Journal of Personality and Social Psychology
2014, Vol. 107, No. 2, 339–351

0022-3514/14/$12.00 http://dx.doi.org/10.1037/a0036853

Explaining the Relationship Between Religiousness and Substance Use: Self-Control Matters

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Religiousness is reliably associated with lower substance use, but little research has examined whether self-control helps explain why religiousness predicts lower substance use. Building on prior theoretical work, our studies suggest that self-control mediates the relationship between religiousness and a variety of substance-use behaviors. Study 1 showed that daily prayer predicted lower alcohol use on subsequent days. In Study 2, religiousness related to lower alcohol use, which was mediated by self-control. Study 3 replicated this mediational pattern using a behavioral measure of self-control. Using a longitudinal design, Study 4 revealed that self-control mediated the relationship between religiousness and lower alcohol use 6 weeks later. Study 5 replicated this mediational pattern again and showed that it remained significant after controlling for trait mindfulness. Studies 6 and 7 replicated and extended these effects to both alcohol and various forms of drug use among community and cross-cultural adult samples. These findings offer novel evidence regarding the role of self-control in explaining why religiousness is associated with lower substance use.

Keywords: religiosity, self-control, self-regulation, alcohol, substance use

Religion is present in virtually every known culture and can have a profound impact on how people think, feel, and behave (Sanderson & Roberts, 2008). Religiousness relates to various health indicators, including lower substance use (e.g., Benda, Pope, & Kelleher, 2006; Gartner, Larson, & Allen, 1991; Gorsuch, 1995; Hallfors et al., 2004; Hill & McCullough, 2008; Humphreys & Gifford, 2006; Johnson, Sheets, & Kristeller, 2008; Kendler et al., 2003; H. G. Koenig, McCollough, & Larson, 2001; Koopmans, Slutske, van Baal, & Boomsma, 1999; Miller, 1998). Yet, little research has examined whether self-control helps explain why religiousness predicts lower substance use.

The current investigation fills this gap in the literature by proposing that the benefits of religiousness on lower substance use are mediated by self-control. In a recent review, McCullough and Willoughby (2009) proposed that religion enhances self-control, which promotes health. Most religions teach their followers to exercise self-control. Followers refrain from eating tempting foods, control their attention by reading and memorizing scriptural passages, override selfish impulses in order to behave prosocially, and engage in behaviors that promote, rather than hinder, their health. Therefore, self-control may account for part of the relationship between religiousness and lower substance use.

Religiousness and Substance Use

Alcohol and drug use can compromise physical and mental health. Substance use increases risky sexual behavior, depression, sexual assault, and even mortality (e.g., Abbey, 2002; Arasteh, Des Jarlais, & Perlis, 2008; Cooper, 2002; Fergusson, Horwood, & Swain-Campbell, 2002; Hallfors et al., 2004; Jones, Oeltmann, Wilson, Brener, & Hill, 2001; Kapner, 2008; Leino et al., 1998). Alcohol and drug use also tend to co-occur, which poses an even greater risk to physical and mental health. Given the considerable negative consequences of substance use for health, it is desirable to identify factors associated with lower substance use.

Religiousness is such a factor. Some religions, such as Islam, The Church of Jesus Christ of Latter-day Saints, certain sects of Hinduism, and schools of Buddhism forbid substance use. Even when one's religion does not prohibit substance use, stronger

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religious commitment often relates to less substance use (e.g., Benda et al., 2006; Ford & Hill, 2012; Gartner et al., 1991; Gorsuch, 1995; Hill & McCullough, 2008; Humphreys & Gifford, 2006; Johnson et al., 2008; Kendler et al., 2003; H. G. Koenig et al., 2001; Koopmans et al., 1999; Miller, 1998; Regnerus & Elder, 2003). Experimentally manipulating religious behavior and cognition, such as prayer, reduces alcohol consumption (Lambert, Fincham, Marks, & Stillman, 2010). One review summarized, "There seems to be little argument that greater religiosity is associated with lesser substance use" (Spilka, Hood, Hunsberger, & Gorsuch, 2003, p. 423).

What remains unclear, however, is whether self-control helps explain why religiousness predicts lower substance use. The next section offers theoretical and empirical support for our prediction: Self-control mediates the relationship between religiousness and lower substance use.

Might Self-Control Help Explain the Link Between Religiousness and Lower Substance?

We test a theoretical framework synthesizes and explains relations between religiousness and substance use (McCullough & Willoughby, 2009). McCullough and Willoughby (2009) proposed that self-control may help explain well-replicated findings that link religiousness to better health, including lower substance-use behaviors. At first glance, this proposal seems plausible: Self-control, the ability to override one's impulses so that one can remain in line with personal and social standards (Baumeister, Heatherton, & Tice, 1994), predicts lower substance use (Johnston, O'Malley, & Bachman, 1991; Tangney, Baumeister, & Boone, 2004; Williamson, 1990). People who have good self-control tend to drink less alcohol and use fewer drugs (Conner, Stein, & Longshore, 2009; Pearson, Kite, & Henson, 2013; Wills, Ainette, Stoolmiller, Gibbons, & Shinar, 2008). Experimental manipulations that impair self-control cause people to drink more alcohol (Christiansen, Cole, & Field, 2012).

McCullough and Willoughby's (2009) review showed consistent support for a link between religiousness and better self-control. For example, compared to less religious people, highly religious people have longer lives (McCullough, Friedman, Enders, & Martin, 2009; McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000), consume less tobacco (Islam & Johnson, 2003), and exhibit less aggressive and criminal behavior (Baier & Wright, 2001; Ellison & Anderson, 2001). Experimental prayer manipulations, compared to people in no prayer conditions, cause people to report engaging in less romantic infidelity (Fincham, Lambert, & Beach, 2010) and to cooperate more after provocation (Lambert, Fincham, DeWall, Pond, & Beach, 2013). Moreover, religious images, and bringing religious concepts to mind, aid in coping with stressors (e.g., Inzlicht & Tullett, 2010; Weisbuch-Remington, Mendes, Seery, & Blascovich, 2005) and improve self-control performance (Rounding, Lee, Jacobson, & Ji, 2012). Thus, a large body of work suggests a close link between indicators of religiousness and effective self-control.

