Original Investigation

Association Between Religious Service Attendance and Lower Suicide Rates Among US Women

Tyler J. VanderWeele, PhD; Shanshan Li, ScD; Alexander C. Tsai, MD; Ichiro Kawachi, PhD

IMPORTANCE Previous studies have linked suicide risk with religious participation, but the majority have used ecologic, cross-sectional, or case-control data.

OBJECTIVE To examine the longitudinal association between religious service attendance and suicide and the joint associations of suicide with service attendance and religious affiliation.

DESIGN, SETTING, AND PARTICIPANTS We evaluated associations between religious service attendance and suicide from 1996 through June 2010 in a large, long-term prospective cohort, the Nurses' Health Study, in an analysis that included 89 708 women. Religious service attendance was self-reported in 1992 and 1996. Data analysis was conducted from 1996 through 2010.

MAIN OUTCOMES AND MEASURES Cox proportional hazards regression models were used to examine the association between religious service attendance and suicide, adjusting for demographic covariates, lifestyle factors, medical history, depressive symptoms, and social integration measures. We performed sensitivity analyses to examine the influence of unmeasured confounding.

RESULTS Among 89 708 women aged 30 to 55 years who participated in the Nurses' Health Study, attendance at religious services once per week or more was associated with an approximately 5-fold lower rate of suicide compared with never attending religious services (hazard ratio, 0.16; 95% CI, 0.06-0.46). Service attendance once or more per week vs less frequent attendance was associated with a hazard ratio of 0.05 (95% CI, 0.006-0.48) for Catholics but only 0.34 (95% CI, 0.10-1.10) for Protestants (*P* = .05 for heterogeneity). Results were robust in sensitivity analysis and to exclusions of persons who were previously depressed or had a history of cancer or cardiovascular disease. There was evidence that social integration, depressive symptoms, and alcohol consumption partially mediated the association among those occasionally attending services, but not for those attending frequently.

CONCLUSIONS AND RELEVANCE In this cohort of US women, frequent religious service attendance was associated with a significantly lower rate of suicide.

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Tyler J. VanderWeele, PhD, Department of Epidemiology, Harvard T. H. Chan School of Public Health, 677 Huntington Ave, Kresge Bldg, Boston, MA 02115 (tvanderw@hsph.harvard.edu).

Suicide is among the 10 leading causes of death in the United States[1]: it is the fourth leading cause of death for persons aged 18 to 65 years, and the risk increases later in life.[2-4] Despite improvements in mental health, the suicide rate in the United States (12 per 100 000) is approximately the same as it was more than 100 years ago.[1-3] The major world religions have traditions prohibiting suicide, and various forms of religious participation have been thought to be linked with reduced risk of suicide.[4,5] Empirical research on the topic was made prominent by the 1897 work *Suicide* by sociologist Emile Durkheim, who noted that, within Europe, suicide rates were higher in Protestant regions than Catholic regions. He attributed the lower suicide rates among Catholics to greater religious integration and less individual autonomy in beliefs.[6]

Although there have been numerous studies of the association between various forms of religious participation and suicide,[2,4-12] most have serious methodological limitations. Many of the studies, including Durkheim's, used ecologic data and could not control for individual-level confounding[13]; many other studies use survey data but, as a result, can only examine suicidal ideation or suicide attempts[10] rather than suicide itself. The association between religious service attendance and suicide and ideation has also been studied using case-control designs.[8] Research with cohort designs is difficult owing to the relatively low baseline rate of suicide. To our knowledge, only 1 study to date has used cohort data to examine the association between religious service attendance and suicide itself,[14] but it was not able to control for depressive symptoms, which are related to both suicide and religious service attendance.[2,4,15,16]

Our objective was to examine the association between religious service attendance and suicide and the joint associations of suicide with service attendance and religious affiliation using the Nurses' Health Study, a large prospective cohort study among US women with repeated measurements of religious service attendance and detailed information on dietary, lifestyle, social, psychological, and medical risk factors.

Methods

Study Design

The Nurses' Health study began in 1976 and included 121 700 nurses aged 30 to 55 years from across the United States.[17] Information on lifestyle and medical history was collected using a questionnaire at baseline and every 2 years subsequently. In our study, follow-up for suicide began with the measure of religious service attendance in 1996 and continued until suicide, loss to follow-up, or the end of follow-up in June 2010. Participants who died before 1996 or did not reply to the 1996 questionnaire (n = 27 122) or who had data missing on 1996 religious service attendance (n = 7246) were excluded. Our study includes 89 708 participants with 1 528 538 person years. We identified 36 suicides during follow-up. The study protocol for the Nurses' Health Study was approved by the Brigham and Women's Hospital and Harvard School of Public Health Insti-

Key Points

Question Is religious service attendance associated with lower risk of suicide among US women?

