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RELIGION AND RISKY HEALTH BEHAVIORS AMONG U.S. ADOLESCENTS AND ADULTS

Jason Fletcher
Sanjeev Kumar

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ABSTRACT

Recent studies analyzing the effects of religion on various economic, social, health and political outcomes have been largely associational. Although some attempts have been made to establish causation using instrument variable (IV) or difference-in-difference (DID) methods, the instruments and the spatial and temporal variations used in these studies suffer from the usual issues that threaten the use of these identification techniques—validity of exclusion restrictions, quality of counterfactuals in the presence of spatial assortative sorting of people, and concern about omitted variable bias in the absence of information on family level unobservables and child-specific investment by families. During the adolescent years, religious participation might be a matter of limited choice for many individuals, as it is often heavily reliant on parents and family background more generally. Moreover, the focus of most of the studies has been on religious rites and rituals i.e., religious participation or on the intensity of participation. Using the National Longitudinal Study of Adolescent Health, this paper analyzes the effects of a broad set of measures of religiosity on substance use at different stages of the life course. In contrast to previous studies, we find positive effects of religion on reducing all addictive substance use during adolescence, but not in a consistent fashion during the later years for any other illicit drugs except for crystal meth and marijuana.

Jason Fletcher
Yale School of Public Health
Department of Health Policy and Management
60 College Street, #303
New Haven, CT 06520
and NBER
jason.fletcher@yale.edu

Sanjeev Kumar
Yale School of Public Health
Department of Health Policy and Management
60 College Street, #312
New Haven, CT 06520
sanjeev.kumar@yale.edu

Introduction

Risky health behaviors among adolescents and adults, especially tobacco- and substance-use, has been an active research area for health economists (Fletcher 2012; Cawley and Ruhm, 2011; Clark and Loheac 2007). Economists have proposed a number of reasons for the continued high rate of substance use among people of all age groups, ranging from the genetic to the environmental. Yet one potentially influential factor which has received little attention in this literature is the role of religion on risky health behaviors. In light of an increasing proportion of single parent and dysfunctional families in the U.S. (Conti and Heckman, 2012), it is crucial to examine the effect of other existing institutions on the mental and physical health of children and youth. This paper is an attempt to re-evaluate the roles that one particularly crucial institution--religion---plays in influencing risky health behaviors among U.S. adolescents.

There is hardly any aspect of a society that is untouched by religion (Guiso et al. 2003, p. 226).[1] However, it is not clear if religious belief is an *ex post* narrative or if it really is a causal factor in shaping the ways individual and society function.[2] It would be appropriate to suggest, as Ulmer et al. (2011) did, that the understanding of the ways religion and its institutions affect human behaviors, in particular, risky health behaviors, is quite insufficient. To the best of our

[1] Americans are strikingly different from other First World nations in their attitudes to religion (Dannett 2006). It also comes out very distinctly in the data that we use for this paper: 81.6% respondents in Wave 3 report that they believe in God and always have.

[2]What sets human beings apart from animals is not the pursuit of happiness, which occurs all across the natural world, but the pursuit of meaning, which is unique to humans (Baumeister 2013). Religion, by virtue of being a sense-making institution, potentially assists people in forming a frame of reference for routine evaluation (i.e., endowing them with a sense of purpose) of the world around them (McCullough et al. 2009; Diamond, 2012). It is the ability for such routine evaluation that endows an individual with the capability to regulate themselves. Thus, we posit that one way religion, potentially, would protect individuals regarding substance use is to equip them with the requisite psychological tools to control their urge to indulge in risky health behaviors.[2] We are able to do this by controlling for the religious affiliation of the respondents.

knowledge, there is no existing study which discusses the effects of religiosity and religious participation on medium- and long-term risky health behaviors and other health-related outcomes using sibling-fixed effects.

If—as scholars claim—religion protects people from self-harm (Desmond et al. 2013; Mellor and Freeborn, 2011; McCullough and Willoughby 2009), then understanding the mechanism by which religion provides such protection and the effects of religiosity more broadly, is crucial to understanding how to reduce indulgence in risky health behaviors. Given the multidimensional nature of religiosity, we expand on the existing measures—frequency of religious attendance and prayers—to include a broad measure of religiosity, which captures the self-reported importance of religion (Iannaccone 1998; Kendler et al. 1997). We suggest that an individual can choose to participate under social and peers' pressures; and hence can choose to pray under unavoidable exigencies, yet not consider religion an important aspect of her life.

Only a handful of studies seek to evaluate the *causal* effect of religion on risky health behaviors. A recent example, by Mellor and Freeborn (2011), uses the instrument variable (IV) method; however, the instrument—a population-based county level measure of religious market density---may not satisfy the exclusion restriction, given that their specifications exclude variables that can capture state, county, parental, and other individual level sources of unobserved heterogeneity. Some studies have exploited policy variations across time and space to glean causal effects using changes in the prices of secular activities (Gruber and Hungerman, 2008; Hungerman, 2010). Evidence on spatial sorting of people, on the basis of their preferences for rules and public goods, makes it difficult to impute causal interpretation to the estimates reported

in the extant literature (Ferreira and Gyourko, 2007; Tiebout, 1956). Furthermore, the focus of most of these previous studies has been the role of rites and rituals (i.e., religious participation or the intensity of such participation). For instance, an individual may not participate in religious activities but still can have strong religious beliefs, or there can be non-believers who participate only to take advantage of social networks and services that religious organizations provide. Thus, one must also account for the role that religious belief, in the sense of the importance that an individual attaches to religion, plays in influencing the usage of addictive substance.

Religion may not be a matter of choice for many individuals during their childhood and adolescent years. Most children grow up practicing some form of religion as a direct result of their parents, social networks and neighborhood characteristics (Iannaccone, 1998). Using the National Longitudinal Study of Adolescent Health (AddHealth), this paper analyzes the effects of religious participation, intensity of participation, and religiosity or intensity of religious beliefs (defined as self-reported importance of religion) on risky health behaviors for adolescents. In contrast to previous studies, we use a sibling sample to parse out the effects of family level unobserved heterogeneity of the effect of religion on risky health behaviors. And in contrast to some of the previous studies, we find positive effects of religion on three specific outcomes: tobacco use, alcohol use and illicit drug use.

We contribute in the literature along the following dimensions: In light of the usual issues involved in the application of IV method to parse out causal effect in observational studies, we use a sample of siblings to evaluate the effects of various measures of religion on not only contemporaneous, but also the medium- as well as the long-term measures of risky health behaviors: cigarette smoking, binge drinking, marijuana use, and other illicit drugs. We include some additional covariates—PVT score, child-weight, urbanization, parental religiosity, county

level measures of religiosity directly relevant for a respondent---on the basis of recent advances in molecular genetics and neuroscience. In addition, we show using Gelbach's (2009) conditional decomposition method the extent to which variation in family level unobserved heterogeneity contributes in driving the estimates of the effects of religion on risky health behaviors.

