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Does Religious Attendance Prolong Survival? A Six-Year Follow-Up Study of 3,968 Older Adults

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Background. The purpose of the study was to examine religious attendance as a predictor of survival in older adults.

Methods. A probability sample of 3,968 community-dwelling adults aged 64–101 years residing in the Piedmont of North Carolina was surveyed in 1986 as part of the Established Populations for the Epidemiologic Studies of the Elderly (EPESE) program of the National Institutes of Health. Attendance at religious services and a wide variety of sociodemographic and health variables were assessed at baseline. Vital status of members was then determined prospectively over the next 6 years (1986–1992). Time (days) to death or censoring in days was analyzed using a Cox proportional hazards regression model.

Results. During a median 6.3-year follow-up period, 1,777 subjects (29.7%) died. Of the subjects who attended religious services once a week or more in 1986 (frequent attenders), 22.9% died compared to 37.4% of those attending services less than once a week (infrequent attenders). The relative hazard (RH) of dying for frequent attenders was 46% less than for infrequent attenders (RH: 0.54, 95% CI 0.48–.0.61), an effect that was strongest in women (RH 0.51, CI 0.43–0.59) but also present in men (RH 0.63, 95% CI 0.52–0.75). When demographics, health conditions, social connections, and health practices were controlled, this effect remained significant for the entire sample (RH 0.72, 95% CI 0.64–.81), and for both women (RH 0.65, 95% CI 0.55–0.76, $p<.0001$) and men (RH 0.83, 95% CI 0.69–1.00, $p=.05$).

Conclusions. Older adults, particularly women, who attend religious services at least once a week appear to have a survival advantage over those attending services less frequently.

IN 1891, John S. Billings, then Surgeon General of the United States Army, reported that religious affiliation was a factor in the differential mortality he observed among social groups (1). Not long afterwards, Emile Durkheim in 1915 laid the foundation for such a connection by pointing out the potential health consequences of weakening or absent religious ties (2). The majority of studies of religion and health since Durkheim, however, have been affiliational studies that have focused on the dietary and health practices of different religious groups [particularly Mormons and Seventh-Day Adventists (3)].

A number of epidemiological studies (4,5) and clinical trials (6,7), however, have demonstrated an association between social support, better physical health, and longer survival. Given Durkheim's theories and the growing evidence suggesting a relationship between church or synagogue attendance and social support (8,9), a number of investigators have now begun examining the link between religious attendance and health (10,11). Attendance at religious services has been associated with higher well-being (12), less depression (13,14), less anxiety (15), less substance abuse (14,16), and fewer suicides (17) as well as lower blood pressure (18,19), fewer strokes (20), and longer survival, even after controlling for social support in some cases. At least seven studies have now examined the relationship between religious attendance and mortality.

In 1972, Comstock and Partridge (21) first reported that frequent church attenders had lower death rates from arteriosclerotic heart disease, pulmonary emphysema, cirrhosis of the liver, and suicide; these findings, however, were later explained by the fact that chronically ill persons attended church less frequently (22). In a 9–12-year follow-up study of 2,754 community-dwelling persons aged 35–69 in the Tecumseh (Michigan) Community Health Study, House and colleagues (23) reported that frequent church attendance was significantly related to survival, but only among women after age and health factors were controlled. Schoenbach and associates (24) followed 2,530 community-dwelling persons (mean age 46) in the Evans County (Georgia) Cardiovascular Study for 10 years, finding that involvement in church activities was also significantly related to longer survival, but only among white males and black females once age and health factors were controlled. Zuckerman and colleagues (25) followed 400 elderly poor residents of New Haven, CT, for two years, finding that religious attendance was among the variables significantly related to lower mortality after sex and physical health were controlled, but the effects were slightly stronger in men than in women.

In contrast, when Idler and Kasl (26) examined 4-year mortality rates in a sample of 2,812 community-dwelling adults aged 65 or older in New Haven (of whom 624 had died), they found no association between religious attendance and mortality after self-rated health and other variables were controlled. Likewise, Oxman and associates (27), examining 6-month survival in 232 subjects aged 55 or older following elective open heart surgery (of whom 21 had died), found religious attendance unrelated to mortality once physical health factors were controlled.

In the largest and best designed study to date, Strawbridge and colleagues (28) reported the results of a 28-year follow-up

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study of 5,286 persons aged 21 to 65 years who participated in the Human Population Laboratory Study of Alameda County (California); by 1993, 770 participants had died. They found that persons who attended religious services at least once a week had a significantly lower risk of dying after controlling for demographic variables, health conditions, social connections, and health practices (relative hazard [RH] 0.77). The association, however, weakened to nonsignificance in men when health conditions were controlled.

