (Oman, Kurata, Strawbridge, & Cohen, 2002; Strawbridge, Cohen, & Shema, 2000).
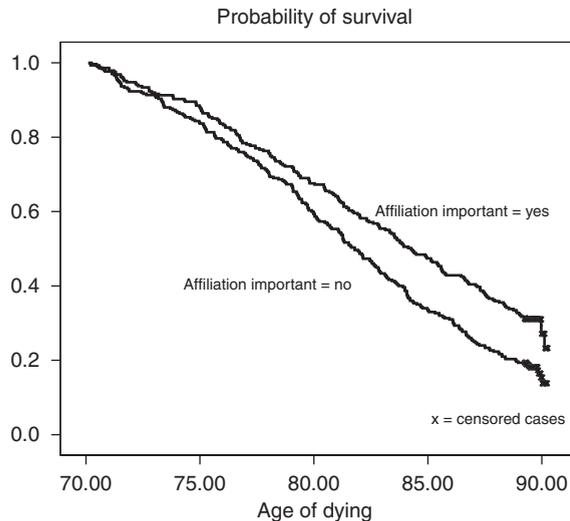
Fig. 1. Twenty-year survival and participants finding religious affiliation important. (Unadjusted Kaplan–Meier curves).

Church attendance

Our results on church attendance and survival largely replicate the findings and conclusions of studies done in the US (Koenig et al., 1999; Strawbridge et al., 1997; Oman et al., 1998; Hummer et al., 1999), but there are also differences. In the American samples, the cut off-point for high/low church attendance is usually defined as attendance once a week or more. In our study, attendance was counted positive if it was only at religious festivals, i.e. once or twice a year, and our measure probably reflects both religious attitude and religious activity. We did not find associations between church attendance and survival as high as in the study by Koenig et al. (1999) who reports adjusted RH .72 (95% CI .64–.81) in a sample situated in the Bible Belt. Our findings are even a bit lower than in the Californian studies: Strawbridge et al. (1997) found adjusted RH .77 (95% CI .64–.93) and Oman et al. (1998) found adjusted RH .76 (95% CI .62–.94), while we have found RH .82 (.68–.97). This probably reflects the relatively lower importance of religion in Denmark, but it also points out that even on a very modest level, church attendance is associated with lower mortality.

The relations between religiosity and longevity are usually discussed by identifying mediation factors, such as better social network, lower levels of anxiety and depression, better health habits, better compliance with

Table 2
Multivariate sequential models to compare hazard ratios (95% CI) of mortality of participants claiming importance of religious affiliation

Model	Total sample N = 587	Females N = 296	Males N = 291
(1) Importance of religious affiliation only	.70 (.58–.85) **	.74 (.56 -.98) *	.89 (.69–1.16)
(2) Model (1) + gender and education	.83 (.68–1.01)	.75 (.56–.99) *	.91 (.70–1.20)
(3) Model (2) + health, physical and mental	.82 (.67–1.00)	.76 (.57–1.02)	.89 (.66–1.16)
(4) Model (3) + social support.	.82 (.67–1.00)	.76 (.57–1.02)	.82 (.62–1.12)
(5) Model (4) + health behaviour	.87 (.71–1.07)	.79 (.59–1.07)	.92 (.68–1.24

* $p < .05$, ** p < .01.

Table 3
Multivariate sequential models to compare hazard ratios (95% CI) of mortality of participants attending church

Model	Total sample N = 732	Females N = 367	Males N = 365
(1) Church attendance only	.73 (.62–.87) **	.73 (.57–.95) *	.78 (.62–.99)*
(2) Model (1) + gender and education	.76 (.64–.91) **	.71 (.54–.92) **	.80 (.63–1.01)
(3) Model (2) + health, physical and mental	.78 (.66–.93) **	.71 (.54–.93) **	.85 (.67–1.09)
(4) Model (3) + social support.	.82 (.68–.98) *	.73 (.55–.96) *	.91 (.71–1.17)
(5) Model (4) + health behaviour	.82 (.68–.97) *	.73 (.55–.97) *	.92 (.71–1.18)

* $p < .05$, ** $p < .01$.

Table 4
Multivariate sequential models to compare hazard ratios (95% CI) of mortality of participants attending religious media

Model	Total sample $N = 732$	Females $N = 367$	Males $N = 365$
(1) Radio or TV attendance only	.92 (.78–1.08)	.85 (.66–1.09)	1.23 (.98–1.54)
(2) Model (1) + gender and education	1.04 (.87–1.23)	.84 (.65–1.08)	1.23 (.98–1.54)
(3) Model (2) + health, physical and mental	1.04 (.87–1.23)	.85 (.67–1.10)	1.22 (.97–1.54)
(4) Model (3) + social support	1.03 (.86 –1.23)	.86 (.66–1.11)	1.19 (.93–1.51)
(5) Model (4) + health behaviour	1.06 (.88–1.26)	.86 (.67–1.13)	1.22 (.96–1.55)

the health care system, lesser stress and better coping resources (Koenig et al., 2001). The mediating mechanisms are likely to interact (Mitchell & Weatherly, 2000). In this Danish study the mechanisms of effect seem to be slightly different. There were no significant associations between the health variables and church attendance; we found church attenders significantly more overweight than non-attenders, with no difference in either smoking or drinking behaviour. The positively related variables of church attendance dealt with better social network: church attenders gave more help to others, they received more help from others and they had contact with friends, children or grandchildren more than once a week. Sociability and social network seem to be the main moderating variables of church attendance and survival in this sample.

Radio and TV church service

There was no significant effect of religious media on survival, but the pattern of gender differences was repeated.

Gender considerations

Gender differences were found on all religious variables. Larger positive effects of religious life were found for women and more modest or no effects were found for men. The gender differences are common in all comparable studies, and they are largely unexplained. In a recent study of elderly Americans, Meisenhelder (2003) found that health effects of religion were linked to different religious practices for men and women; personal activity as prayer had the greatest positive health impact for men, while improved coping abilities and feelings of importance of religion had greatest effects in women. The present study might suggest that social dimensions are the most important clues to understanding the gender differences in a secular society.

Limitations of the study

Although this study includes three measures of religiosity, there was no measure of "religiousness" as such, which would have strengthened the findings and comparisons with studies from other areas of the world.

For direct comparison, there are also some differences in the measures of background variables; especially we had no standardised measure of depression and anxiety, but had to construct measures from other variables.

However, there are also unique qualities of the data— the 20 year follow-up period makes survival mostly an actual fact and not a statistical calculation made from tendencies in the sample. The health variables were based on a comprehensive medical evaluation of chronic diseases, and functional ability was measured by a validated instrument. It was possible to find or construct valid or uniform confounding variables which makes comparisons with the American based studies acceptable and findings reliable. Furthermore, we may have detected a new confounder which could be investigated in further studies: receiving and especially giving help to others may be a mediating variable of religion and health.

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