Literature Review

Iannaccone (1998) introduced the framework of the rational choice model to explain religious institutions and adherence of beliefs, and since then one finds continuous and sustained efforts in building a better understanding of economics of religious institutions (see Iannaccone and Bainbridge (2010), and references therein). Still the infancy of research analyzing the effects of religion on risky healthy behaviors in economics is highlighted by the fact that neither of the two recent handbooks of health economics (Pauly et al. 2012; Glied and Smith, 2011) contains the word 'religion' in their index-sections. However, lately there has been more effort invested by economists and other social scientists in evaluating the causal effects of religion on risky health behaviors (Mellor and Freeborn, 2011; Gruber and Hungerman, 2008; Lillard and Price, 2007; Gruber, 2005; Chatters, 2000).

The study closest in spirit to our paper is Mellor and Freeborn (2011). The authors follow Gruber (2005) and use the proportion of the county population belonging to the same denomination as the respondent as an instrument for religious participation variables. They report that religious participation as defined by both religious attendance and prayer has a significant negative effect on marijuana use. However, though they report negative estimated effects for smoking and binge drinking, their estimates were found to be statistically imprecise. In addition, their study raises

concerns about the validity of exclusion restriction, especially in the absence of information on family level unobservables.

Lillard and Price (2007) apply various estimation techniques using several nationally representative surveys, namely the Panel Survey of Income Dynamics (PSID), the National Longitudinal Surveys of Youth 1979 (NSLY79), the Children of the National Longitudinal Surveys of Youth 1979 (CNLSY79), and Monitoring the Future (MTF) to show that youth who attend church more often are less likely to show socially deviant behaviors and indulge in risky health behaviors.

Gruber (2005) discusses many channels that may explain the positive effects of a higher level of religiosity on various outcomes of interests, namely, religious participation, education, income, marital status, and also substance use. Given the difficulty in finding instruments that satisfy the exclusion restriction, Gruber and Hungerman (2008) and Hungerman (2010) have taken an alternative approach by studying the response of individuals to the change in the price of secular goods due to changes in the policy regimes. Gruber and Hungerman (2008) show that the repeal of 'blue laws' across the US states in the 1970s and '80s led to a significant increase in marijuana and cocaine consumption. They suggest that lowering the price of secular activities would chip away at religious participation because of the higher opportunity cost of religious participation. Consequently, if religion provides protection against the risky behaviors then they suggest that the repeal of "blue laws" would lead individuals to indulge more in these risky behaviors. However, findings for respondents between ages 5 and 30 by Lillard and Price (2007) to some extent challenge this explanation; they find evidence of policy endogeneity: respondents living in the states that repealed blue laws were less likely to initiate smoking. However, individuals living in states without blue laws in which Sunday is treated as the day of obligation

were somewhat more likely to initiate smoking conditional religious affiliation. Crucially, none of the studies we have reviewed control for parental religiosity or spatial sorting of individuals on the basis of policy-framework (Tiebout, 1956), which casts doubt on the robustness and validity of their causal estimates.

In this paper, we improve on the existing literature in a number of ways. First, we expand the outcomes variables of interest to include: consumption of cocaine, methamphetamines, and other illicit drugs. We also investigate the medium- and longer-term effects of religion on risky health behaviors. Moreover, findings from behavioral genetics indicate the potential role that genes play in predisposing a person to religion and religiosity (Sapolsky, 2011[3]), as well as to the usage of additive substance (Fletcher, 2012). If indeed the propensity to have faith is heritable to some extent (Mohr and Huguelet, 2004) then using family-fixed effects, potentially would control for genetic endowments shared among the family members. Also, a more religious household may be more likely to adhere to religious proscription regarding addictive substances, have a higher discount rate, bigger family size, working mother etc., all of which have been shown to affect the demand for substance use (Iannaccone, 1998). The presence of these characteristics also affects the incentives for the suppliers and the state agency to regulate the supply and demand of these commodities. One needs to keep such models in mind when deriving predictions about the propensity for substance use.[4]

Empirical Strategy

[3] Based on Sapolsky's lecture made available on the Internet: http://www.youtube.com/watch?v=4WwAQqWUkpI

[4] We control for family level unobservables through family fixed effects, which helps us to take care of many such confounders.

There are clear reasons that much of the literature linking religion and risky outcomes is descriptive. It is quite difficult to find adequate quasi-experimental variation in individuals' religious beliefs and practices in observational data. This is particularly true for adolescents because of their reliance on parental religious beliefs and practices. Indeed, we suggest that a critical source of heterogeneity that is often unable to be controlled in research is the effect of parents and family background on both religious and health outcomes (Chiswick 1988; Lehrer 1999). Thus, our primary strategy is to use a novel sample of siblings to employ family-fixed effects to capture this specific set of potentially confounding influences, and to evaluate the longer terms effects of religion on risky health behaviors. Since the goal of this paper is to directly account for family-level unobservables rather than through IV methods, we implement the following steps:

First, in contrast to some of the recent studies, we include all denominations as well as the respondents reporting 'no religion.'[5] We extend the analysis by defining new groups namely, other Christian group (Christian Science, Jehovah's Witness, other Protestant, Eastern Orthodox), other religions (Baha'ism, Islam, Hinduism, other Religions), those with no religious group, and also to a group where members don't know their religion.[6] In particular, our method (that of family-fixed effects) is not constrained by the limitation posed by AddHealth data for using the standard IV employed in the literature: county-level proportion of one's own religious

[5] Dull and Skokan (1995, p. 51) put forward more nuanced views regarding religious behaviors: "People may identify themselves as Baptists on a questionnaire because they have been raised in that faith, but not adhere to its tenets for daily living nor attend many of the group's religious functions. In contrast, another person may not identify with any religious group but may still adopt a particular religious or spiritual belief system."

[6] The idea behind including those who don't know their religion is the age of the respondents. Adolescence is the age of a number of changes; one of the siblings may report not knowing her religion when she does not participate in any religious activities, while her other siblings might. Although when we restrict the sample to siblings cluster, there remains just one family which reports not knowing its religion.

affiliates.[7] If our goal is to explore the potential protective effect of religion and its practices for an average person, it is useful to make broader comparisons using information on all religions, as well as those practicing no religion. Second, we use Gelbach (2009) to evaluate the extent to which family-level unobserved heterogeneity drives the estimates.

Given the difficulty in satisfying the exclusion restriction in the case of a variable like religion, which can potentially impact many institutions and behaviors, we felt a more suitable approach is to control for as many confounding variables as we can in order to estimate the effect of religion on risky health behaviors. Although the family fixed effects approach has certain limitations, this approach is an advance over the current literature..

Additionally, we repeat the above analytical framework to understand the medium- and long-terms effects of religion. Going beyond the contemporaneous effect gives us the latitude to include other measures of risky health behaviors: cocaine use, meth use, and use of other illicit drugs.[8] We briefly discuss the results about the effect of religion on other type of health related behaviors and outcomes in the medium- and long-term; for instance, depression, preference for risk, likelihood of not being in excellent health, etc.