The present study is unique in several respects. The population-based sample comprises nearly 4,000 older adults (38% men, 62% women) who have experienced relatively high mortality (30% or 1,177 deaths) during the 6 years since the cohort was formed, thus providing substantial power for examining predictors of survival. This is one of the largest population-based sample of elders with the longest surveillance (of an elderly sample). Vital status was carefully monitored every year, and deaths were documented by death certificates. Multiple subjective and objective measures of physical health, social support, and health practices were available for analysis, similar to those used in the Alameda County Study (28), after which the present study's analysis plan was modeled. We hypothesize that (a) frequent attendance at religious services will predict longer survival, an effect that will persist after controlling for known predictors of mortality, and (b) the effects will be greater in women than in men (given prior results in the literature).

Methods

Community-dwelling adults age 65 or older were sampled for the Duke University site of the National Institutes of Health-sponsored Established Populations for the Epidemiologic Studies of the Elderly (EPESE) program (29). In 1986, subjects were identified for the first wave of this study using a four-stage stratified probability sample of persons from five contiguous counties (one urban and four rural) in central North Carolina. In the first stage, 450 primary sampling units of approximately equal population size were selected from the survey area. In the second stage, one listing area was selected from each sampling unit. In the third stage, all households in a listing area were enumerated, and a certain number were randomly selected from this list. In the fourth stage, the Kish method (30) was used to select a person age 65 or older from each eligible household. Approximately half of the final sample came from the urban county and the rest from the rural counties. Because the Duke EPESE focused on ethnic differences, black elders were oversampled (54% of sample). A total of 5,223 eligible persons were identified, and 4,162 subjects (80% response) completed in-person interviews in their homes. After proxy interviews were excluded, 4,000 evaluations remained; data on religious attendance were available for the 3,968 subjects who constitute the sample for this report.

Baseline and Follow-up Interviews

Vital status.—After the initial evaluation in 1986, participants were contacted for follow-up interviews every year either by telephone or in person. Field investigators provided continuous surveillance through personal contact or proxy information, and confirmed dates of death within the cohort by abstracting death certificates (n=1177). Follow-up time was calculated in days between the baseline and the sixth follow-up interview, (i.e., the third in-person interview, which took place in 1992). Respondents who were lost to follow-up prior to the sixth interview (n=300) or who lived beyond the sixth interview (n=2,491) were censored, respectively, at 183 days (6 months) beyond the last contact date or at the date of their sixth interview.

Religious attendance.—Religious attendance at baseline was assessed by asking the question, "About how often do you go to religious meetings or services?" Response options were (a) never/almost never, (b) once or twice a year, (c) every few months, (d) once or twice a month, (e) once a week, and (f) more than once a week. Responses were dichotomized into less than once a week (code=0) and once a week or more (code=1); 53% of the sample attended religious services at least once a week.

Baseline Covariates

Covariates were chosen because of demonstrated associations with mortality (31–38). One objective was to follow as closely as possible Strawbridge and colleagues' method of handling variables and analyzing the data so that results could be compared (28). For that reason, all covariates except age were dichotomized.

Demographic variables.—Demographic variables included age (64–101 years), gender (male=0, female=1), ethnicity (white=0, black=1), and education (0–11 years=0, 12 years or more=1).

Functioning.—Physical functioning was measured by asking about the person's ability to perform activities of daily living (ADLs) independently. Physical ADLs [(39) bathing, dressing, eating, getting from bed to chair, toilet use], instrumental ADLs [(40) traveling, shopping, preparing meals, doing housework, managing finances], and strength/endurance ADLs [(41) able to do heavy work around house, walk up and down flight of stairs, and walk half a mile or eight city blocks] were assessed. Subjects with no ADL impairment (code=0) were compared to those with one or more impaired ADLs (code=1).

Self-rated health.—Global self-rating of health (38) was measured with a single item that asked, "Overall, how would you rate your health—as excellent, good, fair, or poor?" Responses were dichotomized into good or excellent (code=0) versus fair or poor (code=1).

Chronic conditions.—The presence or absence of eight chronic conditions was assessed (broken hip, cancer, diabetes, hearing problems, vision problems, high blood pressure, shortness of breath, and stroke). Subjects with no chronic conditions (code=0) were compared to those with one or more chronic conditions (code=1).

Depression.—Depressive symptoms were assessed using the 20-item Center for Epidemiological Studies–Depression (CES–D) scale (42). The items on the CES–D were presented to respondents in a yes-no format; positive responses were summed to create a scale ranging from 0 to 20. Scores were dichotomized into depression absent (scores 0–8, code=0) and depression present (scores 9–20, code=1) (43).

Negative life events.—Negative life events (NLEs) experienced during the year prior to the baseline evaluation were recorded

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(44). Events included illness or injury requiring hospitalization, illness or injury preventing usual activities, divorce, death of spouse or child, spouse or child leave home, close family member or friend die or experience serious illness, legal trouble, retirement from work, financial change, relocation, and other stressor. Subjects with none of these negative life events (code=0) were compared to those experiencing one or more NLE (code=1).

