



Original Contribution

Associations of Religious Upbringing With Subsequent Health and Well-Being From Adolescence to Young Adulthood: An Outcome-Wide Analysis

Ying Chen and Tyler J. VanderWeele*

* Correspondence to Dr. Tyler J. VanderWeele, Department of Epidemiology, Harvard T. H. Chan School of Public Health, Kresge Building, 677 Huntington Avenue, Boston, MA 02115 (e-mail: tvanderw@hsph.harvard.edu).

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In the present study, we prospectively examined the associations of religious involvement in adolescence (including religious service attendance and prayer or meditation) with a wide array of psychological well-being, mental health, health behavior, physical health, and character strength outcomes in young adulthood. Longitudinal data from the Growing Up Today Study were analyzed using generalized estimating equations. Sample sizes ranged from 5,681 to 7,458, depending on outcome; the mean baseline age was 14.74 years, and there were 8–14 years of follow-up (1999 to either 2007, 2010, or 2013). Bonferroni correction was used to correct for multiple testing. All models were controlled for sociodemographic characteristics, maternal health, and prior values of the outcome variables whenever data were available. Compared with no attendance, at least weekly attendance of religious services was associated with greater life satisfaction and positive affect, a number of character strengths, lower probabilities of marijuana use and early sexual initiation, and fewer lifetime sexual partners. Analyses of prayer or meditation yielded similar results. Although decisions about religion are not shaped principally by health, encouraging service attendance and private practices in adolescents who already hold religious beliefs may be meaningful avenues of development and support, possibly leading to better health and well-being.

health; lifecourse; outcome-wide analysis; prayer or meditation; religious service attendance; religious upbringing; well-being

Abbreviations: GUTS, Growing Up Today Study; NHSII, Nurses' Health Study II; STI, sexually transmitted infection.

America is highly religious (1, 2). Religious beliefs and practices are likely shaped by a number of factors, the most prominent of which may be religious upbringing in early life (3, 4). It is a common practice for parents to raise their children based on their own religious beliefs (5). There has, however, been a continuing decline in religiosity for decades, for the most part due to lower rates in younger generations (6, 7). Despite the general trends of declining religious participation, there is still considerable intergenerational religious continuity in the United States (4). For instance, recent estimates of the rates of intergenerational transmission of religious affiliation were 82% in Jews, 85% in Muslims, 62% in Evangelical Protestants, and 43% in Catholics, and 59% of parents who attended religious services at least weekly had children who reported frequent service attendance (4).

Empirical research suggests that religion is associated with better health and well-being in adults (8). For instance, there

is a gradient relationship between frequent religious service attendance and lower mortality risk, even in the most rigorous studies (9–14). In other studies, religious involvement has also been linked to a wide range of other outcomes, such as greater psychological well-being, character strengths, reduced mental illness, and healthier behaviors (8, 15, 16). Religious teachings often concern practices related to living a healthy lifestyle and also sometimes explicitly consider character or respect for the body as an integral part of the beliefs (15).

Individuals engage in religion in a variety of ways, such as public participation, religious affiliation and identity, private practices, and religious coping (15). There have only been a limited number of studies in which investigators have compared the health associations of multiple forms of religious participation within the same study. Results from studies in adults generally suggest that religious attendance shows the strongest health associations in community samples, whereas

religious coping is a prominent predictor for recovery and survival in clinically ill populations (13, 15, 17).

To date, prior studies have mostly been conducted in adults. However, research has increasingly suggested that religion may confer lifecourse influences and that religion may have even more profound health effects at younger ages (18, 19). Existing evidence in adolescents suggests that religious involvement may protect against certain behaviors and promote positive practices (20–23). These studies are, however, subject to certain limitations. Specifically, much of the prior work is cross-sectional. There is often limited control for baseline characteristics, and reverse causation often cannot be ruled out. For example, an observed inverse association between service attendance and depression may be confounded by prior depression status, because depression may affect subsequent service attendance (24). In addition, different aspects of religious involvement are often examined in separate studies and a limited number of outcomes are investigated, so that existing evidence remains scattered across studies. It may be important to examine multiple health and well-being outcomes simultaneously within the same study (25, 26).

To provide additional insights into the role of religious upbringing, we used an outcome-wide analytic approach (26) to prospectively examine the associations of religious involvement in adolescence with a wide array of psychological, mental, behavioral, physical health, and character strengths outcomes in young adulthood. The 2 aspects of religious participation that were examined were frequency of religious service attendance (a form of public participation) and frequency of prayer or meditation (a form of private practice). The independent associations of service attendance and prayer or meditation across outcomes were also examined in a secondary analysis. We hypothesized that both frequent service attendance and prayer or meditation are each associated with greater psychological, mental, behavioral, and physical health and character strengths outcomes. Drawing upon prior literature in adults (13, 15, 17), we expected that service attendance would have stronger associations with various outcomes than would prayer or meditation.

