Received: 7 February 2022 | Accepted: 10 October 2022

DOI: 10.1002/jad.12119

RESEARCH ARTICLE

Foundation for PSA WILEY

Religious affiliation protects against alcohol/substance use initiation: A prospective study among healthy adolescents

David H. Rosmarin[1,2] | Steven Pirutinsky[3] | Caroline C. Kaufman[1,2] | Sion K. Harris[4,5] | Jennifer T. Sneider[1,6] | Marisa M. Silveri[1,6]

[1]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts, USA

[2]Spirituality and Mental Health Program, McLean Hospital, Belmont, Massachusetts, USA

[3]Department of Social Work, Touro College, New York, New York, USA

[4]Department of Pediatrics, Harvard Medical School, Boston, Massachusetts, USA

[5]Center for Adolescent Behavioral Health Research, Boston Children's Hospital, Boston, Massachusetts, USA

[6]Neurodevelopmental Laboratory on Addictions and Mental Health, McLean Hospital, Belmont, Massachusetts, USA

Correspondence

David H. Rosmarin, PhD, ABPP, Spirituality & Mental Health Program, McLean Hospital/ Harvard Medical School, 115 Mill St, Belmont, MA 02478, USA.
Email: drosmarin@mclean.harvard.edu

Funding information

NIAAA grant R01 AA022493 (Silveri); NIAAA grant K24 AA025977 (Silveri); McLean Hospital development fund (#041537)

Abstract

Background: A substantial volume of the literature suggests that religious factors buffer against alcohol/substance use among adults, but research among adolescents is sparse. Further, few studies in this area have been prospective, and therefore it is unclear how religion may impact less alcohol/substance use among adolescents.

Method: We prospectively evaluated effects of religious affiliation on initiation of alcohol/substance use in a sample of 81 psychiatrically healthy 13–14-year-olds from New England, over a 3-year period (from November 2015 to January 2019). Known risk factors were also evaluated including anxiety, depression, and impulsivity; family history of mental illness and alcohol/substance misuse; and volume of brain regions implicated in adolescent alcohol/substance misuse (assessed by Magnetic Resonance Imaging).

Results: Religiously affiliated adolescents were significantly less likely to initiate use of alcohol/substances (hazard ratio [HR] = 0.38). The addition of family history of alcohol/substance misuse to the model increased the predictive value of religious affiliation (HR = 0.34). Other risk factors did not diminish nor increase observed effects.

Conclusions: These findings support and extend the current research by suggesting that religious affiliation protects against initiation of alcohol/substance use during early adolescence, particularly in individuals with elevated risk.

KEYWORDS

adolescence, AUD, religion, risk factors, spirituality, structural MRI, SUD

1 | INTRODUCTION

Adolescence is a critical period of risk for initiation of alcohol/substance use; multiple studies show associations between earlier age of first use and greater likelihood of developing alcohol/substance use disorders (Dawson, 2000; Infante et al., 2020; King & Chassin, 2007; Lopez-Quintero et al., 2011; Swendsen et al., 2012; Welty et al., 2017). Furthermore, adolescents are particularly prone to initiate alcohol and other substance use due to heightened mental health issues (Comeau et al., 2001; Pang et al., 2014) and greater impulsivity (Ernst et al., 2006), which commonly occur during this developmental period (Lisdahl et al., 2018). These factors can, at least partially, be explained by unique patterns of neurobiological maturation during adolescence, including the concurrent curvilinear development of subcortical regions alongside linear development of prefrontal regions (Casey et al., 2008). Along these lines, several areas of neuroanatomy are known to be implicated in adolescent alcohol and substance use, including the medial orbitofrontal cortex (mOFC), dorsal striatum (caudate, putamen), cingulate cortex, and insula (Cheetham et al., 2012, 2017). Neural and other risk factors (Kim-Spoon et al., 2019; Martz et al., 2018) for alcohol and substance use are known to be more prominent in the context of familial history of mental illness and

Steven Pirutinsky is a co-first author of this paper. The authors jointly affirm that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

alcohol/substance use disorders (Handley & Chassin, 2013; Van Loon et al., 2014), which are increasingly common today (Substance Abuse and Mental Health Services Administration, 2020). It is important to examine social factors or experiences that may help protect against initiation of alcohol and substance use among adolescents, particularly for individuals with higher risk profiles.

Religious affiliation and involvement are known to be strong protective factors against problematic use of alcohol/substances among adults (Connery & Devido, 2020; Kendler & Myers, 2009; Michalak et al., 2007); religiously involved adults appear to have 20%–30% reduced risk for alcohol or drug dependence (Kendler et al., 2003). Further, the statistical majority of adults who have recovered from an alcohol/substance use disorder have participated in interventions that have spiritual components, such as Alcoholics Anonymous (Kelly et al., 2020). While mechanisms underlying these effects remain unclear due to a lack of research, one prominent theory suggests that religion can buffer against impulsivity and sensation-seeking by accustoming religious individuals to delayed gratification and facilitating greater self-control (McCullough & Carter, 2013; McInnes Miller & Van Ness Sheppard, 2014). Research on religion and alcohol/substance use among adolescents is more limited, but a number of studies have shown inverse associations between various facets of religious life and risk-taking activities including use of alcohol and drugs (Knight et al., 2007; Miller et al., 2000; Russell et al., 2020; Sinha et al., 2007). Moreover, the majority of studies among adults–and all studies known to us among adolescents–have not utilized prospective designs. It is therefore unclear the degree to which religion is associated with lower rates of alcohol/substance use and use disorders among adolescents. Further, the extent to which religious affiliation might protect against initiation of alcohol/substance use among healthy adolescents is not known, and whether religion buffers against initiation in the context of known risk factors (e.g., mental distress, impulsivity, family history of mental disorders or alcohol/substance abuse, neural risk factors) is similarly unclear.

