

Religion and Depression in Adolescence^{*}

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Abstract

Does religiosity affect depression? Although many studies show a correlation between religiosity and mental health, it remains a question as to whether the link is causal. The key issue is selection into religiosity. For instance, individuals who face difficult home environments may suffer from depression and also be less likely to go to church. To deal with selection, we exploit plausibly random variation in adolescents' peers to shift religiosity independently of other individual-level unobservables that might affect depression. Using data on adolescents from the US National Longitudinal Study of Adolescent Health, we find robust effects of religiosity on depression. We find that consistent with the stress process theory, religiosity helps to buffer against some types of stressors and compensates for lack of social support in other areas.

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1 Introduction

Thirty percent of adolescents in the U.S. reported symptoms of depression in 2013.¹ Depression rates rise considerably in adolescence, and it is correlated with a range of adverse outcomes, including lower academic achievement, noncognitive development and repeat incidences of depressive episodes later in life (Cook et al., 2009). It is also a predictor for suicide, which is the third leading cause of death among youths aged 10 to 24 in 2013 (Center for Disease Control). Worldwide, more than eight-in-ten people identify with a religious group (Hackett and Grim, 2012). In the US, 28 percent of adolescents report that religion plays a very important part in their lives.²

While some scholars see religion as a perpetrator of poor mental health, much scientific evidence suggests that religiosity is positively correlated with mental health.³ Yet, the meaning of this correlation remains a puzzle. In this study we contribute to the debates about religion and depression in two ways. First, we explore whether the link between religiosity and depression can be interpreted as causal. Next, we bring insight from the life stress paradigm which is a leading model used to explain the social determinants of mental health problems, exploring different ways in which religiosity protects individuals from stressful situations that are associated with depression.

The key challenge with establishing a causal effect of religiosity, is the issue of selection into religiosity (Hungerman, 2011; Iyer, 2015). In our context, it could be that religiosity simply proxies difficult to measure aspects of family background and that it is family background rather than religiosity that leads to less depression.⁴ Further, it could be that people select into religiosity as a way of dealing with negative shocks to mental health.

To address the issue of selection into religiosity, we exploit the idea that peer religiosity might affect an adolescent's religiosity independently of unobserved individual attributes. This strategy relies on plausibly random variation

¹www.childtrends.org

²www.childtrends.org

³See Ellison and Henderson (2011).

⁴See Wille et al. (2008) for a discussion of the importance of home environment.

in peer composition. We show that this seems to hold based on observables in the data, and that our results are robust to a number of specification checks. We further show that the effect on depression does not derive through the social context of having more mentally healthy or religious peers. To the best of our knowledge, this is new to the literature, which generally identifies an effect of an individual's religiosity as inclusive of a more religious social context.

We consider whether there is evidence of heterogeneity in responses to religiosity. For instance, it could be that the most religious people have the largest benefits for depression as they have better internalized religious teachings or derive most benefit from the social networks provided by their churches. Allowing with heterogeneity by the degree of religiosity, we also consider whether the effect of religiosity varies depending on the severity of depression using quantile regressions.

Drawing from the life stress paradigm described in [Ellison et al. \(2001\)](#) and [Ellison and Henderson \(2011\)](#), we test different theories for why religiosity may have a salutary effect. In particular, we consider 4 hypotheses: whether religiosity (1) bolsters psychological resources, such as self esteem, which can help an individual cope with stress, (2) improves coping mechanisms for dealing with stress, such as active problem-solving, (3) provides social support, such as through financial assistance or social networks, (4) eliminates sources of stress, such as by improving the home environment.

To address these questions, we use data from the National Longitudinal Study of Adolescent Health in the United States, a nationally representative sample of approximately 20,000 adolescents in grades 7 to 12 in 1995, which follows participants into their early adulthood. Because individuals only report religiosity if they report belonging to a religious denomination, we can only say something about the effect of religiosity for this subsample. We find that religiosity has consistently strong effects on depression in adolescence, which is understated by OLS estimates that do not deal with selection into religiosity. We consider whether the effect of the instrument varies across quantiles of the religiosity distribution, to provide evidence for whether our estimates are better interpreted as local average treatment effects. Interest-

ingly, the marginal effect of peer religiosity is fairly homogeneous across the quantiles of the conditional religiosity distribution, suggesting that our estimates can be interpreted as an average treatment effect for those who report belonging to some religious denomination. We find evidence that religiosity reduces depression by helping to buffer against some types of stressors.

A broad literature in psychology and sociology examines the relationship between religiosity, depression and mental health (See [Regnerus et al., 2003](#), for a review.). [Levin \(2010\)](#) points out that interest in this relationship dates back to the nineteenth century and that among clinicians there is great interest in the links between religion and mental health. Discussion of these issues features in [Freud \(1927\)](#) and other writing which examined religion and its effect on the human psyche. Many studies demonstrate a positive correlation between religion and mental health, but none of them have demonstrated a clear causal link between them ([Hackney and Sanders, 2003](#)). [Becker and Woessmann \(2011\)](#) is the only paper we are aware of that estimates a causal effect of religion on mental health, but in the context of 19th century Prussia.

More recently, a number of studies in sociology have used the life stress model to provide insight on why religiosity is linked with mental health problems ([Ellison et al., 2001](#); [Idler, 1987](#); [Nooney, 2005](#)) [Nooney \(2005\)](#) is the study that is most closely related to ours. She also uses Add Health data and considers different stressors in adolescence and how they might mediate the effect of religiosity on depression. We contribute to the literature by bringing insight from economics to attempt to disentangle causal channels. For instance, it is difficult from descriptive analysis to disentangle whether more stress-prone individuals select into religiosity, which could then confound attempts to isolate the role of stress as a mediator.

Our paper contributes methodologically to the literature in economics that attempts to disentangle a causal effect of religiosity. The method we use is similar in spirit to methods developed in [Gruber \(2005\)](#) and later applied in [Mellor and Freeborn \(2011\)](#). These studies use variation in religiosity at the county level to shift individual religiosity, with varying assumptions depending on whether there is time-series variation in religiosity that can be exploited, in

which case panel analysis can be used. Our method considers how school peers can affect religiosity and provides conditions under which the direct effect of religiosity can be separated from a social effect, which is new to the literature.

2 Data

We use data drawn from the restricted version of the National Longitudinal Study of Adolescent to Adult Health (Add Health) for our analysis.⁵ Add Health interviewed a representative sample of U.S. adolescents in grades 7–12 (aged 11–19⁶) during 1994/95 academic year, and followed up with additional waves of data. In Wave I, a short in-school survey was conducted for every student in the sampled schools. Following the in-school survey, a random sample of students also participated in an in-home survey, from which rich information about the adolescent was collected. In addition, a survey was also administered to the parent or guardian of the adolescent. The in-home survey provides detailed information on mental health as well as physical health, religiosity, attitudes and behavior. We focus on the in-home survey from Wave I, where the respondents are at school and we can pin down a group of peers for each student.

Depression is measured on the Center for Epidemiologic Studies Depression Scale (CES-D), one of the most common screening tests for depression and depressive disorder developed by Radloff (1977). CES-D consists of a list of symptoms,⁷ to each of which respondents report how often they experience the

⁵This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

⁶With a few exceptions aged 20–21.

⁷The original CES-D lists 20 items, only 19 of which appear in Wave I of Add Health. Add Health substitutes the CES-D item “You felt life was not worth living” for two questions on sleeping and crying spells,

feeling. Responses are rated on a frequency scale ranging from 0 = never or rarely, to 3 = most or all the time.⁸ Response values are aggregated to create a point score, with higher scores indicating greater depressive symptoms.

The data provides information on four aspects of religiosity: frequency of church attendance, importance of religion, frequency of praying, and frequency of attending youth religious activities. Each aspect is assessed on a scale of 0–3 or 0–4⁹. We use the sum of these four aspects as our main measure of religiosity for our analysis.¹⁰ Previous literature suggests that it may be important to consider these measures separately (Iyer, 2015). Particularly, believing (measured through prayer and religious importance) and belonging (measured through attendance) have been shown to have different types of effects on individual outcomes. This could easily be true in our setting as well. However, we find that these dimensions are not separable in our data.¹¹ A limitation of the data on religiosity is that only adolescents who report a religious affiliation were asked the religious questions. Therefore, we are only able to study the effect of religiosity on mental health for the religious affiliates, i.e., the intensive margin.

The in-home survey identifies 28 religious affiliations. We group religious affiliations into six denominations: no religion, Catholic, liberal Protestant, moderate Protestant, conservative Protestant, and other religion. We map Jewish to “other religions” as it only represents 0.7% of the whole sample. The details of the categorization are summarized in Table A.1.¹²

⁸Responses to positive feelings are coded reversely with 0 = most or all the time, to 3 = never or rarely.

