



Clarifying the relationship between religiosity and psychiatric illness: the impact of covariates and the specificity of buffering effects

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Previous analyses in a large population-based sample of female twins indicated that three dimensions of religiosity – personal devotion, personal conservatism and institutional conservatism – were, in different ways, significantly related to current depressive symptoms and substance use and lifetime psychiatric and substance use disorders. Furthermore, personal devotion, but neither personal conservatism nor institutional conservatism, buffered the depressogenic effects of stressful life events (SLEs). We here explore further these results, using linear, logistic and Cox regression models. Eight personality and six demographic variables had distinct patterns of association with the three dimensions. Personal devotion was positively associated with years of education, age, and optimism and negatively correlated with neuroticism. Personal conservatism was negatively associated with education, income, age, mastery and positively correlated with neuroticism. Institutional conservatism was negatively correlated with self-esteem and parental education. Covarying for these 14 variables produced little change in their association with psychiatric and substance use outcomes. The impact of the dimensions of religiosity differed as a function of the SLE category. High levels of both personal devotion and institutional conservatism protected against the depressogenic effects of death and personal illness. High levels of personal conservatism were associated with increased sensitivity to relationship problems. These results suggest that the association between religiosity and low risk for symptoms of depression and substance use may be in part causal. The relationship between dimensions of religiosity and response to SLEs is complex but probably of importance in clarifying the nature of the coping process.

Keywords: twins, religion, depression, anxiety disorders, stressful life events, buffering

Introduction

Given its importance for a wide range of human behavior,¹ religion has been relatively neglected in empirical studies of the etiology of mental illness and substance use and misuse.^{2–5} In studies from major psychiatric journals, measures of religion have been only rarely included and, when assessed, most studies examined only affiliation.³ This single measure, used alone, is problematic, since religiosity is multidimensional including, in addition to affiliation, aspects of devotion and beliefs.⁶

We recently reported results obtained at personal interview, on 1902 twins from female–female pairs from the population-based Virginia Twin Registry⁷ which included 10 items reflecting a range of religious behavior and beliefs, current religious affiliation rated on a scale of institutional conservatism (IC), prior stressful life events (SLEs), current psy-

chiatric symptoms and substance use, and lifetime psychiatric disorders and substance dependence. We found that we could extract two meaningful factors reflecting personal devotion (PD) and personal conservatism (PC) from the 10 items. PD, PC and IC were all strongly familial and model fitting suggested that this familial resemblance was due largely to the effect of environmental factors. None of the dimensions of religiosity was strongly associated with lifetime psychopathology or current symptomatology except that low levels of depressive symptoms were related to high levels of PD. By contrast, all three religiosity dimensions were significantly and inversely associated with levels of current drinking and smoking or lifetime risk for alcoholism and nicotine dependence. PD, but not PC or IC, buffered the depressogenic effects of stressful life events (SLEs).⁸

In this report, we follow up these intriguing findings in two ways. First, our initial analyses of the relationship between the dimensions of religiosity and psychiatric and substance-use outcome controlled only for years of education and age. Many

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Received 16 February 1999; accepted 17 March 1999

other variables might mediate these associations including particularly personality and demographic variables such as income and urbanicity. To what extent could the observed relationship between the three dimensions of religiosity and psychiatric and substance use disorders be 'explained' by demographic and personality covariates?

Second, in our analyses of the potential buffering effect of dimensions of religiosity on the impact of SLEs, we examined only an aggregate summary measure of the total number of events experienced. However, as Strawbridge *et al* pointed out,⁹ religiosity might buffer the depressogenic effects of some stressors but exacerbate the effects of others. Therefore, in this report we repeat those analyses, dividing SLEs into 14 separate event categories.