Data and Estimation

[7] County level data available in the Add Health dataset, in the absence of geographical identifiers, does not have information on the proportion of county level adherents belonging to other religions. In a sample restricted to Judeo-Christian religious denominations, the IV estimates reported in the literature …..

[8] Given the age-cohorts (12-18) interviewed, there were only 1-2% users of illicit drugs besides marijuana in 1994-1995

We used the restricted version of the National longitudinal Study of Adolescent Health (Add Health), a nationally representative study of 7^{th}-12^{th} grade students, their parents (or guardians), and school administration surveyed in 1994-1995 (Wave 1; N=20,745); with longitudinal follow up surveys of only students and administration in 1996 (Wave 2), in 2001-2002 (Wave 3; N=15,701), and in 2007-2008 (Wave 4; N>14,000). We used data from Wave 1, 3 and 4 to understand both the short run as well as long run effects of religion on risky health behaviors. However, after limiting the sample to those who in Wave 1, 3, and 4 leaves us with around 12,000 individuals. There are over 5000 individuals who have a sibling or twin who also had been surveyed. However, we were left with around 3,000 siblings who are found in all three waves used for this study. We chose to impute missing values with county-level mean values (by controlling for the corresponding dummy variables) for many of the variables to maximize available sample size for the analysis. The Add Health sample follows a stratified sampling design based on region, urbanization, school type, ethnic mix, and size. Moreover, the benefit in using Add Health to analyze risky health behaviors comes with its careful approach to elicit information on these behaviors, which makes it a more reliable source of data (Clark and Loheac, 2007; Mellor and Freeborn, 2011).

Table 1 compares the summary statistics of the full Add Health sample and the siblings cluster within it (respondents identified as twin pairs, full-siblings, half-siblings, or unrelated siblings raised together). The siblings' sample is demographically similar to the full sample. For three measures of religion used in this paper, religious attendance, frequency of prayers, and importance of religion, we found that only 59%, 48%, and 43% of siblings report the same values. This allays the apprehension that one may not find much variation the measures of religion in the siblings' subsample

We used three contemporaneous measures of risky health behaviors from Wave 1—cigarettes smoking, binge drinking, and marijuana use. To bring focus on the medium- and long-term effects on these measures, along with usages of other illicit drugs, we created various measures from Wave 3 and Wave 4. Past research could not use information on other drugs in Wave 1 as a very low percentage of the respondents reported using drugs other than marijuana (Mellor and Freeborn, 2011). In Table 1 we report that 6% respondents reported taking meth, and 16% reported using other illicit drugs in Wave 3; while the figure for the use of any illicit drugs is 10% in Wave 4.[9]

To measure the long-term effects of religion, we analyzed information on the usage of other drugs provided in Wave 4, besides the three measures used to measure contemporaneous risky health behaviors: During the past 12 months, on how many days did you use {favorite drug}? The list of favorite drugs included: ecstasy, inhalants, LSD, heroin, PCP, and other illegal drugs. This survey question provided us with a composite measure of any illicit drug usage in the past year to capture the long-term effects of religiosity & participation in religious rites and rituals during the adolescent years.

We also used a measure of risk preference from Wave 3 and Wave 4 surveys along with a measure of general well-being from Wave 4. In particular, from Wave 3 we used the following question to measure the propensity to take risk, “Do you agree or disagree that when making a decision, you go with your "gut feeling" and don't think much about the consequences of each

[9] In particular, for cocaine in Wave 3, we selected the question: “Since June 1995, have you used any kind of cocaine—including crack, freebase, or powder?”; for meth, we used “Since June 1995, have you used crystal meth?”; for the measure of other drugs use, we chose the question: “Since June 1995, have you used any other types of illegal drugs, such as LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin, or prescription medicines not prescribed for you?”

alternative?" And to measure the propensity to take risk from Wave 4, we use, "How much do you agree with each statement about you as you generally are now, not as you wish to be in the future?' I like to take risks." We define a dummy variable that switches on when respondents report: "strongly agree" and "agree" for both Wave 3 and Wave 4 questions. Additionally, from Wave 4, we use the question, "In general, how is your health?" to measure the general well-being of the respondents in the long-run. To create a health measure less prone to measurement error, we created a dummy variable that switches on for those who self-report to be in excellent health.

In our effort to account for the recent advances in our understanding of addictive behaviors and religious inclinations, we included additional covariates in our regression models. In particular, we controlled for the level of urbanization, which we define as the proportion of the population of a county living in the urban areas. We also controlled for some neighborhood-level characteristics: proportion of individuals of same race, age groups, religion living in the respondents' area. It has been consistently shown that living in a close proximity to those who share the similar background has many health benefits (Egolf et al. 1992; Bruhn and Wolf, 1979).

The other additional set of confounding variables[10]—parental religiosity, birth-weight, PVT scores for associational intelligence—that we use in this paper all come from the survey instruments used in Wave 1. Retrospective information on the birth-weight of adolescents and their parents' religiosity (an index created by using Principle Component Analysis) was collected from parents interviewed in Wave 1. The reason for the inclusion of these additional variables is

[10] We also ran a separate set of regressions controlling for adherent based religious market density measure; we find similar results.

not only to control for the unobserved heterogeneity in the parental investment across different offspring, but also to factor in individual specific differences owing to complex interaction between genes and environment in influencing both religiosity and substance use (Sapolsky, 2011). Datar, Kilburn, and Loughran (2010) report about differential parental investment based on birth weight of babies, which becomes a matter for concerns as the family-level fixed effects cannot control for such heterogeneity. A series of research has shown the deleterious effects of adverse birth-weight on long-term adult outcomes (Almond et al. 2005; Fletcher 2011 and references therein). We circumvent this issue by directly controlling for the birth-weight of respondents retrospectively reported by their parents. Also, Burdette et al. (2012) suggested that parental religiosity affects the birth-weights of their babies. Our decision to include a parental religiosity variable helped us to control for the family and parental characteristics that may have had an impact on both religiosity as well as the propensity for substance use. The inclusion of a Picture Vocabulary Test (PVT) score allowed us to control for the heritable dimension of religiosity that is reflected in a higher propensity to seek our loose associations (Mohr and Huguelet, 2004; Sapolsky, 2011). One of the characteristic features of religiosity is to have an inclination for metamagical thinking and seeing patterns where there might be none. Such inclination potentially can lead to more responsivity to stress (Smith, 2010) and a higher propensity for substance use (Sinha, 2000).