Over a 3-year period, the current study examined the prospective effect of having a religious affiliation at baseline on subsequent initiation of alcohol/substance use among 13- to 14-year-old adolescents who, at study start, screened negative for significant psychiatric and medical histories and had not yet used alcohol ("more than a few sips") or substances (any use at all). We also examined the effect of religious affiliation on risk of alcohol/substance use initiation in the context of known intrapsychic (e.g., anxiety, depression, impulsivity), familial (e.g., family history of alcohol/substance use disorder), and neural (e.g., brain morphometry) risk factors. Given previous research, we hypothesized that religious affiliation would provide a buffer against the initiation of alcohol/substance abuse in this sample, and that protective effects would be greater for adolescents with heightened risk.

2 | METHODS

2.1 | Participants and procedures

The study sample consisted of 81 psychiatrically healthy adolescents, recruited from New England between November 2015 and January 2019, who were alcohol and substance naïve at the start of the study (see Table 1 for baseline descriptive values of all study variables). Online social media platforms (e.g., Facebook), local flyers, and patient registries via partnership with Boston Children's Hospital, were utilized for study recruitment. To determine eligibility for the study, interested adolescents completed a computerized questionnaire via Research Electronic Data Capture (REDCap, a secure online database for administering surveys and organizing responses) (Harris et al., 2009), as well as a screening process which included collection of a medical, alcohol/drug use, and psychiatric history. A phone interview was then administered to parents/guardians to confirm medical and psychiatric history questions. Parents and adolescents provided consent and assent, respectively, before participation, and adolescents were monetarily compensated for participation. The research protocol was approved by the Massachusetts General Brigham Institutional Review Board.

At each study visit, procedures included self-report measures, structured clinical interviews, and magnetic resonance imaging (MRI). Participants were excluded from the study based on a number of criteria at the outset of the study including: Any history of or current diagnosed psychiatric illness; any history of or current alcohol/substance use (more than a "few sips" of alcohol and/or any psychoactive substance use); pregnancy; or MRI contraindications such as serious physical health complications, history of head injury with loss of consciousness, or presence of radiologic brain abnormalities, at baseline. In addition, at each study visit, all adolescents underwent urine screening before scanning to rule out alcohol/substance use (Clarity Diagnostics Drugs of Abuse Panel) and/or pregnancy (QuPID One-Step Pregnancy, Stanbio Laboratory, Inc.). At the start of the study, all adolescents reported no significant psychiatric history, however over the course of the study, three participants retroactively endorsed the possible presence of psychiatric symptoms before the first study visit.[1] Our main study

[1]One had a chromosomal abnormality and related learning disability; another reported a diagnosis of Attention Deficit Hyperactivity Disorder; a third had a provisional diagnosis of an unspecified mood disorder.

TABLE 1 Participant demographics

Variable	Total sample ($n = 81$) M (SD) or %
Family history of depression	66.7% Yes
Family history of anxiety	51.9% Yes
Family history of alcohol/substance abuse	33.3% Yes
Age (years)	13.78 (0.61), range: 13.04–14.98
Anxiety[a]	43.87 (15.02), range: 10–72
Depression[b]	10.90 (9.24), range: 0–43
Impulsivity[c]	61.72 (9.35), range: 33–86
Sex assigned at birth	51.9% Female 48.1% Male
Ethnicity	96.3% Non-Hispanic
Race	75.3% White/European American 13.5% Multi-racial 4.9% Asian 2.5% African American/Black 2.5% Not reported 1.2% Native Hawaiian/Other Pacific Islander
Religious affiliation	66.7% Religiously Affiliated

Note: Data represent means ± standard deviation.

[a]MASC, Multidimensional Anxiety Scale for Children (possible range: 0–117);

[b]The Center for Epidemiological Studies—Depression Scale for Children (possible range: 0–60);

[c]Barrett Impulsiveness Scale (possible range: 30–120).

results were similar when these participants were excluded from analyses; they were therefore retained in the sample to maintain statistical power based on responses provided at the point of initial screening (results of these additional analyses are reported below). Participants were enrolled into the study before the initiation of alcohol or other substance use at 13–14 years of age and were then followed for 3 years via quarterly online surveys to assess initiation of alcohol/substance use. Those who went on to endorse alcohol/substance use before reaching age 16 were classified as initiators and those who reached age 16 without having endorsed alcohol/substance use were classified as non-initiators.

2.2 | Clinical and self-report measures

2.2.1 | Alcohol/substance use

Participants were asked to report their frequency of alcohol and/or substance use (over the last 3 months), via confidential surveys using REDCap. Specifically, participants were asked about alcohol, marijuana, cigarettes, or other tobacco products, and for "any other type of drug that was not prescribed to you by a doctor." Response options for each category were "Never," "Only a few times," "1–3 times per month," "1–5 times per week" or "Daily" (Simpson & Chatham, 1995) Participants were told their responses would be kept confidential and not reported to their parents. In addition, at each study visit, all adolescents underwent urine screening before scanning to rule out alcohol/substance use (Clarity Diagnostics Drugs of Abuse Panel). Parents of adolescent participants were assessed via a Family History Epidemiologic interview administered at baseline to assess family history (i.e., one or both biological parents or any grandparents) of alcohol/substance use, depressive and/or anxiety disorders.