Findings In a long-term cohort study, women who attended religious services once or more per week had a 5-fold lower risk of subsequent suicide compared with women who never attended religious services; the inverse association of service attendance with suicide was stronger for Catholics than for Protestants.

Meaning Frequent religious service attendance was associated with substantially lower suicide risk among US women compared with women who never attended religious services.

tutional Review Boards. Study participants provided written informed consent.

Religious service attendance was self-reported in 1992 and 1996. The questionnaire asked, "How often do you go to religious meetings or services?" Response categories included more than once a week, once a week, 1 to 3 times per month, less than once per month, never, or almost never. The primary exposure variable was attendance in 1996, with attendance in 1992 controlled for as a covariate to examine the associations between incident attendance and risk of suicide.

Deaths were identified by using state mortality files and the US National Death Index and by reports from next of kin. We defined suicide deaths using the *International Classification of Diseases, Eighth Revision* definition for suicide and self-inflicted injury (codes E950-E959), including suicide and self-inflicted poisoning by solid or liquid substances (E950), by gases in domestic use (E951), or by other gases and vapors (E952); suicide and self-inflicted injury by hanging, strangulation, and suffocation (E953), by submersion (E954), by firearms and explosives (E955), by cutting and piercing instruments (E956), by jumping (E957), or by other and unspecified means (E958); and late effects of self-inflicted injury (E959).

We selected covariates that were important predictors for both general health and suicide, including age (as a continuous variable); employment status (part-time, full-time, unemployed, or retired); family history of alcoholism (yes or no); body mass index (calculated as weight in kilograms divided by height in meters squared; <20, 20-24.9, 25-29.9, 30-34.9, or ≥35); physical activity (quintiles); caffeine intake (grams per day); alcohol intake (grams per day); smoking status (never, former, or current [1-14, 15-24, and ≥25 cigarettes per day]); depressive symptoms (yes or no); history of type 2 diabetes, hypertension, cancer, or hypercholesterolemia (yes or no); family income (quintiles); live alone (yes or no); geographic region (North, South, or Midwest); religious service attendance in 1992 (never, less than once per week, or once or more per week); and the Berkman-Syme social integration score.[18] Social integration was derived using the following 6 components (excluding the service attendance component): marital status, other group participation, number of close friends, number of close relatives, number of close friends seen at least once per month, and number of close relatives seen at least once per month. Indicator variables were used for any missing covariate information for categorical variables, and median impu-

tation was used for missing continuous covariates. Covariate measurements before the religious attendance exposure were taken as confounders, and the first available measurements subsequent to religious attendance exposures were taken as mediators. For mediators, we considered depressive symptoms in 2000 measured using the Center for Epidemiologic Studies Depression-10 Scale,[19] alcohol consumption in 1998, and social integration in 2000.

Statistical Analysis

We examined the association of religious service attendance with suicide using multivariable Cox proportional hazards regression models. We calculated hazard ratios (HRs) and their 95% CIs, comparing frequency of religious service attendance (once or more per week or less than once per week) vs never attending. To accommodate the relatively small number of events, we also used exact logistic regression as a sensitivity analysis, which was developed to address small numbers of events,[20] and adjusted for depressive symptoms and social support. We further stratified the analysis by religious affiliation (Catholic vs Protestant).

We applied mediation analysis methods[21,22] to examine proportions of the association between religious service attendance in 1996 and subsequent suicide that were mediated by depressive symptoms, alcohol intake, and social integration. Methods for mediation assume that baseline covariates suffice to control for exposure-outcome, mediator-outcome, and exposure-mediator confounding.

We conducted several sensitivity analyses to assess the robustness of the results. To minimize the influence of reverse causation, we additionally performed further analyses by excluding women who were depressed in 1996 (score of ≤52 on the 5-item Mental Health Inventory, self-reported depressive symptoms, or use of an antidepressant) and women who, in 1996, had a history of cancer (except nonmelanoma skin cancer) or a cardiovascular condition (myocardial infarction, coronary artery bypass graft surgery, percutaneous transluminal coronary angioplasty, or stroke). We used sensitivity analysis to assess how substantial any unmeasured confounding would need to be to explain the observed associations.[23,24] All statistical analyses were performed from 1996 through 2010 using the SAS Unix system (SAS Institute Inc).