METHODS

We used longitudinal data from the Nurses' Health Study II (NHSII) and the Growing Up Today Study (GUTS). NHSII was initiated in 1989, and it enrolled 116,430 nurses aged 25–42 years. In 1996, NHSII participants with children between 9 and 14 years of age were invited to have their children participate in another cohort of GUTS. A total of 16,882 children completed the questionnaires about their health. NHSII and GUTS participants continue to be followed up with mailed or Web-based questionnaires annually or biennially (27, 28). This study was approved by the Brigham and Women's Hospital Institutional Review Boards.

Religious participation was first assessed in the GUTS 1999 questionnaire wave; therefore, this year was considered as baseline for the present study. The outcome variables were assessed in the most recent waves, either the 2010 wave (for participants aged 23–30 years) or the 2013 or 2007 wave (if data were not available

in the 2010 wave). Of respondents to the 1999 questionnaire ($n = 12,410$), those with missing data on the exposure ($n = 1,597$ on religious service attendance and $n = 1,621$ on prayer or meditation) or the outcome variable (n ranged from 3,355 to 5,124 for analyses on service attendance and from 3,341 to 5,108 for analyses on prayer or meditation, depending on the outcome) were removed from each analysis involving those variables. Missing data on the covariates were imputed from the previous questionnaire year; if no such data were available, the mean values (for continuous variables) or values of the largest category (for categorical variables) of the nonmissing data were used for imputation. This yielded samples of 5,689–7,458 individuals (up to 1,329 were siblings) for analyses on service attendance and 5,681–7,448 individuals (up to 1,325 were siblings) for analyses on prayer or meditation, depending on the outcome. Compared with participants who were lost to follow-up in the 2010 questionnaire wave, those who remained in the cohort were older and healthier, had a higher socioeconomic status, and were more likely to report frequent religious participation at baseline; in addition, a higher percentage was female (Web Table 1, available at <https://academic.oup.com/aje>).

Web Table 2 shows the timing of the assessment of all variables. The exposure variables (service attendance and prayer or meditation) were assessed in the GUTS 1999 questionnaire wave (participants aged 12–19 years). To reduce the possibility of reverse causation, prior values of the outcome variables assessed in wave 1998 or 1999 were used as a covariate whenever available.

Exposure assessment

Religious service attendance. Frequency of religious service attendance (1999 wave) was measured using the question, “How often do you go to religious meetings or services?” Response options ranged from 1 (never) to 5 (more than once per week). Responses were grouped into 3 categories: never, less than once per week, and at least once per week (29).

Prayer or meditation. Frequency of prayer or meditation (1999 wave) was assessed with the question, “How often do you pray or meditate?” Response categories ranged from 1 (never) to 4 (once per day or more).

Outcome assessment

A wide array of psychological well-being (life satisfaction, positive affect, self-esteem, emotional processing, and emotional expression), character strengths (frequency of volunteering, sense of mission, forgiveness of others, and being registered to vote), physical health (number of physical health problems and overweight/obesity), mental health (depression, anxiety, and probable posttraumatic stress disorder), and health behavioral (cigarette smoking, frequent binge drinking, marijuana use, other illicit drug use, prescription drug misuse, number of lifetime sexual partners, early sexual initiation, history of sexually transmitted Infections (STIs), teen pregnancy, abnormal Pap test results) outcomes were assessed (waves 2010, 2013, or 2007). See Web Table 3 and the Web Appendix for details on each measurement.

Covariates assessment

Sociodemographic characteristics. Sociodemographic covariates included participant age (in years), sex (female or male), race (white or nonwhite), and geographic region (West, Midwest, South, or Northeast) (GUTS 1999). Maternal covariates included maternal age (in years; NHSII 1999), race (white or nonwhite; NHSII 1999), marital status (NHSII 1997), subjective socioeconomic status in the United States and in the community (both rated on a scale from 1 to 10), and pretax household income (<\$50,000, \$50,000–\$74,999, \$75,000–\$99,999, or ≥\$100,000; NHSII 2001). We also considered census-tract college education rate (used as a continuous variable) and median income (<\$50,000, \$50,000–\$74,999, \$75,000–\$99,999, or ≥\$100,000; NHSII 2001).

Maternal depression. The 5-item Mental Health Index (30) was used to measure maternal depressive symptoms over the past 4 weeks (NHSII 1997). As in prior work, a score less than 53 was considered to be an indicator of probable depression (31).

Maternal smoking. The mothers also reported their current smoking status (NHSII 1997). The response categories were yes and no.

Prior values of the outcome variables. To reduce the possibility of reverse causation, we adjusted for prior values of the outcome variables whenever data were available. Specifically, adjustments were made for prior depressive symptoms, weight status, smoking, drinking, marijuana use, other drug use, prescription drug misuse, number of lifetime sexual partners, history of early sexual initiation, history of STIs, and history of pregnancy (GUTS 1998 or 1999).