Marital status.—Subjects who were divorced, separated, widowed, or single in 1986 (code=0) were compared to those who were married (code=1).

Social support.—Social support was assessed using four of the five subscales of the Duke Social Support Index (45). Subscales included here were a 7-item social network subscale; a 2-item confidant subscale (perceived presence of a confidant or someone to provide support in difficult times); a 2-item subjective support subscale (perceived satisfaction with amount of contact with friends/relatives); and a 13-item instrumental support subscale (amount of help received). The fifth subscale, assessing social interaction, was dropped because it includes membership in church-related groups that would confound the analysis. Scores on these subscales were dichotomized at approximately the midpoint of their distribution in the sample into low (code=0) and high (code=1) categories.

Cigarette smoking.—Smoking was determined by the following questions: "Do you smoke cigarettes regularly now?" Response options were "no" (code=0) and "yes" (code=1).

Alcohol consumption.—Alcohol use was determined by the following three questions: "Over the last month how often have you had beer or ale?"; "Over the last month how often have you had wine?"; and "Over the last month how often have you had

Table 1. Percent Reporting Frequent Religious Attendance at Baseline by Selected Characteristics

1986 Variable	Value	*n*	% FrequentAttendance	OR (95% CI)*
Demographics				
Age	65–74 yrs	2488	53.9	0.92 (0.81–1.06)
	≥75	1480	52.1	
Gender	Male	1387	48.8	1.32 (1.16–1.52)
	Female	2581	55.6	
Education	0–11 yrs	3058	50.4	1.69 (1.45–1.98)
	≥12	910	62.5	
Ethnicity	White	1807	52.8	1.14 (1.00–1.30)
	Black	2161	53.5	
Physical and Mental Health				
Impaired function (ADLs)	No (0)	1837	63.4	0.44 (0.38–0.51)
	Yes (≥1)	2131	44.4	
Chronic conditions	No (0)	849	59.1	0.75 (0.64–0.88)
	Yes (≥1)	3119	51.6	
Self-rated health	Good/Excellent	2116	60.1	0.58 (0.51–0.66)
	Fair/Poor	1852	45.4	
Depressed	No	3587	54.7	0.53 (0.43–0.66)
	Yes	381	38.9	
Negative life events	Low	2233	54.2	0.91 (0.81–1.02)
	High	1735	51.9	
Social Connections				
Married	No	2434	51.9	1.32 (1.13–1.53)
	Yes	1534	55.4	
Social network	Low	2066	50.1	1.39 (1.22–1.58)
	High	1902	56.6	
Supportive confidantes	Low	1252	45.9	1.50 (1.31–1.72)
	High	2716	56.6	
Satisfaction with support	Low	2589	53.0	1.05 (0.92–1.21)
	High	1379	53.6	
Help received	Low	2138	54.7	0.88 (0.77–1.00)
	High	1830	51.5	
Health Practices				
Smoking cigarettes	No	3280	56.3	0.50 (0.41–0.59)
	Yes	688	38.7	
Alcohol consumption	<20 episodes/mo	3726	54.3	0.44 (0.34–0.58)
	≥20	242	36.4	
Weight	Lower 4 quintiles	3174	53.3	0.96 (0.82–1.13)
	Highest BMI quint	794	52.6	

*OR=odds ratio; CI=confidence interval; obtained from logistic regression model with religious attendance as dependent variable, all analyses controlled for age, sex, race, and education (all dichotomized).

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Table 2. Multivariate Sequential Models Using Baseline Covariates To Compare Mortality Rates for Frequent versus Infrequent Attenders of Religious Services During 6 Years of Follow-up

Model and Covariates	Total Sample (*N*=3968) RH (95% CI)	Females (*n*=2581) RH (95% CI)	Males (*n*=1387) RH (95% CI)
I. Religious attendance only	0.54 (0.48–0.61)	0.51 (0.43–0.59)	0.63 (0.52–0.75)
II. Model I plus age, gender, ethnicity, and education	0.59 (0.53–0.66)	0.56 (0.48–0.65)	0.64 (0.53–.0.76)
III. Model II plus health conditions	0.69 (0.61–0.78)	0.64 (0.54–0.75)	0.76 (0.63–0.91)
IV. Model III plus social connections	0.70 (0.62–0.79)	0.64 (0.55–0.75)	0.78 (0.65–0.94)
V. Model IV plus health practices	0.72 (0.64–0.81)	0.65 (0.55–0.76)	0.83 (0.69–1.00)

Notes: RH = relative hazard; CI = confidence interval. RH and CI for males and females estimated from separate models. Using a single model containing gender by attendance interaction term, *p* values for this interaction term were .33 (Model II), .17 (Model III), .13 (Model IV), and .07 (Model V).