Results

Among 89 708 women at the 1996 baseline, 17 028 attended more than once per week, 36 488 attended once per week, 14 548 attended less than once per week, and 21 644 never attended (**Table 1**). Most study participants were Catholic or Protestant. Women who attended religious services frequently were less likely to use an antidepressant (Table 1). They were also less likely to be current smokers and more likely to be married. There were 36 suicide events during follow-up, with suicide incidence declining with increasing religious service attendance (**Figure**; eTable 1 in the Supplement).

Using a multivariable Cox proportional hazards regression model, compared with women who never attended religious services, women who attended religious services once per week or more in 1996 had an approximately 5-fold lower rate of suicide (adjusted HR, 0.16; 95% CI, 0.06-0.45) (**Table 2**). When further adjustment was made for the social integration score (other than religious service attendance), the HR was essentially unchanged (0.16; 95% CI, 0.06-0.46). Results were also similar after excluding participants who were depressed in 1996 as defined by a score of 52 or less on the 5-item Mental Health Inventory, self-reported depressive symptoms, or use of antidepressants or after excluding those who had a history of cancer or of a cardiovascular condition in 1996 (eTable 2 in the Supplement). The odds ratio from exact logistic regression to address the small number of suicide events was likewise similar (0.17; 95% CI, 0.06-0.44). Results were also similar across strata of attendance in 1992 (eTable 3 in the Supplement).

Even after contemporaneous adjustment in 1996 for all other individual components of the social integration score, the association between religious service attendance when comparing once or more per week vs less often was similar and substantial (HR, 0.17; 95% CI, 0.07-0.47), and was larger than the effect size for a 1-SD change in social integration score, either with religious service attendance excluded (HR, 0.82; 95% CI, 0.52-1.28) or included (HR, 0.67; 95% CI, 0.41-1.10). When using a median split dichotomization, the effect size for religious service attendance was also larger than that of any other single component of the social integration score (eTable 4 in the Supplement). The effect size for religious service attendance was similar to or larger in magnitude than that of every other covariate in the adjusted model (eTable 5 in the Supplement).

For an unmeasured confounder to explain the HR estimate of 0.16 (95% CI, 0.06-0.46), the unmeasured confounder would have to both increase the likelihood of religious service attendance and decrease the likelihood of suicide by 12-fold above and beyond the measured confounders; weaker confounding would not suffice. To bring the estimate's upper confidence limit of 0.46 above 1.0, the unmeasured confounder would still have to both increase the likelihood of religious service attendance and decrease the likelihood of suicide by 3.7-fold above and beyond the measured confounders.

There was evidence that the association between religious service attendance and suicide differed between Catholic and Protestant participants: the religious service attendance HR for Catholics for attending once per week or more vs less often was 0.05 (95% CI, 0.006-0.48), which was approximately 7-fold smaller than the analogous hazard for Protestants (HR, 0.34; 95% CI, 0.10-1.10) (*P* = .05 for heterogeneity) (**Table 3**).

We used mediation analysis to investigate whether depressive symptoms in 2000, alcohol consumption in 1998, and subsequent social integration score in 2000 mediated the association between religious service attendance and suicide. No single mediator seemed to explain much of the association (**Table 4**). When adjustment was made for depressive symptoms, alcohol consumption, and social integration score together, the HR for those attending religious services less than once per week vs not at all changed from 0.85 (95% CI, 0.36-

Table 1. Age-Adjusted Baseline Characteristics of Participants in the Nurses' Health Study by Religious Service Attendance in 1996