Other variables in the control set included: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, a cigarette tax at the county level, median income, density measure of county, own race density measure, same-age density measures, regional

dummies, school size and type dummies, school-level measure of proportional of smokers, and drug and alcohol expulsion policies.[11]

We used a series of OLS specifications that control for environmental (school, county, and state level) as well as family level confounding variables, including the source of family-level unobserved heterogeneity. We first ran the base-line regressions where the main explanatory variables of interest are religious involvement (frequency of participation and prayer) and religiosity. Then, we performed regressions where we controlled for family-fixed effects. Finally, we conducted falsification tests with variable that could not be taken to be influenced by religion.

Results

Table 2 displays the OLS estimates in the first row using exactly the same set of covariates as in Mellor and Freeborn (2011) in Panel I. The second row in Panel I reports the OLS estimates that include additional covariates--parental religiosity, birth-weight, PVT score, urbanization, and county-level measures of the strength of religion-relevant social networks. For all the results that we report in the rest of the paper, we included these additional covariates in all the specifications that we estimate. The OLS estimates of the association between the two measures of religion—attendance and frequency of prayers—match the ones reported in the literature. Religious attendance is associated with anywhere between 4% to 5% reduction in smoking, a 3% to 4% reduction in binge drinking, and 2% to 3.3% reduction in marijuana smoking. Prayer frequency

[11] Many of the confounding variables, which are invariant across siblings, will drop out in our family-fixed effects specifications; however, they remain relevant variables in our OLS and IV specifications (see footnote 12).

has similar but smaller effects; while importance attached to religion has larger effects. The associations that we find between the last measure of religion and the measures of risky health behaviors are bigger in magnitude than the associations reported for other measures of religion by anywhere between 30-50%. This indicates the importance of religious belief in developing a better understanding of the correlates and determinants of substance (ab)use.[12] Panel II of Table 2 displays the estimates when all the religious denominations, as well as those reporting being atheist are included in the sample. The reported estimates follow a similar pattern as the ones shown in Panel I.

Family-Fixed Effects

In Table 3, we move our focus to siblings subsample to introduce family-fixed effects; our focus for the remainder of the paper will be on this sample. Additionally, in contrast to Mellor and Freeborn (2011) and Lillard and Price (2007), we analyze the medium- (6 years later) and long-term (13 years later) measures of risky health behaviors as the outcome variables.

Table 3 displays the associations of all three measures of religion on risky health behaviors. The effect of extrinsic religiosity (religious service attendance) is more pronounced during late adolescence and young adulthood period, then goes down again during the mid-20s and early 30s'. However, once we account for family-level unobserved heterogeneity in our fixed effects

[12] We also carried out IV estimation using the proportion of the county-level population belonging to the same religious denomination as the respondent as an instrument for the two measures of religion emphasized in the literature (Mellor and Freeborn, 2011; Gruber, 2005). In the presence of the issues around the validity of exclusion restrictions, and for the sake of brevity, we focus on family-fixed effects estimates, Gelbach's decomposition analyses, and the longer terms effects of religion. Although our estimates for effect on marijuana use were similar to the ones found in the literature, we found very imprecise IV estimates for the smoking and binge drinking variables.

specifications, the association of religious attendance and cigarette smoking over the six-year periods, from the time when the religion variables were measured, went down from -0.034 to -0.017, and it further went down to -0.005, when the respondents were in mid-20s to early 30s. This suggests that family level unobservables play a crucial role in mediating the effect of religion on risky health behaviors as time goes by: if family-level unobservables invariant across siblings make respondents more likely to smoke, they also are more likely to be less religious in terms of the number of times that they attend their respective religious institutions.

An intriguing trend was discovered for binge drinking: the contemporaneous effect of religious attendance became more pronounced after controlling for family-fixed effects, in contrast to its contemporaneous effect in the case of cigarette smoking (see Table 3). The intriguing result is the association when respondents are at or near college age. The magnitudes of the estimates suggest that those who report a higher frequency of religious attendance are more likely to indulge in binge drinking. This estimate, in particular, captures the rebel-like propensities during the adolescence years. By the time respondents are in their late 20s or early 30s, religious attendance once again reverses its value in the expected direction (though one that is statistically insignificant).

Once again, after controlling for family-fixed effects, the associations of all three measures of religion with marijuana use become significantly smaller, and are never found to be statistically significant at the conventional level of significance. This illustrates the important role that family plays in influencing both religiosity and the usage of additive substance. However, controlling for family-level unobservables does not overturn the effects of prayer on marijuana use; estimates are of similar magnitude but with higher variance. Also, a similar trend is observed in the case of the importance of religion variable for the medium term outcome (Wave 3) (see Panel

II & III in Table 3). The effects of prayer and religiosity both go up and then come down in the case of marijuana use: (-0.013, -0.022, -0.010) for prayers & (-0.009, -0.023, -0.011) for the degree of religiosity. Though estimates are not statistically significant, they are still economically meaningful and in expected directions. The estimates hint towards the fact that religion does provide some kind of protective psychological support at times when adolescents are most vulnerable to the external influences: during their late teen and early adulthood years, when they venture out on their own (Blackmore and Choudhury, 2006).

The most encouraging aspect of our findings concerns the strong and persistent associations of the variable importance of religion with regard to smoking. In light of the recent findings that the demand for cigarettes is very price inelastic, and also quite impervious to the regulatory arms of the government because of the environmentally modulated genetic propensity for nicotine dependence (Fletcher, 2012), this result becomes quite important. Interestingly, the contemporaneous association of religious participation gets bigger in the opposite direction after we control for family-level unobservables (indicating that those who are more likely to indulge in substance use are also less likely to be religious). In addition, the estimate of long-term associations continues to remain economically meaningful and statistically significant at the conventional level of significance. This captures the rebellious attitude of adolescents trying to go against the familial environment (Finkel et al. 2009[13]): family unobservables which make adolescents become more religious also drive them to smoking, which seems to fit the observation that during their teen years adolescents try to build their own independent identity. Or, as pointed by Mellor and Freeborn (2011), religion becomes more important as it allows

[13] During adolescence we are primed to commit ourselves to belonging to certain groups and not belonging to others (Finkel et al. 2009)

them to deal with the same pressures and problems that lead them to engage in drug use. This suggests that even after accounting for important confounding variables, religion continues to have a strong association with the propensity to use addictive substances.

Other Illicit Drugs

We also conducted analyses of the effects of different measures of religion on cocaine, meth, and other illicit drugs (which include, LCD, ecstasy etc.). The OLS estimates, without siblings fixed effects, suggest that all three measures of religion reduce the propensity to use the illicit drugs both in the medium as well as in the long term (see Cols. 1-5, Table 4). However, once we controlled for the family-level unobservables, the effect remained only for meth usages, after six years from the interview date, when respondents were in their late teen and early 20s for all three measures of religion. We found no statistically significant associations for any other illicit drug usages in Wave 4. The negative and statistically significant association of 'importance of religion' variable with the measure of general wellbeing and health in Wave 4 suggests that religiosity during adolescence continues to influence young adults' lives (see Col. 6, Panel III in Table 4). Furthermore, religion seems to make individuals more risk averse during their early- and mid-20s; but, interestingly, ends up leaving those who hold religion in high regard more risk loving.