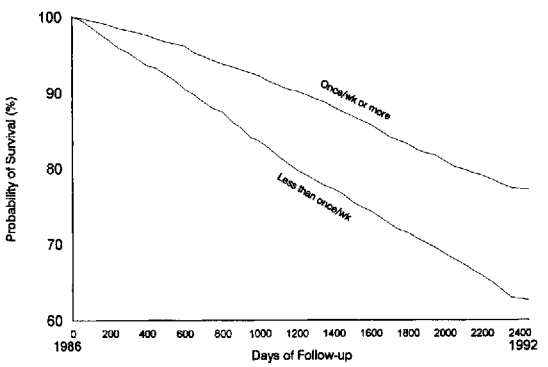

Figure 1. Six-year survival and religious attendance in 3,968 persons age 65 years or over (unadjusted Kaplan-Meier curves)

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liquor?" The responses to these three questions were summed to create an alcohol use index. Subjects having less than 20 drinking occasions in the past month (code=0) were compared to those having 20 or more drinking occasions in the past month (code=1).

Body mass index.—Body mass index (BMI) or Quetelet Index was calculated by dividing a subject's weight in kilograms by height in meters squared (46). BMI was divided into five quintiles for analysis; persons in the lower four quintiles (code=0) were compared to those in the upper quintile (code=1).

Missing values at baseline.—Covariates with missing data at baseline were handled in the following manner. For measures with fewer than 2% missing values, the mean value was imputed. For measures with between 2% and 5% missing data (instrumental and endurance ADLs, marital status, social support scales), imputed versions were created using regression-predicted scores (Y-hats). For measures with more than 5% missing data (11% for NLEs and 9% for BMI), we created imputed versions using more complicated stochastic regression techniques (47).

Statistical Analysis

The primary hypothesis of the study is to examine religious attendance as a predictor of survival in older adults. Baseline associations between frequent attendance and covariates were analyzed through percentages and logistic regression models (48). Odds ratios, adjusted for the covariates age, sex, race, and education, were obtained using logistic regression with religious attendance as the dependent variable. The association between frequent religious attendance and survival was examined using a Cox proportional hazards regression model (49). Survival time was entered as days. The validity of the proportional hazards assumption was examined and confirmed both graphically and with the normal score test of proportionality (50). Five sequential models were used to assess the relative impacts of the covariates on the relationship between attendance and mortality. First, religious attendance was examined alone in the model; second, demographic variables (age, gender, education, ethnicity) were added; third, physical and mental health variables (impaired function, chronic conditions, self-rated health, depression, NLEs) were added; fourth, social connections (marital status, social network, supportive confidants, help received) were added; and fifth, health practices (smoking cigarettes and alcohol consumption) were added. Because satisfaction with support and BMI were not related to religious attendance or mortality, they were not included in the models. Gender differences in outcome and gender-specific associations between attendance and mortality were assessed by adding gender by attendance interaction terms to the models. Analyses were then stratified by gender to obtain relative hazard ratios and 95% confidence intervals. All analyses were carried out using the statistical software SAS [SAS Institute Inc., Cary, NC] (48).

RESULTS

Baseline Associations

Table 1 presents associations between frequent religious attendance and covariates in 1986. Frequent religious attenders were more than likely to be women, better educated, and black. They were less likely than infrequent attenders to have impaired physical functioning, chronic health conditions, fair or poor self-rated health, or depression. Frequent attenders were more likely to be married, have larger social networks, and have confidants, persons on whom they could depend in times of trouble. Finally, frequent attenders were less likely to smoke cigarettes (51) and less likely to consume alcohol. Thus, at baseline, religious attenders were physically healthier, had more social support, and lived healthier lifestyles than less frequent attenders.

Mortality and Survival

Frequent religious attenders were less likely to die than infrequent attenders during the median 2,293-day follow-up period

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(22.9% vs 37.4%, χ^2=99.4, 1 *df*, p<.001). Unadjusted Kaplan-Meier survival curves for frequent and infrequent religious attenders are plotted in Figure 1. Table 2 presents the results of the Cox proportional hazards analyses. Without control variables in the model (I), frequent religious attenders in 1986 had a lower relative hazard (RH) of dying compared with infrequent attenders (RH 0.54, 95% CI 0.48–0.61). When age, gender, education, and ethnicity were added to the model (II), the relationship was reduced slightly (RH 0.59). Adding health conditions (III), social connections (IV), and health practices (V) to the model produced further reductions in the magnitude of relationship between religious attendance and survival, but did not eliminate it (RH 0.72, 95% CI 0.64–0.81, p<.0001).