Characteristic	Religious Service Attendance in 1996[a]			
	Never (n = 21 644)	Less Than Once per Week (n = 14 548)	Once per Week (n = 36 488)	More Than Once per Week (n = 17 028)
Age, mean (SD), y	61.5 (7.1)	61.2 (7.3)	62.4 (7.1)	63.5 (6.9)
White race/ethnicity	21 189 (97.9)	14 112 (97.0)	35 649 (97.7)	16 500 (96.9)
Employment status				
Not employed outside the home or retired	5736 (26.5)	3492 (24.0)	9633 (26.4)	4955 (29.1)
Employed part-time	3290 (15.2)	2750 (18.9)	7407 (20.3)	3593 (21.1)
Employed full-time	9134 (42.2)	5921 (40.7)	13 865 (38.0)	5926 (34.8)
Missing	3485 (16.1)	2386 (16.4)	5546 (15.2)	2537 (14.9)
Family history of alcoholism	4589 (21.2)	2720 (18.7)	6750 (18.5)	3235 (19.0)
BMI, mean (SD)	26.4 (5.5)	26.6 (5.2)	26.4 (5.0)	26.5 (5.1)
Physical activity, mean (SD), METs/wk	19.8 (24.5)	20.4 (24.8)	19.5 (24.4)	19.6 (24.2)
Intake, mean (SD), g/d				
Alcohol	6.7 (11.2)	5.3 (9.0)	4.6 (8.3)	3.4 (7.3)
Caffeine	266.3 (214.5)	249.6 (204.8)	237.4 (204.6)	216.2 (199.7)
Smoking status				
Never	7272 (33.6)	5921 (40.7)	17 003 (46.6)	9808 (57.6)
Former	9870 (45.6)	6488 (44.6)	15 544 (42.6)	6232 (36.6)
Current, cigarettes/d				
1-14	1558 (7.2)	917 (6.3)	1861 (5.1)	494 (2.9)
15-24	1883 (8.7)	887 (6.1)	1496 (4.1)	375 (2.2)
≥25	1039 (4.8)	349 (2.4)	547 (1.5)	119 (0.7)
History				
Hypertension	7575 (35.0)	5019 (34.5)	12 151 (33.3)	5670 (33.3)
Diabetes	1234 (5.7)	800 (5.5)	1934 (5.3)	868 (5.1)
Hypercholesterolemia	9632 (44.5)	6532 (44.9)	16 566 (45.4)	7714 (45.3)
Antidepressant use	1840 (8.5)	1135 (7.8)	2335 (6.4)	1124 (6.6)
Religious service attendance more than once per week in 1992	498 (2.3)	1353 (9.3)	19 813 (54.3)	3865 (22.7)
Married	16 969 (78.4)	11 667 (80.2)	30 869 (84.6)	14 304 (84.0)
Close friends seen once per mo, mean (SD), No.	2.7 (1.0)	2.9 (1.0)	3.0 (1.0)	3.2 (1.1)
Close friends, mean (SD), No.	3.2 (1.2)	3.4 (1.1)	3.5 (1.2)	3.6 (1.2)
Close relatives seen once per mo, mean (SD), No.	2.1 (1.0)	2.4 (1.1)	2.5 (1.1)	2.5 (1.2)
Close relatives, mean (SD), No.	2.9 (1.3)	3.2 (1.3)	3.3 (1.3)	3.4 (1.3)
Social integration index score without religious service attendance component, mean (SD)	4.7 (2.7)	5.4 (2.7)	5.8 (2.7)	6.3 (2.8)
Religious group				
Catholic	6363 (29.4)	4117 (28.3)	19 594 (53.7)	6999 (41.1)
Protestant	13 354 (61.7)	8932 (61.4)	15 544 (42.6)	8786 (51.6)
Ashkenazi Jewish	822 (3.8)	946 (6.5)	219 (0.6)	51 (0.3)
Eastern (eg, Buddhist, Hindu)	65 (0.3)	44 (0.3)	0	17 (0.1)
Muslim	0	0	0	0
Other religious heritage	519 (2.4)	189 (1.3)	365 (1.0)	187 (1.1)
Live alone	2511 (11.6)	1600 (11.0)	3320 (9.1)	1686 (9.9)
Geographic region				
North	7813 (36.1)	5223 (35.9)	12 917 (35.4)	5483 (32.2)
South	2835 (13.1)	1586 (10.9)	3430 (9.4)	2299 (13.5)
Midwest	8463 (39.1)	5965 (41.0)	15 872 (43.5)	7271 (42.7)
Other	2532 (11.7)	1775 (12.2)	4269 (11.7)	1975 (11.6)
Family income, mean (SD), dollars/y	67 510.5 (27 282.5)	67 124.0 (27 210.2)	63 068.7 (23 926.4)	61 307.5 (23 963.9)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); MET, metabolic equivalent.

[a] Data are presented as number (percentage) of patients unless otherwise indicated. Values are standardized to the age distribution of the study population.