Methods

Sample

The Caucasian female same-sex twins studied in this report are part of a longitudinal study of genetic and environmental risk factors for common psychiatric disorders. The twins, ascertained from the population-based Virginia Twin Register, were eligible to participate in this study if both members of the pair had previously responded to a mailed questionnaire, to which the individual response rate was 64%. In our first personal interview, we succeeded in interviewing 92% of the eligible individuals; 90% of the interviews were face-to-face, whilst the rest were completed by phone. Written informed consent was obtained prior to all face-to-face interviews. The mean age of the participating twins was 30.1 ± 7.6 years. Zygosity was determined blindly by standard questions,¹⁰ photographs and, when necessary, DNA.¹¹

Since this original interview, we have completed two additional waves of phone interviews, which succeeded in interviewing 2001 (92.5%) and 1902 (87.9%) of the original sample, respectively. The mean (\pm SD) of months between the first and third interviews was 61.3 ± 5.1 . In the third interview, we assessed both members of 849 pairs, 496 of whom were monozygotic (MZ) and 353 of whom were dizygotic (DZ).

Measures

Our first personal interview assessed lifetime diagnoses of major depression (MD), generalized anxiety disorder (GAD), panic disorder, bulimia, phobias and alcohol dependence. In addition, past-year MD and GAD were assessed during the second and third waves of phone interviews. MD and alcohol dependence were assessed, by computer algorithm, using

DSM-III-R criteria. For GAD, we used the symptomatic criteria from DSM-III-R, but followed DSM-III in requiring one month minimum duration of illness. Phobia was defined as the presence of one of 17 specific fears which the respondent considered to be irrational and which, in the interviewer's judgement, produced objective behavioral interference with the respondent's life.¹² To maximize our power, we used broader definitions of bulimia and panic disorder, where previous analyses have shown that the additional 'possible' cases of illness were on the same continuum of liability as those diagnosed with greater certainty.^{13,14} We also examined a broader definition of alcoholism in this sample by adding cases of 'problem drinking', which defines individuals who appear to have a milder disturbance on the same liability dimension that influences alcohol dependence.¹⁵

At both the first and third personal interviews, current psychiatric symptoms were assessed by 30 items selected from the SCL-90.¹⁶ As seen previously,¹⁷ VARIMAX factor analysis extracted four symptom scales – termed depression, panic-phobia, somatization and insomnia – which we analyze here. We used the SCL measures from the first personal interview so as to separate in time the assessment of religiosity and symptoms. We also recorded the presence and month of occurrence of nine personal and 22 network stressful life events (SLEs), the details of which have been outlined previously.¹⁸

In the third interview, we assessed average monthly alcohol consumption and average daily cigarette intake over the last year. In addition, for 'ever smokers', we obtained, at the time of their heaviest cigarette consumption, the Fagerstrom Tolerance Questionnaire.¹⁹ We define as nicotine-dependent any individual with a history of regular smoking and a Fagerstrom Tolerance Questionnaire score of ≥ 7 .

In our first interview, we assessed religious affiliation by asking the twins: 'What is your religious preference – Protestant, Catholic, Jewish or something else? If they responded 'Protestant', we then inquired as to their specific denomination. 'No preference' was also a permitted response. From the responses on religious affiliation, as outlined in detail elsewhere,⁸ we developed and validated an Institutional Conservatism scale (IC) which ranked sects into five groups of decreasing conservatism: i) fundamentalist Protestant, ii) Baptist, iii) mainline Protestant, iv) Catholic and v) other and unaffiliated. Baptists were assigned their own category both because they are the most common denomination in our sample and because, in Virginia, Baptists generally occupy a 'middle ground' on principles of faith between more conservative (eg Church of God, Pentecostal Assembly of God, Jehovah's Witnesses)

and more mainline Protestant denominations (eg Episcopalian, Methodist, Presbyterian).

In the first interview, we also inquired about the frequency of attendance at religious services or meetings, with six possible responses ranging from 'more than once a week' to 'never'. The wave3 interview inquired again about the frequency of attendance at religious services and also contained nine questions designed to assess a range of attitudes and beliefs about religion. These items were selected from used in the National Comorbidity Survey,²⁰ the Gallup poll¹ and the Religiousness scale of Strayhorn *et al.*²¹ As reported elsewhere,⁸ a factor analysis, conducted by the method of rotated principal factors²² by SAS routine PROC FACTOR,²³ using traditional eigenvalue criteria, produced two clear factors. The first factor, which we called Personal Devotion (PD) had heaviest loadings on six items: importance of religious beliefs (+), frequency of church attendance (+), consciousness of religious purpose (+), frequency of seeking spiritual comfort (+), frequency of private prayer (+) and dissatisfaction with spiritual life (-). The second factor, which we called Personal Conservatism (PC) had the highest loadings on four items: belief in God (+), belief that God rewards and punishes (+), belief in being 'born again' (+), and literal belief in the Bible (+).