2.2.2 | Religion

Participants reported if they affiliated with a religious group (Yes or No). As a validity check, we also administered items assessing importance of religion (0–5 "not at all" to "very"), frequency of religious service attendance (0–6, "never" to "more than once a week"), and belief in God (0–4, "strongly disagree" to "strongly agree"). Religiously affiliated adolescents reported significantly greater importance of religion, frequency of service attendance, and belief in God ($t(79)$ ranging from 6.6 to 7.2, $p > .001$ for all analyses)

2.2.3 | Demographics

We administered a brief demographic survey to obtain information regarding age, sex assigned at birth, and gender identity.

2.2.4 | Psychiatric disorders

The Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), a structured clinical interview, was used to assess presence of psychiatric disorders (Sheehan et al., 2010) in the sample.

2.2.5 | Depression

The Center for Epidemiological Studies—Depression Scale for Children (CES-DC) was used to assess depressive symptoms among adolescents (Fendrich et al., 1990). The CES-DC is a 20-item self-report assessment of depressive symptoms across a variety of domains. Reliability for the current study was high ($\alpha = .91$).

2.2.6 | Anxiety

The Multidimensional Anxiety Scale for Children was used to assess anxiety symptoms among adolescent participants (March et al., 1997). The MASC is a 39-item self-report measure that assesses anxiety symptoms across the following domains: physical symptoms, social anxiety, harm avoidance, anxious coping, and separation anxiety. Reliability for the sample was high ($\alpha = .91$).

2.2.7 | Impulsivity

The Barratt Impulsiveness Scale (BIS) was used to assess impulsive personality traits among adolescents (Patton et al., 1995). The BIS is a self-report measure with 30-items to assess impulsivity attentional, motor, and non-planning domains, as well as components of self-control, cognitive complexity, perseverance, and cognitive instability. Reliability for the sample was adequate ($\alpha = 80$).

2.3 | Magnetic resonance imaging acquisition and processing

Magnetic resonance imaging data on brain volume were acquired at baseline using a Siemens TIM Trio 3.0 Tesla MRI system (Erlangen) with a 32-channel head coil. High-resolution structural images were obtained using a T1-weighted multi-echo magnetization prepared rapid acquisition gradient echo (ME-MPRAGE) 3D sequence in 4 echoes. The following parameters were utilized: TE = 1.64/3.5/5.36/7.22 ms, TR = 2.1 s, TI = 1.1 s, FA = 12°, 176 slices, 1 mm × 1 mm × 1.3 mm voxel size, acquisition time = 5 min. T1-ME-MPRAGE images were labeled, segmented, and analyzed utilizing FreeSurfer version 6.0 semi-automated reconstruction pipeline (Fischl et al., 2002; Fischl, 2012). Full structural analysis details have been previously reported (Maksimovskiy et al., 2019). In general, all structural MRI data were manually inspected and edited to confirm high image quality. Manual edits were applied to the brainmask file and mainly consisted of adjustments to pial surfaces to exclude dura matter (all files) and a minimal number of edits in which pial surfaces were adjusted to expand the white matter surface. Volumetric files (aseg and subfield volumes) were inspected for accuracy of reconstruction, and no edits were made. All brain regions were adjusted for each individual's respective head size using a measure generated by FreeSurfer, estimated total intracranial volume (eTIV). In this study, we analyzed volume measures of key brain regions including medial orbitofrontal cortex, dorsal striatum (caudate, putamen), cingulate cortex, and insula. Of note, structural MRI data was obtained for all adolescents in the study, but at the time of analyses processing of variables was only completed for 65 participants, due to pandemic-related staffing shortages. Pairwise deletion was used to remove participants with missing data from the relevant analysis.

2.4 | Statistical modeling

To test our primary hypothesis that religious affiliation would lower the risk of substance use initiation, we estimated a series of Cox Proportional Hazards Models (Cox, 1972). These models assessed the degree to which the probability of initiation

occurring before a particular time was proportional to predictor variables. The dependent variable in this analysis was the number of days from the start of the study elapsing before initiation of alcohol/substance use, and data were considered censored if no initiation occurred before the end of data collection. Following the recommendations of Grambsch and Therneau (1994), assumptions for these models such as proportional hazards, the absence of influential outliers, and linearity were assessed using Schoenfeld, deviance, and martingale residuals respectively. Analyses began with a basic model that included key demographic covariates (i.e., initial age and gender) as predictors of time to initiation of alcohol/substance use. We then added religious affiliation in a second model (Model 2). Finally, to assess the relative contribution of religious affiliation over and above other previously established risk factors, we estimated additional models that included individual mental health (Model 3: impulsivity, depression, anxiety), family history of alcohol/substance misuse (Model 4), and volume of key brain regions (Model 5) including the medial orbitofrontal cortex, dorsal striatum (caudate, putamen), cingulate cortex, and insula. We then tested if these models explained a significant proportion of the variance in risk above and beyond the baseline model described above, and we evaluated effects of religious affiliation within each model. To provide a conservative evaluation of effects, each set of risk factors was examined independently. Models were compared using loglikelihood ratio-based chi-square tests, and coefficients were evaluated using Wald statistics, and statistical analyses were conducted using SPSS 24.0 and the survival (Therneau & Lumley, 2014) and survminer (Kassambara et al., 2017) packages in R Statistical Computing (R Core Team, 2013).