Present Studies

Here, we present the results of a programmatic test of the hypothesis that self-control mediates the relationship between religiousness and lower substance use. To our knowledge, only four previously published studies have explored this question. All four relied on samples of early and middle adolescents (Desmond, Ulmer, & Bader, 2013; Kim-Spoon, Farley, Holmes, Longo, & McCullough, 2014; Kim-Spoon, McCullough, Bickel, Farley, & Longo, 2014; Walker, Ainette, Wills, & Mendoza, 2007). Compared to younger adolescents, college students and adults consume more alcohol and drugs, and they are also at greater risk for substance-use problems. Hence, the links among religion, self-control, and substance use merit examination in people who are beyond middle and high school. We explored these linkages in diverse set of samples, including college student samples and samples of community-dwelling adults from the United States and four Asian countries. An additional strength is that we examined these associations at both the between-persons level and the within-persons level in hopes of gaining better purchase on how such causal associations might occur (Borsboom, Mellenbergh, & van Heerden, 2003).

An additional unique contribution is our effort to ensure that the associations of religion, self-control, and substance use are not caused by previously unconsidered confounds. In particular, our studies evaluate whether the mediational effects of lower substance use through heightened self-control remain significant after controlling for social desirability, which is a known correlate of religiousness (in particular in U.S. samples; Sedikides & Gebauer, 2010). We also examined whether our effects would remain significant after controlling for a non-religious mental state associated with self-awareness and contemplation—mindfulness. Whereas religiousness encompasses individual beliefs, practices, and dedications (Worthington et al., 2003), mindfulness refers to a "receptive attention to and awareness of present events and experience" (Brown, Ryan, & Creswell, 2007, p. 212). Religiousness often depends in part on a supernatural agent, whereas mindfulness does not. Religious people, by definition, associate themselves with a particular religion, whereas mindfulness practitioners may or may not identify as religious (Longo & Peterson, 2002). Hence, religiousness may continue to predict lower substance use even after controlling for mindfulness.

Also, we examined the potential moderating effects of participant gender, for two reasons. First, compared to women, men often consume more alcohol and drugs and have poorer self-control (e.g., Back, Payne, Simpson, & Brady, 2010; Brady, Back, & Greenfield, 2009; Geisner, Larimer, & Neighbors, 2004; Kahler, Read, Wood, & Palfai, 2003; Stoltenberg, Batien, & Birgenheir, 2008). Second, women tend to be more religious than men—particularly in the West (Francis & Penny, 2013). Therefore, it seemed prudent to ensure that any apparent mediational relationships we discovered were not due to the confounding effects of gender.

Thus, the current investigation is unmatched in its scope in testing the hypothesis that self-control mediates the relationship between religiousness and lower substance use. We predicted that self-control would mediate the association between religiousness and lower substance use, although we expected the size of the mediating effect to be in the small-to-medium range, given the often small size of mediating effects (Preacher & Kelley, 2011; Shrout & Bolger, 2002) and the small-to-moderate sizes of the bivariate relationships among religiousness, self-control, and substance use that previous research led us to anticipate.

Study 1: Prayer Predicts Less Alcohol Consumption Over Time

Study 1 provided an initial test of the hypothesis that religiousness was associated with lower alcohol use over time. It remains unclear how the relationship between religiousness and lower alcohol use unfolds in people's everyday lives. To date, no study has investigated whether religious activities reported daily over a period of time, such as prayer, predict lower alcohol use concurrently or prospectively. Because daily prayer may occur before, during, or after one's alcohol use, its relation to concurrent alcohol use may not be reliable. Moreover, in this diary study, participants reported on their daily prayer and alcohol consumption at the end of the day, which left the timing of each activity unclear. That is, daily prayer may have occurred before, during, or after the alcohol consumption. Because previous research has shown that prayer has a causal effect on reducing self-reported alcohol consumption (Lambert et al., 2010), how much alcohol a person consumes may be estimated most effectively by their previous day's prayer.

Method

Participants. Participants consisted of 460 undergraduate students (80% women)[1] at a large, Southern-Atlantic university. With a mean age of 19.35 years ($SD = 1.75$), 63.6% of participants were Caucasian, 13.9% were Hispanic, 2.2% were Asian American, 15.4% were African American, 0.2% were American Indian or Alaskan Native, and 4.7% of participants reported their race as "other."

Measures.

Prayer frequency. To measure prayer frequency, participants reported how much they had prayed since their last log, using an 8-point scale (1 = *Prayer is something I never engage in*, 8 = *I prayed more than once a day with great intensity*; $M = 3.17$, $SD = 2.12$).

Daily alcohol consumption. Participants completed a one-item measure that assessed how many drinks containing alcohol they had consumed since their last log ($M = 2.35$, $SD = 2.81$).

Procedure. Participants were given a URL to record their prayer frequency and alcohol consumption three times each week for 25 days (total of 11 waves). Participants were instructed to complete their daily surveys at the end of each day before midnight.

Results and Discussion

We used multilevel modeling techniques to analyze the nested diary data (i.e., repeated measures nested within participants) with HLM Version 6.08 (Raudenbush, Bryk, Cheong, & Congdon, 2000). Four hundred and sixty people provided a total of 4,252 days of data ($M = 9.24$). The intraclass correlation coefficient (ICC) for daily alcohol use was 0.32, suggesting significant within- and between-person variability. We next constructed a multilevel model with lagged Level 1 predictors that were group-mean centered (i.e., person-centered), which eliminated the influence of person-level differences on parameter estimates of mean lagged daily prayer and mean lagged daily alcohol consumption (Nezlek, 2001, 2011). In within-person analyses, a participant's coefficient for lagged daily prayer describes the relationship between deviations from his or her mean lagged daily prayer level and deviations from his or her mean daily alcohol consumption level.