Figure. Suicide Incidence From 1996 to 2010 by Frequency of Religious Service Attendance in 1996
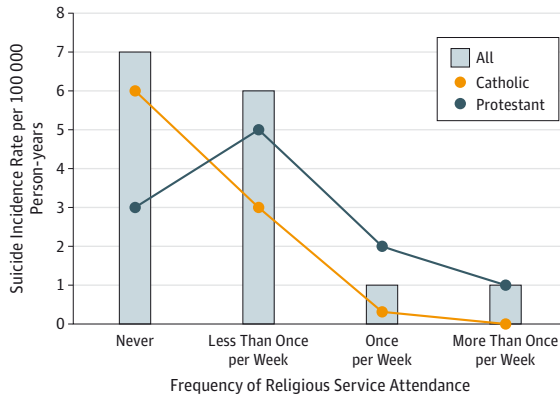
Patterns of suicide incidence per 100 000 person-years by religious service attendance for Protestants, Catholics, and overall.

2.00) to 0.94 (95% CI, 0.40-2.23), accounting for about half of the association; however, for those attending religious services more than once per week vs not at all, the HR remained essentially unchanged (0.16; 95% CI, 0.06-0.46) (Table 4).

Discussion

In this large prospective cohort of 89 708 US nurses with 1 528 538 person-years of follow-up, we found a substantial inverse association between frequent religious service attendance and risk of suicide. Compared with women who had never attended religious services, women who attended religious services once or more per week had a more than 5-fold lower risk of suicide; results were robust across various exclusions, methods of analysis, and in sensitivity analysis.

Our results are consistent with other literature suggesting an inverse association between religious participation and suicide.[7-14] In contrast to other studies, however, we used longitudinal cohort data rather than cross-sectional or ecologic data; we made extensive adjustment for confounding; we were

Table 2. Multivariable Adjusted Hazard Ratios for Suicide Events (1996-2010) by Frequency of Religious Service Attendance in 1996[a]

	Religious Service Attendance in 1996		
Adjustment	Never	Less Than Once per Week	Once or More per Week
Total, No.	18	11	7
Hazard ratio adjusted for age	1 [Reference]	0.91 (0.43-1.94)	0.15 (0.06-0.37)
Hazard ratio adjusted for age, lifestyle demographic variables, and religious service attendance in 1992	1 [Reference]	0.88 (0.38-2.07)	0.16 (0.06-0.45)
Hazard ratio further adjusted for other aspects of social integration in 1992	1 [Reference]	0.85 (0.36-2.00)	0.16 (0.06-0.46)

[a] For the covariates for which the multivariable model adjusted for, see the Methods section.

Table 3. Joint Associations Between Religious Service Attendance in 1996 and Protestant vs Catholic Identity[a,b]

Frequency of Religious Service Attendance	Protestant		Catholic	
	Event/Years	HR (95% CI)	Event/Years	HR (95% CI)
Never or less than once per wk	14/260 486	1 [Reference]	8/129 319	0.97 (0.38-2.46)
Once per wk or more	5/292 735	0.34 (0.10-1.10)	1/322 692	0.05 (0.006-0.45)
Service attendance within strata of religious affiliation		0.34 (0.10-1.10)		0.05 (0.006-0.48)

Abbreviation: HR, hazard ratio.

[a] For the covariates for which the multivariable model adjusted for, see the Methods section.

[b] P value for multiplicative interaction, P = .05. Relative excess risk due to interaction, HR, −0.26 (95% CI, −1.33 to 0.81); P = .63 for additive interaction.

Table 4. Adjustment for Potential Mediators for the Association Between Religious Service Attendance in 1996 and Suicide[a]

	Religious Service Attendance in 1996, HR (95% CI)		
Adjustment	Never	Less Than Once per Week	Once or More per Week
Multivariable adjusted model[b]	1 [Reference]	0.85 (0.36-2.00)	0.16 (0.06-0.46)
Further adjusted for mediators			
Social integration score in 2000[c]	1 [Reference]	0.85 (0.36-2.02)	0.16 (0.06-0.46)
Alcohol consumption in 1998[d]	1 [Reference]	0.86 (0.36-2.05)	0.16 (0.06-0.45)
Depressive symptoms or antidepressant use in 2000[e]	1 [Reference]	0.92 (0.39-2.17)	0.17 (0.06-0.48)
Alcohol consumption in 1998, social integration score in 2000, and depressive symptoms or antidepressant use in 2000	1 [Reference]	0.94 (0.40-2.23)	0.16 (0.06-0.46)

Abbreviation: HR, hazard ratio.