Urbanicity was assessed on a 7-point, interviewer-rated scale describing the population size where the respondent lives, ranging from greater than one million to a cluster of less than 20 houses.

Statistical methods

The relationships between the dimensions of religiosity and psychiatric symptoms and current alcohol and cigarette use were assessed by linear regression analysis. We here report multivariate analyses. Univariate analyses – examining the relationship between single predictor variables and the three dimensions of religiosity – were relatively similar and are available from the author on request. To correct for the correlated observations in twin pairs, we used the SAS procedure PROC MIXED,²⁴ which treated the twin pairs as correlated observations using the repeated statement.

The relationship between the religiosity dimensions and lifetime risk for psychiatric and substance dependence disorders was assessed using the Cox Proportional Hazards method, as operationalized in the PHREG procedure in SAS. Currently, no model-based method exists to correct Cox regressions for correlated observations in twins. Given the large sample size employed, the biases introduced by using standard models should be slight.

We assessed the 'buffering' effect of religiosity by examining interactions, in linear regression, between the individual classes of SLEs (occurring in the month of the interview and the prior month) and the dimensions of religiosity, in the prediction of depressive symptoms. To reduce the possibility of correlated errors of measurement, we performed these analyses using religiosity as assessed at our third interview to predict the depressive response to SLEs assessed 5 years earlier at our first personal interview with this twin sample. To correct for the correlated observations in twin pairs, we also performed these analyses using the SAS procedure PROC MIXED, treating twin pairs as correlated observations.

Because of the low power in these models to detect interactions, in these analyses, we proposed a priori to relax our type I error rate to 10% to reduce our rate of type II errors.

Results

Relationship between levels of religiosity and personality and demographic variables

Table 1 depicts the standardized regression coefficients between eight personality constructs examined together in a single multivariate analysis and the three dimensions of religiosity. High levels of PD were significantly predicted by low levels of neuroticism (N) and high levels of optimism, altruism and interpersonal dependency. High levels of PC were predicted by high levels of altruism and low levels of mastery and interpersonal dependency. IC was significantly predicted only by low levels of self-esteem. While several of these associations were highly significant, they explained, in total, only between 1.2 and 5.7% of the variance in the religiosity dimensions.

Table 2 depicts the multivariate association between the three dimensions of religiosity and six

Table 1 Personality correlates of dimensions of religiosity – multivariate analysis

Personality measure	Dimensions of Religiosity		
	Personal devotion	Personal conservatism	Institutional conservatism
Neuroticism	-0.09 ^b	+0.06	-0.03
Extroversion	-0.02	+0.00	-0.01
Locus of control	-0.03	+0.05	+0.04
Mastery	-0.05	-0.14 ^d	-0.03
Dispositional optimism	+0.12 ^c	-0.00	+0.02
Altruism	+0.14 ^d	+0.07 ^b	+0.04
Self-esteem	-0.01	-0.05	-0.08 ^a
Interpersonal dependency	+0.06 ^a	-0.10 ^c	-0.02
r ²	0.057	0.046	0.012

^aP<0.05; ^bP<0.01; ^cP<0.001; ^dP<0.0001.

demographic variables. High levels of PD were significantly associated with higher levels of respondent education, family income and age, but low levels of self-generated income, and a less urban living environment. High levels of PC were significantly predicted by low levels of education in both the respondent and her parents, low levels of family income, younger age and a less urban living environment. High levels of IC were significantly associated with less parental education and a less urban living environment. These demographic variables explained between 6.7 and 17.8% of the variance in the three religiosity dimensions. Notably, more than twice as much variance in PC than either of the two other religiosity dimensions was explained by demographic factors.