Association between lagged daily prayer and daily alcohol consumption. We modeled daily alcohol consumption as a function of lagged prayer and lagged alcohol consumption, using Equation 1:

$$\text{Alcohol consumption} = \beta_{0j} + \beta_{1j}(\text{prayer}_{t-1}) + \beta_{2j}(\text{alcohol consumption}_{t-1}) + r_{ij},$$

where β_{0j} represents the initial alcohol consumption of person j; β_{1j} estimates the within-person association between reports of prayer, lagged by one log (i.e., t − 1), and subsequent alcohol consumption, controlling for the within-person association between reports of alcohol consumption, also lagged by 1 day, and subsequent alcohol consumption; β_{2j} estimates the within-person association between reports of alcohol consumption, lagged by one day, and subsequent alcohol consumption, controlling for the within-person association between lagged prayer and subsequent alcohol consumption; r_{ij} is the residual variance in repeated measurements for person j, assumed to be independent and normally distributed across individuals.

As expected, reports of prayer from a previous night's log predicted less alcohol consumption on a subsequent day at the within-person level, controlling for the lagged effect of alcohol consumption, $b = -0.12$, $t(440) = -2.67$, $p = .008$. The lagged effect of alcohol consumption also predicted less future alcohol use, controlling for the lagged prayer effect, $b = -0.24$, $t(440) = -10.07$, $p < .001$.

Study 1 offered the first evidence that religiousness was associated with less drinking longitudinally. Higher amounts of prayer predicted lower levels of alcohol use on subsequent days. However, these findings did not test whether self-control mediated this relationship. To test the hypothesis, we conducted Studies 2–7.

Study 2: Self-Control Mediates the Link Between Religiousness and Lower Alcohol Use

Study 2 sought to replicate and extend the results of Study 1 by demonstrating that the relationship between religiousness and lower alcohol use was mediated by self-control. Participants completed self-report measures of religiousness, trait self-control, and alcohol use. We predicted that religiousness would relate to greater self-control, which would in turn predict lower alcohol use.

[1] Due to a technical error, 122 participants were missing demographic data on gender. Thus, the gender proportion reported in the Method section was inferred from the sub-sample of 338 participants who had complete demographic information. Due to the missing data, gender was not added as a covariate in the analyses reported in the Results section. Nonetheless, we performed identical analyses for the sub-sample of 338 participants. Gender did not moderate the effect of lagged prayer on alcohol consumption, $b = 0.27$, $t(334) = 1.86$, $p = .06$. Also, the effect of lagged prayer on alcohol consumption was not made statistically nonsignificant when gender was entered as a Level 2 covariate, $b = -0.20$, $t(334) = -3.77$, $p < .001$.

Method

Participants. Participants consisted of 582 undergraduate students (59% women) at a large, mid-Eastern university. With a mean age of 19.65 years ($SD = 2.95$), 80.8% of participants were Caucasian, 2.4% were Hispanic, 3.4% were Asian American, 9.8% were African American, 0.3% were American Indian or Alaskan Native, and 3.5% of participants reported their race as "other."

Measures.

Religious commitment. To measure religiousness, participants completed the Religious Commitment Inventory (RCI; Worthington et al., 2003). The RCI items were averaged to form a composite measure of religiousness, with higher numbers indicating greater religiousness ($\alpha = .94$; $M = 2.69$, $SD = 1.01$).

Self-control. To assess individual differences in self-control, participants completed the Self-Control Scale–Brief Version (Tangney et al., 2004). The self-control items were averaged to form a composite measure of self-control, with higher numbers indicating greater self-control ($\alpha = .84$).

Alcohol use. To measure alcohol use, participants completed seven items from the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) that assessed "harmful" and "hazardous" drinking. The AUDIT items were averaged to form a composite measure of alcohol use, with higher numbers indicating greater alcohol use ($\alpha = .81$; $M = 0.82$, $SD = 0.67$).

Procedure. After giving informed consent, participants completed the religiousness, self-control, and alcohol use items on a laboratory computer in a cubicle separated from all other participants.

Results and Discussion

Association between religious commitment and alcohol use. We predicted that religiousness would relate to lower alcohol use, which would be mediated by heightened self-control. Because gender did not moderate any of our effects, we included participant gender as a covariate, but not as a moderator, in all analyses.

Study 2 hinged on a relationship between religiousness and lower alcohol use. Therefore, it was first necessary to document that such a relationship existed. As expected, religiousness was associated with lower alcohol use, $b = -0.25$, $t(577) = -7.69$, $p < .001$.

Mediation analyses. Next, we tested whether the relationship between religiousness and lower alcohol use was mediated by self-control. As predicted, religiousness was related to greater trait self-control, $b = 0.16$, $t(578) = 6.18$, $p < .001$. Trait self-control also predicted less alcohol use, even after controlling for religiousness and gender, $b = -0.32$, $t(577) = -8.49$, $p < .001$. A bootstrapping mediational analysis (using 5,000 bootstrapped samples) yielded a 95% bias corrected and accelerated confidence interval for the indirect effect that did not include zero [−0.07, −0.03], which indicated a significant indirect effect. These results offer initial evidence that religiousness relates to lower alcohol use by way of its intermediate association with self-control. They also confirmed our prediction that self-control has a small mediating effect on the link between religiousness and lower substance use.

To determine whether self-control was a reliable mediator of the relationship between religiousness and alcohol use, we conducted five additional studies. Study 3 sought to demonstrate that self-control mediated the relationship between religiousness and lower alcohol use using a behavioral measure of self-control.