Statistical analyses

All statistical analyses were performed using SAS, version 9.4 (SAS Institute, Inc., Cary, North Carolina) (*P* values were calculated based on 2-sided tests). Distributions of participant characteristics in the full analytic samples were first examined. Next, χ^2 test and analysis of variance test were used to examine the associations of service attendance and prayer or meditation with covariates separately.

In primary analyses, multiple generalized estimating equations were first used to regress each health and well-being outcome on religious service attendance in separate models, with adjustment for clustering by sibling status. Continuous outcomes were standardized (mean = 0, standard deviation, 1) to facilitate comparison of effect estimates across outcomes. Bonferroni correction was used to correct for multiple testing. For all analyses, we adjusted for sociodemographic characteristics, maternal health, and prior values of the outcome variables whenever available. Next, we reanalyzed the primary sets of models with prayer or meditation as the exposure. Lastly, we included service attendance and prayer or meditation simultaneously in the models to examine their independent associations across outcomes.

Sensitivity analyses were performed to assess the robustness of the observed associations to unmeasured confounding (32, 33). Specifically, we calculated E-values (33), which indicate the minimum strength of association that an unmeasured confounder would need to have with both the exposure and the outcome on the risk ratio scale to fully account for an

observed exposure-outcome association, above and beyond the measured covariates.

RESULTS

Descriptive analyses

In the full analytic sample, participants were predominantly white, a higher percentage was female, and most had a high family socioeconomic status (Web Tables 4 and 5). The mean baseline age was 14.74 (standard deviation, 1.66) years. Nearly 60% of the participants attended religious services at least weekly, and 36% reported prayer or meditation at least once per day. Participant characteristics by frequency of service attendance are shown in Table 1, and characteristics by frequency of prayer or meditation are shown in Web Table 6.

Religious service attendance, health, and well-being

Compared with never attendance, at least weekly service attendance was subsequently associated with greater life satisfaction and positive affect, greater volunteering, greater sense of mission, more forgiveness, and lower probabilities of drug use and early sexual initiation (Table 2). It was also possibly associated with fewer depressive symptoms and lower probabilities of probable posttraumatic stress disorder, cigarette smoking, prescription drug misuse, history of STIs, and abnormal Pap test results, although the associations did not reach $P < 0.05$ after correction for multiple testing. In comparison, there was little difference between less than weekly and never attendance of services except for in the character outcomes.

When service attendance and prayer or meditation were simultaneously included in the model, the associations of service attendance with outcomes were mostly attenuated (Web Table 7), which may be due to the correlation between service attendance and prayer or meditation ($r = 0.60$). Nevertheless, the associations of service attendance with volunteering, forgiveness, marijuana use, early sexual initiation, and the number of lifetime sexual partners remained at the level $P < 0.05$ even after correction for multiple testing.

Prayer or meditation, health, and well-being

Compared with never praying or meditating, at least daily practice was associated with greater positive affect, emotional processing, and emotional expression; greater volunteering, greater sense of mission, and more forgiveness; lower likelihoods of drug use, early sexual initiation, STIs, and abnormal Pap test results; and fewer lifetime sexual partners (Table 3). It was also possibly associated with greater life satisfaction and self-esteem, greater likelihood of being registered to vote, fewer depressive symptoms, and a lower risk of cigarette smoking, although the associations did not reach a level of $P < 0.05$ after correction for multiple testing. Somewhat unexpectedly, compared with never praying or meditating, at least daily practice was possibly associated with more, rather than fewer, physical health problems. A comparison of less than daily praying or meditating with never showed little difference, with only a few exceptions. For example, prayer or meditation was positively associated with volunteering, sense of mission, and forgiveness

Table 1. Distribution of Participant Characteristics by Frequency of Religious Service Attendance at Study Baseline ($n = 10,813$), Growing Up Today Study, 1999