Table 2 Demographic correlates of dimensions of religiosity – multivariate analysis

Demographic variable	Dimensions of Religiosity		
	Personal devotion	Personal conservatism	Institutional conservatism
Years education – self	+0.12 ^d	-0.21 ^d	-0.04
Years education – parent	-0.04	-0.16 ^d	-0.15 ^d
Income – family	+0.05 ^a	-0.11 ^d	-0.01
Income – self	-0.11 ^d	+0.01	-0.03
Age	+0.21 ^d	-0.08 ^b	0.04
Urbanicity	-0.04 ^b	-0.05 ^d	-0.05 ^c
r ²	0.084	0.178	0.067

^aP<0.05; ^bP<0.01; ^cP<0.001; ^dP<0.0001.

Association between religiosity and psychiatric and substance use outcomes covarying for personality and demographic variables

We then explored how much the association between the dimensions of religiosity and a range of psychiatric and substance use symptoms and disorders were changed when the personality and demographic variables were added to the regression equation as covariates. In Tables 3 and 4, in the analyses termed model 1, we controlled only for age and years of education. In the analyses termed model 2, all 14 of the personality and demographic variables outlined in Tables 1 and 2 were added as covariates.

In Table 3, we examined last-year alcohol and cigarette intake and symptoms of depression, somatic-anxiety, panic-phobia and sleep difficulties in the last month. It can be seen that the negative associations between PD and alcohol consumption, cigarette consumption and symptoms of depression are not substantially altered by the addition of the covariates. The same pattern is seen for the negative associations between alcohol consumption and PC and IC.

Table 4 depicts the association between the dimensions of religiosity and lifetime psychiatric and substance use disorders. Overall, few associations are significant. Here, the impact of the addition of the covariates is somewhat more complex. Two of the observed significant protective effects (PD and nicotine dependence and lifetime MD and IC) are

Table 3 Association of dimensions of religiosity with current substance use and psychiatric symptoms without covariates

	Personal devotion		Personal conservatism		Institutional conservatism	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Log No. drinks	-0.22 ^d	-0.21 ^d	-0.08 ^a	-0.07	-0.12 ^b	-0.10 ^b
Log No. cigarettes	-0.17 ^d	-0.18 ^d	-0.02	-0.02	-0.05	-0.04
Sxs dep	-0.09 ^c	-0.07 ^b	0.04	0.02	-0.01	-0.02
Sxs som anx	0.03	0.04	0.01	-0.01	0.01	0.00
Sxs panic phobia	-0.01	-0.01	0.02	0.01	0.03	0.03
Sxs sleep diff	-0.01	-0.02	-0.02	-0.04	0.03	0.03

^aP<0.05; ^bP<0.01; ^cP<0.001; ^dP<0.0001. Sxs - Symptoms. Model 1. Covariates: age, years education–self; Model 2. Covariates: age, years education–self, years education–parents, income–family, income–self, urbanicity, neuroticism, extroversion, locus of control, mastery, dispositional optimism, altruism, self-esteem, interpersonal dependency.

Table 4 Association of dimensions of religiosity with lifetime psychiatric and substance use disorders with and without covariates

Disorder	Personal devotion		Personal conservatism		Institutional conservatism	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
MD	1.04	1.08	0.90 ^b	0.87 ^c	0.94	0.94
GAD	1.04	1.05	0.99	0.94	0.99	0.96
Panic	1.15	1.30	0.79	0.76	1.25	1.41 ^a
Phobia	1.03	1.06	0.92	0.89 ^a	1.10 ^a	1.10
Bulimia	0.90	0.89	1.02	1.00	0.97	0.96
Problem drinker	0.83 ^a	0.95	0.88	0.91	0.86 ^a	0.94
Ethanol dep	0.86	0.95	0.88	0.90	0.81 ^a	0.87
Nicotine dep	0.83 ^a	0.84 ^a	0.87	0.87	0.88	0.89

^aP<0.05; ^bP<0.01; ^cP<0.001. dep - dependence. Model 1. Covariates: age, years education–self; Model 2. Covariates: age, years education–self, years education–parents, income–family, income–self, urbanicity, neuroticism, extroversion, locus of control, mastery, dispositional optimism, altruism, self-esteem, interpersonal dependency.

unchanged as is the increased risk for lifetime phobia in those with high levels of IC. Two other significant protective effects involving alcohol (PD and problem drinking and IC and ethanol dependence) were substantially attenuated with the addition of the covariates. Two associations were substantially strengthened by adding the covariates: an inverse association between levels of PC and risk for phobia and a positive association between levels of IC and risk for panic disorder.