It is quite interesting to find that religious attendance and activities during adolescence years cease their association in the long term, when adolescents' brains' executive control area (PFC) becomes fully mature (Blakemore and Choudhury, 2006). This time period also coincides with

adolescents becoming financially more independent and also more integrated into the labor market.

Falsification Tests

To further explore the nature of the relationship between religion and risky health behaviors, we conducted a series of falsification tests. Table 5 displays results from the falsification tests. We used self-reported incidents of a headache and cold sweat in Wave 1, as well as respondents' adult height measured in Wave 4 as the outcome variables. We concluded that all three measures of religion are not statistically related to these outcome variables. In all family-fixed effects specifications, none of the variables measuring religion has any statistically significant impact on the any of the outcome variables. This is consistent with the correlations we report between various measures of religion and different measures of risky health behaviors not being spurious.

Given that except in the case of headache, other three outcome variables mentioned above are not significant even in the OLS specification make these variables not very relevant in our efforts to use them in falsification tests for our preferred family-fixed effects specifications. Therefore, in parallel with that, while keeping in mind that we are not able to provide full control for genes and their interactions with environment, we ran a separate set of regressions with many personality traits that are used to measure neuroticism and conscientiousness as the outcome variables (Young et al. 2011). We used 10 different factors reported in Wave 1 to check if our measures of religion, after controlling for family-fixed effects, predicted any of these factors. All four factors that are employed to define conscientiousness measures showed positive and significant associations with the broad measures of religiosity, and also to some extent with the

frequency of prayer. This casts doubt to some extent on our previous results; however, it is difficult to discern if it is perhaps the religiosity that is influencing these personality measures. Keeping that in mind, we ran all our specifications with two of the factors (results not reported here) which show strong associations with risky health behaviors—"You feel wanted and loved (Col.6) " and "Propensity for more deliberate thinking (Col. 8)"--and we found no substantive change in our estimates.

Limitations

The sample we used for this study was conditional on subjects being in school during 1994-1995, which potentially limits the external validity of the associations reported here for other cohorts. The extent to which genetic endowment in association with environment creates a predilection for religious matters and propensity for substance use can only be partially controlled by a family-fixed effects specification. Keeping that in mind, we carried out an estimation exercise (reported in Appendix 1) using a sample of monozygotic twins to better control for the roles of genetic propensity for religiosity and substance use. We ended up having a very small sample, and the estimates turned out to be very noisy, except for the estimate of the effect of religious participation on binge drinking and the estimate of the effect of religiosity on smoking. It is somewhat encouraging to find the negative association (see Col.1, Panel III in Appendix 1) of religious belief with an individual's propensity for cigarette smoking, especially in the presence of high persistence in the proportion of adults addicted to cigarette smoking as reported in Fletcher (2012).

Although we have controlled for variables that potentially could capture the heterogeneous treatment of children within a family, we were unable to control for direct measures for many

more variables that could confound our estimates, such as, individuals' response to stress, parental behaviors, respondents' social network, etc. Although not emphasized here, we ran a set of separate regressions with county-level adherents-based religion density measure that controlled for the effects of being in close proximity to people of the same faith and denominations. We did not find any substantial changes in the results reported above. Furthermore, given the recent study on the linked genes and phenotypic manifestations, incorporation of some of the variables capturing individual heterogeneity should be able to control for some of the genetic sources of such phenotypic variation. As we get a better and more nuanced understanding of the biological pathways, it will gradually become clearer how the environment interacts with biological pathways to differentially impact individuals in their religiosity and their propensity for substance use. We will then be able to better control for the many variables that could potentially be inducing the observed relationship between religion and risky health behaviors.

Conclusions

While providing methodological critiques of the previous work delineating the association (effects) of religion to various measures of risky health behaviors, this paper makes both substantive and methodological contributions. The structure of the data allowed us to control for sibling-fixed effects (and also to conduct analyses of longer-term effects). Thus, it helped us account for many potential sources of omitted variable bias—family-level covariates, which includes a significant part of genetic endowment. As pointed by De Neve and Oswald (2012), it is the sibling-fixed effects that allowed us to make inferences about the lagged effects of

religious rites and rituals on risky health behaviors (which could not have been possible with individual-fixed effects).

In particular, we estimated the contemporaneous as well as the longer term effects of religion on risky healthy behaviors. Our measures of the risky behaviors include usage of both licit and illicit substance—cigarettes, binge drinking, marijuana, cocaine, meth, ecstasy, inhalants, LSD, heroin, PCP, and other illegal drugs.

Findings from a number of studies suggest that it is the rites and rituals which hold the key to understand the positive effects that religion has consistently been shown to have (Luhrmann, 2012). Our findings corroborate the importance of extrinsic aspects of religion, but point to a more important role for the beliefs and intrinsic aspect of religion (captured by both prayer and the importance of religion measures. Our findings suggest that the positive effect of religion is driven both by the extrinsic (in the form of frequency of religious attendance and public prayer) as well as by the intrinsic (the belief system that goes with being religious). Furthermore, we find that family as an institution plays a very significant role in moderating the effects of religion on risky health behaviors. [When controlling for family effects] The intrinsic aspect becomes more salient as the extrinsic aspect loses its effect in the longer term, especially in the case of binge drinking and marijuana use.[14]). It seems religion provides the focal point for societies and families where secular focal points have not been created to coordinate the activities of the members, or where they would take time to establish and find wide acceptance.

[14] We also conducted the conditional decomposition of the changes in the estimates of the effect of various measures of religion on risky health behaviors using Gelbach's (2009) method. Surprisingly, we found that though the variations in the family level unobserved heterogeneity do contribute to the changes in the estimates of the effects of religion, they were never found to be statistically significant. We report our findings in Appendix 2 just for one of the outcome variables, cigarette smoking in Wave 1, for the effect of religious attendance; and we found similar effects for most of the outcome and explanatory variables that are the focus of this paper.

Given how critical adolescence is for determining long-term health and well-being of the individual and for society as a whole (Call et al. 2003), our study suggests that we need to build a more nuanced understanding of the ways religion brings about positive health outcomes.

If it is indeed the case, as we report, that religion provides protection against indulgence in risky health behavior, then it indeed is a very striking finding. In light of the research showing the positive effects of education on health and risky health behaviors (Grossman and Kaestner, 1997), and given the high cost of education in the US, bringing in a familiar non-market institution as a prevention strategy seems promising. More specifically, Cutler and Lleras-Muney (2010), using the National Health Interview Survey data, report that an additional year of education is associated with a 3% lower probability of being a current smoker, a 1.4% lower probability of being a heavy drinker, and a 0.1% probability of using marijuana in the past month (Cawley and Ruhm, 2011). In comparison, in our family-fixed effects specification, we show a stronger association for smoking and drinking (-5.8%, -4.8%). It is these two substances that pose a greater risk than the marijuana and other illicit drug use (Cawley and Ruhm, 2011).