Participant Characteristic	Frequency of Religious Service Attendance ^a						P Value
	Never ($n = 1,703$)		Less Than Once per Week ($n = 2,922$)		At Least Once per Week ($n = 6,188$)		
	%	Mean (SD)	%	Mean (SD)	%	Mean (SD)	
Sociodemographic factors							
Age, years ^b		15.03 (1.66)		14.94 (1.67)		14.56 (1.64)	<0.001
Male sex	44.86		40.97		40.16		0.002
White race	90.04		93.69		94.07		<0.001
Geographic region							
West	27.97		15.31		11.34		<0.001
Midwest	27.44		32.43		39.23		
South	9.25		13.15		16.47		
Northeast	35.34		39.11		32.97		
Mother's age, years ^b		44.91 (3.62)		44.37 (3.53)		43.81 (3.52)	<0.001
Mother's race (white)	95.42		97.53		97.72		<0.001
Mother married	87.61		89.32		94.88		<0.001
Mother's subjective SES in the United States ^b		7.15 (1.35)		7.13 (1.32)		7.14 (1.28)	0.90
Mother's subjective SES in the community ^b		6.87 (1.61)		6.98 (1.56)		7.08 (1.53)	<0.001
Pretax household income							
<\$50,000	11.74		12.67		13.67		<0.001
\$50,000–\$74,999	23.40		21.97		24.83		
\$75,000–\$99,999	20.73		21.43		23.60		
≥\$100,000	44.13		43.94		37.90		
Census tract college education rate, ^b %		33.45 (16.77)		32.81 (16.40)		30.33 (15.81)	<0.001
Census tract median income							
<\$50,000	22.91		23.44		28.18		<0.001
\$50,000–\$74,999	45.53		46.34		48.03		
\$75,000–\$99,999	22.39		22.93		18.29		
≥\$100,000	9.17		7.29		5.49		
Maternal health							
Maternal depression	11.14		12.14		9.21		<0.001
Maternal current smoking	9.87		9.31		5.37		<0.001
Prior health status or prior health behaviors							
Prior depressive symptoms ^b		1.26 (0.62)		1.24 (0.58)		1.16 (0.57)	<0.001
Prior overweight or obesity	21.09		19.18		19.68		0.30
Prior cigarette smoking	24.85		22.59		12.70		<0.001
Prior alcohol drinking	13.79		12.16		4.97		<0.001
Prior marijuana use	21.97		17.46		7.03		<0.001
Prior drug use other than marijuana	8.93		5.50		2.40		<0.001
Prior prescription drug misuse	8.83		8.36		5.30		<0.001
Prior number of lifetime sexual partners ^b		0.40 (1.10)		0.27 (0.89)		0.10 (0.55)	<0.001
Prior history of early sexual initiation	11.86		8.02		3.24		<0.001
Prior history of sexually transmitted infections	0.62		0.40		0.05		<0.001
Prior history of teen pregnancy	0.75		0.61		0.26		0.006

Abbreviations: SD, standard deviation; SES, socioeconomic status.

^a Analysis of variance or χ^2 tests were used to examine the mean (SD) levels of the characteristic or proportion of individuals within each religious service attendance category with that characteristic.

^b Ranges of the participant characteristics were as follows: age, 12–19 years; mother's age, 35–54 years; mother's subjective SES in the United States, 1–10; mother's subjective SES in the community, 1–10; census tract college education rate, 0%–85%; prior depressive symptoms, 0–4; and prior number of lifetime sexual partners, 0–6.

Table 2. Religious Service Attendance in Adolescence and Health and Well-Being in Young Adulthood ($n = 5,689-7,458^a$), Growing Up Today Study, 1999 to 2007, 2010, or 2013

Health and Well-Being Outcome	Religious Service Attendance Comparison							
	Less Than Once per Week vs. Never				At Least Once per Week vs. Never			
	RR ^b	β^c	95% CI	P Value Threshold	RR ^b	β^c	95% CI	P Value Threshold
Psychological well-being								
Life satisfaction		0.04	-0.05, 0.12		0.13	0.05, 0.21		<0.0019 ^d
Positive affect		0.09	0.01, 0.17	<0.05	0.18	0.10, 0.25		<0.0019 ^d
Self-esteem		0.05	-0.03, 0.12		0.07	-0.00, 0.14		
Emotional processing		0.04	-0.04, 0.12		0.03	-0.05, 0.10		
Emotional expression		0.04	-0.04, 0.12		0.04	-0.03, 0.12		
Character strengths								
Frequency of volunteering		0.13	0.06, 0.20	<0.0019 ^d	0.28	0.21, 0.35		<0.0019 ^d
Sense of mission		0.11	0.03, 0.19	<0.01	0.28	0.20, 0.35		<0.0019 ^d
Forgiveness of others		0.33	0.24, 0.41	<0.0019 ^d	0.69	0.61, 0.77		<0.0019 ^d
Registered to vote	1.04		1.01, 1.07	<0.01	1.03		1.01, 1.06	<0.05
Physical health								
No. of physical health problems		0.10	0.02, 0.18	<0.05	0.02	-0.05, 0.09		
Overweight/obesity	0.98		0.89, 1.08		1.01		0.92, 1.10	
Mental health								
Depressive symptoms		-0.03	-0.11, 0.05		-0.12	-0.19, -0.04		<0.01
Depression diagnosis	0.90		0.76, 1.06		0.87		0.75, 1.01	
Anxiety symptoms		0.03	-0.05, 0.11		-0.04	-0.11, 0.04		
Anxiety diagnosis	1.01		0.84, 1.22		0.89		0.75, 1.07	
Probable PTSD	0.87		0.67, 1.13		0.72		0.57, 0.93	<0.01
Health behaviors								
Cigarette smoking	0.99		0.88, 1.11		0.85		0.76, 0.96	<0.01
Frequent binge drinking	1.05		0.95, 1.17		0.97		0.87, 1.07	
Marijuana use	0.99		0.93, 1.04		0.83		0.78, 0.88	<0.0019 ^d
Any other illicit drug use	0.92		0.75, 1.13		0.67		0.55, 0.81	<0.0019 ^d
Prescription drug misuse	1.02		0.90, 1.15		0.84		0.74, 0.95	<0.01
Number of lifetime sexual partners		-0.02	-0.09, 0.04		-0.28	-0.34, -0.21		<0.0019 ^d
Early sexual initiation	0.91		0.78, 1.06		0.65		0.55, 0.77	<0.0019 ^d
History of STIs	0.99		0.82, 1.20		0.79		0.66, 0.95	<0.05
Teen pregnancy	0.81		0.47, 1.37		0.76		0.45, 1.28	
Abnormal Pap test results	0.87		0.75, 1.02		0.82		0.71, 0.95	<0.01