Specific categories of stressful life events and the buffering effect of religiosity

Table 5 presents the results of three regression analyses predicting the level of depressive symptoms from the occurrence of 14 different categories of SLEs occurring in the 2 months preceding the interview, the level of PD, PC or IC and the interaction between them. Negative and positive interaction terms indicate that high levels of that dimension of religiosity buffer or exacerbate, respectively, the depressogenic effects of that particular SLE category.

Examining first protective effects, we see that high levels of PD significantly buffered the depressogenic effects of being a criminal victim, whilst high levels of both PD and IC reduced the depressogenic effects of having health problems or experiencing a death in the social network. High levels of PC buffered only the depressogenic impact of job loss.

High levels of PC and IC but not PD were also associated with a greater elevation in depressive symptoms after the experience of several classes of SLEs. Specifically, high levels of PC had such an exacerbating effect on the response to being a criminal victim, or having marital, housing, financial

or relationship problems. High levels of IC exacerbated the depressive impact of loss of confidant and marital and housing problems.

Discussion

In this paper, we have attempted to follow up two sets of results obtained from our earlier investigation of the relationship between dimensions of religiosity and psychiatric and substance abuse outcomes.⁸ We will now review these new findings in turn.

Association between religiosity and psychiatric and substance abuse symptoms

In our previous analyses⁸ of the association between the dimensions of religiosity and psychiatric and substance use outcome measures, we had controlled only for years of education and age. With these minimal covariates, we had found that, with the possible exception of depressive symptoms, religiosity was often related to levels of substance use and misuse, but had little overall relationship with more classic psychiatric symptoms or disorders. Whilst the data on psychiatric symptoms and disorders and substance use were collected at a different interview wave from that on religiosity, we had little power to infer the causal relationship between these variables. One approach that might throw light on the nature of the correlation, however, is to explore plausible covariates that could be responsible for much of the observed association. Of the numerous possible variables, we here considered two domains which have been shown to substantially correlate with risk

Table 5 Prediction of depressive symptoms from stressful life events occurring in the last two months, dimensions of religiosity and their interaction

Life event	Personal devotion (PD)			Personal Conservatism (PC)			Institutional conservatism (IC)		
	SLE	PD	Interaction	SLE	PC	Interaction	SLE	IC	Interaction
Criminal victim	+0.77 ^d	-0.07 ^c	-0.46 ^b	+0.74 ^d	+0.03	+0.42 ^b	+0.73 ^d	-0.02	-0.05
Loss of confidant	+0.43 ^c	-0.07 ^c	+0.24	+0.40 ^c	+0.04	-0.00	+0.37 ^b	-0.03	+0.44 ^c
Divorce/separation	+0.24	-0.07 ^c	+0.04	+0.25	+0.04	-0.02	+0.27	-0.03	+0.21
Romantic/marital problems	+1.21 ^e	-0.06 ^c	+0.08	1.25 ^e	+0.02	+0.43 ^d	+1.31 ^e	-0.03	+0.55 ^e
Health problems	+0.36 ^c	-0.06 ^c	-0.28 ^b	+0.28 ^b	+0.03	+0.04	+0.36 ^c	-0.02	-0.41 ^c
Housing problems	+0.01	-0.07 ^c	-0.10	+0.10	+0.03	+0.48 ^b	-0.05	-0.03	+0.60 ^b
Legal problems	+0.27	-0.07 ^c	-0.22	+0.31	+0.04	-0.26	+0.27	-0.03	+0.05
Job loss	+0.72 ^b	-0.07 ^c	+0.20	+0.48	+0.04	-0.40 ^b	+0.61 ^b	-0.03	+0.32
Work problems	+0.31 ^b	-0.08 ^c	+0.16	+0.30 ^b	+0.04	-0.04	+0.35 ^c	-0.03	+0.11
Financial problems	+0.60 ^c	-0.07 ^c	-0.15	+0.56 ^c	+0.03	+0.33 ^a	+0.50 ^b	-0.03	+0.33
Death in network	+0.34	-0.06 ^c	-0.63 ^b	+0.55	+0.04	-0.20	+0.62 ^b	-0.02	-0.65 ^c
Illness in network	+0.21 ^b	-0.07 ^c	-0.01	+0.21 ^b	+0.04	-0.01	+0.19 ^b	-0.02	-0.07
Relationship problems with network	+0.38 ^d	-0.07 ^c	+0.00	+0.35 ^c	+0.02	+0.43 ^d	+0.44 ^e	-0.03	+0.10
Crisis in network	+0.08	-0.08 ^c	+0.09	+0.08	+0.03	+0.01	+0.10	-0.03	+0.01