⁹The two attendance variables take values from 0 = never to 3 = once a week or more. On top of these values, frequency of praying has an additional value 4 = at least once a day. Importance of religion is rated on a scale from 0 = not important at all, to 3 = very important.

¹⁰Although these values are ordinal, the three frequency variables for the most part approximately measure the number of times practicing each religious activity every month.

¹¹Both a principal component analysis and exploratory factor analysis support a model where the different dimensions of religiosity load on a single factor. We also find that results are similar if we use the extracted factor as our variable of interest rather than our index of religiosity.

¹²The categorization is based on the Churches and Church Membership 1990 (CCM1990) data which collect county-level membership information on 133 Judeo-Christian church bod-

We control for a wide range of covariates that may affect mental health: individual characteristics such as age, sex, race, physical development, whether respondent was interviewed during school year session; parental background including whether mother or father was present, mother’s education, household income; grade and wave dummies; proportions of same race and denomination in the school; same school-denomination average religiosity; peer characteristics, background and mental health.

Table A.3 describes the sample attrition cause by missing variables. Non-responses to depression (Column 2) and religious affiliation questions (Column 3) constitute only a slight proportion of the full in-home sample (Column 1). Only less than 3% are dropped from these selection processes. Next, we have to exclude respondents who report no religious affiliations, as they are skipped for the religiosity questions. In addition, we do not include “other religion” in the analysis, in recognition of fundamental differences in religious beliefs and practices among those religious bodies and it seemed inappropriate to lump them in a single category. After this selection, we are left with 80% of the whole sample (see Column 4). At this stage, the selected sample appears to be mentally healthier and more religious, but only slightly. Then, missing data on religiosity (Column 5) and covariates (Column 6) further reduce the sample by about 4%. These deletions lead to trivial changes on mental health and religiosity. Our last step of sample selection is to exclude observations that do not have any peer respondent with the same school, grade, race, gender and denomination (Column 7), dropping another 13%. This leaves 63% of the full sample. In comparison, the selected sample are mentally healthier and more religious, but the magnitude of differences is generally of the order of less than 3%. Descriptive statistics of the final sample are summarized in Table 1.

We also observe considerable heterogeneity in mental health and religiosity by race, denomination and family background. Table 2 examines mental health by race, denomination, household income, and mother’s education, as well

ies in the US. Add Health categorizes these church bodies as Jewish, Catholic, Black Baptist, other liberal, other moderate and other conservative denominations in the Contextual Database.

as gender. On average, females are more religious and more depressed than males. Blacks are the most religious ethnic group, while Hispanics are the least. Whites are the least depressed ethnic group, while Hispanics are the most. By denomination, Conservative Protestants are the most religious group, followed by Moderate and Liberal Protestants. Catholics are the least religious group. In terms of depression, Liberal Protestants suffer less depression than all three other religious denominations. There are small differences in religiosity by family background, but the differences in mental health are more pronounced, with disadvantaged children suffering much higher depression.

3 Empirical Strategy

Adolescent i ' mental health (H_i) is determined by religiosity (R_i) and background characteristics (X_i),

$$H_i = \alpha_0 + \alpha_1 R_i + \alpha_2 X_i + \epsilon_i, \tag{1}$$

where ϵ_i denotes the residual. X_i in the baseline model includes a dummies for race, denominational affiliation, sex, age, age when started puberty and parental background characteristics, including education of the mother, whether the father or mother is not present and the log of household income.

The key concern with identifying an effect of religiosity is unobservable individual characteristics that may affect mental health and make an individual more likely to be religious. For instance, religiosity may signal something about the home environment, which affects mental health. Similarly, a shock, like the death of a friend or family member, could lead an individual to become more religious and also suffer from mental health issues. Reverse causality could also be a concern if individuals go to church as a way of dealing with poor mental health. Depending on the type of selection, it is ambiguous whether OLS estimates of equation (1) would over- or under-state the effect of religiosity.

We address these concerns using an instrument that arguably shifts an individual's religiosity independently of other individual background charac-

teristics or individual-specific shocks that might affect mental health. The instrument we use is based on two ideas. First, friend religiosity affects adolescent choices of religiosity (Cheadle and Schwadel, 2012). Second, there is homophily in friendship formation (McPherson et al., 2001). Because friends are arguably selected based on unobservable attributes that are correlated with religiosity and mental health, they are not a valid exclusion. However, there exists plausibly random variation in the religiosity of “like” peers within schools that can be exploited to shift own religiosity independent of unobservable individual background characteristics.

To formalize this, suppose $f(i)$ denotes friends of i and $\bar{R}_{f(i)}$ denotes average religiosity of friends excluding i . Consider a simple model where individuals just choose religiosity and they care about mental health. Let utility take the simple form as in Brock and Durlauf (2001) in order to achieve the linear specification as above, where

$$U_i = \gamma_1 \tilde{X}_i H_i - \frac{\gamma_2}{2} R_i^2 + \gamma_3 R_i \bar{R}_{f(i)}$$

and $\tilde{X}_i = (X_i, v_i)$ denotes both observed and unobserved (to the econometrician) characteristics of the student and $\epsilon_i = v_i + \eta_i$ and η_i is a shock to mental health (which is unobserved to the student at the time of choosing religiosity).¹³ Individuals make decisions simultaneously based on their information sets, Ω_i , which includes X_i and v_i and characteristics of peers in a way that will be made specific below. In this case, we can write down the individual’s best response as

$$R_i = \frac{\alpha_1 \gamma_1}{\gamma_2} X_i + \frac{\gamma_3}{\gamma_2} E(\bar{R}_{f(i)} | \Omega_i) + \frac{\alpha_1 \gamma_1}{\gamma_2} v_i. \quad (2)$$

We assume that the religiosity that we see in the data is a result of optimizing behavior, and we omit *’s here for notational simplicity, though in reality we should distinguish between realized mental health outcomes that come from optimizing behavior and the production function of hypothetical outcomes.¹⁴

¹³Note that it is trivial to introduce a direct utility of religiosity.

¹⁴Given that religiosity is bounded and the model is linear, we know that an equilibrium

Note that equation (2) suggests that average friendship religiosity may be a plausible exclusion for shifting own religiosity independently of unobservable characteristics v_i that cause R_i to be endogenous in the mental health equation. There are 2 key concerns with using this as an exclusion. First, if individuals observe their friends' v 's at the time of making their decision (i.e., $\Omega_i = (X_i, v_i, X_{f(i)}, v_{f(i)})$), then there is a simultaneity concern in that peer average religiosity reflects v_i . Note that this is not the case if v_i is not observed by the friends of i at the time of making their decision, though this may be a strong assumption. Second, friendship choices are likely to be endogenous and are determined by v_i and $v_{f(i)}$.

We can use instead the average religiosity of “like” students, i.e., students at the same school, in the same grade, race, gender and religious affiliation, denoted $g(i)$. This is correlated with $\bar{R}_{f(i)}$ given homophily, but not with unobservable individual level attributes that might determine religiosity, v_i (after conditioning on the student’s own grade, race, gender and religious affiliation).¹⁵ Furthermore, simultaneity at this level is less likely to be a concern. One type of argument that would support this is that we are isolating more of the type of variation coming from the friends of friends, as discussed in [Bramouille et al. \(2009\)](#). By this argument, while my friends affect my behavior directly, the friends of my friends only affect my behavior indirectly through my friends’ behavior.¹⁶ We also expect simultaneity to be less of a concern with larger peer groups $g(i)$. We check robustness to dropping observations where the subgroup is small, just to be sure that this is not driving our results. Finally, it is worth noting that if simultaneity is present and $\bar{R}_{g(i)}$ is correlated with v_i , then we should see evidence of this in the specification checks where we control for peer characteristics and peer depression.

Note that a key concern with this strategy, as in the seminal work of [Patacchini and Zenou \(2013\)](#), exists and is unique in this model.

¹⁵Note that [Patacchini and Zenou \(2013\)](#) use a similar strategy of “like” peers to instrument for friend religiosity, with the focus on identifying the effect of friend religiosity on parental religiosity choices.

¹⁶We cannot look at friends directly as this information is only available for about a third of the sample.

Hoxby (2000), is whether we can think of this variation in peer groups as being plausibly random, something that we return to in Section 4.2. Intuitively, this argument is only likely to hold within schools. Some schools may have more religious students because they are in a neighborhood with more churches or a particularly influential church. The provision for mental health at the school level, for instance, might also vary depending on the resources in the community, such as the number of churches. Thus, it is important for our strategy that we also control for school fixed effects to eliminate these potential biases.

Therefore, we estimate the following system of equations as our baseline model:

$$\begin{aligned} H_{is} &= \alpha_0 + \alpha_1 R_{is} + \alpha_2 X_i + \alpha_s + \epsilon_{is}, \\ R_{is} &= \beta_0 + \beta_1 \bar{R}_{g(i)s} + \beta_2 X_i + \beta_s + u_{is}, \end{aligned} \tag{3}$$

where the s subscript denotes the school.