Abbreviations: CI, confidence interval; PTSD, posttraumatic stress disorder; RR, risk ratio; STIs, sexually transmitted infections.

^a The full analytic sample was restricted to those who had valid data on religious service attendance. The actual sample size for each analysis varied depending on the number of missing values for each outcome under investigation. Missing data on the covariates were imputed from previous questionnaire years; if no such data were available, missing data were imputed as the mean values (continuous variables) or values of the largest category (categorical variables) of the nonmissing data. All models were controlled for participants' age, race, sex, geographic region, and prior health status or prior health behaviors (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, number of sexual partners, early sexual initiation, history of sexually transmitted infections, history of teen pregnancy), as well as their mother's age, race, marital status, socioeconomic status (subjective socioeconomic status, household income, census tract college education rate, and census tract median income), depression, and smoking.

^b The effect estimates for the outcomes of probable PTSD, any other illicit drug use, and teen pregnancy were odds ratios; these outcomes were rare (prevalence <10%), so the odds ratios would approximate the RRs. The effect estimates for other dichotomized outcomes were RRs.

^c All continuous outcomes were standardized (mean = 0, standard deviation, 1), and β was the standardized effect size.

^d $P < 0.05$ after Bonferroni correction (the P value cutoff for Bonferroni correction = $0.05/26$ outcomes = 0.0019).

in a monotonic fashion; compared with never praying or meditating, doing so 1–6 times per week was related to greater emotional expression, fewer depressive symptoms, and fewer sexual

partners. When prayer or meditation and service attendance were simultaneously included in the model, the associations of at least daily versus never praying or meditating with emotional

Table 3. Prayer or Meditation in Adolescence and Health and Well-Being in Young Adulthood ($n = 5,689-7,448^a$), Growing Up Today Study, 1999 to 2007, 2010, or 2013

Health and Well-Being Outcome	Prayer or Meditation Comparison											
	Less Than Once per Week vs. Never				1–6 Times per Week vs. Never				Once per Day or More vs. Never			
	RR ^b	β^c	95% CI	P Value Threshold	RR ^b	β^c	95% CI	P Value Threshold	RR ^b	β^c	95% CI	P Value Threshold
Psychological well-being												
Life satisfaction		0.05	-0.04, 0.13		0.10	0.02, 0.17	<0.05		0.12	0.04, 0.20	<0.01	
Positive affect		0.07	-0.01, 0.15		0.11	0.04, 0.18	<0.01		0.16	0.08, 0.23	<0.0019 ^d	
Self-esteem		0.01	-0.07, 0.09		0.10	0.02, 0.18	<0.05		0.08	0.00, 0.15	<0.05	
Emotional processing		0.03	-0.05, 0.12		0.10	0.02, 0.18	<0.05		0.13	0.06, 0.21	<0.0019 ^d	
Emotional expression		0.08	0.00, 0.17	<0.05	0.13	0.06, 0.21	<0.0019 ^d		0.15	0.07, 0.22	<0.0019 ^d	
Character strengths												
Frequency of volunteering		0.14	0.07, 0.22	<0.0019 ^d	0.27	0.20, 0.34	<0.0019 ^d		0.36	0.29, 0.43	<0.0019 ^d	
Sense of mission		0.14	0.05, 0.22	<0.0019 ^d	0.21	0.13, 0.28	<0.0019 ^d		0.43	0.36, 0.51	<0.0019 ^d	
Forgiveness of others		0.37	0.29, 0.46	<0.0019 ^d	0.60	0.52, 0.68	<0.0019 ^d		0.83	0.75, 0.91	<0.0019 ^d	
Registered to vote	1.01		0.99, 1.04		1.01		0.99, 1.04		1.03		1.00, 1.05	<0.05
Physical health												
Number of physical health problems		0.10	0.02, 0.18	<0.05	0.02	-0.05, 0.10			0.08	0.01, 0.15	<0.05	
Overweight/obesity	1.02		0.92, 1.13		0.99		0.90, 1.10		1.00		0.91, 1.10	
Mental health												
Depressive symptoms		-0.07	-0.16, 0.01		-0.15	-0.22, -0.07	<0.0019 ^d		-0.09	-0.16, -0.01	<0.05	
Depression diagnosis	0.93		0.78, 1.10		0.95		0.80, 1.12		0.88		0.74, 1.03	
Anxiety symptoms		0.02	-0.06, 0.10		0.00	-0.08, 0.07			0.04	-0.03, 0.11		
Anxiety diagnosis	1.00		0.82, 1.23		1.00		0.82, 1.21		0.96		0.79, 1.16	
Probable PTSD	0.72		0.53, 0.97	<0.05	0.93		0.72, 1.21		0.94		0.73, 1.22	