^aP<0.10 (interactions only); ^bP<0.05; ^cP<0.01; ^dP<0.001; ^eP<0.0001.

for psychiatric and substance use disorders: personality^{25,26} and demographic factors.^{20,27}

We found a range of intriguing relationships between personality and the dimensions of religiosity. Of particular interest was how different the personality correlates were for the two 'personal' dimensions of religiosity: devotion and conservatism. PD was negatively and PC positively correlated with N. PC was negatively correlated with mastery whilst PD was positively correlated with optimism. The two traits shared a similar relationship with only one personality trait: altruism. A similar pattern of differences emerged in the demographic correlates for PD and PC. PD was positively and PC negatively correlated with years of education, income level and age. The two traits were similar only in both being negatively correlated with urbanicity.

Although not the major goal of this report, these data do provide further support for the validity of the distinction between these two dimensions of personal religiosity. Although initially identified by factor analysis from a modest 10 item scale, they each show quite a distinct pattern of personality and demographic correlates.

As might be expected, we are able to predict a much lower proportion of variance in IC than in the two personal dimensions of religiosity. The very modest relationships between personality variation and IC were especially noteworthy.

As recently reviewed by McCullough,²⁸ congruent with our findings, prior work has tended to support a relationship between level of religious involvement and optimism but not locus of control. Most studies that have examined the association between Eysenck's personality dimension and religiosity find a significant association only with psychoticism.²⁹⁻³¹ We are unaware of previous evidence that religious devotion is significantly and inversely associated with N. However, this modest association may have been detectable in our study because of the large sample size.

The question of greatest interest is what would happen to our previously observed negative associations between the dimensions of religiosity and psychiatric and substance use outcomes when the personality and demographic correlates were added. Overall, the answer was not much. With the exception of the association between PD and IC and lifetime alcohol problems, the other associations remained unchanged or declined only slightly. In particular, the association between PD and low levels of current cigarette and alcohol use and depressive symptoms remained essentially unchanged.

These findings increase the probability that the associations observed between dimensions of religiosity

and depression and substance use and misuse are specific and potentially causal. It is unlikely that much of the observed association can be explained by personality or demographic factors which impact, independently, on both religiosity and risk for symptoms or substance use patterns. We were able to locate one study which addressed a similar question. Consistent with our own findings, in over 11 000 teenagers, Francis reported that personal religiosity was positively correlated with rejection of substance use, even after controlling for individual differences in personality.³²