Below we consider two possible remaining concerns with this identification strategy in turn: (1) a direct effect of peers on mental health and (2) unobserved shared group characteristics that are correlated with peer religiosity and mental health.

Peers may directly affect mental health, either through their religiosity or mental health (which is determined in part by their religiosity). In this case, our instrumenting strategy would not identify the direct effect of an individual’s religiosity, but the effect inclusive of peer religiosity on mental health. As far as we know, this is a characteristic that is shared by all the instrumenting strategies used to identify the effect of religiosity, it is just made more explicit in our context. For instance, Gruber and Hungerman (2008) has one of the most convincing identification strategies for studying the effect of religiosity. They use changes in blue laws, which ban shopping on Sundays, to identify an effect of religiosity on different outcomes. The argument follows that by changing the outside options for an individual, this would affect church attendance of that individual. Implicitly, this is also an equilibrium argument,

as these laws affect whether everyone in the community goes to church on Sundays, and so any estimated effects of religiosity would be inclusive of peer religiosity and associated peer outcomes, like mental health in our context. Arguably, this parameter inclusive of social context is also of policy interest. However, we describe below assumptions that would make our instrument valid for identifying the direct effect of religiosity.

The case where own mental health depends on peer mental health is most straightforward. Assuming that religiosity has an effect on mental health ($\alpha_1 \neq 0$), then peer religiosity is correlated with the residual in equation (1) through its correlation with peer mental health. It is then necessary to condition on peer mental health to separate the direct effect of R_{igs} from the equilibrium effect deriving from better peer mental health, i.e.,

$$H_{is} = \alpha_0 + \alpha_1 R_{is} + \alpha_2 X_i + \alpha_3 \bar{H}_{g(i)s} + \alpha_s + \zeta_{is}. \quad (4)$$

Under these assumptions, peer religiosity now only affects mental health through its effect on own religiosity, after conditioning on peer mental health (the equilibrium effect). However, if individuals take into account their effect on peer mental health, we may introduce an additional problem of simultaneity of own and peer mental health. This is unlikely to be problematic in our setting for peer groups that are sufficiently large or if the feedback occurs at the friendship level for which the peer group variable is an imperfect proxy. However, if there is simultaneity, our estimate of α_3 would be biased upward.¹⁷

Next, suppose that there is a direct effect of peer religiosity on mental health, so that

$$H_{is} = \alpha_0 + \alpha_1 R_{is} + \alpha_2 X_{is} + \alpha_4 \bar{R}_{-g(i)s} + \alpha_s + \zeta_{is}. \quad (5)$$

¹⁷The additional question this raises is whether the instrument is still valid, conditional on peer mental health. Note that if $\alpha_1 \neq 0$ then peer religiosity has a direct effect on peer mental health. Intuitively if we treat mental health as exogenous, then peer religiosity might be correlated with the residual in the mental health equation through its correlation with peer mental health. If the estimated α_3 is small, then it seems unlikely that the potential endogeneity caused by peer mental health is a concern, particularly if it is biased upward. In our robustness checks, we also consider some possible instruments for peer mental health and see whether results are robust.

Now peer religiosity is not a valid exclusion because it directly affects mental health. However, solving for peer mental health using equation (5), we have

$$\bar{H}_{g(i)s} = \alpha_0 + \left(\alpha_1 + \alpha_4 \frac{N_{g(i)s} - 1}{N_{g(i)s}}\right) \bar{R}_{g(i)s} + \alpha_2 \bar{X}_{g(i)s} + \frac{\alpha_4}{N_{g(i)s}} R_{is} + \alpha_s + \bar{\zeta}_{g(i)s}, \quad (6)$$

where $N_{g(i)s}$ denotes the number of peers in i 's group excluding i . We can then solve for $\bar{R}_{g(i)s}$ as a function of peer mental health, i.e.,

$$\bar{R}_{g(i)s} = \frac{1}{\alpha_1 + \alpha_4 \frac{N_{g(i)s} - 1}{N_{gs}}} (\bar{H}_{g(i)s} - \alpha_0 - \alpha_2 \bar{X}_{g(i)s} - \frac{\alpha_4}{N_{g(i)s}} R_{is} - \alpha_s - \bar{\zeta}_{g(i)s}).$$

Plugging this into equation (1), we have

$$H_{is} = \alpha_0(1 - \delta) + \left(\alpha_1 - \delta \frac{\alpha_4}{N_{g(i)s}}\right) R_{is} + \alpha_2 X_{is} + \delta \bar{H}_{g(i)s} - \delta \alpha_2 \bar{X}_{g(i)s} + \alpha_s(1 - \delta) + \zeta_{is} - \delta \bar{\zeta}_{g(i)s}, \quad (7)$$

where $\delta \equiv \frac{\alpha_4}{\alpha_1 + \alpha_4 \frac{N_{g(i)s} - 1}{N_{g(i)s}}}$. Now, own mental health does not depend on peer religiosity because peer mental health proxies for it. The question is whether $\bar{R}_{g(i)s}$ is now a valid exclusion for identifying an effect of own religiosity. Conditioning on $\bar{X}_{g(i)s}$ is necessary as it is likely correlated with peer religiosity. If $\alpha_4 \neq 0$, we still have the problem that controlling for peer mental health means that the parameter on i 's religiosity is $\tilde{\alpha}_1 = \alpha_1 - \delta \frac{\alpha_4}{N_{g(i)s}}$. This means that our estimate of the effect of religiosity will be biased toward 0, but as the group size increases, the second term will go to 0. Given that we also have an estimate of δ coming from the coefficient on $\bar{H}_{g(i)s}$, we can solve for α_1 from these parameters and recover the direct effect of own religiosity. Our estimate of δ will be biased downward through the negative correlation with $\bar{\zeta}_{g(i)s}$. We can also use insight from the coefficient on $\bar{X}_{g(i)s}$ to determine whether peers are playing an important role. For instance, given that X_{is} is a significant determinant of mental health but $\bar{X}_{g(i)s}$ is not, this would also suggest that δ is small in magnitude.

Given these arguments, among the robustness checks we will see whether

the marginal effect of peer mental health is non-zero and whether the marginal effect of R_{is} is robust to controlling for peer mental health. We will also check robustness to controlling for peer observable characteristics, $\bar{X}_{g(i)s}$.

The remaining concern is whether there is an unobservable third factor that simultaneously predicts peer religiosity and own mental health; this is an example of a correlated effect, in the language of [Manski \(1993\)](#). To be a threat to identification it would need to vary at the group level within the school and be correlated with (but not determined by) peer religiosity. Given that the variation in peer groups is plausibly random, we have eliminated the concerns of these correlated effects deriving through selection of like peers into similar peer groups. An example of a remaining correlated effect would be if the peers' better home environment is correlated with peer religiosity and this directly affects the student's own mental health. To the extent that $\bar{X}_{g(i)s}$ and $\bar{H}_{g(i)s}$ are not significant determinants of own mental health, this provides some assurance that peer unobservable characteristics are unlikely to be important.

The identification strategies in [Gruber \(2005\)](#) and [Mellor and Freeborn \(2011\)](#) are closest in spirit to the strategy we use. However, their instrument is the density of people of the same religion in the county. Using the school level makes sense in our context, as the students' choices are affected by their peer environments. Also, the rich data allows us to explore equilibrium effects, such as the possibility that effects derive through better mental health of peers.

4 Results

4.1 Baseline Results

In [Table 3](#) we present the results for the OLS and IV estimation of the relationship between mental health and religiosity. In all specifications, we control for individual characteristics, family background, and grade dummies. Standard errors are clustered at the school level to allow for any arbitrary correlation within the school.

We start with the OLS specification in column (1) which includes the basic

covariates as above but does not control for the school fixed effects. The OLS estimates indicate that religiosity decreases depression by 0.15. More religious adolescents tend to be less depressed. Point estimates on the coefficients of ethnicity controls show that all other race groups (black, Hispanic, and other) tend to be more depressed than the omitted white group. Conditional on other controls, religious denomination does not seem to play a significant role in determining mental health, except that liberal Protestants are less depressed. Physical development is also associated with mental health in different ways for boys and girls. Adolescents are consistently mentally healthier during holidays relative to school term-time, suggesting either seasonal effects or a role of school stress. Family background seems an influential factor in determining adolescent mental health. Not living with father is associated with higher depression. Mothers with more education have children with lower depression. Conditional on mother's education and father being no present, household income is not predictive of mental health. This could be because of the well-known problem of measurement error in income and that 25% of the sample does not report income.