Table continues

processing, emotional expression, volunteering, sense of mission, forgiveness, drug use, number of sexual partners, and history of STIs still held (Web Table 7); associations were attenuated, though some remained, when instead controlling for young adult, rather than adolescent, service attendance (Web Table 8).

Sensitivity analyses for unmeasured confounding

To assess the robustness of the observed associations to unmeasured confounding, we calculated E-values (33) for the associations of religious service attendance (at least weekly vs. never) and prayer or meditation (at least daily vs. never) with various outcomes (Table 4). In the present study, there is evidence suggesting that some of the observed associations were likely robust to unmeasured confounding. This is especially true with the character outcomes, drug use, and sexual behaviors. For example, as noted in Table 4, an unmeasured

confounder would need to be associated with both service attendance and volunteering by risk ratios of 1.90 each to fully explain away the observed association of at least weekly (vs. never) attendance of services with volunteering and by 1.72-fold each to shift the lower confidence limit for the estimate to include the null value, above and beyond the measured covariates.

DISCUSSION

There is growing interest in promoting protective factors that lead to better health, beyond the traditional approach that focuses on reducing risk factors for diseases (34). Once risk factors are established, it can be difficult to restore a healthy state. It may be more effective to promote and maintain health and well-being starting in early life (35). Results from the present study suggest that religious involvement in adolescence may

Table 3. Continued

Health and Well-Being Outcome	Prayer or Meditation Comparison											
	Less Than Once per Week vs. Never				1–6 Times per Week vs. Never				Once per Day or More vs. Never			
	RR ^b	β^c	95% CI	P Value Threshold	RR ^b	β^c	95% CI	P Value Threshold	RR ^b	β^c	95% CI	P Value Threshold
Health behaviors												
Cigarette smoking	0.98		0.86, 1.11		0.99		0.88, 1.12		0.89		0.78, 1.00	<0.05
Frequent binge drinking	0.97		0.87, 1.09		1.00		0.90, 1.10		0.91		0.82, 1.01	
Marijuana use	0.99		0.93, 1.05		0.92		0.87, 0.97	<0.01	0.75		0.71, 0.80	<0.0019 ^d
Any other illicit drug use	0.91		0.74, 1.12		0.75		0.62, 0.92	<0.01	0.56		0.46, 0.69	<0.0019 ^d
Prescription drug misuse	0.90		0.79, 1.02		0.88		0.78, 0.99	<0.05	0.72		0.64, 0.82	<0.0019 ^d
Number of lifetime sexual partners		-0.05	-0.12, 0.02			-0.13	-0.20, -0.07	<0.0019 ^d		-0.40	-0.46, -0.34	<0.0019 ^d
Early sexual initiation	1.05		0.89, 1.24		0.84		0.71, 1.00		0.70		0.59, 0.84	<0.0019 ^d
History of STIs	0.90		0.68, 1.18		0.83		0.64, 1.08		0.60		0.47, 0.78	<0.0019 ^d
Teen pregnancy	0.87		0.50, 1.52		0.64		0.36, 1.15		0.88		0.52, 1.48	
Abnormal Pap test results	0.82		0.70, 0.98	<0.05	0.95		0.81, 1.11		0.74		0.63, 0.88	<0.0019 ^d

Abbreviations: CI, confidence interval; PTSD, posttraumatic stress disorder; RR, risk ratio; STIs, sexually transmitted infections.

^a The full analytic sample was restricted to those who had valid data on frequency of prayer or meditation. The actual sample size for each analysis varied depending on the number of missing values for each outcome under investigation. Missing data on the covariates were imputed from previous questionnaire years; if no such data were available, missing were imputed as the mean values (continuous variables) or values of the largest category (categorical variables) of the nonmissing data. All models were controlled for participants' age, race, sex, geographic region, and prior health status or prior health behaviors (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, number of sexual partners, early sexual initiation, history of sexually transmitted infections, history of teen pregnancy), as well as their mother's age, race, marital status, socioeconomic status (subjective socioeconomic status, household income, census tract college education rate, and census tract median income), depression, and smoking.