3 | RESULTS

Approximately two-thirds of the sample (66.7%) reported affiliation with a religious group. Results of the basic model indicated that 30/81 (37%) of participants initiated alcohol/substance use over the course of the study, with risk increasing linearly over time. The remaining 51 (63%) did not initiate. In the basic model, baseline age (hazard ratio [HR] = 1.83, 95% confidence interval [CI]: 0.997–3.37, *Wald* = 3.81, $p = .051$) and sex (HR = 0.90, 95% CI: 0.44–1.85, Wald = 0.09, $p = .77$) did not significantly increase risk in our sample. The addition of religious affiliation (Model 2) significantly improved fit ($\chi^2(1) = 6.38$, $p = .012$), and examination of coefficients suggested that participants reporting a religious affiliation were significantly less likely to initiate substance use over the course of the study (HR = 0.38, 95% CI: 0.18–0.79, Wald = 6.71, $p = .01$; Table 2; Figure 1). These results were similar when we excluded the three participants who retroactively reported the possible presence of psychiatric symptoms (HR = 0.44, 95% CI: 0.20–0.94, Wald = 4.49, $p = .03$).

TABLE 2 Cox proportional hazard models for religious affiliation ($N = 81$)

	B	*SE*	*Wald*	*df*	*p*	HR	95% CI for HR
Initial age	0.62	0.31	4.08	1	.04	1.85	1.02–3.36
Sex	−0.23	0.38	0.38	1	.54	0.79	0.38–1.66
Religious affiliation	0.97	0.37	6.71	1	.01	2.63	1.27–5.47

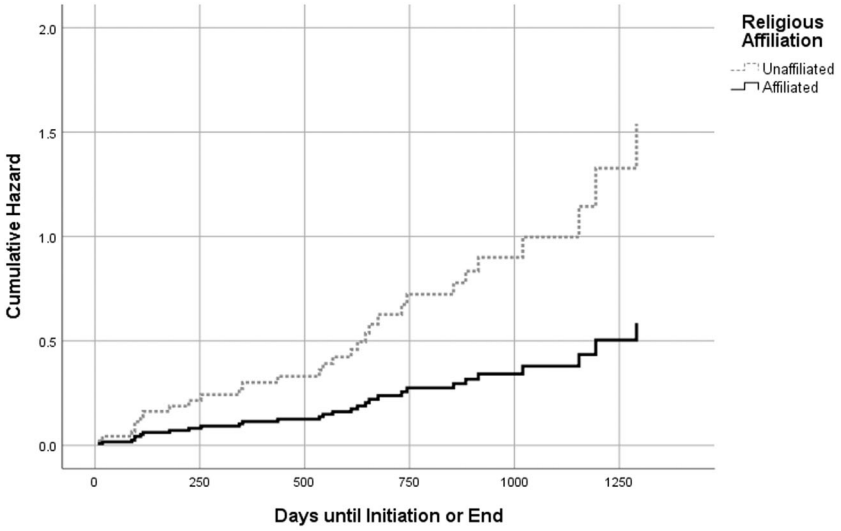

FIGURE 1 Initiation of alcohol/substance use among religiously affiliated and unaffiliated adolescents. Cumulative Hazard represents the cumulative risk of initation at or before each specific time point.

TABLE 3 Comparison of cox proportional hazard models ($n = 65–81$)

	N (event/censored)	−2*LL*	χ^2	*df*	*p*
Model 1 (baseline)					
Model 2 (religious affiliation)	30/45	219.29			
Model 3 (individual factors)	30/45	213.24	6.05	3	.11
Model 4 (family history)	30/45	217.29	1.99	3	.57
Model 5 (regional volume)	27/44	186.36	6.06	18	.64

Note: χ^2 statistics compare each model to Model 2, which included initial age, sex, and religious affiliation.

To assess the relative effect of religious affiliation as a predictor of alcohol/substance use initiation over and above other established risk factors, we conducted a series of additional models that included various risk factors in the model along with religious affiliation (see Table 3). Results indicated that adding family history of alcohol/substance use, anxiety, and depression did not significantly improve model fit ($\chi^2(3) = 2.00$, $p = .57$), and none of these individual variables significantly predicted initiation. In fact, the addition of these covariates descriptively increased the predictive value of religious affiliation (HR = 0.34, 95% CI: 0.16–.73, Wald = 7.67, $p = .006$) suggesting that religious affiliation was a better predictor of (less) alcohol/substance initiation when family-related risk level was held constant, although the difference between these coefficients was not statistically significant ($t(140) = 0.33$, $p = .74$). Results were similar for individual factors (i.e., impulsivity, anxiety, and depression); the addition of these variables did not improve model fit ($\chi^2(3) = 6.05$, $p = .11$), none were significant predictors of alcohol/substance initiation, and affiliation retained its predictive values (HR = 0.47, 95% CI: 0.22–0.996, Wald = 3.89, $p = .05$). Finally, the addition of regional brain volume at baseline (medial orbitofrontal cortex, dorsal striatum, cingulate cortex, and insula) similarly did not improve model fit ($\chi^2(18) = 6.06$, $p = .06$), and religious affiliation retained its significance in this model (HR = 0.34, 95% CI: 0.2913–0.88, Wald = 4.87, $p = .03$). Results for all these models were similar when we excluded three participants who retroactively endorsed possible psychiatric illnesses.