As discussed above controlling for school fixed effects helps eliminate concerns about fixed factors at the school or community level that might predict both religiosity and mental health. For example, the provision of mental health support at the church level may depend on the provision at the school level, creating correlations between the average religiosity of the school and the mental health of adolescents attending the school. School fixed effects also helps control for differences at the community level in the availability of churches or mental health care.¹⁸ Column (2) shows that controlling for school fixed effects only leads to small changes in the estimates of the effect of religiosity, from -.15 to -.16. This suggests that fixed characteristics of the school that determine mental health are not correlated with the adolescent's religiosity.

Column (3) presents results when we instrument for religiosity using the average religiosity of same grade, gender, race and denomination. We find that

¹⁸[Maimon and Payne \(2007\)](#) shows that being in a more religious neighborhood, for instance, protects depressed adolescents from suicide.

higher religiosity leads to lower depression. The estimated effect is -0.70 , over four times as large as the OLS estimates of -0.16 , and it is statistically significant at the 5% level. In standardized terms, this indicates that a one standard deviation (SD) increase in religiosity leads to 0.31 SD reduction in the depression scale. That the IV estimates predict more negative effects of religiosity than OLS suggests there may be negative selection into religiosity, *i.e.*, more depressed adolescents participate in more religious activities. One explanation for this selection is that adolescents may choose religion as a way of coping with depression or other difficult home circumstances that are correlated with depression.¹⁹

Column (4) reports the first stage results for the IV estimation. This equation is of interest in its own right as it provides us with information about the predictors of religiosity. The results show that conservative protestant adolescents are the most religious, followed by moderate protestants. Catholic and liberal protestants do not differ in statistically significant ways. Also, black, Hispanic and other ethnicity adolescents are all more religious than whites. Adolescents whose mothers have a college degree or above are more religious than those with less educated mothers. Finally, adolescents whose fathers are not present at home are less religious.

Most importantly, for the purposes of our study, peer religiosity positively predicts own religiosity at the 1% statistical significance level and the F -statistic on the instrumental variable is 30. This is readily above the conventional rule-of-thumb critical value of 10 for diagnosing weak instruments (Staiger and Stock, 1997). Benchmarked to the Stock-Yogo critical value of 16.38 to bound the size of Wald tests for the case of one endogenous variable and one instrumental variable (Stock and Yogo, 2005),²⁰ the F -statistic is also

¹⁹An alternative interpretation is that IV and OLS results may not be directly comparable if there is heterogeneity in the effect of religiosity on mental health, as OLS estimates the average treatment effect and IV a weighted local average effect for those adolescents whose religiosity is affected by their peers. We return to consider heterogeneity in treatment effects in Section 4.3.

²⁰The Stock-Yogo critical values apply to i.i.d. errors. As there are no concrete routines for testing weak instruments with non-i.i.d. errors (Baum et al., 2002), we stick to using Stock-Yogo critical values, and also conduct Anderson-Rubin 1949 check weak-instrument-

large enough to restrict the rejection rate to be lower than 10% for a 5% Type-I error.

4.2 Potential Threats to Identification

In this section we check the robustness of the estimates to a number of potential threats to our identification strategy as discussed in Section 3.

One key concern with the proposed instrumental variable is that students may select peers based on religiosity at the group level, so that peer religiosity may reflect other unobservable attributes of the student. School fixed effects control for selection into schools based on fixed characteristics of the peer group. Dating back to Hoxby (2000), the literature often exploits random variation within schools to identify peer effects. The idea is that while individuals may select schools and friends, the variation in peer composition across grades within schools is plausibly random variation that can be exploited. The resemblance with the typical peer effect specification in the literature can be made clear by considering the reduced form equation,

$$H_{is} = \delta_0 + \delta_1 \bar{R}_{g(i)s} + \delta_2 X_{is} + \gamma_s + \mu_{is}, \quad (8)$$

where $\mu_{is} = \epsilon_{is} + \alpha_1 u_{is}$. In our case, the random variation in cohort composition across grades within schools creates variation in average religiosity at the group level.²¹

Comparable to other studies that use random variation in peer composition across cohorts, we check this assumption using balancing tests, to see whether peer religiosity predicts observable individual characteristics. The added complication in our context is that instead of just using variation across grades within schools, we are also using variation across gender, race, and denomination. The balancing tests should hold conditional on the full set of gender, race

robust inference for support.

²¹While gender and race are exogenous characteristics that cannot be changed, and therefore follow the argument of plausibly random variation across cohorts within schools, there may be concern whether religious denomination is exogenous. We find that religious denomination is not affected by peers.

and denomination dummies that define the peer group and that we condition on in the main regressions. For instance, Hispanics are more religious, and so they also have peers who are more religious. Hispanic is also correlated with lower socioeconomic status. In Table 4, we regress a battery of individual characteristics and family background indicators on the instrument, conditional on group fixed effects at the school, grade, gender, race and denomination levels. Out of 9 indicators for adolescent and family background characteristics, only one variable, mother not being present, seems to be correlated with peer religiosity and the size of the correlation is very small, at $-.002$. Thus the observable covariates seem to be well balanced between adolescents facing more religious peers and those facing less religious peers, conditional on the group dummies. Though we cannot rule out selection of peer religiosity based on unobservable characteristics, this provides supportive evidence that in terms of observables the assumption of random variation in peer religiosity appears to be valid.

Note that an alternative explanation for correlation between peer religiosity and individual characteristics could be through simultaneity. The fact that we do not see this correlation in terms of observables provides support that it is less likely to there in unobservables as well.

Given random variation in peer religiosity, it remains to disentangle whether the estimated effect of religiosity derives through social context of more religious peers (and associatedly less depressed peers) and mental health or through a direct effect of an individual's own religiosity on mental health. First, in column (1) of Table 5 we check that our results are not driven by school contextual variables that vary across grades and are used to define our subgroups, including the percentage female, the percentage belonging to different racial subgroups and the percentage belonging to different denominations. None of these are individually or jointly significant in determining mental health. Most importantly, this does not affect our estimate of the effect of religiosity on mental health. In column (2), we add in controls for peer characteristics at the subgroup level. Note that if peer mental health or peer religiosity were important direct determinants of mental health, we

would expect to see that some of these observable characteristics of the peer group matter, particularly the ones that are relevant at the individual level for determining mental health and religiosity. However, none of these variables are individually or jointly significant and controlling for them does not change our estimates of the effect of religiosity.

In columns (3) and (4), we control for peer depression, both alone (column (3)) and with other peer characteristics in column (4). Recall from the discussion in Section 3 that peer mental health may be biased upward due to simultaneity or biased toward 0 if it proxies for peer religiosity or unobserved shared group characteristics that might affect mental health. The coefficient on peer depression is close to 0 in both cases, suggesting at least that simultaneity is unlikely to be a driving concern. We also see that peer characteristics in column (4) remain jointly insignificant, providing additional support that peer unobservable characteristics are unlikely to be driving the link between religiosity and depression.

Despite the strong evidence regarding the robustness of our results to different contextual variables, there may be remaining concerns about unobserved shared group effects. A particular type of this shared group effect could come from the presence of an influential local church which may encourage greater religiosity for students in a given denomination and also positively affect mental health. We check that this is not a concern by controlling for average religiosity of same-denomination peers. Also, because church attendance is often segregated along racial lines, we see whether results are affected by controlling for same-race average religiosity. The school fixed effects do not necessarily pick this up as the effect of that church would likely vary depending on the race and denomination of the student. The results in column (5) suggest that neither average race or average denomination religiosity predicts mental health, conditional on own religiosity. However, the average religiosity of the same denomination peers is a strong predictor of own religiosity and does weaken the first stage marginally, though the F-statistic remains strong at 16.6. Furthermore the point estimate of the effect of religiosity remain robust. Finally, column (6) just checks robustness when we also include peer depression, and

results are very similar.²²

Lastly, to provide further evidence of the validity of our instruments and improve the precision of our estimates, we consider an over-identified version of our model. We allow individuals to be influenced by opposite gender peers of the same school, grade denomination as well as same gender peers. The results are presented in Table 6. These results show that own religiosity is affected by both same-gender and opposite-gender peers, but relatively more by same-gender peers. The second-stage results are similar to those obtained from using only one instrument in Table 5. Assuming validity of one instrument, the over-identification tests show that we cannot reject validity of the other instrument, providing further support for the strategy.

4.3 Local effect?

One concern with instrumenting techniques is that when there is heterogeneity in the effect of treatment, then IV estimates need to be interpreted more as a local result rather than an average treatment effect. This is less problematic in many settings where the instrument is a policy, so that the treatment effect though it depends on the instrument, has a natural policy interpretation. In our setting, this may be particularly problematic given that the instrument is not a policy, and the choice of peer religiosity is somewhat arbitrary. This is problematic for us if the marginal effect of peer religiosity differs for people of different degrees of religiosity, i.e., if friends are more influential for less or more religious students. We test whether this is a concern by doing a quantile regression of the first stage.²³ Table 7 shows that peer religiosity shifts across

²²Out of concern that there may be racial segregation across churches, so that for instance black and white students of the same denomination may face different church influences, we also attempt a specification where we control for average religiosity of the same school, race, denomination peers. In this case, there is again no effect of average same school, race, denomination religiosity on depression, suggesting this type of unobserved group effect is not a concern. However, the first stage loses power because it is a strong predictor of own religiosity.