[a] For the covariates for which the multivariable model adjusted for, see the Methods section.

[b] From the last row of Table 2.

[c] The mediator of social integration score in 2000 was modeled as >3 vs ≤3. Median level = 3.

[d] The mediator of alcohol consumption in 1998 was modeled as >0.9 g/d vs ≤0.9 g/d. Median level = 0.9 g/d.

[e] The mediator of depressive symptoms or antidepressant use in 2000 was modeled as yes vs no.

able to examine incident rather than prevalent religious service attendance by controlling for past attendance; and we were able to examine suicide itself rather than suicidal ideation or suicide attempts. We were also able to control for depressive symptoms, which are related to both suicide and service attendance.[15,16] Although other aspects of social integration are also associated with reduced rates of suicide,[25,26] when we compared the effect size of religious service attendance with social integration components, it was religious service attendance itself that seemed most prominent among these associations. Subsequent social support seemed to mediate little of the association between religious service attendance and suicide.

In examining the potential pathways from religious service attendance to suicide, depressive symptoms, social integration, and alcohol consumption seem to explain some of the association for those attending less than once per week but little of the association for those attending once per week or more. The mediation estimates were limited by the potential for suicide to occur before the mediators were measured and by the use of mediators measured at a single point in time. Nevertheless, the evidence seems to indicate an association independent of these pathways. It is likely that religious service attendance is itself associated with the belief that suicide is wrong and that this belief may be the primary pathway. This hypothesis has been proposed previously with some preliminary empirical evidence to support it.[12,27] Religious reasons sometimes given for prohibitions against suicide include the following: life being a gift from God, suicide being against the natural order, suicide causing injury to the community, suicide encouraging others to follow a similar course, and death being this life's greatest evil.[28,29] That most of the association in our analysis was not explained by depressive symptoms, alcohol consumption, or social integration is consistent with moral beliefs being the dominant pathway. Future research could also examine other potential mediators, such as hopelessness or the meaning and purpose in life.

Our results suggested that the inverse association of religious service attendance with suicide was stronger for Catholics than Protestants. The result is of historic and sociological significance since, in the 1897 work *Suicide*—a book that both strongly influenced research on religion and health and shaped the discipline of sociology itself—Durkheim[6] had noted that, within Europe, suicide rates were higher in Protestant than Catholic regions. Durkheim's analysis, and many since, used ecologic data and has thus been criticized on these grounds.[4,7,30] Although Durkheim's analysis was replicated using individual-level data in Switzerland with similar results,[11] our analyses suggest that the lower suicide rates among Catholics vs Protestants may in fact apply only to those regularly attending religious services, with the inverse association between service attendance and suicide was stronger for Catholics than for Protestants.

Although the Nurses' Health Study was not targeted to a particular religious group, the study sample in fact consists mainly of white Christians and entirely of US female nurses. The suicide rate in our sample was about half of that on average among US women.[2] Our results might thus not be gener-

alizable to the general US population, to men, to other races, to other countries, or to areas with limited religious freedom.[31] Our results are consistent with previous research among African American individuals on suicidal ideation and behaviors,[32,33] although suicide rates are in general lower among African American individuals,[2] and patterns across religious denominations may also differ for African American individuals.

Although religious service attendance has commonly been used in previous published studies and tends to be the strongest religious predictor of health,[4] religiosity is multidimensional, and different aspects of religion and spirituality may therefore be differently associated with suicide. Data on religious service attendance were collected through a self-reported questionnaire and, moreover, may be subject to measurement error and possible overreporting, although the relative ordering of frequency might still be preserved. Further research could examine other religious practices, mindfulness practices, other aspects of spirituality and religiosity, other race/ethnic and demographic groups, and other forms of social participation.