Gender

The data in Table 2 indicate that the relationship between religious attendance and survival tended to be greater for women than for men. Before controlling for covariates, women who attended religious services once a week or more were only about one-half as likely to die as women attending services less often (RH 0.51, 95% CI 0.43–0.59); this effect was weaker in men (RH 0.63, 95% CI 0.52–0.75). When demographics, health conditions, social connections, and health practices were successively added to the model, this reduced the relationship between religious attendance and survival for both genders, but more so for men (RH 0.83, 95% CI 0.69–1.00, p=.05) than for women (RH 0.65, 95% CI 0.55–0.76. p<.0001). The Sex by Attendance interaction term approached significance in the final model (unstandardized beta –0.22, SE 0.12, p=.07).

Discussion

We examined the relationship between religious attendance in 1986 and 6-year survival in a cohort of 3,968 elderly persons. Compared with less frequent attenders, persons attending religious services once a week or more at baseline were physically and mentally healthier, had larger social support networks, had more confidants and lived healthier lifestyles (less smoking and alcohol consumption). By 1992, nearly one third of the sample had died (n=1,177). Analyses revealed that the risk of dying for frequent attenders was 46% lower than for those attending services less often. This risk lessened (28%) but remained significant after adjusting for demographic factors, physical and mental health conditions, social connections, and health practices (and was equivalent in magnitude to cigarette smoking). The association was stronger in women than in men (35% vs 17%), but was present in both sexes.

Our findings replicate those of Strawbridge and colleagues' 28-year follow-up of 5,286 participants in the Alameda County Study (28). They reported that the risk of dying was 23% less (RH 0.77, 95% CI 0.64–0.93) in frequent attenders (women, RH 0.66, 95% CI 0.51–0.86; men, RH 0.90, 95% CI 0.70–1.15). Our results, however, extend their findings because we included persons aged 65 years or older (the Alameda Study included only persons aged 21 to 65 years), and our sample was drawn from a southeastern U.S. community. In both studies, a survival advantage was found for frequent religious attenders, and the advantage was stronger in women than in men.

Mechanism of Effect

If religious attendance did impact on health, how might this have occurred? There are a number of psychosocial and behavioral pathways by which involvement in a religious community could affect health. First, we have seen in both this study and others that frequent attenders have larger social networks and experience greater support than infrequent attenders (8,9,28). Because frequent attenders have more contact with others, they may be subject to greater surveillance and checking for health problems. If problems are identified by fellow congregants, they may be encouraged to consult a physician and perhaps be assisted in getting to the doctor's office. In this way, diseases might be diagnosed earlier and help obtained sooner (52). Great social support may also have direct effects on the immune system to fend off disease, facilitate recovery, or otherwise extend survival (6,7). In a recent report of 1,718 community-dwelling older adults, interleukin-6 levels (an indicator of immune system dysregulation) were found to be significantly lower among frequent church attenders after controlling for age, functional status, and chronic health conditions (53).

Second, frequent religious attendance may foster attitudes of compliance and care for the physical body that carry over into adherence to medical treatments. Conservative religious attitudes (two thirds of our sample were conservative Protestants) may foster compliance with medication (54), keeping of medical appointments (55,56), or participation in preventive health services (57).

Third, religious attendance is related to lower rates of depression, anxiety, and stress. A strong religious faith reinforced by active religious participation may help persons to cope better with stressors, particularly physical health problems in later life (58). Lower rates of depression, like higher social support, may translate into stronger immune systems and better defenses against disease (59,60). Improved coping may also lead to fewer direct (17) and indirect (61) self-destructive behaviors.

Fourth, as we have seen in the present study, religious involvement is associated with avoidance of smoking (28,51,62), reduced alcohol consumption (16,28,63), and safer sexual practices (64), all of which may prevent physical diseases that impact on mortality. Strawbridge and colleagues (28), following their sample over time, also discovered that frequent religious attenders were more likely than infrequent attenders to stop smoking, increase exercise, and stay married to the same person. Thus, there are multiple pathways by which religious attendance may reduce mortality and enhance survival.

In spite of controlling for several of these potential mechanisms (e.g., social support, stress, depression), the effect of religious attendance on survival persisted in both the current study and the Strawbridge study. One reason for the unexplained variance is the use of relatively weak measures to assess depressive symptoms, stress, and social support. Both of these studies were large epidemiological surveys that necessitated a relatively superficial assessment of these constructs. For example, our measure of stress involved number of stressful life events experienced during the year prior to evaluation (hardly a robust measure of current stress), and the Strawbridge study did not report any direct measure of stress. Likewise, both studies measured depression using a symptom checklist, which is not the same as depression diagnosed by clinical evaluation or by structured psychiatric interview. Thus, had more in-depth psychosocial measures been available, a greater amount of the variance in the attendance effect might have been explained.