²³To control for school fixed effects, we first extract a school fixed effect from the mean regression and use the predicted school fixed effect as a control in the quantile regression, a methodology developed in Canay (2011). The reported standard errors do not correct for

the quantiles of the religiosity distribution and that the effects are pretty similar (between 0.10 and 0.15) at all quantiles except the 0.9 quantile, where the effect is weak, 0.05. We hypothesize that our instrument is weak at the highest quantiles because of censoring of religiosity.

We further estimate the average treatment effect using different quantiles of the first stage regression residuals as controls.²⁴ We find that estimates of the average treatment effect are very similar across the quantiles of the religiosity distribution and similar in magnitude to the treatment effect estimated in the second stage, with all but the most religious students, where the estimates are quite large likely due to the weak instrument problem. Overall these findings provide support that our estimates apply to all but the most religious students in our sample.

5 Mechanisms

[Ellison and Henderson \(2011\)](#) provide a synthesis of the literature on religiosity and mental health and discuss the ability of a stress process model to explain the link between religiosity and mental health. They highlight several different mechanisms through which religiosity can affect mental health. First, religiosity may affect psychological resources, such as self esteem, which may lead to better mental health. Second, religiosity might help provide coping tools for dealing with stressful life events. For instance, it may reduce the extent to which people engage in active problem solving in response to a stressful situation by encouraging a more fatalistic attitude. Third, religiosity may provide social resources which help individuals deal with stressful situations in healthy ways. These might include helpful friendships or direct financial assistance from the church. Fourth, religiosity might reduce exposure to stressors that can be linked with depression, for instance, by helping to foster more stable home environments.

the fact that the school fixed effect is a generated regressor.

²⁴We use a series expansion to control flexibly for the first stage residual, as described in [Lee \(2007\)](#).

Nooney (2005) highlights the role of stressors, such as school stress and health stresses, as well as perceived support and self esteem as mediating the relationship between religiosity and mental health. Eliassen et al. (2005) find that social support and stress exposure largely explains the relationship between religiosity and mental health. Causality remains a concern in both cases however, as it is difficult to disentangle the role of religiosity from selection. We hope to add to this discussion by isolating a causal channel.

5.1 Psychological resources and coping tools

Self esteem is one focal point in the literature on psychological resources that can help individuals cope with stress in healthy ways. Psychologists hypothesize that self-esteem can develop through the positive regard of others they hold in esteem. The church community can play a role in this, either positively or negatively, by imposing a different value system than adolescents experience in school, i.e., valuing moral integrity over scholastic achievement. Furthermore, it is hypothesized that relationship with a divine other can help provide a sense of worth and a source of solace. We base our self esteem index on 4 questions in the Add Health, which parallels Rosenberg’s global self esteem scale that is widely used in the literature (Rosenberg, 1989; Nooney, 2005). The details are in Appendix Table A.4.

The first 3 columns of Table 8 considers the effect of religiosity on self esteem. We use the same set of controls as in our regressions of religiosity on depression, as in Table 3. Consistent with the literature described in Ellison and Henderson (2011) religiosity is positively correlated with self esteem. However, column (2) shows that when we instrument for religiosity to control for selection and potential reverse causality, we fail to reject that there is no effect of religiosity on self esteem. The standard errors are fairly large, so it could be because of variation in the effects of religiosity on self esteem. Importantly, the arguments for why religiosity could support self esteem could also be turned to suggest reasons that religiosity could hurt self esteem. For instance, relationship with a divine other that is seen largely as punitive could

plausibly hurt self esteem. Either way, our results do not support self esteem as a channel through which religiosity improves depression on average.

A second related theory is that religiosity affects how people cope with difficult situations or problems. For instance, different scholars have suggested that religion can lead one to engage in less active problem-solving and more passive problem-solving, in part because they have a more fatalistic perspective on life. We use the definitions of active and passive problem solving in [Nooney \(2005\)](#) to capture this, which is an index of several self-reported measures of how adolescents approach problems, as described in detail in Appendix Table [A.4](#).

The second and third sets of results in Table [8](#) show the results for active and passive problem solving. OLS shows that religiosity is negatively correlated with active problem-solving and positively correlated with passive problem-solving. However, once we instrument for religiosity, we cannot reject that the effect of religiosity on either is 0.

While we do not find direct evidence that religiosity affects coping or psychological resources with measures available in the Add Health data, we look for indirect evidence of this as we consider the remaining hypotheses in the next section.

5.2 Social Resources and Stressors

Because we do not have data on the churches students attend, we cannot test the hypothesis of churches providing social resources directly. However, [Bradley \(1995\)](#) has shown that there is a positive relationship between more frequent church-going and the size of one's social network, the frequency of contact by telephone and in-person, the support received and the perception of the quality of those supportive relationships. There is also evidence in the literature that religiosity does reduce exposure to stressors that may be correlated with mental health. In the case of adolescents, who may be transitioning from early family life and experiencing stress or distress, the anchor that religious commitment provides, may help them deal better with nega-

tive influences such as anger or conflict, which are thought to emerge from a lack of trust within the home and established family routines (Eliassen, Taylor and Lloyd, 2005, p.189). Gruber and Hungerman (2008) shows that repealing blue laws led to an increase in drinking and drug use among people who were formerly religious. Using the Add Health Mellor and Freeborn (2011) and Fletcher and Kumar (2014) also show that religiosity reduces risky behaviors. In continuing work, we find evidence of this as well. We also see that more depressed adolescents are more likely to engage in these risky behaviors. However, we cannot say anything conclusively about the direction of causality, i.e., are depressed individuals more likely to engage in risky behaviors or is it the risky behaviors that are leading to depression.

The hypotheses described above suggest that religiosity should also help buffer against stressors. To test this hypothesis, we consider a set of potential stressors for adolescents that we find to be correlated with depression—GPA, whether a family member or friend has committed suicide in the past 12 months and general health. Table 10 columns (1)-(3) shows the instrumented effect of religiosity on each of these stressors. In none of these cases, does religiosity appear to have a causal effect, suggesting that religiosity does not reduce exposure to these types of stressors.²⁵

Column (4)-(6) then consider whether there appears to be any stress-buffering effects of religiosity, by considering the interaction between religiosity and the stressor. We instrument for religiosity and the interaction of religiosity and the stressor using our measure of peer religiosity and peer religiosity interacted with the stressor.²⁶ We find that the stress-buffering hypothesis does seem to hold for the suicide of someone close to the adolescent and general health, but not for GPA. This could be interpreted as indirect evidence that religion provides better ways of coping with stress or psychological resources for

²⁵We do not consider risky behaviors because it is difficult to interpret the direction of causality with depression.

²⁶Note that this is easiest to interpret when the stressor is exogenous, which may not be plausible here. Bun and Harrison (2014) describe conditions under which the interaction can be interpreted as exogenous even if the stressor itself is endogenous. The key condition in our context is that the covariance of peer religiosity and the unobservable determinants of mental health do not vary systematically with the stressor.

dealing with stress in some cases, even though we did not see direct evidence of this in the previous section.

An alternative hypothesis supported by these findings is that religiosity helps provide social resources to deal with stressful situations. This could be through direct financial help, alternative social support structures (such as a church friend or leader). We do not have data on the churches the adolescents attend to test this directly, but we can test it indirectly by considering whether adolescents who have less support in other key places, like in the home, school or neighborhood, have experience larger effects of religiosity. In Table 9, we consider three indicators of these types of support structures that are correlated with depression— whether they are from a single parent home, protective factors that include questions related to how much the adolescents feels he is cared for (see appendix Table A.4) and an index of neighborhood resources indicating how much people in the neighborhood know and look after each other. The interaction is significant for the case of coming from a single parent home and for protective factors and supports the theory that religiosity matters more when other support structures at school and in the home are weaker. However, as in the previous table, this could also be indicative of better coping or psychological resources associated with religiosity. Given that we did not see any direct evidence of an effect on coping and psychological resources we could measure, this suggests that the measures we had either did not capture the dimensions that matter or that social resources may play a dominant role.

6 Conclusion

In this paper, we contribute to the literature on religiosity and mental health by showing that religiosity has a causal effect on depression in adolescence, so that adolescents who are more religious are less depressed. The estimate is bigger than what is found in OLS, suggesting negative selection into religiosity, i.e., that individuals may select into religiosity to deal with depression or shocks associated with depression. Our strategy does not allow us to explore the

potentially important margin of selection into religiosity. To the extent that this margin is important, we may understate the benefits of religiosity for depression.