Study 3: Delay Discounting Mediates the Link Between Religiousness and Lower Alcohol Use

Study 3 sought to replicate and extend the results of Studies 1 and 2 by evaluating whether the relationship between religiousness and lower alcohol use was mediated by a behavioral measure of self-control. Participants completed a self-report measure of religiousness, a behavioral measure of self-control, and a self-report measure of alcohol use. The self-control measure was a delay discounting task, in which participants reported their preferences for future versus current monetary rewards. Overriding impulses for immediate gratification is a core feature of self-control and is associated with a variety of desirable outcomes (Audrain-McGovern et al., 2009; Kollins, 2003; Oberlin & Grahame, 2009; Reynolds et al., 2007). Preliminary evidence suggests that discounting can be used to understand the relationship between religiousness and substance use among adolescents (Kim-Spoon, McCullough, et al., 2014). Therefore, we predicted that religiousness would be related to placing a greater value on future (vs. immediate) monetary rewards, which would in turn predict lower alcohol use.

Method

Participants. Participants consisted of 327 undergraduate students (59% women) at a large, Southeastern university. With a mean age of 19.03 years ($SD = 2.08$), 51.1% of participants were Caucasian, 5.5% were Asian American, 5.5% were African American, 0.9% were American Indian or Alaskan Native, 13.1% of participants reported their race as "other," and 23.9% of participants did not report any information on their ethnicity. Of these participants, 14.7% considered themselves to be Hispanic, whereas the rest of participants considered themselves non-Hispanic.

Measures.

Religious commitment. As in Study 2, participants completed the RCI measure of religious commitment (Worthington et al., 2003; $\alpha = .94$; $M = 2.01$, $SD = 1.03$).

Self-control. To assess individual differences in self-control, participants completed the Monetary Choice Questionnaire (MCQ), which yielded estimates for participants' rates of hyperbolic discounting (k; Mazur, 1987) for real future monetary rewards (Kirby & Maraković, 1996). Because people tend to discount near future rewards more than distant future rewards (Frederick, Loewenstein, & O'Donoghue, 2002; Green & Myerson, 2004), estimating a hyperbolic discounting function is preferable to an exponential function. Participants' answers on the 27 binary choice items (e.g., "Would you prefer $20 today or $55 in 7 days?") are used to estimate k for 3 magnitudes of reward: small ($25–$35), medium ($50–$60), and large ($75–$85).

Alcohol use. As in Study 2, participants again completed the seven "harmful" and "hazardous" items of the AUDIT (Babor et al., 2001; $\alpha = .84$; $M = 0.76$, $SD = 0.71$).

Procedure. Participants completed the religiousness and alcohol use items during a pretesting session. Participants then signed up for lab visits to complete the MCQ in groups of up to four

people. Participants were not pre-selected on the basis of their responses to the religiousness or alcohol use questionnaires.

Participants were told that they had a 25% chance of receiving one of their 27 MCQ choices. Because there was a chance that each response was worth real money, the experimenter encouraged participants to thoroughly consider each choice. When participants finished the MCQ, the experimenter handed them four poker cards. Participants then selected one of the four cards, one of which was an ace. If participants selected an ace, they pulled a number from a bag, which corresponded to an MCQ item. After participants had pulled a number, the experimenter gave them the amount chosen on the item. If participants received a delayed payment (e.g., $80 in 14 days), the experimenter made an appointment to pay them at the appropriate time.

Results and Discussion

Because one of our variables was a latent variable reflecting more than one indicator of discounting, data were analyzed with structural equation modeling (SEM) in Mplus Version 4.21 (Muthén & Muthén, 2004). To create the latent discounting variable, only the estimates of *k*s for medium and small magnitude rewards were used; *k* for large rewards was so highly correlated with *k* for medium rewards that when it was included as an indicator, its standardized loading on the latent variable exceeded 1.0, suggesting that a more appropriate approach was to only include *k* values for small and large rewards. The magnitude of the reward is known to effect rates of discounting (i.e., larger rewards relate to steeper discounting functions). Creating a latent variable for discounting rates as indicated by rates from both small and large rewards allows for the measurement of discount rates devoid of any effect of the magnitude of the reward. Because gender did not moderate any of our effects, we again included participant gender as a covariate in all analyses.

The mean of the seven AUDIT items was regressed on the RCI, the latent variable for discounting, and on gender. The latent variable for rates of discounting was regressed on the RCI and gender, and the covariance between gender and the RCI was estimated freely (see Figure 1 for standardized coefficients).

The test of model fit was not significant, $\chi^2(2, N = 326) = 0.003$, $p = .99$, indicating that the model fit the data well. Additional fit indices also supported this conclusion: The comparative fit index (CFI) was 1.00, the standardized root-mean-square residual (SRMR) was .00, and the root-mean-square error of approximation (RMSEA) was .00 (with a *p*-value of .99, indicating that this value is very likely equal to or below the cutoff of .05). These findings support previous theoretical and empirical work regarding a link between religiousness and effective self-control (McCullough & Willoughby, 2009) and between discounting rates and alcohol use (e.g., Kollins, 2003).

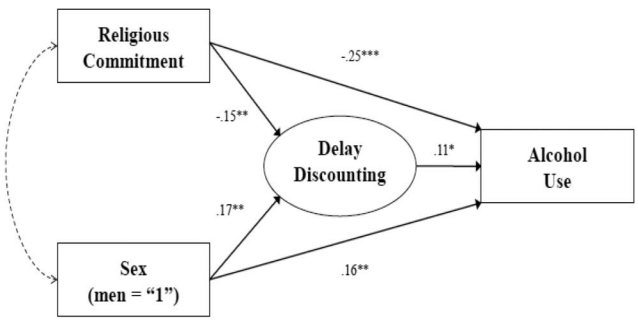

Figure 1. Structural equation model displaying the associations between religiousness, delay discounting, and alcohol use, while controlling for participant gender. Solid lines indicate statistical significance. Study 2. * $p < .05$. ** $p < .01$. *** $p < .001$.

We next obtained the bias corrected and accelerated 95% confidence interval for the indirect effect (using 5,000 bootstrapped samples; Shrout & Bolger, 2002), which was [−0.04, −0.002]. Thus, discounting rates mediated the relationship between religiousness and lower alcohol use.