Gender Effect

It is not clear why the association between religious atten-

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dance and survival should be stronger in women than in men, a finding also reported by both Strawbridge and associates (28) in the Alameda County Study and by House and colleagues (23) in the Tecumseh Community Health Study. Women, in general, tend to involve themselves in religious practices more than men. In the present study, women were more likely to attend religious services frequently, and other studies report that they are more likely than men to pray (65), say religion is important in their lives (65), and depend on religion as a coping behavior (66). Thus, it is possible that religious beliefs and practices are more ingrained in the social and psychological lives of women, and thus convey greater health effects. Strawbridge and colleagues (28) point out that given the much higher proportion of widowhood among older women, religious institutions may act to fill an otherwise unmet social need for support. Likewise, Idler (67) stresses a general tendency for women to seek and use social interaction to cope with stress. None of these explanations, however, can account for the equal or stronger relationship between religious attendance and survival *in men* reported by other investigators in Georgia (24) and Connecticut (25). Thus, gender differences in the association between religious attendance and survival remain somewhat a mystery.

Limitations

We did not include time-varying covariates in our analyses (as Strawbridge and colleagues did). Thus, the impact of changes in health, social supports, and health behaviors was not assessed. Furthermore, we did not measure other important variables that might help to explain the relationship between religious attendance and mortality, such as beliefs or attitudes about the effects of religious faith on health, dietary practices, exercise, or level of psychosocial stress (other than number of NLEs, where 11% of data were missing). Detailed clinical measures of physical and mental health were also lacking. Attendance at religious services is also a relatively weak indicator of a deep, enduring religious faith, as persons may attend services for reasons other than religious ones. Measures of intrinsic religiosity (i.e., the extent to which religious beliefs and commitment are the motivating factors in a person's life) were not obtained (68). While religious attendance and intrinsic religiosity are related (Pearson r=0.44, n=455), they are not the same and may not have the same health effects (69).

Finally, over 95% of our sample were affiliated with traditional Judeo-Christian religious groups (59% Baptist, 17% Methodist, 4% Presbyterian, 4% Pentecostal/Holiness, 11% other Protestant), and the results may only be generalizable to persons from these religious backgrounds. The study took place in the Bible Belt (southeastern United States), where rates of religious attendance may be higher than in other parts of the country (53% of our participants attended weekly or more often). Nevertheless, a recent national survey by the Gallup Poll found that 53% of persons aged 65 or older attended church or synagogue within the past 7 days (65).

Conclusions

Frequent religious attendance has now been found in at least two large, population-based studies located at opposite ends of the United States to be associated with a reduced hazard of dying, particularly among women. Frequent religious attenders in both studies reported greater social support, less depression, and better health practices (reduced smoking and alcohol consumption), factors that may preserve health and extend survival. These factors, however, were not sufficient to explain the relationship between religious attendance and longer survival. Replication of these findings is needed from prospective studies that correct for some of the methodological limitations noted above. Further research is also necessary to identify the specific psychosocial, behavioral, and biological mechanisms by which involvement in the religious community prevents disease, maintains health, or speeds recovery.

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REFERENCES

1. Billings JS. Vital statistics of the Jews. *N Am Rev.* 1891;153:70–84.
2. Durkheim E. *The Elementary Forms of Religious Experience.* London: Allen & Unwin; 1915.
3. Levin JS, Schiller PL. Is there a religious factor in health? *J Relig Health.* 1987;26:9–36.
4. House JS, Landis KR, Umberson D. Social relationships and health. *Science.* 1988;241:540–545.
5. Williams RB, Barefoot JC, Califf RM, et al. Prognostic importance of social and economic resources among medically treated patients with angiographically documented coronary artery disease. *JAMA.* 1992;267:520–524.
6. Spiegel D, Bloom JR, Kraemer HC, Gottheil E. Effect of psychosocial treatment on survival of patients with metastatic breast cancer. *Lancet.* 1989;ii(8668):888–891.
7. Spiegel D. Effects of psychosocial support on patients with metastatic breast cancer. *J Psychosoc Oncol.* 1992;10:113–120.
8. Ellison CG, George LK. Religious involvement, social ties, and social support in a southeastern community. *J Sci Study Relig.* 1994;33:46–61.
9. Maton KI. Community settings as buffers of life stress? Highly supportive churches, mutual help groups, and senior centers. *Am J Comm Psychol.* 1989;17:203–232.
10. Levin JS. How religion influences morbidity and health: reflections on natural history, salutogenesis, and host resistance. *Soc Sci Med.* 1996;43:849–864.
11. Koenig HG. *Is Religion Good for Your Health?* New York: Haworth Press; 1997.
12. Ellison CG. Religious involvement and subjective well-being. *J Health Soc Behav.* 1991;32:80–99.
13. Koenig HG, Hays JC, George LK, Blazer DG. Modeling the cross-sectional relationships between religion, physical health, social support, and depressive symptoms. *Am J Geriatr Psychiatry.* 1997;5:131–143.
14. Kendler KS, Gardner CO, Prescott CA. Religion, psychopathology, and substance use and abuse: a multi-measure, genetic-epidemiologic study. *Am J Psychiatry.* 1997;154:322–329.
15. Koenig HG, Ford S, George LK, Blazer DG, Meador KG. Religion and anxiety disorder: an examination and comparison of associations in young, middle-aged, and elderly adults. *J Anxiety Disord.* 1993;7:321–342.
16. Koenig HG, George LK, Meador KG, Blazer DG, Ford SM. Religious practices and alcoholism in a southern adult population. *Hosp Community Psychiatry.* 1994;45:225–237.
17. Martin WT. Religiosity and United States suicide rates, 1972–1978. *J Clin Psychol.* 1984;40:1166–1169.
18. Armstrong B, Merwyk A, Coates H. Blood pressure in Seventh Day Adventist vegetarians. *Am J Epidemiol.* 1977;105:441–449.
19. Timio M, Verdecchia P, Venanzi S, et al. Age and blood pressure changes: a 2-year follow-up study in nuns in a secluded order. *Hypertension.* 1988;12:457–461.
20. Colantonio A, Kasl SV, Ostfeld AM. Depressive symptoms and other psychosocial factors as predictors of stroke in the elderly. *Am J Epidemiol.* 1992;136:884–894.