We consider potential mechanisms for why religiosity may affect depression. While we do not find direct evidence of it improving psychological resources (as measured through self esteem index) or coping skills (as measured through active problem solving), we do find that it helps to buffer against stressors. We also find that individuals who have fewer support structures in place at home and in school have bigger effects of religiosity. This could provide indirect evidence that religiosity helps through coping skills or psychological resources, or it could be that religiosity is providing social resources to compensate through direct assistance or social networks. Interestingly, if anything, higher SES individuals benefit more from religiosity, suggesting that direct financial assistance is unlikely to be the dominant story.

The method we use to identify a causal effect of religiosity relies on variation in peer compositions within schools across time and homophily in individual responses to peers. We find that the effect of religiosity on mental health does not appear to be driven by social context. Determining a causal effect of religiosity is a notoriously difficult problem, and we hope that our method can be applied more generally to infer an effect of religiosity in other settings.

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Table 1: Summary statistics

	Mean	Std. Dev.	Min.	Max.	N
<i>Mental Health</i>					
Depression	11.10	7.43	0.00	56.00	12,945
<i>Religiosity</i>					
Religiosity	8.58	3.30	0.00	13.00	12,945
Religious attendance	2.00	1.07	0.00	3.00	12,945
Youth religious activities	1.22	1.24	0.00	3.00	12,945
Praying	3.00	1.26	0.00	4.00	12,945
Religious importance	2.36	0.75	0.00	3.00	12,945
<i>Individual characteristics</i>					
Female	0.51	0.50	0.00	1.00	12,945
White	0.53	0.50	0.00	1.00	12,945
Black	0.22	0.41	0.00	1.00	12,945
Hispanic	0.17	0.38	0.00	1.00	12,945
Other ethnicity	0.08	0.27	0.00	1.00	12,945
Catholic	0.33	0.47	0.00	1.00	12,945
Liberal Protestant	0.09	0.28	0.00	1.00	12,945
Moderate Protestant	0.19	0.40	0.00	1.00	12,945
Conservative Protestant	0.39	0.49	0.00	1.00	12,945
Age	16.17	1.68	11.42	21.25	12,945
School year in session	0.37	0.48	0.00	1.00	12,945
Puberty (male)	5.50	6.04	0.00	19.00	12,945
Puberty (female)	7.32	7.59	0.00	26.00	12,945
<i>Parental background</i>					
Mother not present	0.05	0.22	0.00	1.00	12,945
Mother high school or some college	0.57	0.50	0.00	1.00	12,945
Mother degree and above	0.23	0.42	0.00	1.00	12,945
Father not present	0.29	0.45	0.00	1.00	12,945
Log household income	7.85	4.57	0.00	13.81	12,945
Log household income squared/10	82.48	49.49	0.00	190.84	12,945
Household income missing	0.25	0.43	0.00	1.00	12,945
<i>Peer mental health</i>					
Peer depression	11.13	4.45	0.00	46.00	12,945
<i>Peer religiosity</i>					
Peer religiosity	8.57	2.24	0.00	13.00	12,945
Same-gender peer religiosity	8.57	2.24	0.00	13.00	12,945

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	Mean	Std. Dev.	Min.	Max.	<i>N</i>
Cross-gender peer religiosity	8.55	2.12	0.00	13.00	11,831
<i>School-race and school-deomination religiosity</i>					
SR religiosity	8.53	1.32	2.50	13.00	12,945
SD religiosity	8.58	1.42	3.00	13.00	12,945
<i>Psychological resources</i>					
Self-esteem	16.37	2.53	4.00	20.00	12,931
Active problem-solving	8.67	2.47	4.00	20.00	12,869
Passive problem-solving	8.26	2.20	3.00	15.00	12,900
<i>Stressors</i>					
Most recent GPA	2.76	0.77	1.00	4.00	12,838
Friends/Family suicide	0.19	0.39	0.00	1.00	12,888
General health	3.90	0.90	1.00	5.00	12,944

Notes: Peer group is defined as the students in the same school-grade with the same gender, race, and religious denomination.

Source: Add Health Wave I.

Table 2: Heterogeneity in religiosity and mental health

	<i>N</i>	Religiosity		Depression	
		Mean	SD	Mean	SD
<i>Gender</i>					
Female	6666	8.89	(3.18)	11.99	(8.03)
Male	6279	8.25	(3.38)	10.15	(6.61)
<i>Race</i>					
White	6826	8.17	(3.46)	10.06	(7.09)
Hispanic	2243	8.07	(3.09)	12.80	(7.88)
Black	2817	9.78	(2.75)	11.46	(7.42)
Other ethnicity	1059	9.10	(3.09)	13.26	(7.49)
<i>Denomination</i>					
Catholic	4275	7.66	(3.09)	11.53	(7.65)
Liberal Protestant	1130	8.09	(3.56)	9.34	(6.46)
Moderate Protestant	2506	8.48	(3.43)	10.98	(7.25)
Conservative Protestant	5034	9.51	(3.08)	11.19	(7.49)
<i>Household income</i>					
Low income	1951	8.61	(3.25)	12.45	(7.75)
Mid income	5283	8.51	(3.36)	10.89	(7.35)
High income	2496	8.49	(3.31)	9.71	(6.97)
<i>Mother's education</i>					
Mother no high school	2039	8.36	(3.22)	13.21	(7.93)
Mother high school	7320	8.48	(3.32)	10.91	(7.29)
Mother degree and above	2914	9.15	(3.21)	9.82	(6.99)

Table 3: OLS and IV estimates of the effect of religiosity on adolescent mental health

	(1) OLS	(2) OLS	(3) IV	(4) First stage
Religiosity	-0.147*** (0.025)	-0.163*** (0.024)	-0.698** (0.289)	
Peer religiosity				0.112*** (0.020)
Black	0.767*** (0.272)	0.526 (0.372)	0.918** (0.455)	0.660*** (0.120)
Hispanic	1.485*** (0.460)	1.165*** (0.287)	1.515*** (0.365)	0.600*** (0.133)
Other ethnicity	3.069*** (0.490)	2.240*** (0.393)	2.766*** (0.561)	0.864*** (0.212)
Liberal Protestant	-0.668** (0.296)	-0.616* (0.325)	-0.466 (0.342)	0.242 (0.195)
Moderate Protestant	0.172 (0.221)	0.074 (0.253)	0.436 (0.303)	0.604*** (0.116)
Conservative Protestant	0.220 (0.244)	0.155 (0.251)	0.757* (0.392)	1.006*** (0.134)
Female	0.646 (0.502)	0.826 (0.511)	1.132** (0.558)	0.505** (0.208)
Age	1.396*** (0.117)	1.405*** (0.105)	1.276*** (0.135)	-0.235*** (0.048)
School year in session	1.068*** (0.145)	1.092*** (0.149)	1.146*** (0.162)	0.100 (0.064)
Puberty (male)	-0.113*** (0.032)	-0.108*** (0.032)	-0.119*** (0.034)	-0.022 (0.014)
Puberty (female)	0.016 (0.032)	0.015 (0.031)	0.008 (0.032)	-0.014 (0.010)
Mother not present	-0.149 (0.326)	-0.181 (0.339)	-0.302 (0.347)	-0.206 (0.136)
Mother high school or some college	-1.063*** (0.243)	-1.100*** (0.280)	-1.035*** (0.251)	0.124 (0.119)
Mother degree and above	-1.711*** (0.310)	-1.646*** (0.351)	-1.266*** (0.390)	0.718*** (0.157)
Father not	0.609***	0.591***	0.292	-0.555***

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	(1)	(2)	(3)	(4)
	OLS	OLS	IV	First stage
present	(0.169)	(0.163)	(0.228)	(0.069)
Log household income	1.767 (1.426)	1.194 (1.500)	1.367 (1.451)	0.388 (0.662)
Log household income squared/10	-0.109 (0.069)	-0.079 (0.073)	-0.087 (0.071)	-0.019 (0.033)
Household income missing	6.680 (7.351)	3.843 (7.722)	4.812 (7.445)	2.123 (3.367)
Grade 8	-1.048*** (0.285)	-1.113*** (0.273)	-1.179*** (0.258)	-0.089 (0.104)
Grade 9	-1.624*** (0.333)	-2.058*** (0.443)	-2.060*** (0.420)	0.044 (0.163)
Grade 10	-2.492*** (0.483)	-3.092*** (0.521)	-3.070*** (0.503)	0.110 (0.177)
Grade 11	-3.904*** (0.544)	-4.522*** (0.601)	-4.432*** (0.597)	0.242 (0.213)
Grade 12	-5.685*** (0.730)	-6.310*** (0.705)	-6.198*** (0.696)	0.299 (0.256)
School FE <i>F</i> -statistic	No	Yes	Yes	Yes 30.438

Notes This table reports the OLS and IV estimates of religiosity on The omitted groups for race, religious denomination, and mother's education background are white, Catholic, and mother's education lower than high school respectively. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. *F*-statistic on the excluded instrument refers to the Wald version of the Kleibergen-Paap (2006) *rk*-statistic on the excluded instrumental variables for non-i.i.d. errors. The number of observations is 12,945 for all models.