Additionally, given the usually low price elasticity of addictive substances (Kenkel and Sindelar, 2011), the risk of the emergence of an underground illegal market owing to regulation (especially the failed policy of quantity/supply regulation of the illicit drugs), and high deadweight loss involved in price-based regulation of alcohol (Glied and Smith, 2011), religion could potentially complement the existing prevention efforts to rein in a persistently high level of smoking, high alcohol consumption, and illicit drug usage.

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Table 1: Descriptive Statistics

	Full Sample			Siblings Sample		
Variable	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**
Adolescent Risk Behaviors						
Smoking (W1)	15258	0.24	0.43	3651	0.25	0.44
Binge Drinking (W1)	15320	0.25	0.43	3663	0.25	0.43
Marijuana Use (W1)	15354	0.15	0.35	3669	0.14	0.34
Smoking (W3)	11236	0.30	0.46	2968	0.31	0.46
Binge Drinking (W3)	11225	0.47	0.50	2956	0.44	0.50
Marijuana Use (W3)	11263	0.30	0.46	2973	0.29	0.45
Cocaine (W3)	11124	0.10	0.29	2938	0.09	0.28
Meth (W3)	11121	0.06	0.23	2936	0.05	0.22
Other Illicit Drugs (W3)	11112	0.16	0.36	2933	0.13	0.34
Smoking (W4)	11592	0.34	0.47	3018	0.36	0.48
Binge Drinking (W4)	11634	0.46	0.50	3031	0.44	0.50
Marijuana Use (W4)	11669	0.21	0.41	3041	0.21	0.41
Any Illicit Drugs (W4)	11673	0.10	0.30	3042	0.09	0.30
Depression (W3)	11258	0.10	0.30	2971	0.10	0.30
Propensity to like risk (W3)	11275	0.32	0.47	2975	0.34	0.47
Propensity to seek novel Experience (W3)	11275	0.25	0.43	2975	0.24	0.43
Not in Excellent Health (W4)	11680	0.80	0.40	3044	0.80	0.40
Depression (W4)	11678	0.15	0.36	3043	0.15	0.35
Panic Attack (W4)	11679	0.11	0.32	3044	0.11	0.32
Propensity to get angry (W4)	11664	0.20	0.40	3039	0.20	0.40
Propensity to like risk (W4)	11661	0.35	0.48	3036	0.36	0.48
Adolescent-level Explanatory Variables						
Religious Attendance (W1)	13337	3.01	1.07	3159	3.04	1.07
Some Attendance (W1)	15354	0.76	0.43	3669	0.76	0.43
Weekly Attendance (W1)	15354	0.39	0.49	3669	0.40	0.49
Freq. of Prayers (W1)	13339	2.98	1.28	3161	3.00	1.27
Urbanization	15283	0.64	0.40	3669	0.60	0.40
PVT Score	14631	100.44	14.84	3669	99.20	14.27
Birth Weight (kg)	11661	3.32	0.57	3669	3.21	0.54
No Religion	15354	0.11	0.32	3669	0.12	0.33
Other Christians	15354	0.05	0.22	3669	0.05	0.21
Other Religions	15354	0.04	0.19	3669	0.04	0.20
Don't Know My Religion	15354	0.01	0.11	3669	0.01	0.12
Catholic	15354	0.25	0.44	3669	0.23	0.42
Moderate Protestant (W1)	15354	0.14	0.34	3669	0.15	0.35
Lib. Protestant	15354	0.09	0.28	3669	0.09	0.28
Con. Protestant	15354	0.30	0.46	3669	0.31	0.46
Jewish	15091	0.01	0.08	3603	0.01	0.08
Age	15345	16.12	1.68	3668	16.14	1.64
Female	15354	0.51	0.50	3669	0.50	0.50
Hispanic	15311	0.16	0.37	3660	0.13	0.34

Black	15331	0.24	0.43	3666	0.25	0.43
Asian	15331	0.08	0.27	3666	0.08	0.27
Other Race	15331	0.09	0.29	3666	0.08	0.27
Parent and Household level Explanatory Variables						
Parent Age	15354	42.54	6.36	3669	42.02	6.08
High School	15354	0.25	0.43	3669	0.27	0.44
Some College	15354	0.25	0.43	3669	0.26	0.44
College Grad	15354	0.12	0.33	3669	0.13	0.33
Graduate degree	15354	0.08	0.27	3669	0.07	0.25
Income refused	15354	0.09	0.29	3669	0.08	0.28
Income 2	15354	0.12	0.33	3669	0.13	0.33
Income 3	15354	0.18	0.38	3669	0.19	0.39
Income 4	15354	0.36	0.48	3669	0.35	0.48
Income 5	15354	0.10	0.30	3669	0.10	0.30
Income 6	15354	0.09	0.28	3669	0.08	0.27
Household size	15354	4.39	1.14	3669	4.85	0.99
Mother present	15354	0.76	0.43	3669	0.76	0.43
Father present	15354	0.45	0.50	3669	0.45	0.50
Mother works	15354	0.74	0.45	3669	0.74	0.46
Mother work missing	15354	0.06	0.23	3669	0.05	0.22
Area-level Explanatory Variables						
Cigarette tax	15354	32.09	16.26	3669	31.05	16.50
Median income ('000)	15354	30.24	8.00	3669	29.73	7.82
Age-sex density	15283	0.07	0.01	3651	0.07	0.01
Religious density	15022	0.19	0.17	3586	0.19	0.17
Area density	15354	0.59	1.56	3669	0.45	1.16
Race density	15224	0.64	0.35	3640	0.65	0.34
Pr (Hispanic)	15283	0.10	0.14	3651	0.09	0.13
South	15354	0.40	0.49	3669	0.39	0.49
Midwest	15354	0.22	0.42	3669	0.27	0.44
West	15354	0.22	0.41	3669	0.21	0.41
Northeast	15354	0.16	0.36	3669	0.12	0.33
School-level Explanatory Variables						
Religious school	15303	0.05	0.21	3662	0.04	0.21
Small School	15354	0.14	0.34	3669	0.16	0.36
Medium school	15354	0.38	0.49	3669	0.37	0.48
Large school	15354	0.48	0.50	3669	0.47	0.50
Pr (Smokers)	15354	0.33	0.10	3669	0.34	0.11
Drug Expulsion	14908	0.30	0.46	3603	0.31	0.46
Alcohol Expulsion	15042	0.16	0.37	3624	0.18	0.39
Drug abuse program	15354	0.47	0.50	3669	0.51	0.50

Notes: Descriptive statistics are not weighted by the survey provided sampling weights as weights are not available for the siblings sub-sample.