^b The effect estimates for the outcomes of probable PTSD, any other illicit drug use, and teen pregnancy were odds ratios; these outcomes were rare (prevalence <10%), so the odds ratios would approximate the RRs. The effect estimates for other dichotomized outcomes were RRs.

^c All continuous outcomes were standardized (mean = 0, standard deviation, 1), and β was the standardized effect size.

^d $P < 0.05$ after Bonferroni correction (the P value cutoff for Bonferroni correction = $0.05/26$ outcomes = 0.0019).

be one such protective factor for a range of health and well-being outcomes (20).

Consistent with prior literature, our results suggest associations of frequent religious participation in adolescence with greater subsequent psychological well-being, character strengths, and lower risks of mental illness and several health behaviors (36–38). For instance, congruent with prior meta-analyses of mostly cross-sectional adolescent studies on religion and health behaviors (37, 38), we found reduced probabilities of drug use and several sexual behaviors among religiously observant adolescents. Also, consistent with results from a prior meta-analysis of religion and forgiveness (39), we found a positive association of religious involvement with forgiveness in early life. Likewise, the effect size between religious involvement and depressive symptoms in the present study is similar to that from a meta-analysis ($\beta = -0.09$, 95% confidence interval: $-0.11, -0.08$) in which investigators integrated evidence across ages (40). In our study, there was little association between religious involvement and anxiety, which is in fact consistent with results from other prior longitudinal studies of adult populations (15) and contrasts with results from cross-sectional studies (16). Our study adds to prior literature by providing evidence from longitudinal data with

confounding control and also control for baseline values of the outcome variables.

Contrary to our expectation, our results suggest that frequent prayer or meditation may be associated with more physical health problems. To our knowledge, the association between religion and adolescent physical health has not been well-studied; we are not aware of any prior longitudinal work in this area using community samples of adolescents (41). There is, however, evidence from clinical populations that individuals with chronic conditions are more likely to use private religious practices to cope with illness (41, 42). Because of the lack of available data, we did not control for baseline physical health. The inverse association between prayer or meditation and physical health in the present study may in part be due to reverse causation. Those who already have physical health problems may be more likely to pray. It is also conceivable that those with religious beliefs may sometimes avoid medical care because of these beliefs or potentially thinking that the prayer will suffice for healing.

Service attendance is generally the strongest religious/spiritual predictor of health in nonclinical adult samples (8, 13, 17, 36). In contrast, we found that compared with service attendance, prayer

Table 4. Robustness to Unmeasured Confounding (E-Values^a) for Assessing the Causal Associations Between Religious Upbringing in Adolescence and Health and Well-Being in Young Adulthood ($n = 5,681-7,458^a$), Growing Up Today Study, 2007, 2010, or 2013

Health and Well-Being Outcome	Religious Service Attendance		Prayer or Meditation	
	For Effect Estimate ^b	For CI Limit ^c	For Effect Estimate ^b	For CI Limit ^c
Life satisfaction	1.50	1.28	1.47	1.25
Positive affect	1.64	1.44	1.58	1.38
Self-esteem	1.33	1.00	1.36	1.07
Emotional processing	1.20	1.00	1.50	1.28
Emotional expression	1.23	1.00	1.56	1.35
Frequency of volunteering	1.90	1.72	2.12	1.93
Sense of mission	1.90	1.71	2.32	2.11
Forgiveness of others	3.15	2.88	3.68	3.37
Registered to vote	1.21	1.11	1.21	1.08
Number of physical health problems	1.16	1.00	1.36	1.10
Overweight/obesity	1.11	1.00	1.00	1.00
Depressive symptoms	1.47	1.25	1.39	1.13
Depression diagnosis	1.56	1.00	1.53	1.00
Anxiety symptoms	1.23	1.00	1.23	1.00
Anxiety diagnosis	1.50	1.00	1.25	1.00
Probable posttraumatic stress disorder	2.12	1.36	1.32	1.00
Cigarette smoking	1.63	1.25	1.50	1.03
Binge drinking	1.21	1.00	1.43	1.00
Marijuana use	1.70	1.53	2.00	1.81
Any other illicit drug use	2.35	1.77	2.97	2.26
Prescription drug misuse	1.67	1.29	2.12	1.74
Number of lifetime sexual partners	1.90	1.73	2.23	2.06
Early sexual initiation	2.45	1.92	2.21	1.67
History of sexually transmitted infections	1.85	1.29	2.72	1.88
Teen pregnancy	1.96	1.00	1.53	1.00
Abnormal Pap test	1.74	1.29	2.04	1.53

Abbreviation: CI, confidence interval.

^a See VanderWeele and Ding (33) for the formula for calculating E-values.