4 | DISCUSSION

In this 3-year prospective study among healthy adolescents, religiously affiliated 13–14-year-olds were approximately 2.6 times less likely to initiate alcohol/substance use. The potentially protective role of religious affiliation was robust and endured when controlling for age and gender, as well as known intrapsychic and familial risk factors. In fact, descriptive effects of religious affiliation increased once family history of mental distress and alcohol/substance use was added to our statistical model. These findings are consistent with prior literature indicating that religion has a protective role against alcohol/substance initiation and use among adults and youth (Connery & Devido, 2020; Kendler & Myers, 2009; Machalak et al., 2007). However, these results also extend prior literature given the prospective design of the current study, and the inclusion of multiple risk factors including known neural correlates of alcohol/substance use among adolescents.

What might account for our results? It has been proposed that spirituality and religion can buffer against impulsivity and sensation-seeking experiences by enhancing self-control (McCullough & Willoughby, 2009). Indeed, this proposed relationship has been demonstrated among youth (Desmond et al., 2013). For adolescents in particular, religious affiliation may accomplish this via social networks (Hodge et al., 2011). For example, religiously affiliated youth may have more access to peers who abstain from, or use less, alcohol and other substances, and social activities within this context may be less likely to include use. Religious engagement may thereby provide youth with models of alcohol/substance abstinence, and less peer-pressure. In addition, religious affiliation may provide opportunities for meaning- or value-based behavior (e.g., volunteering, leadership) that are commonly associated with spiritual or transcendent significance (Hodge et al., 2011). Such behavior may create less time, opportunity or urges to engage in alcohol or substance use behaviors. Furthermore, religious identity may be incongruent or dissonant with alcohol/substance use.

The current study has several limitations that must be noted. First, our study was among healthy adolescents, and findings do not necessarily generalize to adolescents with psychiatric symptoms or diagnoses. This is an important limitation given increasing rates of mental health concerns among adolescents (Leeb et al., 2020). Second, our study extends what is known regarding the relationship between brain volume, religious affiliation, and alcohol/substance use initiation, but future research examining additional neurobiological markers (e.g., functional activation and network brain connectivity, neurochemistry, etc.) is warranted. Third, our findings expand the understanding of a social-religious experience to a mental health phenomenon, however, our study design does not allow for translation of findings into clinical or preventative interventions. Another potential limitation was the use of urine screenings and self-report to identify initiation, which may have been more effective for identification of substance versus alcohol use. Future research may include additional screenings

(e.g., hair, saliva) to objectively identify recent alcohol use. Finally, while sample size is a limitation of our study that should be addressed in future research, these findings provide critical foundational information for future studies aimed at replication in a larger sample. Despite these limitations, the results of the current study are novel and among the first of their kind to reveal the important relevance of religious affiliation as a protective mechanism against growing mental health issues–alcohol/substance use among adolescents–particularly in the context of well-established risk factors, such as family history.

ACKNOWLEDGMENT

Financial support was received from McLean Hospital development fund (#041537), NIAAA grant R01 AA022493 (Silveri), and NIAAA grant K24 AA025977 (Silveri).

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS APPROVAL STATEMENT

The study received IRB approval.

PATIENT CONSENT STATEMENT

Participants provided informed consent and were assured raw data would remain confidential and would not be shared.

ORCID

David H. Rosmarin http://orcid.org/0000-0002-0146-7716
Marisa M. Silveri http://orcid.org/0000-0001-9668-8548

REFERENCES

Burstein, M. (2012). Use and abuse of alcohol and illicit drugs in US adolescents: Results of the national comorbidity survey–adolescent supplement. *Archives of General Psychiatry*, *69*(4), 390–398. https://doi.org/10.1001/archgenpsychiatry.2011.1503

Casey, B. J., Getz, S., & Galvan, A. (2008). The adolescent brain. *Developmental Review*, *28*(1), 62–77. https://doi.org/10.1016/j.jaac.2010.08.017

Cheetham, A., Allen, N. B., Whittle, S., Simmons, J., Yücel, M., & Lubman, D. I. (2017). Orbitofrontal cortex volume and effortful control as prospective risk factors for substance use disorder in adolescence. *European Addiction Research*, *23*(1), 37–44. https://doi.org/10.1159/000452159

Cheetham, A., Allen, N. B., Whittle, S., Simmons, J. G., Yücel, M., & Lubman, D. I. (2012). Orbitofrontal volumes in early adolescence predict initiation of cannabis use: A 4-year longitudinal and prospective study. *Biological Psychiatry*, *71*(8), 684–692. https://doi.org/10.1016/j.biopsych.2011.10.029

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors*, *26*(6), 803–825. https://doi.org/10.1016/S0306-4603(01)00238-6

Connery, H. S., & Devido, J. (2020). Spirituality/religion and substance use disorders. *Handbook of Spirituality, Religion, and Mental Health*, 119–138. https://doi.org/10.1016/B978-0-12-816766-3.00007-0