Our study made use of observational data. Although we adjusted for major confounders regarding the association between religious service attendance and suicide, the results may still be subject to unmeasured confounding by personality, impulsivity, feelings of hopelessness, or other cognitive factors. However, in sensitivity analysis, for an unmeasured confounder to explain the effect of religious service attendance on suicide, it would have to both increase the likelihood of religious service attendance and decrease the likelihood of suicide by greater than 10-fold above and beyond the measured covariates. Such substantial confounding by unmeasured factors seems unlikely, given adjustment for an extensive set of covariates and the known risk factor associations for suicide.[34,35] The results comparing Catholic and Protestant participants could also be subject to differential misclassification of suicide by affiliation,[36] with Catholics potentially underreporting suicide events owing to suicide being considered a mortal sin. Suicide events were identified using the US National Death Index as well as reports from next of kin. In some cases, suicide events may be missed if the family members choose not to share. Although such misclassification might affect comparisons between Catholics and Protestants, it may be less likely to affect hazard ratios for religious service attendance within strata of affiliation. Our results were based on a relatively small number of events, which can make modeling difficult; however, results were similar when using an exact logistic regression technique intended to address small event numbers. The small number of events also creates considerable uncertainty in the religious service attendance estimates stratified by affiliation.

Our study was intended to overcome methodological limitations in previous research. Strengths of our study include a large sample size, long duration of follow-up, a prospective cohort study design, repeated measures of religious service attendance, and extensive control for confounding. We have clear temporality of the covariates, exposure, and outcome. We were able to adjust for baseline religious service attendance level

to avoid reverse causation and to estimate the effect of incident exposure; we were also able to adjust for depressive symptoms and social support as potential confounders.

Conclusions

In this large, prospective, long-term cohort study of US women, frequent religious service attendance was associated with substantially lower suicide risk. Our results do not imply that health care providers should prescribe attendance at religious services. However, for patients who are already religious, service attendance might be encouraged as a form of meaningful social participation. Religion and spirituality may be an underappreciated resource that psychiatrists and clinicians could explore with their patients, as appropriate.

Author Affiliations: Department of Epidemiology, Harvard T. H. Chan School of Public Health, Boston, Massachusetts (VanderWeele, Li); Department of Biostatistics, Harvard T. H. Chan School of Public Health, Boston, Massachusetts (VanderWeele); Program on Integrative Knowledge and Human Flourishing, Institute of Quantitative Social Science, Harvard University, Cambridge, Massachusetts (VanderWeele); Center for Global Health, Massachusetts General Hospital, Boston (Tsai); Harvard Center for Population and Development Studies, Cambridge, Massachusetts (Tsai); Mbarara University of Science and Technology, Mbarara, Uganda (Tsai); Department of Social and Behavioral Sciences, Harvard T. H. Chan School of Public Health, Boston, Massachusetts (Kawachi).

REFERENCES

1. Jones DS, Podolsky SH, Greene JA. The burden of disease and the changing task of medicine. *N Engl J Med*. 2012;366(25):2333-2338.

2. Nock MK, Borges G, Bromet EJ, Cha CB, Kessler RC, Lee S. Suicide and suicidal behavior. *Epidemiol Rev*. 2008;30(1):133-154.

3. Kachur SP, Potter LB, James SP, Powell KE. *Suicide in the United States 1980-1992*. Atlanta, GA:

US Dept of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention; 1995.

4. Koenig HG. *Handbook of Religion and Health*. 2nd ed. New York, NY: Oxford University Press; 2012.

5. Gearing RE, Lizardi D. Religion and suicide. *J Relig Health*. 2009;48(3):332-341.

6. Durkheim E. *Suicide: A Study in Sociology*. 1st Free Press paperback ed. New York, NY: Free Press; 1966.

7. Stack S. Suicide: a 15-year review of the sociological literature: part II: modernization and social integration perspectives. *Suicide Life Threat Behav*. 2000;30(2):163-176.

8. Nisbet PA, Duberstein PR, Conwell Y, Seidlitz L. The effect of participation in religious activities on suicide versus natural death in adults 50 and older. *J Nerv Ment Dis*. 2000;188(8):543-546.

9. Thompson MP, Ho CH, Kingree JB. Prospective associations between delinquency and suicidal behaviors in a nationally representative sample. *J Adolesc Health*. 2007;40(3):232-237.

10. Rasic DT, Belik SL, Elias B, Katz LY, Enns M, Sareen J; Swampy Cree Suicide Prevention Team. Spirituality, religion and suicidal behavior in a nationally representative sample. *J Affect Disord*. 2009;114(1-3):32-40.

11. Spoerri A, Zwahlen M, Bopp M, Gutzwiller F, Egger M; Swiss National Cohort Study. Religion and assisted and non-assisted suicide in Switzerland: national cohort study. *Int J Epidemiol*. 2010;39(6):1486-1494.