Table 4: Balancing test

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Mother not present	Father not present	Mother no high school	Mother high school	Mother degree and above	Log household income	School year in session	Puberty (male)	Puberty (female)
Peer religiosity	-0.002** (0.001)	-0.003 (0.002)	0.001 (0.002)	0.002 (0.003)	0.000 (0.002)	-0.011 (0.023)	0.001 (0.002)	0.025 (0.021)	0.010 (0.021)
Female	-0.006 (0.005)	0.038*** (0.008)	0.010 (0.007)	0.001 (0.010)	-0.005 (0.009)	-0.206** (0.103)	-0.036*** (0.012)		
Black	-0.007 (0.008)	0.219*** (0.016)	-0.003 (0.020)	0.013 (0.023)	-0.003 (0.021)	-0.785*** (0.182)	0.068*** (0.021)	-1.311*** (0.132)	-0.375** (0.180)
Hispanic	-0.007 (0.007)	0.038** (0.019)	0.352*** (0.045)	-0.180*** (0.031)	-0.165*** (0.025)	-1.544*** (0.221)	0.041* (0.021)	-0.353** (0.162)	-0.057 (0.169)
Other ethnicity	-0.001 (0.012)	0.002 (0.018)	0.030 (0.045)	-0.143*** (0.026)	0.114** (0.049)	-1.556*** (0.279)	0.003 (0.027)	-1.057*** (0.169)	-0.432** (0.173)
Liberal Protestant	-0.018* (0.009)	0.001 (0.015)	-0.031** (0.013)	-0.037 (0.027)	0.086*** (0.025)	0.377** (0.178)	0.035 (0.023)	0.367*** (0.131)	0.060 (0.166)
Moderate Protestant	0.004 (0.006)	0.037*** (0.010)	-0.013 (0.016)	0.019 (0.023)	-0.009 (0.015)	-0.080 (0.148)	-0.005 (0.013)	0.201* (0.107)	0.297** (0.148)
Conservative Protestant	0.001 (0.007)	0.055*** (0.013)	0.022 (0.016)	0.013 (0.019)	-0.036*** (0.012)	-0.148 (0.129)	0.021 (0.015)	0.185 (0.112)	0.260* (0.147)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grade dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12,945	12,945	12,945	12,945	12,945	12,945	12,945	6,279	6,666

Notes: Clustered standard levels at the school level are in parentheses. ***, **, and * denote significance at 0.01, 0.05, and 0.10 levels respectively.

Table 5: Robustness of IV estimates of the effect of religiosity on depression

	(1)		(2)		(3)		(4)		(5)		(6)	
	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage
Religiosity	-0.675** (0.295)		-0.606** (0.302)		-0.655** (0.314)		-0.597* (0.318)		-0.747* (0.381)		-0.740* (0.403)	
Peer depression					0.010 (0.025)	-0.009 (0.006)	0.005 (0.024)	-0.008 (0.006)			0.004 (0.025)	-0.008 (0.006)
SR religiosity ^a									-0.021 (0.198)	-0.151 (0.103)	-0.021 (0.198)	-0.151 (0.102)
SD religiosity ^b									0.156 (0.169)	0.176** (0.082)	0.155 (0.170)	0.177** (0.082)
Peer religiosity		0.110*** (0.021)		0.108*** (0.021)		0.108*** (0.021)		0.107*** (0.021)		0.097*** (0.024)		0.095*** (0.024)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SG contextuals ^c	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Joint test 1 ^d	0.879	0.052	0.858	0.073	0.880	0.062	0.861	0.085	0.887	0.058	0.890	0.068
Peer characteristics	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Joint test 2 ^e		0.886		0.517		0.882		0.543		0.577		0.608
F-statistic		28.664		27.817		27.477		27.024		16.569		16.091

Notes All models include the baseline controls as in column (3) of Table 3. Clustered standard levels at the school level are in parentheses. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. *F*-statistic on the excluded instrument refers to the Wald version of the Kleibergen-Paap (2006) *rk*-statistic on the excluded instrumental variables for non-i.i.d. errors. The number of observations is 12,945 in all models.

^a School-race average religiosity.

^b School-denomination average religiosity.

^c School-grade level contextual variables, including proportions of female, each race, and each denomination.

^d This row reports the *p*-values of a joint significance test on all school-grade contextual variables.

^e This row reports the *p*-values of a joint significance test on all peer characteristics.

Table 6: Same-gender and cross-gender peer religiosity as instruments

	(1)		(2)		(3)		(4)		(5)		(6)	
	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage
Religiosity	-0.889*** (0.301)	-0.780** (0.311)	-0.923*** (0.328)	-0.826** (0.335)	-0.813** (0.361)	-0.862** (0.392)						
Same-gender peer depression			-0.020 (0.027)	-0.011 (0.027)	-0.030 (0.027)	-0.011 (0.007)						
Cross-gender peer depression			-0.001 (0.024)	-0.006 (0.008)	-0.009 (0.024)	-0.003 (0.008)						
School-race average religiosity												
School-denomination average religiosity												
Same-gender peer religiosity		0.115*** (0.022)		0.112*** (0.022)		0.110*** (0.022)						
Cross-gender peer religiosity		0.061*** (0.022)		0.059*** (0.022)		0.060*** (0.023)						
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SG contextuals ^a	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Joint test 1 ^b	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.087
Peer characteristics	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Joint test 2 ^c		0.070		0.290		0.094		0.301		0.432		0.460
F-statistic		18.074		18.201		17.216		17.814		12.304		12.069
Hansen J-test ^d	0.768	0.933	0.797	0.946	0.869	0.882						
N	11,831	11,831	11,831	11,784	11,831	11,784	11,784	11,784	11,784	11,784	11,784	11,784

Notes Same-gender peers are defined as adolescents who are of the same school, grade, race, denomination and gender. Cross-gender peers are defined as adolescents who are of the same school, grade, race, denomination, but opposite gender. All models include the baseline controls as in column (3) of Table 3. Clustered standard levels at the school level are in parentheses. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. F-statistic on the excluded instrument refers to the Wald version of the Kleibergen-Paap (2006) rk-statistic on the excluded instrumental variables for non-i.i.d. errors.

Table 7: Quantile regressions of adolescent religiosity on peer religiosity

	Quantiles								
	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
Peer religiosity	0.110*** (0.032)	0.145*** (0.031)	0.152*** (0.029)	0.146*** (0.030)	0.139*** (0.026)	0.138*** (0.024)	0.127*** (0.027)	0.109*** (0.024)	0.053*** (0.015)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes Baseline controls are as in model (3) of Table 3. School fixed effects are estimated using a mean regression of own religiosity on peer religiosity and other baseline controls. Standard errors in parentheses are obtained by bootstrapping with 500 replications allowing for clustering at the school level. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. The number of observations is 12,945 in all models.

Table 8: The effect of religiosity on psychological resources

	(a) Self-Esteem			(b) Active Problem-Solving			(c) Passive Problem-Solving		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	2SLS second stage	2SLS first stage	OLS	2SLS second stage	2SLS first stage	OLS	2SLS second stage	2SLS first stage
Religiosity	0.075*** (0.008)	0.153 (0.105)		-0.077*** (0.007)	0.079 (0.105)		0.022*** (0.007)	0.113 (0.102)	
Peer religiosity			0.112*** (0.020)			0.114*** (0.020)			0.114*** (0.020)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>F</i> -statistic			30.399			31.662			31.916
<i>N</i>	12,931	12,931	12,931	12,869	12,869	12,869	12,900	12,900	12,900

Notes Baseline controls include all covariates as in column (3) of Table 3. Clustered standard levels at the school level are in parentheses. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. *F*-statistic on the excluded instrument refers to the Wald version of the Kleibergen-Paap (2006) *rk*-statistic on the excluded instrumental variables for non-i.i.d. errors.

Table 9: Religiosity, support structures and depression

	(a) Support structures			(b) Depression		
	(1) single parent	(2) protective factors	(3) neighborhood resources	(4) single parent	(5) protective factors	(6) neighborhood resources
Religiosity	0.014 (0.013)	0.163 (0.174)	-0.020 (0.052)	-0.575* (0.320)	-1.316** (0.537)	-0.963*** (0.299)
Interaction				-0.322* (0.177)	0.024* (0.014)	0.086 (0.056)
Support structure				2.630* (1.525)	-0.805*** (0.119)	-1.427*** (0.485)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>F</i> -statistic	28.102	32.337	30.324	14.120	16.172	15.338
<i>N</i>	10,504	12,675	12,750	10,504	12,675	12,750

Notes Columns (1)–(3) report the IV estimates for the effect of religiosity on support structures. Columns (4)–(6) report the IV estimates for the main and interaction effects of religiosity on depression conditional on support structures. Baseline controls include covariates as in model (2) of Table 3. Clustered standard levels at the school level are in parentheses. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. *F*-statistic refers to the Wald version of the Kleibergen-Paap (2006) *rk*-statistic on the excluded instrumental variables for non-i.i.d. errors.