Cox, D. R. (1972). Regression models and life-tables. *Journal of the Royal Statistical Society: Series B (Methodological)*, *34*(2), 187–202. https://doi.org/10.1111/j.2517-6161.1972.tb00899-x

Dawson, D. A. (2000). The link between family history and early onset alcoholism: earlier initiation of drinking or more rapid development of dependence. *Journal of Studies on Alcohol*, *61*(5), 637–646. https://doi.org/10.15288/jsa.2000.61.637

Desmond, S. A., Ulmer, J. T., & Bader, C. D. (2013). Religion, self control, and substance use. *Deviant Behavior*, *34*(5), 384–406. https://doi.org/10.1080/01639625.2012.726170

Ernst, M., Luckenbaugh, D. A., Moolchan, E. T., Leff, M. K., Allen, R., Eshel, N., London, E. D., & Kimes, A. (2006). Behavioral predictors of substance-use initiation in adolescents with and without attention-deficit/hyperactivity disorder. *Pediatrics*, *117*(6), 2030–2039. https://doi.org/10.1542/peds.2005-0704

Fendrich, M., Weissman, M. M., & Warner, V. (1990). Screening for depressive disorder in children and adolescents: Validating the center for epidemiologic studees depression scale for children. *American Journal of Epidemiology*, *131*(3), 538–551. https://doi.org/10.1093/Oxfordjournals.Aje.A115529

Fischl, B. (2012). FreeSurfer. *NeuroImage*, *62*(2), 774–781.

Fischl, B., Salat, D. H., Busa, E., Albert, M., Dieterich, M., Haselgrove, C., van der Kouwe, A., Killiany, R., Kennedy, D., Klaveness, S., Montillo, A., Makris, N., Rosen, B., & Dale, A. M. (2002). Whole brain segmentation. *Neuron*, *33*(3), 341–355. https://doi.org/10.1016/S0896-6273(02)00569-X

Grambsch, P. M., & Therneau, T. M. (1994). Proportional hazards tests and diagnostics based on weighted residuals. *Biometrika*, *81*(3), 515–526. https://doi.org/10.1093/biomet/81.3.515

Handley, E. D., & Chassin, L. (2013). Alcohol-specific parenting as a mechanism of parental drinking and alcohol use disorder risk on adolescent alcohol use onset. *Journal of Studies on Alcohol and Drugs*, *74*(5), 684–693. https://doi.org/10.15288/jsad.2013.74.684

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381.

Hodge, D. R., Marsiglia, F. F., & Nieri, T. (2011). Religion and substance use among youths of Mexican heritage: A social capital perspective. *Social Work Research*, *35*(3), 137–146. https://doi.org/10.1093/swr/35.3.137

Infante, M. A., Nguyen-Louie, T. T., Worley, M., Courtney, K. E., Coronado, C., & Jacobus, J. (2020). Neuropsychological trajectories associated with adolescent alcohol and cannabis use: A prospective 14-year study. *Journal of the International Neuropsychological Society*, *26*(5), 480–491. https://doi.org/10.1017/S1355617719001395

Kassambara, A., Kosinski, M., Biecek, P., & Fabian, S. (2017) survminer: Drawing Survival Curves using 'ggplot2'. R package version 3.1. https://www.sthda.com/english/rpkgs/survminer/

Kelly, J. F., Humphreys, K., & Ferri, M. (2020). Alcoholics anonymous and other 12-step programs for alcohol use disorder. *Cochrane Database of Systematic Reviews*, *3*(3), CD012880. https://doi.org/10.1002/14651858.CD012880.pub2

Kendler, K. S., Liu, X. Q., Gardner, C. O., McCullough, M. E., Larson, D., & Prescott, C. A. (2003). Dimensions of religiosity and their relationship to lifetime psychiatric and substance use disorders. *American Journal of Psychiatry*, *160*(3), 496–503. https://doi.org/10.1176/appi.ajp.160.3.496

Kendler, K. S., & Myers, J. (2009). A developmental twin study of church attendance and alcohol and nicotine consumption: A model for analyzing the changing impact of genes and environment. *American Journal of Psychiatry*, *166*(10), 1150–1155. https://doi.org/10.1176/appi.ajp.2009.09020182

Kim-Spoon, J., Lauharatanahirun, N., Peviani, K., Brieant, A., Deater-Deckard, K., Bickel, W. K., & King-Casas, B. (2019). Longitudinal pathways linking family risk, neural risk processing, delay discounting, and adolescent substance use. *Journal of Child Psychology and Psychiatry*, *60*(6), 655–664. https://doi.org/10.1111/jcpp.13015

King, K. M., & Chassin, L. (2007). A prospective study of the effects of age of initiation of alcohol and drug use on young adult substance dependence. *Journal of Studies on Alcohol and Drugs*, *68*(2), 256–265. https://doi.org/10.15288/jsad.2007.68.256

Knight, J. R., Sherritt, L., Harris, S. K., Holder, D. W., Kulig, J., Shrier, L. A., Gabrielli, J., & Chang, G. (2007). Alcohol use and religiousness/spirituality among adolescents. *Southern Medical Journal*, *100*(4), 349–355. https://doi.org/10.1097/SMJ.0b013e3180316a32