Second, in our initial analyses of the potential buffering effect of SLEs, we examined only an aggregate measure of the total number of events experienced. However, as Strawbridge *et al* have pointed out,⁹ religiosity might buffer the impact of some stressors while exacerbating the effects of others. Our results confirmed this prediction but also further clarified the impact of the different dimensions of religiosity. Our previously demonstrated overall impact of PD in buffering SLEs⁸ can now be seen to be a much more specific protective effect for a class of fateful SLEs, especially medical illness, death of a loved one and criminal victimization. These three events have at least two characteristics in common. First, active or 'problem-solving' approaches are unlikely to be entirely efficacious in coping because the problems are not entirely practical or 'this-worldly'. Second, each of these events directly confronts individuals with facts about the nature of life that many of us, although intellectually aware of, in fact actively deny. These facts include our own mortality, our vulnerability to random acts of violence and the finite nature of the life of our loved ones. It is intuitively reasonable that individuals with high levels of PD, which reflects a 'rootedness' in a comforting theistic world view (reflected in such items as 'to what extent are you conscious of some religious goal or purpose in life which serves to give you direction') would cope relatively well with such crises. PC, by contrast, did not have these buffering effects. Doctrinal beliefs alone do not appear to be protective against these fateful events. Indeed, with respect to at least one of them (crime), high levels of PC exacerbates the depressive reaction. Most striking is the evidence that high levels of PC exacerbated the depressogenic effects of interpersonal difficulties either within the marriage or with the social network. We might speculate that this reflects greater culture censure for interpersonal and especially marital conflict – with fewer options available for divorce. Alternatively, this might reflect a rigidity of cultural and/or personal expectations that makes resolution of these conflicts more problematic and stressful.

Limitations

These results should be interpreted in the context of two potentially significant limitations. First, our sample is entirely female. These results may or may not extrapolate to males. Second, we cannot rule out the possibility that the experience of the symptoms of psychiatric illness or substance misuse might influence levels of religiosity. However, we explored this question in our previous article⁸ and concluded that it was unlikely to explain the bulk of the observed association. For example, we had longitudinal data on both alcohol intake and one item from the PD scale (frequency of church attendance). The association between church attendance at time 1 and alcohol intake at time 2 was stronger than the association between alcohol intake at time 1 and church attendance at time 2.

Acknowledgements

This work was supported by NIH grants MH/AA-49492, AA-09095, a Research Scientist Award (MH-01277) to KSK and by grant No 519 from the John Templeton Foundation. The Virginia Twin Registry, established by WNance MD, PhD and maintained by L Corey PhD, is supported by the United States National Institutes of Health grants HD-26746 and NS-31564. These data were collected under the direction of Lisa Halberstadt, MS, and Barbara Brooke, MSW.