Study 3 replicated and extended Studies 1 and 2 by showing that a measure of self-control based on the concept of delay discounting mediates the association between religiousness and alcohol use. In Studies 4 and 5, we examined whether self-control mediates the association between religiousness and alcohol use longitudinally.

Study 4: Self-Control Mediates the Relationship Between Religiousness and Changes in Alcohol Use Over Time

Study 4 was a conceptual replication of Studies 2 and 3, with two important modifications. First, participants completed different measures of religiousness and alcohol use. Second, rather than only measuring alcohol use cross-sectionally, as in Studies 2 and 3, participants reported on their monthly alcohol use initially and then again 6 weeks later, which enabled us to examine whether self-control mediated the effect of religiousness on lower alcohol use over time. Study 4 also included a measure of social desirability to ensure that our results were not due to a systematic bias in underreporting alcohol use among highly religious participants. We predicted that controlling for initial levels of alcohol use, religiousness would relate to lower alcohol use 6 weeks later, in part because of its intermediate associations with effective self-control.

Method

Participants. Participants were 971 undergraduate students (72.5% women) at a large, Southern-Atlantic university. With a mean age of 19.66 years (*SD* = 2.14), 67% of participants were Caucasian, 11.9% were African American, 9.1% were Latino/a, 1.3% were Asian American, 3.3% reported their race as "mixed," and 7.4% of participants reported their race as "other." Students received research credit for participation.

Measures.

Religiousness. To measure religiousness, participants completed four items that assessed how much they considered themselves a religious person (1 = *not at all*, 2 = *slightly*, 3 = *moderately*, 4 = *very*), how often they attended religious services (1 = *never, or almost never*, 2 = *occasionally, but less than once per month*, 3 = *one to three times per month*, 4 = *one or more times per week*), whether they prayed daily (1 = *strongly agree*, 2 = *agree*, 3 = *neither agree nor disagree*, 4 = *strongly disagree*; reverse-scored), and whether they agreed that a morning prayer helped them cope with the world during the day (1 = *strongly*

agree, 2 = *agree*, 3 = *neither agree nor disagree*, 4 = *strongly disagree*; reverse-scored). We included these items because college students, even those who identify as highly religious, may take a hiatus from attending religious services and may instead pray on their own. The four items had high levels of internal reliability ($\alpha = .88$; $M = 2.61$, $SD = 1.03$), and therefore responses were averaged to create a composite of religiousness, with higher numbers indicating greater religiousness.

Self-control. Participants completed the same self-control measure used in Study 2 (Tangney et al., 2004; $\alpha = .86$).

Alcohol use. To measure alcohol use, participants completed a three-item measure of their alcohol use in the previous month, which included items assessing on how many days participants consumed alcohol ("Within the last 30 days, on how many days did you have a drink containing alcohol?"; 1 = *never drank all 30 days*, 2 = *have drunk, but not in last 30 days*, 3 = *1–2 days*, 4 = *3–5 days*, 5 = *6–9 days*, 6 = *10–19 days*, 7 = *20–29 days*), amount of alcohol consumed during each drinking episode ("How many drinks containing alcohol did you have on a typical day when you were drinking?"; 1 = *never drank*, 2 = *1 or 2*, 3 = *3 or 4*, 4 = *5 or 6*, 5 = *7 to 9*, 6 = *10 or more*), and excessive amount of alcohol consumed during each drinking episode ("How often in the last 30 days did you have five or more drinks on one occasion?"; 1 = *never happened*, 1 = *1 time*, 2 = *2 times*, 3 = *3 times*, 4 = *4 times*, 5 = *5–6 times*, 6 = *7–8 times*, 7 = *9–10 times*, 8 = *more than 10 times*). Participants completed the alcohol use items initially and then again 6 weeks later. The internal reliability of the scale items was excellent at both time points (Time 1: $\alpha = .84$; $M = 3.08$, $SD = 1.52$; Time 2: $\alpha = .86$; $M = 3.11$, $SD = 1.57$). Therefore, responses were averaged to create a composite measure of alcohol use, with higher numbers indicating greater alcohol use.

Social desirability. Because we anticipated that participants' responses might be affected by their desire to respond in socially appropriate ways, participants completed a 10-item, shortened version of the Marlowe–Crowne Social Desirability Scale (e.g., "I have never intensely disliked anyone"; Strahan & Gerbasi, 1972). Although reliability was somewhat low ($\alpha = .49$), lower reliabilities often accompany abbreviated scales, and this level is comparable to previously published reports using this shortened version of the scale (Strahan & Gerbasi, 1972; Thompson & Phua, 2005).

Procedure. After giving informed consent, participants completed measures of religiousness, self-control, and alcohol use. Six weeks later, participants completed the alcohol use measure again.

Results and Discussion

Our main prediction was that religiousness would relate to less alcohol use over time and that this association would be mediated by self-control. Participant gender did not moderate any of the effects, and therefore the main effect of gender was included as a covariate in all analyses.

Association between religiousness and alcohol use. Consistent with Study 1, religiousness predicted lower alcohol use at Time 1, $b = -0.42$, $t(963) = -9.42$, $p < .001$. Also, as expected, religiousness predicted lower levels of Time 2 alcohol use, controlling for initial levels of alcohol use, $b = -0.16$, $t(826) = -5.45$, $p < .001$. Both the cross-sectional, $b = -0.41$, $t(961) = -9.15$, $p < .001$, and longitudinal, $b = -0.16$, $t(825) = -5.43$, $p < .001$, associations between religiousness and lower alcohol use remained significant after controlling for social desirability.