Leeb, R. T., Bitsko, R. H., Radhakrishnan, L., Martinez, P., Njai, R., & Holland, K. M. (2020). Mental health-related emergency department visits among children aged <18 years during the COVID-19 pandemic - United States, January 1-October 17, 2020. *MMWR. Morbidity and Mortality Weekly Report*, *69*(45), 1675–1680. https://doi.org/10.15585/mmwr.mm6945a3

Lisdahl, K. M., Sher, K. J., Conway, K. P., Gonzalez, R., Feldstein Ewing, S. W., Nixon, S. J., Tapert, S., Bartsch, H., Goldstein, R. Z., & Heitzeg, M. (2018). Adolescent brain cognitive development (ABCD) study: Overview of substance use assessment methods. *Developmental Cognitive Neuroscience*, *32*, 80–96. https://doi.org/10.1016/j.dcn.2018.02.007

Van Loon, L. M. A., Van de Ven, M. O. M., Van Doesum, K. T. M., Witteman, C. L. M., & Hosman, C. M. H. (2014). The relation between parental mental illness and adolescent mental health: The role of family factors. *Journal of Child and Family Studies*, *23*(7), 1201–1214. https://doi.org/10.1007/s10826-013-9781-7

Lopez-Quintero, C., Cobos, J. P., Hasin, D. S., Okuda, M., Wang, S., Grant, B. F., & Blanco, C. (2011). Probability and predictors of transition from first use to dependence on nicotine, alcohol, cannabis, and cocaine: Results of the national epidemiologic survey on alcohol and related conditions (NESARC. *Drug and Alcohol Dependence*, *115*(1–2), 120–130. https://doi.org/10.1016/j.drugalcdep.2010.11.004

Maksimovskiy, A. L., Oot, E. N., Seraikas, A. M., Rieselbach, M., Caine, C., Sneider, J. T., Cohen-Gilbert, J. E., Harris, S. K., Nickerson, L. D., Rohan, M. L., & Silveri, M. M. (2019). Morphometric biomarkers of adolescents with familial risk for alcohol use disorder. *Alcoholism: Clinical and Experimental Research*, *43*(11), 2354–2366. https://doi.org/10.1111/acer.14201

March, J. S., Parker, J. D., Sullivan, K., Stallings, P., & Conners, C. K. (1997). The multidimensional anxiety scale for children (MASC): Factor structure, reliability, and validity. *Journal of the American Academy of Child and Adolescent Psychiatry*, *36*(4), 554–565. https://doi.org/10.1097/00004583-199704000-00019

Martz, M. E., Zucker, R. A., Schulenberg, J. E., & Heitzeg, M. M. (2018). Psychosocial and neural indicators of resilience among youth with a family history of substance use disorder. *Drug and Alcohol Dependence*, *185*, 198–206. https://doi.org/10.1016/j.drugalcdep.2017.12.015

McCullough, M. E., & Carter, E. C. (2013). Religion, self-control, and self-regulation: How and why are they related? In K. I. Pargament, J. J. Exline, & J. W. Jones (Eds), *APA handbook of psychology, religion, and spirituality (Vol. 1): Context, Theory, and Tesearch* (pp. 123–138). American Psychological Association. https://doi.org/10.1037/14045-006

McCullough, M. E., & Willoughby, B. L. B. (2009). Religion, self-regulation, and self-control: Associations, explanations, and implications. *Psychological Bulletin*, *135*(1), 69–93. https://doi.org/10.1037/14045-006

McInnes Miller, M., & Van Ness Sheppard, N. (2014). What does spirituality mean to you? Mapping the spiritual discourses of psychotherapy graduate students. *Journal of Spirituality in Mental Health*, *16*(4), 286–310. https://doi.org/10.1080/19349637.2014.957605

Michalak, L., Trocki, K., & Bond, J. (2007). Religion and alcohol in the US national alcohol survey: How important is religion for abstention and drinking? *Drug and Alcohol Dependence*, *87*(2–3), 268–280. https://doi.org/10.1016/j.drugalcdep.2006.07.013

Miller, L., Davies, M., & Greenwald, S. (2000). Religiosity and substance use and abuse among adolescents in the national comorbidity survey. *Journal of the American Academy of Child and Adolescent Psychiatry*, *39*(9), 1190–1197. https://doi.org/10.1097/00004583-200009000-00020

Pang, R. D., Farrahi, L., Glazier, S., Sussman, S., & Leventhal, A. M. (2014). Depressive symptoms, negative urgency and substance use initiation in adolescents. *Drug and Alcohol Dependence*, *144*, 225–230. https://doi.org/10.1016/j.drugalcdep.2014.09.771

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, *51*(6), 768–774. https://doi.org/10.1002/1097-4679(199511)51:6<768::AID-JCLP2270510607>3.0.CO;2-1

R Core Team. (2013) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Russell, A. M., Yu, B., Thompson, C. G., Sussman, S. Y., & Barry, A. E. (2020). Assessing the relationship between youth religiosity and their alcohol use: A meta-analysis from 2008 to 2018. *Addictive Behaviors*, *106*, 106361. https://doi.org/10.1016/j.addbeh.2020.106361

Sheehan, D. V., Sheehan, K. H., Shytle, R. D., Janavs, J., Bannon, Y., Rogers, J. E., Milo, K. M., Stock, S. L., & Wilkinson, B. (2010). Reliability and validity of the mini international neuropsychiatric interview for children and adolescents (MINI-KID). *The Journal of Clinical Psychiatry*, *71*(3), 313–326.