Table 10: Religiosity, stressors and depression

	(a) Stressors			(b) Depression		
	(1) GPA	(2) family/friends suicide	(3) general health	(4) GPA	(5) family/friends suicide	(6) general health
Religiosity	0.033 (0.031)	-0.006 (0.019)	-0.063 (0.039)	-0.667* (0.349)	-0.643** (0.293)	-1.436*** (0.389)
Interaction				0.015 (0.088)	-0.598*** (0.197)	0.160** (0.072)
Stressor				-1.747** (0.780)	8.214*** (1.687)	-3.050*** (0.623)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>F</i> -statistic	30.425	30.284	30.416	14.615	14.914	16.010
<i>N</i>	12,838	12,888	12,944	12,838	12,888	12,944

Notes Columns (1)–(3) report the IV estimates for the effect of religiosity on exposure to stressors. Columns (4)–(6) report the IV estimates for the main and interaction effect of religiosity on depression conditional on stressors. Baseline controls include covariates as in model (2) of Table 3. Clustered standard levels at the school level are in parentheses. ***, **, and * denote statistical significance at 0.01, 0.05, and 0.10 levels respectively. *F*-statistic refers to the Wald version of the Kleibergen-Paap (2006) *rk*-statistic on the excluded instrumental variables for non-i.i.d. errors.

Table A.1: Categorization of religious affiliations

Religious denomination	Religious affiliations
No religion	No religion
Catholic	Catholic
Liberal Protestant	Episcopal, Friends/Quaker, Methodist, Presbyterian, United Church of Christ, Unitarian
Moderate Protestant	Christian Church (Disciples of Christ), Lutheran, National Baptist, other Protestant
Conservative Protestant	Adventist, AME/AME Zion/CME, Assemblies of God, Baptist, Christian Science, Jehovah's Witness, Congregational, Holiness, Latter Day Saints (Mormon), Pentecostal
Other religion	Baha'i, Buddhist, Eastern Orthodox, Hindu, Islam, Jewish, other religion

A Appendix

Table A.2: Definition of key variables

No.	Question
<i>Religiosity</i>	
Definition: sum over the following variables.	
(1)	In the past 12 months, how often did you attend religious services? Responses: 0 = never, 1 = less than once a month, 2 = less than once a week/at least once a month, 3 = once a week or more.
(2)	Many churches, synagogues, and other places of worship have special activities for teenagers—such as youth groups, Bible classes, or choir. In the past 12 months, how often did you attend such youth activities? Responses: coded same as question (1) above.
(3)	How important is religion to you? Responses: 0 = not important at all, 1 = fairly unimportant, 2 = fairly important, 3 = very important.
(4)	How often do you pray? Responses: 0 = never, 1 = less than once a month, 2 = at least once a month, 3 = at least one a week, 4 = at least once a day.
<i>Depression</i>	
Definition: sum over the following variables.	
Coding of responses: 0 = never/rarely, 1 = sometimes, 2 = a lot of the time, 3 = most/all of the time.	
(1)	You were bothered by things that usually don't bother you.
(2)	You didn't feel like eating, your appetite was poor.
(3)	You felt that you could not shake off the blues, even with help from your family and your friends.
(4)	You felt that you were just as good as other people. ^a
(5)	You had trouble keeping your mind on what you were doing.
(6)	You felt depressed.
(7)	You felt that you were too tired to do things.
(8)	You felt hopeful about the future. ^a
(9)	You thought your life had been a failure.
(10)	You felt fearful.
(11)	You were happy. ^a
(12)	You talked less than usual.
(13)	You felt lonely.
(14)	People were unfriendly to you.
(15)	You enjoyed life. ^a
(16)	You felt sad.
(17)	You felt that people disliked you.
(18)	It was hard to get started doing things.
(19)	You felt life was not worth living.

Notes

^a Responses to these questions are reverse coded, such that 3 = never/rarely, 2 = sometimes, 1 = a lot of the time, 0 = most/all of the time.

Table A.3: Sample selection criteria and sample means of key variables

	Sample selection criterion						
	(1) Full in-home sample	(2) Mental health not missing	(3) Religious affiliation not missing	(4) Excluding no and other religion	(5) Religiosity not missing	(6) Covariates not missing	(7) Peer variables not missing
<i>Mental health</i>							
Depression	11,390 (20,662)	11,390	11,366	11,228	11,226	11,169	11,099
<i>Religiosity</i>							
Religiosity	8,493 (17,748)	8,492 (17,725)	8,495 (17,706)	8,558 (16,736)	8,558	8,555	8,578
Religious attendance	1,973 (17,801)	1,974 (17,776)	1,974 (17,757)	1,993 (16,781)	1,994	1,994	2,002
Youth religious activities	1,204 (17,804)	1,204 (17,780)	1,204 (17,760)	1,218 (16,783)	1,218	1,218	1,219
Praying	2,967 (17,799)	2,967 (17,775)	2,968 (17,755)	2,992 (16,781)	2,993	2,991	2,999
Religious importance	2,345 (17,799)	2,345 (17,775)	2,345 (17,755)	2,353 (16,780)	2,353	2,353	2,358
Sample size	20,745	20,662	20,312	16,806	16,736	15,869	12,945
% of full sample	100.00	99.60	97.91	81.01	80.67	76.50	62.40

Notes Sample means of key variables under each sample selection criterion are reported in cells. The number of observations for each variable is reported in parenthesis when it is different from the total sample size under that selection criterion.

Table A.4: Definition of additional variables

No.	Question
<i>Self-esteem</i>	
	Definition: sum over the following variables.
	Coding of responses: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
(1)	You have a lot to be proud of.
(2)	You like yourself just the way you are.
(3)	You feel like you are doing everything just about right.
(4)	You have a lot of good qualities.
<i>Active problem-solving</i>	
	Definition: sum over the following variables.
	Coding of responses: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
(1)	When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible.
(2)	When you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible.
(3)	When making decisions, you generally use a systematic method for judging and comparing alternative.
(4)	After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong.
<i>Passive problem-solving</i>	
	Definition: sum over the following variables.
	Coding of responses: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
(1)	You usually go out of your way to avoid having to deal with problems in your life.
(2)	Difficult problems make you very upset.
(3)	When making decisions, you usually go with your “gut feeling” without thinking too much about the consequences of each alternative.
<i>Protective factors</i>	
	Definition: sum over the following variables.
	Coding of responses: 1= not at all, 2 = very little, 3 = somewhat, 4 = quite a bit, 5 = very much.
(1)	How much do you feel that adults care about you?
(2)	How much do you feel that your teachers care about you?
(3)	How much do you feel that your parents care about you?
(4)	How much do you feel that your friends care about you?
(5)	How much do you feel that people in your family understand you?
(6)	How much do you feel that you want to leave home?
(7)	How much do you feel that you and your family have fun together?
(8)	How much do you feel that your family pays attention to you?
<i>Neighborhood resources</i>	

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No.	Question
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Definition: sum over the following variables.
Coding of responses: 1 = true/yes, 0 = false/no.

- (1) You know most of the people in your neighborhood.
- (2) In the past month, you have stopped on the street to talk with someone who lives in your neighborhood.
- (3) People in this neighborhood look out for each other.
- (4) Do you usually feel safe in your neighborhood?
- (5) On the whole, how happy are you with living in your neighborhood?^a

GPA

Definition: average across the following variables.
Coding of responses: 1 = D or lower, 2 = C, 3 = B, 4 = A.

- (1) At the most recent grading period, what was your grade in each of the following subjects? English/Language Arts
- (2) At the most recent grading period, what was your grade in each of the following subjects? Mathematics
- (3) At the most recent grading period, what was your grade in each of the following subjects? History/Social Studies
- (4) At the most recent grading period, what was your grade in each of the following subjects? Science

Family/friends suicide

Definition: equals 1 if answer is "yes" to either question, and 0 otherwise.
Coding of responses: 1 = yes, 0 = no.

- (1) Have any of your family tried to kill themselves during the past 12 months?
- (2) Have any of your friends tried to kill themselves during the past 12 months?

General health

Definition: response to the following variable.
Coding of responses: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

- (1) In general, how is your health?

Notes

^a Coded as: 1 = somewhat/quite a bit/very much, 0 = not at all/very little.