References

- 1 Gallup Institute. Religion in America – 50 Years. Princeton Religious Research Center: Princeton, NJ, 1995.
- 2 Gartner J, Larson DB, Allen GD. Religious commitment and mental health: a review of the empirical literature. *J Psychol Theol* 1991; 19: 6–25.
- 3 Larson DB, Larson SS. The Forgotten Factor in Physical and Mental Health: What Does the Research Show? An Independent Study Seminar. National Institute for Healthcare Research: Rockville, MD, 1994.
- 4 Crossley D. Religious experience within mental illness: opening the door on research. *Br J Psychiatry* 1995; 166: 284–286.
- 5 King M, Speck P, Thomas A. The Royal Free Interview for Religious and Spiritual Beliefs: development and standardization. *Psychol Med* 1995; 25: 1125–1134.
- 6 King MB, Hunt RA. Measuring the religious variable: national replication. *J Sci Study Religion* 1975; 14: 13–22.
- 7 McNeil TF. Obstetric factors and perinatal injuries. In: Tsuang MT, Simpson JC, eds. *Handbook of Schizophrenia. Vol 3: Nosology, Epidemiology and Genetics of Schizophrenia*. Elsevier: Amsterdam, 1988 pp 319–344.
- 8 Kendler KS, Gardner CO, Prescott CA. Religion, psychopathology and substance use and abuse: a multimeasure genetic epidemiologic study. *Am J Psychiatry* 1997; 154: 322–329.
- 9 Strawbridge WJ, Shema SJ, Cohen RD, Roberts RE, Kaplan GA. Religiosity buffers effects of some stressors on depression but exacerbates others. *J Gerontol Soc Sci* 1998; 53B: S118–S126.
- 10 Eaves LJ, Eysenck HJ, Martin NG, Jardine R, Heath AC, Feingold L, Young PA, Kendler KS. *Genes, Culture and Personality: An Empirical Approach*. Academic Press: London, 1989.
- 11 Spence JE, Corey LA, Nance WE, Marazita ML, Kendler KS, Schieken RM. Molecular analysis of twin zygosity using VNTR DNA probes. *Am J Hum Genet* 1988; 43(3): A459 (Abstract).
- 12 Kendler KS, Neale MC, Kessler RC, Heath AC, Eaves LJ. The genetic epidemiology of phobias in women: The inter-relationship of agoraphobia, social phobia, situational phobia and simple phobia. *Arch Gen Psychiatry* 1992; 49: 273–281.
- 13 Kendler KS, MacLean CJ, Neale MC, Kessler RC, Heath AC, Eaves LJ. The genetic epidemiology of bulimia nervosa. *Am J Psychiatry* 1991; 148: 1627–1637.
- 14 Kendler KS, Neale MC, Kessler RC, Heath AC, Eaves LJ. Panic disorder in women: a population based twin study. *Psychol Med* 1993; 23: 397–406.
- 15 Kendler KS, Heath AC, Neale MC, Kessler RC, Eaves LJ. A population-based twin study of alcoholism in women. *JAMA* 1992; 268: 1877–1882.
- 16 Derogatis LR, Lipman RS, Covi L. SCL-90 – An outpatient psychiatric rating scale – preliminary report. *Psychopharmacol Bull* 1973; 9: 13–25.
- 17 Kendler KS, Walters EE, Truett KR, Heath AC, Neale MC, Martin NG, Eaves LJ. The sources of individual differences in depressive symptoms: An analysis of two twin-family samples. *Am J Psychiatry* 1994; 151: 1605–1614.
- 18 Kendler KS, Kessler RC, Walters EE, MacLean CJ, Sham PC, Neale MC, Heath AC, Eaves LJ. Stressful life events, genetic liability and onset of an episode of major depression in women. *Am J Psychiatry* 1995; 152: 833–842.
- 19 Fagerstrom K-O, Schneider NG. Measuring nicotine dependence: a review of the Fagerstrom Tolerance Questionnaire. *J Behav Med* 1989; 12: 159–182.
- 20 Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, Wittchen H-U, Kendler KS. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: results from the National Comorbidity Survey. *Arch Gen Psychiatry* 1994; 51: 8–10.
- 21 Strayhorn JM, Weidman CS, Larson DB. A measure of religiousness and its relation to parent and child mental health variables. *J Comm Psychol* 1990; 18: 34–43.
- 22 Johnson RA, Wichern DW. *Applied Multivariate Statistical Analysis*. Prentice Hall: Englewood Cliffs, NJ, 1988.
- 23 SAS Institute. *SAS/STAT User's Guide, Version 6, 4th edn*, vols 1 and 2. SAS Institute Inc: Cary, NC, 1990.
- 24 Littell RC, Milliken GA, Stroup WW, Wolfinger RD. *SAS System for Mixed Models*. SAS Institute Inc: Cary, NC, 1996.
- 25 Kendler KS, Neale MC, Kessler RC, Heath AC, Eaves LJ. A longitudinal twin study of personality and major depression in women. *Arch Gen Psychiatry* 1993; 50: 853–862.
- 26 Cloninger CR, Przybeck TR, Svrakic DM, Wetzel RD. *The Temperament and Character Inventory (TCI): A Guide to Its Development and Use*. Center for Psychobiology and Personality; Washington University: St Louis, 1994.
- 27 Robins LN, Regier DA. *Psychiatric Disorders in America*. The Free Press: New York, 1991.
- 28 McCullough ME. *Religion, personality, and health*. Oxford Press, 1999 (in Press).
- 29 Maltby J. Personality correlates of religiosity among adults in the Republic of Ireland. *Psychol Rep* 1997; 81: 827–831.
- 30 Lewis C-A, Maltby J. Personality, prayer, and church attendance in a sample of male college students in the USA. *Psychol Rep* 1996; 78: 976–978.



31 Francis L. Personality, prayer, and church attendance among undergraduate students. *Int J Psychol Religion* 1997; 7: 127–132.

32 Francis LJ. The impact of personality and religion on attitude towards substance use among 13–15 year olds. *Drug Alcohol Depend* 1997; 44: 95–103.