Table 2: OLS

	Religious Attendance			Freq. of Prayers			Importance of Religion		
	Smoking	**Binge**	**Marijuana**	**Smoking**	**Binge**	**Marijuana**	**Smoking**	**Binge**	**Marijuana**
I. OLS estimates excluding atheists and non-Christian religions									
S-OLS	-0.049‡	-0.031‡	-0.033‡	-0.036‡	-0.028‡	-0.025‡	-0.057‡	-0.045‡	-0.038‡
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.007)	(0.006)	(0.007)
X-OLS	-0.043‡	-0.041‡	-0.022‡	-0.037‡	-0.024‡	-0.022‡	-0.058‡	-0.045‡	-0.037‡
	(0.006)	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)	(0.007)	(0.006)	(0.007)
N	10,802	10,844	10,866	10,805	10,848	10,870	10,813	10,856	10,878
II. All Religion & no religion									
X-OLS	-0.039‡	-0.042‡	-0.024‡	-0.033‡	-0.023‡	-0.022‡	-0.054‡	-0.048‡	-0.036‡
	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(-0.178)	(-0.154)	(-0.145)
N	12,005	12,049	12,075	12,005	12,050	12,076	13,562	13,612	13,641

Note: R-OLS indicates the sample and covariates used in Mellor and Freeborn (2011) paper. X-OLS indicates for extra covariates: birth-weight, parental religiosity, county level urbanization, and PVT score. Robust standard errors clustered at the county level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. The last panel provides results which include all those who belong to non-Judeo-Christian religious denominations as well as those who report to not belonging to any religion.

Table 3: OLS and Family Fixed Effects Estimates of the Effects of Religion on Risky Health Behaviors at Different Stages of Young Adults since their Adolescence

	Smoking			Binge Drinking			Marijuana Use		
Variable	**W1**	**W3**	**W4**	**W1**	**W3**	**W4**	**W1**	**W3**	**W4**
I. Religious Attendance									
X-OLS	-0.039‡	-0.044‡	-0.030‡	-0.034‡	-0.016	-0.024†	-0.021‡	-0.036‡	-0.026‡
	(0.008)	(0.010)	(0.010)	(0.008)	(0.010)	(0.010)	(0.006)	(0.010)	(0.008)
FFE	-0.034*	-0.017	-0.005	-0.053‡	0.038*	-0.011	-0.013	0.002	-0.009
	(0.017)	(0.021)	(0.024)	(0.018)	(0.021)	(0.026)	(0.014)	(0.021)	(0.019)
II. Frequency of Prayers									
X-OLS	-0.026‡	-0.037‡	-0.035‡	-0.029‡	-0.008	-0.021†	-0.014‡	-0.018†	-0.013*
	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.009)	(0.006)	(0.008)	(0.007)
FFE	-0.033‡	-0.043‡	-0.050‡	-0.040‡	-0.019	-0.034*	-0.013	-0.022	-0.010
	(0.012)	(0.016)	(0.019)	(0.013)	(0.017)	(0.018)	(0.011)	(0.016)	(0.015)
N	3,066	2,516	2,540	3,076	2,505	2,548	3,081	2,520	2,558
III. Importance of Religion									
X-OLS	-0.048‡	-0.053‡	-0.042‡	-0.048‡	-0.015	-0.033‡	-0.023‡	-0.023†	-0.035‡
	(0.009)	(0.011)	(0.011)	(0.009)	(0.010)	(0.010)	(0.007)	(0.010)	(0.009)
FFE	-0.058‡	-0.049†	-0.036*	-0.048‡	-0.026	-0.014	-0.009	-0.023	-0.011
	(0.015)	(0.020)	(0.021)	(0.015)	(0.020)	(0.021)	(0.013)	(0.021)	(0.019)
N	3,066	2,516	2,540	3,076	2,505	2,548	3,081	2,520	2,558

Note: All specifications include a set of extra covariates: birth-weight, parental religiosity, county level urbanization and own religion adherent-based density measures, and PVT score. Robust standard errors clustered at the family level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. FFE stands for family fixed effects. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. The last panel provides results with Importance of religiosity, a self-reported measure of degree of religiosity.

Table 4: Illicit Drug Use in Wave 3 and Wave 4

	Wave 3				Wave 4		
variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
	Cocaine	**Meth**	**Other drugs**	**Risk pref.**	**Any illicit drugs**	**Not in excellent health**	**Risk pref.**
I. Religious Attendance							
X-OLS	-0.013†	-0.014‡	-0.023‡	-0.017*	-0.017‡	-0.006	-0.007
	(0.006)	(0.005)	(0.007)	(0.010)	(0.006)	(0.009)	(0.010)
FFE	0.008	-0.020†	-0.007	-0.038	-0.005	-0.012	-0.006
	(0.013)	(0.009)	(0.014)	(0.025)	(0.014)	(0.022)	(0.025)
II. Frequency of Prayers							
X-OLS	-0.003	-0.005	-0.009	-0.016†	-0.005	-0.014*	-0.001
	(0.005)	(0.004)	(0.006)	(0.008)	(0.005)	(0.007)	(0.008)
FFE	-0.001	-0.022‡	-0.003	-0.001	-0.005	-0.030*	0.022
	(0.010)	(0.007)	(0.013)	(0.017)	(0.012)	(0.016)	(0.019)
III. Importance of Religion							
X-OLS	-0.014†	-0.018‡	-0.025‡	-0.019*	-0.006	-0.013	0.002
	(0.007)	(0.006)	(0.009)	(0.010)	(0.006)	(0.009)	(0.010)
FFE	0.004	-0.014*	-0.010	-0.029	-0.000	-0.039†	0.048†
	(0.011)	(0.008)	(0.014)	(0.019)	(0.015)	(0.017)	(0.020)
N	2,825	2,823	2,820	2,860	2,917	2,919	2,911

Note: All specifications include a set of extra covariates: birth-weight, parental religiosity, county level urbanization and own religion adherent-based density measures, and PVT score. Robust standard errors clustered at the family level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. FFE stands for family fixed effects. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. Cols. 1-4 belongs to measures from Wave 3; while 5-7 from Wave 4. The last panel provides results with Importance of religiosity, a self-reported measure of degree of religiosity.

Table 5: Falsification Tests I

Variable	Headache (W1)	Cold Sweat (W1)	Birth Weight (W1)	Height (W4)
I. Religious Attendance				
X-OLS	-0.012*	0.003	-14.461	0.045
	(0.007)	(0.008)	(10.851)	(0.168)
FFE	0.012	-0.019	-15.454	0.012
	(0.015)	(0.019)	(17.690)	(0.335)
II. Frequency of Prayers				
X-OLS	-0.003	0.007	-9.103	0.136
	(0.006)	(0.006)	(9.217)	(0.131)
FFE	0.015	0.005	-2.396	0.186
	(0.011)	(0.014)	(13.486)	(0.223)
III. Importance of Religion				
X-OLS	-0.010	0.000	-10.678	-0.116
	(0.007)	(0.008)	(11.239)	(0.172)
FFE	-0.001	-0.018	-4.909	0.283
	(0.012)	(0.016)	(13.889)	(0.343)
N	3,510	3,509	3,510	2,900

Note: All specifications include a set of extra covariates: birth-weight, parental religiosity, county level urbanization and own religion adherent-based density measures, and PVT score. Robust standard errors clustered at the family level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. FFE stands for family fixed effects. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. The last panel provides results with Importance of religiosity, a self-reported measure of degree of religiosity.