Mediation analyses. Having established cross-sectional and longitudinal relationships between religiousness and lower alcohol use over time, we examined whether these relationships were mediated by heightened self-control. As predicted, religiousness predicted higher self-control, $b = 0.13$, $t(963) = 6.10$, $p < .001$, which remained significant after controlling for social desirability, $b = 0.11$, $t(961) = 5.53$, $p < .001$. We then examined the cross-sectional association between self-control and Time 1 alcohol use, controlling for religiousness. Self-control uniquely predicted lower levels of alcohol use at Time 1, $b = -0.67$, $t(962) = -10.28$, $p < .001$, which again remained significant after controlling for social desirability, $b = -0.68$, $t(960) = -9.75$, $p < .001$. Next, we predicted Time 2 alcohol use from self-control, controlling for Time 1 alcohol use, religiousness, and social desirability. As expected, self-control predicted lower Time 2 alcohol use, controlling for religiousness, Time 1 alcohol use, and social desirability, $b = -0.19$, $t(824) = -4.01$, $p < .001$.

The bias corrected and accelerated 95% confidence intervals for the indirect path coefficient (using 5,000 bootstrapped samples; Preacher & Hayes, 2008) were [−0.12, −0.06] cross-sectionally and [−0.03, −0.004] longitudinally, both of which indicate a significant indirect effect. After controlling for social desirability, the 95% confidence intervals remained significant [Cross-Sectional: −0.11, −0.05; Longitudinal: −0.02, −0.003]. Because the confidence intervals exclude the value zero, self-control appeared to mediate the relationship between religiousness and lower alcohol use both cross-sectionally and longitudinally.

Studies 2–4 offered consistent evidence that self-control mediates the relationship between religiousness and lower alcohol use. We conducted Study 5 to address a potential limitation of the previous studies. That is, none of the previous studies examined whether religiousness remained a significant predictor of alcohol consumption after controlling for other mental states that involve contemplation and self-awareness, such as mindfulness.

Study 5: Religiousness Predicts Lower Alcohol Use Over and Above Trait Mindfulness

Study 5 sought to replicate and extend the results of Studies 1–4 by demonstrating that the relationships observed thus far among religiousness, alcohol use, and self-control remain significant after controlling for other contemplative mental states associated with self-awareness, such as mindfulness. Mindfulness refers to intentionally attending to current experiences in a nonjudgmental and accepting manner (Kabat-Zinn, 1990). Like religiousness, mindfulness is broadly associated with markers of mental and relational health (Brown & Ryan, 2003; Creswell, Way, Eisenberger, & Lieberman, 2007; Heppner et al., 2008).

However, religiousness also differs from mindfulness. Religiousness involves specific beliefs, practices, and dedications, often in relation to a supernatural agent (Worthington et al., 2003). In contrast, mindfulness encourages enhanced awareness of present events and experience and does not involve a supernatural agent (Brown et al., 2007). Given these conceptual and experiential differences, between religiousness and mindfulness, we predict that the effect of religiousness on lower alcohol use would remain

significant after controlling for mindfulness. Study 5 tested this hypothesis.

Method

Participants. Participants were 210 undergraduate students (75% women) at a large, mid-Eastern university. With a mean age of 18.60 years ($SD = 1.25$), 82.9% of participants were Caucasian, 3.8% were Hispanic, 2.4% were Asian American, 6.6% were African American, 0.5% were American Indian or Alaskan Native, and 3.8% of participants reported their race as "other."

Measures.

Religiousness. As in Studies 2 and 3, participants completed the Religious Commitment Inventory (Worthington et al., 2003; $\alpha = .93$; $M = 2.71$, $SD = 0.96$).

Self-control. Participants completed the same trait self-control measure used in Studies 2 and 4 (Tangney et al., 2004; $\alpha = .85$).

Mindfulness. Participants completed the 15-item Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003). The mindfulness items were averaged to form a composite score, with higher numbers indicating greater levels of mindfulness ($\alpha = .88$; $M = 3.68$, $SD = 0.74$).

Alcohol use. To assess alcohol use, participants completed a modified version of the Timeline Follow-Back (TLFB) procedure (Sobell & Sobell, 1992). The measure uses "anchor points" to help participants recall past drinking episodes, providing a more accurate account of alcohol use during the relevant time-period. Over the course of a 21-day period, participants were asked to complete a weekly diary each Sunday, reporting on the number of alcoholic drinks that they consumed each day of the previous 7 days. Responses were averaged across each week to obtain a measure of average weekly alcohol use ($M = 3.39$, $SD = 6.58$).

Procedure. During the initial visit, participants completed the religiousness, self-control, and mindfulness items. Next, participants completed weekly diaries about their alcohol use at the end of each week for 21 days. Participants were instructed to complete their weekly diaries at the end of each Sunday before midnight.

Results and Discussion

Association between religiousness and alcohol use. We predicted that religiousness would relate to lower alcohol use, controlling for trait mindfulness. Because gender did not moderate any of our effects, we included participant gender as a covariate in all analyses. As expected, religiousness was associated with lower weekly alcohol consumption, controlling for trait mindfulness, $b = -1.44$, $t(202) = -3.03$, $p = .003$. Thus, religiousness predicted lower alcohol use as in Studies 1–4. Mindfulness was also associated with less weekly alcohol consumption, controlling for religiousness, $b = -1.60$, $t(202) = -2.55$, $p = .01$.

Mediation analyses. Next, we tested whether the relationship between religiousness and lower alcohol use was mediated by self-control after controlling for trait mindfulness. As predicted, religiousness was related to greater trait self-control, $b = 0.13$, $t(202) = 3.12$, $p = .002$. Trait self-control also predicted lower alcohol use, even after controlling for religiousness and mindfulness, $b = -1.69$, $t(201) = -2.09$, $p = .04$. Last, the 95% bias corrected and accelerated confidence interval for the indirect effect (using 5,000 bootstrapped samples; Preacher & Hayes, 2008) was $[-0.55, -0.05]$, which indicated a significant indirect effect.

Study 5 replicated and extended Studies 1–4 by showing that religiousness predicted less weekly alcohol consumption, using an alternate measure of alcohol use. In addition, the effect of religious commitment on alcohol use remained significant after controlling for trait mindfulness. Finally, the mediating effect of heightened self-control held up, even after controlling for trait mindfulness.