^b The E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to fully explain away the observed associations of religious service attendance (at least weekly vs. never) and prayer or meditation (at least daily vs. never) with various health outcomes as shown in the last column of Tables 2 and 3, conditional on the measured covariates. For example, an unmeasured confounder would need to be associated with both religious service attendance and forgiveness of others by risk ratios of 3.15 each, above and beyond the measured covariates, to fully explain away the observed association between at least weekly religious service attendance and forgiveness of others.

^c The E-values for the limit of the 95% CI closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to shift the confidence interval to include the null value, conditional on the measured covariates. For example, an unmeasured confounder would need to be associated with both religious service attendance and forgiveness of others by 2.88-fold each, above and beyond the measured covariates, to shift the lower limit of the CI for the observed association between at least weekly service attendance and forgiveness of others to include the null value.

or meditation had more robust associations with a number of outcomes, including emotional processing, emotional expression, number of physical health problems, prescription drug misuse, history of STIs, and abnormal Pap test results. The exceptions to this were for life satisfaction, positive affect, probable posttraumatic stress disorder, cigarette smoking, and early sexual initiation,

for which the associations with service attendance were stronger. In adolescent populations, service attendance may be a marker of parental service attendance patterns that may not persist into later life, whereas private religious practices may more closely correspond to their own service attendance patterns later in life (43). Adjustment of the prayer or meditation analyses for young adult

service attendance only partially attenuated the associations, perhaps suggesting some independent effect.

Adolescents are particularly vulnerable to heightened interest in pursuing thrill-seeking behaviors (18). The behavioral norms and patterns formed in this period may, in fact, exert profound influences over the lifecourse (18). For example, the initiation of smoking is more likely to occur in adolescence than in other stage of life, if it happens at all. Adolescents who have initiated smoking are also likely to continue smoking into adulthood (44). Therefore, if a resilience factor can protect adolescents from initiating smoking, it may reduce their lifetime health risk substantially (18). The present study adds to prior evidence suggesting that religious involvement in adolescence may serve as one such protective factor in not only reducing smoking but also in maintaining psychological well-being, developing character strengths, and reducing certain behaviors, as well as possibly also reducing depression. The beneficial effects of religious involvement in adolescence may function through a number of mechanisms. For instance, religion provides directives or personal virtue to help maintain self-control and develop negative attitudes toward certain behaviors (45). Some religious groups promote beliefs that create meaning and practices that foster active coping, such as practicing forgiveness and meditation, which could help youth actively cope with stress (45). Moreover, peer religious youth groups may be an important source of social support and adult role modeling, and they may be an avenue to direct peer influences on behavioral choices. Religious congregations could also connect adolescents to networks and resources in the broader community (41, 45).

The present study advances beyond prior literature in a number of ways. First, we took an outcome-wide analytic approach to provide a broad picture of the role of religious participation during adolescence in relation to a wide range of health and well-being outcomes within the same sample, which helps synthesize previously scattered evidence on individual health outcomes in separate studies. Second, the longitudinal design and the follow-up periods of 8–14 years help establish temporal ordering for assessing causality. Third, the longitudinal data along with the adjustment for baseline values of the outcome variables help reduce the possibility of reverse causation, which has been identified as a major threat to assessing causal effects of religious practice (8). The present study also used sensitivity analyses to assess the robustness of the associations to unmeasured confounding, which provides further evidence for assessing causality.

Our study is, however, subject to certain limitations. First, religious involvement was measured with 2 single items that were widely used in adults. These measures did not consider developmental characteristics of adolescents. For instance, adolescents' decisions on religious participation are likely shaped by both parents and peers. It may, therefore, be important to assess influences from both (e.g., pressure by parents to attend religious services and participation in peer religious youth groups) to facilitate understanding in a developmentally relevant framework (46). Second, the results may be subject to residual confounding by parental religiousness (e.g., parental church attendance and parental religious affiliation) for which information was not available. However, we adjusted for baseline maternal depression and smoking status, which have both been linked to religious participation and to child outcomes (16, 47). Results from the sensitivity analysis also suggest that a number of the observed

associations are relatively robust to potential unmeasured confounding. As a further limitation, GUTS participants were mostly white, and their mothers all worked in the nursing field. Therefore, results of this study may not be generalizable to other populations.

There is evidence that religion is an important social determinant of health over the lifecourse (18). Religious participation in adulthood is, in many cases, a function of religious upbringing in early life (18). Intergenerational transmission of religious values and practices occurs largely through parental modeling and is likely facilitated by close parent-child relationships (48). Although decisions about religion are not shaped principally by health, for adolescents who already hold religious beliefs, encouraging service attendance and private practices may be meaningful avenues of development and support, possibly leading to better health and well-being.

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Author affiliations: Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts (Ying Chen, Tyler J. VanderWeele); and Human Flourishing Program, Institute for Quantitative Social Science, Harvard University, Cambridge, Massachusetts (Ying Chen, Tyler J. VanderWeele).

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