Table 6: Falsification Tests II

	Neuroticism (Wave 1)					Conscientiousness (Wave 1)				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
I. Religious Attendance										
OLS	0.031†	0.032†	0.042†	0.021	0.046‡	0.039‡	0.025	0.014	0.042†	0.014
	(0.013)	(0.014)	(0.018)	(0.017)	(0.015)	(0.014)	(0.017)	(0.015)	(0.017)	(0.016)
FFE	0.013	0.009	0.029	0.047	0.087‡	0.023	0.058	0.059*	0.114‡	0.056*
	(0.030)	(0.030)	(0.043)	(0.039)	(0.031)	(0.028)	(0.037)	(0.032)	(0.038)	(0.032)
II. Frequency of Prayers										
OLS	0.044‡	0.056‡	0.026*	0.034†	0.039‡	0.051‡	0.066‡	0.049‡	0.042‡	0.053‡
	(0.010)	(0.012)	(0.015)	(0.014)	(0.012)	(0.012)	(0.014)	(0.013)	(0.014)	(0.013)
FFE	0.043†	0.047†	-0.052	0.025	-0.003	0.025	0.066†	0.032	0.036	0.044*
	(0.020)	(0.024)	(0.033)	(0.028)	(0.022)	(0.025)	(0.027)	(0.027)	(0.028)	(0.024)
III. Importance of Religion										
OLS	0.055‡	0.073‡	0.060‡	0.061‡	0.055‡	0.078‡	0.088‡	0.075‡	0.095‡	0.077‡
	(0.013)	(0.014)	(0.018)	(0.017)	(0.014)	(0.015)	(0.017)	(0.016)	(0.018)	(0.016)
FFE	0.056†	0.054†	0.028	0.051	0.045	0.051*	0.058*	0.091‡	0.086‡	0.080‡
	(0.022)	(0.026)	(0.036)	(0.031)	(0.028)	(0.029)	(0.032)	(0.030)	(0.032)	(0.027)
N	3,077	3,078	3,079	3,080	3,077	3,077	3,069	3,068	3,065	3,073

Note: All specifications include a set of extra covariates: birth-weight, parental religiosity, county level urbanization and own religion adherent-based density measures, and PVT score. Robust standard errors clustered at the family level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. FFE stands for family fixed effects. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. Columns 1-6 include factors that go into measures of Neuroticism; Columns 7-10 include factors that go into measuring Conscientiousness. The last panel provides results with Importance of religiosity, a self-reported measure of degree of religiosity.

Appendix 1: Monozygotic Twins Subsample

	(1) smokew1	(2) smokew3	(3) smokew4	(4) bingew1	(5) bingew3	(6) bingew4	(7) marijuanaw1	(8) marijuanaw3	(9) marijuanaw4
IA. Religious Attendance: OLS									
X-OLS	-0.064†	-0.086‡	-0.045	-0.037	-0.031	0.006	-0.075‡	-0.064†	-0.004
	(0.026)	(0.032)	(0.028)	(0.024)	(0.031)	(0.031)	(0.022)	(0.030)	(0.023)
IB. Religious Attendance: Family Fixed Effects									
FE	-0.012	0.012	0.058	-0.083*	0.065	0.075	0.040	0.101	-0.003
	(0.038)	(0.037)	(0.059)	(0.048)	(0.063)	(0.073)	(0.033)	(0.068)	(0.028)
Observations	324	270	273	325	269	275	326	270	275
IIA. Frequency of Prayers: OLS									
X-OLS	-0.061‡	-0.103‡	-0.062‡	-0.025	-0.020	0.025	-0.046†	-0.017	0.009
	(0.022)	(0.022)	(0.021)	(0.020)	(0.023)	(0.023)	(0.019)	(0.024)	(0.022)
IIB. Frequency of Prayers: Family Fixed Effects									
FE	-0.030	0.018	-0.058	0.049	-0.050	0.018	0.014	-0.064	-0.034
	(0.037)	(0.043)	(0.043)	(0.039)	(0.060)	(0.067)	(0.013)	(0.067)	(0.023)
	324	270	273	325	269	275	326	270	275
IIIA. Religiosity: OLS									
X-OLS	-0.061‡	-0.094‡	-0.060‡	-0.049‡	-0.033	-0.004	-0.071‡	-0.051†	0.000
	(0.019)	(0.021)	(0.022)	(0.018)	(0.022)	(0.023)	(0.016)	(0.022)	(0.018)
IIIB. Religiosity: Family Fixed Effects									
FE	-0.062*	-0.021	-0.040	-0.034	0.039	0.029	0.028	-0.067	-0.027
	(0.036)	(0.056)	(0.062)	(0.030)	(0.055)	(0.070)	(0.027)	(0.060)	(0.028)
	368	308	310	369	306	312	370	308	312

Note: All specifications include a set of extra covariates: birth-weight, parental religiosity, county level urbanization and own religion adherent-based density measures, and PVT score. Robust standard errors clustered at the family level are in parentheses. Linear probability regression models are used with the sampling weights provided in the survey. FFE stands for family fixed effects. All models include the full set of adolescent, parent, household, area, and school level explanatory variables. ‡1%, †5%, *10%. Xs: religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies. Columns 1-6 include factors that go into measures of Neuroticism; Columns 7-10 include factors that go into measuring Conscientiousness. The last panel provides results with Importance of religiosity, a self-reported measure of degree of religiosity.

Appendix 2: Gelbach's (2009) decomposition of the effects of religiosity Into Standard Covariates, Additional Covariates, and Family Components

	Full Specification	
Smoking in Wave 1	Explained	Standard Error
Changes in the Effect of Religiosity	-0.02225	0.067069
Covariates		
Standard Covariates	-0.00756	0.051581
Additional Covariates	0.003621	0.097048
Family Components	-0.01831	0.026983

Base model contains no exogenous covariates. Full model covariates are religious affiliation dummies (Catholic, Mod. Protestants etc.), age, gender, race, household size, family income, parental education, parental age, presence of biological mother and father, Cigarette tax at the county level, median income, density measure of county, own race density measure, same age density measures, regional dummies, school size and type dummies, school level measure of proportional of smokers, and drug and alcohol expulsion policies, and dummies for each family. Standard Covariates include the variables in included in Mellor and Freeborn (2011); Additional Covariates includes Child-weight, PVT score, Proportion of adherents in a county belonging to the same religion as the respondent, Parental Religiosity, Proportion of Urban Population.