Despite the consistency of our results, three limitations remain. First, the studies relied on college samples of individuals who were relatively moderate drinkers, thereby leaving open the question about whether our results can generalize to national samples of adults. Second, the studies focused exclusively on alcohol consumption, which ignores the potential importance of self-control in inhibiting use of other substances (e.g., marijuana, cocaine). Third, the studies concentrated only on American participants instead of examining whether the observed effects differ in other societies. To address these limitations, we ran two additional studies.

Study 6: Replication and Extension in a National Sample of American Adults

We conducted Study 6 to achieve two main goals. First, we sought to extend our previous findings to a possible relationship between religiousness and lower substance use, including both alcohol and drugs. Second, we sought to confirm the generalizability of our results by using a national sample of U.S. adults. Participants reported their level of religiousness, their self-control, and their use of alcohol and drugs. We predicted that religiousness would relate to lower substance use, which would be mediated by self-control.

Method

Participants. Two hundred eighty-eight adults (61.5% female) participated in this study. Average age was 34.6 years ($SD = 11.16$). Participants originated from Amazon.com's website "Mechanical Turk" (or MTurk.) Mechanical Turk is a website where over 100,000 users ("workers") from all over the world complete tens of thousands of tasks daily (Pontin, 2007). MTurk samples offer slightly more representativeness of the U.S. population than standard American samples and significantly more diversity than typical American college samples (Buhrmester, Kwang, & Gosling, 2011). In this study, participants received $0.50 for participating.

Materials and procedures.

Religiousness. To measure religiousness, we again used the Religious Commitment Inventory (RCI; Worthington et al., 2003). The RCI items were averaged to form a composite measure of religiousness ($\alpha = .96$; $M = 2.15$, $SD = 1.13$).

Self-control. To assess self-control, participants completed the Brief Self-Control Scale (Tangney et al., 2004). Responses were averaged to form a composite self-control score ($\alpha = .87$).

Alcohol and drug use. To measure alcohol and drug use, participants reported how often they had used alcohol (1 = *Nearly every day*, 6 = *Did not drink in past 12 months*), marijuana (1 = *Nearly every day*, 5 = *Less than once a month*), cocaine (1 = *Nearly every day*, 5 = *Less than once a month*), prescription drugs without a doctor's recommendation (1 = *Nearly every day*, 5 = *Less than once a month*), and other drugs (1 = *Nearly every day*, 5 = *Less than once a month*). To facilitate interpretation, we

reverse-scored responses so that higher numbers indicated more frequent substance use. Responses across the variables showed adequate internal consistency ($\alpha = .85$; $M = 1.87$, $SD = 0.82$), and therefore responses were averaged to create a substance-use index.

Results and Discussion

Association between religiousness and substance use: Replication. We expected to show that religiousness would relate to lower substance use. As predicted, gender did not moderate any of our effects; hence, we included participant gender as a covariate in all analyses. As expected, religiousness predicted lower use of alcohol and various drugs, $b = -0.18$, $t(285) = -4.40$, $p < .001$.

Mediation analyses. Next, we examined whether self-control would mediate the relationship between religiousness and substance use after controlling for participant gender. As predicted, religiousness predicted higher levels of self-control, $b = 0.12$, $t(285) = 3.44$, $p = .001$. Controlling for religiousness and gender, self-control predicted lower substance use, $b = -0.49$, $t(284) = -7.96$, $p < .001$. Bootstrapping analyses (with 5,000 iterations) showed that the 95% confidence interval for the indirect effect did not include zero [−0.11, −0.02].

Study 6 offered additional evidence that self-control helps account for the relationship between religiousness and lower substance use. It also shows that religiousness relates to both lower alcohol and drug use among a national sample of American adults. These findings offer converging evidence for self-control as a crucial mechanism underlying the relationship between religiousness and lower substance use.

Study 7: Replication and Extension in American and Non-American Samples

Study 7 sought to replicate and extend our prior findings regarding self-control's role as a mediator of the relationship between religiousness and lower alcohol and drug use among adults. The main goal was to demonstrate that better self-control helps explain why religiousness relates to lower substance use in both U.S. and non-U.S. adult samples. In Study 7, adult participants from the United States and Asia completed measures of religiousness, self-control, and substance use. We predicted that self-control would mediate the relationship between religiousness and lower alcohol and drug use among both U.S. and Asian adults.

Method

Participants. Three hundred and four adults (39.8% female) participated in this study. Average age was 32.83 years ($SD = 10.74$). As in Study 6, participants were recruited from Amazon.com's website "Mechanical Turk." Two separate surveys were posted; one limited respondents to U.S. adults ($n = 151$), and one limited respondents to Asian adults ($n = 153$). Asian countries included were India, Hong Kong, Japan, and Korea. Participants received $1 for participating. Among the U.S. sample, 43% identified as Christian, 23.8% identified as atheist, 19.9% identified as agnostic, 4.6% identified as none, 3.3% identified as "other," 2.6% identified as Buddhist, 0.7% identified as Taoist, and 0.7% identified as Muslim. Among the Asian sample, 68.8% identified as Hindu, 14% identified as Muslim, 9.8% identified as Christian, 3.2% identified as Jainist, 1.3% identified as Buddhist, 1.3% identified as Sikh, 0.7% identified as agnostic, and one participant did not report a religious identification.

Materials and procedure.

Religiousness. To assess religiousness, participants again completed the RCI (Worthington et al., 2003). Responses were internally reliable ($\alpha = .97$; $M = 2.55$, $SD = 1.25$) and therefore were averaged to create a composite religiousness index.

Self-control. To assess self-control, participants completed the Brief Self-Control Scale (Tangney et al., 2004). Responses were internally reliable ($\alpha = .67$) and therefore were averaged to create a composite self-control index.