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21. Comstock GW, Partridge KB. Church attendance and health. *J Chronic Dis*. 1972;24:665–672.
22. Comstock GW, Tonascia JA. Education and mortality in Washington County, Maryland. *J Health Soc Behav*. 1977;18:54–61.
23. House JS, Robbins C, Metzner HL. The association of social relationships and activities with mortality: prospective evidence from the Tecumseh Community Health Study. *Am J Epidemiol*. 1982;116:123–140.
24. Schoenbach VJ, Kaplan BH, Fredman L, Kleinbaum DG. Social ties and morality in Evans County, Georgia. *Am J Epidemiol*. 1986;123:577–591.
25. Zuckerman DM, Kasl SV, Ostfeld AM. Psychosocial predictors of mortality among the elderly poor. The role of religion, well-being, and social contacts. *Am J Epidemiol*. 1984;119:410–423.
26. Idler EL, Kasl S. Health perceptions and survival: do global evaluations of health status really predict mortality? *J Gerontol Soc Sci*. 1991;46:S55–S65.
27. Oxman TE, Freeman DH, Manheimer ED. Lack of social participation or religious strength and comfort as risk factors for death after cardiac surgery in the elderly. *Psychosom Med*. 1995;57:5–15.
28. Strawbridge WJ, Cohen RD, Shema SJ, Kaplan GA. Frequent attendance at religious services and mortality over 28 years. *Am J Public Health*. 1997;87:957–961.
29. Cornoni-Huntley J, Blazer DG, Lafferty ME, Everet DF, Brock DB, Farmer ME, eds. *Established Populations for the Epidemiologic Studies of the Elderly, II. Resource Data Book*. NIA publication 90-495. Washington, DC: National Institute on Aging; 1990.
30. Kish L. *Survey Sampling*. New York: John Wiley & Sons; 1965.
31. Berkman LF, Breslow L. *Health and Ways of Living: The Alameda County Study*. New York: Oxford University Press; 1983.
32. Kaplan GA, Seeman TE, Cohen RD, Knudsen LP, Guralnik J. Mortality among the elderly in the Alameda County Study: behavioral and demographic risk factors. *Am J Public Health*. 1987;77:307–312.
33. LaCroix AZ, Guralnik JM, Berkman LF, Wallace RB, Satterfield S. Maintaining mobility in later life. II: Smoking, alcohol consumption, physical activity and body mass index. *Am J Epidemiol*. 1993;137:858–869.
34. Berkman LF, Syme SL. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol*. 1979;109:186–204.
35. Broadhead WE, Kaplan BH, James SA, et al. The epidemiologic evidence for a relationship between social support and health. *Am J Epidemiol*. 1983;117:521–537.
36. Kaplan GA, Wilson TW, Cohen RD, Kauhanen J, Wu M, Salonen JT. Social functioning and overall mortality: prospect evidence from the Kuopio Ischemic Heart Disease Risk Factor study. *Epidemiology*. 1994;5:495–500.
37. Vogt T, Mullooly J, Ernst D, Pope C, Hollis J. Social networks as predictors of ischemic heart disease, cancer, stroke, and hypertension: incidence, survival and mortality. *J Clin Epidemiol*. 1992;5:659–666.
38. Hays JC, Schoenfeld D, Blazer DG, Gold DT. Global self-ratings of health and mortality: hazard in the North Carolina Piedmont. *J Clin Epidemiol*. 1996;49:969–979.
39. Katz S, Akpom CA. A measure of primary sociobiological functions. *Int J Health Service*. 1976;6:493–507.
40. Fillenbaum GG. Screening the elderly: a brief instrumental ADL measure. *J Am Geriatr Soc*. 1985;33:698–706.
41. Rosow I, Breslau N. A Guttman health scale for the aged. *J Gerontol*. 1966;21:556–559.
42. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psych Measur*. 1977;5:385–401.
43. Blazer DG, Burchett BM, Service C, et al. The association of age and depression among the elderly: an epidemiologic exploration. *J Gerontol Med Sci*. 1991;46:M210–M215.
44. Blazer DG, Hughes DC, George LK. The epidemiology of depression in an elderly community population. *Gerontologist*. 1987;27:281–287.
45. Landerman R, George LK, Campbell RT, et al. Alternative models of the stress buffering hypothesis. *Am J Community Psychol*. 1989;17:625–642.