12. Dervic K, Oquendo MA, Grunebaum MF, Ellis S, Burke AK, Mann JJ. Religious affiliation and suicide attempt. *Am J Psychiatry*. 2004;161(12):2303-2308.

13. Wray M, Colen C, Pescosolido B. The sociology of suicide. *Annu Rev Sociol*. 2011;37:505-528. doi:10.1146/annurev-soc-081309-150058.

14. Kleiman EM, Liu RT. Prospective prediction of suicide in a nationally representative sample: religious service attendance as a protective factor. *Br J Psychiatry*. 2014;204:262-266.

15. Harris EC, Barraclough B. Suicide as an outcome for mental disorders: a meta-analysis. *Br J Psychiatry*. 1997;170:205-228.

16. Maselko J, Hayward RD, Hanlon A, Buka S, Meador K. Religious service attendance and major depression: a case of reverse causality? *Am J Epidemiol*. 2012;175(6):576-583.

17. Colditz GA, Hankinson SE. The Nurses' Health Study: lifestyle and health among women. *Nat Rev Cancer*. 2005;5(5):388-396.

18. 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(2):186-204.

19. Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *Am J Prev Med*. 1994;10(2):77-84.

20. Hosmer DW, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. 3rd ed. Hoboken, NJ: Wiley; 2013.

21. VanderWeele T. *Explanation in Causal Inference: Methods for Mediation and Interaction*. New York, NY: Oxford University Press; 2015.

22. MacKinnon DP. *Introduction to Statistical Mediation Analysis*. New York, NY: Lawrence Erlbaum Associates; 2008.

23. Ding P, VanderWeele TJ. Sensitivity analysis without assumptions. *Epidemiology*. 2016;27(3):368-377.

24. VanderWeele TJ. Unmeasured confounding and hazard scales: sensitivity analysis for total, direct, and indirect effects. *Eur J Epidemiol*. 2013;28(2):113-117.

25. Tsai AC, Lucas M, Kawachi I. Association between social integration and suicide among women in the United States. *JAMA Psychiatry*. 2015;72(10):987-993.

26. Tsai AC, Lucas M, Sania A, Kim D, Kawachi I. Social integration and suicide mortality among men: 24-year cohort study of US health professionals. *Ann Intern Med*. 2014;161(2):85-95.

27. Oquendo MA, Dragatsi D, Harkavy-Friedman J, et al. Protective factors against suicidal behavior in Latinos. *J Nerv Ment Dis*. 2005;193(7):438-443.

28. Aquinas T. *Summa Theologica: Ad Manuscriptos Codices a Francisco Garcia, Gregorio Donato, Lovaniensibus ac Duacensibus Theologis, Joanne Nicolai ac Thoma Madalena Diligentissime Collata, Variis Indicibus Aucta. Lutetiæ Parisiorum*. 1859.

29. Catholic Church. *Catechism of the Catholic Church*. 2nd Ed. Chicago, IL: Libreria Editrice Vaticana Loyola University Press; 2000.

30. Selvin HC. *Durkheim's Suicide: Further Thoughts on a Methodological Classic*. In:Nisbet RA. *Émile Durkheim*. Westport, CT: Greenwood Press; 1965:113-136.

31. Hayward R, Elliott M. Cross-national analysis of the influence of cultural norms and government restrictions on the relationship between religion and well-being. *Rev Relig Res*. 2014;56(1):23-43. doi:10.1007/s13644-013-0135-0.

32. Taylor RJ, Chatters LM, Joe S. Religious involvement and suicidal behavior among African Americans and black Caribbeans. *J Nerv Ment Dis*. 2011;199(7):478-486.

33. Chatters LM, Taylor RJ, Lincoln KD, Nguyen A, Joe S. Church-based social support and suicidality among African Americans and black Caribbeans. *Arch Suicide Res*. 2011;15(4):337-353.

34. Kessler RC, Berglund P, Borges G, Nock M, Wang PS. Trends in suicide ideation, plans, gestures, and attempts in the United States, 1990-1992 to 2001-2003. *JAMA*. 2005;293(20): 2487-2495.

35. Nock MK, Borges G, Bromet EJ, et al. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *Br J Psychiatry*. 2008;192(2):98-105.

36. Van Poppel F, Day LH. A test of Durkheim's theory of suicide—without committing the "ecological fallacy." *Am Sociol Rev*. 1996;61(3):500-507.