Simpson, D., & Chatham, L. (1995) *TCU/DATAR Forms Manual*. Improving Drug Abuse Treatment, Assessment, and Research (DATAR) Project. Fort Worth, Texas: Institute of Behavioral Research, Texas Christian University.

Sinha, J. W., Cnaan, R. A., & Gelles, R. J. (2007). Adolescent risk behaviors and religion: Findings from a national study. *Journal of Adolescence*, *30*(2), 231–249. https://doi.org/10.1016/j.adolescence.2006.02.005

Substance Abuse and Mental Health Services Administration. (2020). *Key substance use and mental health indicators in the United States: Results from the 2019 National Survey on Drug Use and Health* (HHS Publication No. PEP20-07-01-001, NSDUH Series H-55). Rockville, MD: Center for behavioral health statistics and quality, substance abuse and mental health services administration. Retrieved from https://www.samhsa.gov/data/

Therneau, T. M., & Lumley, T. (2014). Survival: Survival analysis. *R package version*, *2*, 37. https://CRAN.R-project.org/package=survival

Welty, L., Harrison, A., Abram, K., Olson, N., Aaby, D., McCoy, K., & Substance Abuse and Mental Health Services Administration. (2017). *Key substance use and mental health indicators in the United States: Results from the 2016 national survey on drug use and health* (HHS publication No. SMA 17-5044, NSDUH series H-52). Rockville, MD: Center for behavioral health statistics and quality, Substance Abuse and Mental Health Services Administration. Retrieved. *College of Health Sciences*, *106*(5), 128.

How to cite this article: Rosmarin, D. H., Pirutinsky, S., Kaufman, C. C., Harris, S. K., Sneider, J. T., & Silveri, M. M. (2023). Religious affiliation protects against alcohol/substance use initiation: A prospective study among healthy adolescents. *Journal of Adolescence*, 95, 372–381. https://doi.org/10.1002/jad.12119

APPENDIX A

Tables A1–A4.

TABLE A1 Baseline cox proportional hazard model (Model 1, $N = 81$)

	B	*SE*	*Wald*	*df*	*p*	*HR*	95% CI for HR
Initial age	0.61	00.31	3.81	1	.05	1.83	1.00–3.37
Sex (F)	−11	0.37	0.09	1	.77	0.90	0.44–1.85

TABLE A2 Cox proportional hazard model for individual factors (Model 3, $N = 75$)

	B	*SE*	*Wald*	*df*	*p*	HR	95% CI for HR
Initial Age	0.59	0.32	3.48	1	.06	1.81	0.97–3.36
Sex (F)	−0.15	0.40	0.14	1	.71	0.86	0.40–1.88
Religious Affiliation	−0.76	0.39	3.89	1	.049	0.47	0.22–1.00
Impulsivity	0.04	0.02	3.69	1	.06	1.05	1.00–1.09
Depression	0.001	0.03	<0.001	1	.99	1.00	0.95–1.06
Anxiety	−0.03	0.02	2.48	1	.120	0.97	0.94–1.001

Note: Model did not significantly improve fit over the religious affiliation only model (Model 2; $\chi^2(3) = 6.05$, $p = .11$).

TABLE A3 Cox proportional hazard model for family history (Model 4, $N = 75$)

	B	*SE*	*Wald*	*df*	*p*	HR	95% CI for HR
Initial age	0.66	0.32	4.25	1	.04	1.93	1.03–3.61
Sex (F)	−0.37	0.39	0.87	1	.35	0.69	0.32–1.50
Religious affiliation	−1.07	0.39	7.67	1	.006	0.34	0.16–0.73
Family history							
Alcohol abuse	0.21	0.42	0.24	1	.63	1.23	0.54–2.82
Anxiety	0.05	0.39	0.02	1	.89	1.06	0.50–2.25
Depression	−0.57	0.40	2.05	1	.15	0.57	0.26–1.24

Note: Model did not significantly improve fit over the religious affiliation only model (Model 2; $\chi^2(3) = 1.99$, $p = .57$).

TABLE A4 Cox proportional hazard model for regional volume model 5, $N = 71$)

	B	*SE*	*Wald*	*df*	*p*	HR	95% CI for HR
Initial age	0.97	0.39	6.19	1	.01	2.63	1.23–5.63
Sex (F)	−.18	0.54	0.11	1	.75	0.84	0.29–2.43
Religious affiliation	−1.07	0.48	4.87	1	.03	0.34	0.13–0.89
Medial orbitofrontal (Left)	0.004	0.005	0.63	1	.43	1.00	0.995–1.01
Medial orbitofrontal (Right)	0.006	0.005	1.52	1	.22	1.01	0.996–1.02
Dorsal striatum (Left)	0.00	0.001	0.39	1	.54	1.00	0.999–1.002
Dorsal striatum (Right)	−.001	0.001	0.78	1	.38	0.999	0.998–1.01
Cingulate cortex (Left)	0.003	0.003	1.01	1	.32	1.00	0.997–1.01
Cingulate cortex (Right)	−.003	0.003	1.15	1	.28	0.997	0.99–1.003
Insula (Left)	0.000	0.001	0.02	1	.89	1.00	0.998–1.002
Insula (Right)	0.000	0.001	0.05	1	.83	1.00	0.998–1.002

Note: Model did not significantly improve fit over the religious affiliation only model (Model 2; $\chi^2(8) = 6.06$, $p = .64$).