46. Tyroler H, Heyden S, Hames C. Weight and hypertension: Evans County studies of blacks and whites. In: Oglesby P, ed. *Epidemiology and Control of Hypertension*. New York: Stratton Intercontinental Medical Book Association; 1975:177–204.
47. Landerman R. *EPESE Composite Measures and Other Commonly Used Measures: Description and Documentation of Original Variables and Variables With Missing Values Imputed*. Durham, NC: Center for the Study of Aging and Human Development; 1996.
48. SAS Institute. *SAS STAT User's Guide*. Version 6, 4th ed., vol. II. Cary, NC: SAS Institute Inc.; 1994.
49. Cox DR. Regression models and life tables (with discussion). *J R Stat Soc*. 1972;34B:187–220.
50. Grambsch PM, Therneau TM: Proportional hazards tests and diagnostics based on weighted residuals. *Biometrika*. 1994;81:515–526.
51. Koenig HG, George LK, Cohen HJ, Hays JC, Larson DB, Blazer DG. The relationship between religious activities and cigarette smoking in older adults. *J Gerontol Med Sci*. 1998;53A:M426–M434.
52. Zollinger TW, Phillips RL, Kuzman JW. Breast cancer survival rates among Seventh-Day Adventists and non-Seventh-Day Adventists. *Am J Epidemiol*. 1984;119:503–509.
53. Koenig HG, Cohen HJ, George LK, Hays JC, Blazer DG. Attendance at religious services, interleukin-6, and other biological indicators of immune function in older adults. *Int J Psychiatry Med*. 1997;27:233–250.
54. Koenig HG, George LK, Cohen HJ, Hays JC, Larson DB, Blazer DG. The relationship between religious activities and blood pressure in older adults. *Int J Psychiatry Med*. 1998;28:189–213.
55. Mechanic D. Religion, religiosity, and illness behavior. *Human Organization*. 1963;22:202–208.
56. Chang BL, Uman GC, Linn LS, Ware JE, Kane RL. Adherence to health care regimens among elderly women. *Nursing Res*. 1984;34:27–31.
57. Levin JS, Vanderpool HY. Relgious factors in physical health and the prevention of illness. In: Pargament KI, Maton KI, Hess RE, eds. *Religion and Prevention in Mental Health: Research, Vision, and Action*. New York: Haworth Press; 1992.
58. Koenig HG, Cohen HJ, Blazer DG, et al. Religious coping and depression in elderly hospitalized medically ill men. *Am J Psychiatry*. 1992;149:1693–1700.
59. Irwin M, Patterson T, Smith TL, et al. Reduction of immune function in life stress and depression. *Biol Psychiatry*. 1990;27:22–30.
60. Lesserman J, Petitto JM, Perkins DO, Folds JD, Golden RN, Evans DL. Severe stress, depressive symptoms, and changes in lymphocyte subsets in human immunodeficiency virus-infected men: A 2-year follow-up study. *Arch Gen Psychiatry*. 1997;54:279–285.
61. Nelson FL. Religiosity and self-destructive crises in the institutionalized elderly. *Suicide Life Threat Behav*. 1977;7:67–74.
62. Gottlieb NH, Green LW. Life events, social network, life style, and health: an analysis of the 1979 National Survey of Personal Health Practices and Consequences. *Health Education Quarterly*. 1984;11:91–105.
63. Parfrey PS. The effect of religious factors on intoxicant use. *Scand J Soc Med*. 1976;3:135–140.
64. Jensen L, Newell RJ, Holman T. Sexual behaviors, church attendance, and permissive beliefs among unmarried young men and women. *J Sci Study Relig*. 1990;29:113–117.
65. Princeton Religion Research Center. *Religion in America*. Princeton, NJ: The Gallup Poll; 1996.
66. Koenig HG, George LK, Siegler I. The use of religion and other emotion-regulating coping strategies among older adults. *Gerontologist*. 1988;28:303–310.
67. Idler EL. *Cohesiveness and Coherence: Religion and the Health of the Elderly*. New York: Garland; 1994.
68. Allport GW, Ross JM. Personal religious orientation and prejudice. *J Pers Soc Psychol*. 1967;5:432–443.
69. Koenig HG. Religious attitudes and practices of hospitalized medically ill older adults. *Int J Geriatr Psychiatry*. 1998;13:213–224.

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