Alcohol and drug use. To provide a comprehensive measure of substance use, we included the full AUDIT (Babor et al., 2001) and the alcohol and drug use items from Studies 6 and 7. Responses were appropriately reverse-scored so that higher numbers indicated greater substance use. Because responses showed adequate internal consistency ($\alpha = .83$; $M = 2.33$, $SD = 1.93$), they were averaged to create a substance-use index.

Results and Discussion

Associating religiousness and alcohol use: Replication and extension. We first examined whether greater religious commitment would predict lower alcohol and drug use among both U.S. and Asian adults. Gender did not interact with any of our effects; hence, it was included as a covariate in all analyses. To facilitate interpretation, all predictors were centered prior to analysis.

Consistent with the previous six studies, we observed a significant main effect of religiousness, such that greater religious commitment was associated with lower alcohol and drug use, $b = -0.22$, $t(299) = -2.11$, $p < .04$. Neither the country main effect, $b = 0.24$, $t(299) = 0.91$, $p = .36$, nor the Religious Commitment × Country interaction, $b = -0.12$, $t(299) = -0.57$, $p = .57$, achieved significance. Thus, these findings indicate that religious commitment was associated with lower alcohol and drug use among both American and Asian adults.

Mediational analyses. Next, we examined whether self-control mediated the relationship between religiousness and substance use among U.S. and Asian adults, controlling for gender and country, and the Religiousness × Country interaction. As predicted, religious commitment was associated with better self-control, $b = 0.11$, $t(299) = 3.18$, $p = .002$. When religiousness, self-control, gender, country, and the Religiousness × Country interaction were entered simultaneously as predictors of alcohol and drug use, religiousness was no longer significant, $b = -0.14$, $t(298) = -1.34$, $p = .18$, but self-control remained significant, $b = -0.73$, $t(298) = -4.35$, $p < .001$. Bootstrapping analyses (using 5,000 iterations) showed that the 95% confidence interval for the indirect effect of self-control did not include zero [−0.16, −0.03] (see Figure 2).

Study 7 provided additional evidence that self-control plays a key role in the relationship between religiousness and lower alcohol and drug use. As in our previous studies, the more religious commitment participants endorsed, the less they consumed alcohol and used drugs. Self-control again mediated the relationship between religiousness and lower alcohol and drug use. The similarity

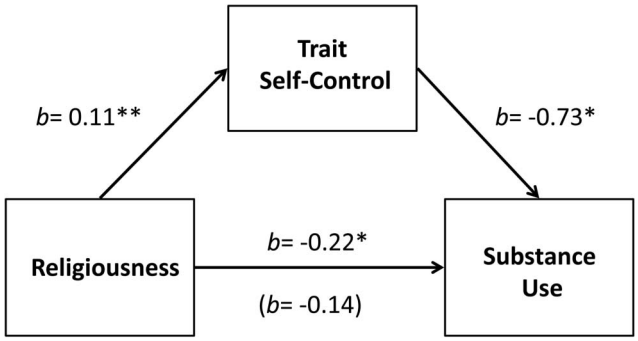

Figure 2. Relationship between daily prayer and lower substance is mediated by higher self-control among both Americans and Asians. Values refer to unstandardized regression coefficients. Study 8. * $p < .05$. ** $p < .01$.

of results across both American and Asian participants underscores the generalizability of our effects.

General Discussion

Religion is pervasive. One estimate suggests that 68% of human beings would say that religion is important in their daily lives (Diener, Tay, & Myers, 2011). A growing body of research has shown that religiousness relates to lower substance use (Benda et al., 2006; Gartner et al., 1991; Gorsuch, 1995; Hill & McCullough, 2008; Humphreys & Gifford, 2006; Johnson et al., 2008; Kendler et al., 2003; H. G. Koenig et al., 2001; Koopmans et al., 1999; Miller, 1998). Here, we provided a comprehensive test of the hypothesis that self-control represents one factor that helps explain why religiousness relates to lower substance (McCullough & Willoughby, 2009).

Using diverse samples (college students and more general samples of adults; people from the United States and from four Asian nations) and methods (daily diary, cross-sectional, and longitudinal), seven studies supported this hypothesis. Study 1 showed that daily prayer had a lagged effect on daily alcohol use. Higher amounts of prayer predicted lower alcohol use on the subsequent day. Study 2 demonstrated that the cross-sectional relationship between religiousness and lower alcohol use was mediated by self-reported self-control. Study 3 replicated and extended these results using a behavioral self-control task, which enhances the validity of our findings. It showed that religiousness was associated cross-sectionally with both lower alcohol use and higher self-control on a delay discounting task, as indicated by expressing greater preferences for future monetary reward over immediate monetary rewards. As in Study 2, the relationship between religiousness and lower alcohol use appeared to be mediated by behavioral self-control. Study 4 replicated and extended the results of Studies 2 and 3 by showing that self-reported self-control mediated the effect of religiousness on changes in alcohol use over 6 weeks. Study 5 replicated the mediational pattern again with two-wave longitudinal data and showed that it remained significant after controlling for mindfulness. Thus, religiousness consistently predicted lower alcohol use, which was mediated by self-control.

Studies 6 and 7 replicated and extended these findings in two main ways. First, they extended McCullough and Willoughby's (2009) theorizing by showing that self-control mediated the relationship between religiousness and both alcohol use and drug use. By demonstrating self-control as a mediator of various health behaviors, these studies offered additional support for the proposition that religiousness can help reduce substance use generally through its relationship to higher self-control. Second, Studies 6 and 7 showed that self-control mediates the relationship between religiousness and lower substance use in diverse samples. Whereas our first five studies drew on largely Caucasian, American, highly educated samples, our final two studies used national samples of American and Asian adults. The fact that the mediating pattern replicated in these diverse samples suggests that self-control is a reliable mechanism underlying the association between religiousness and lower substance use. The consistency across these diverse samples is similar to previous research that has documented reliable relationships between religiousness and self-control across varied samples (see McCullough & Willoughby, 2009, p. 72). Thus, our findings provide a broad and novel demonstration of the reliability and validity of self-control as a mechanism underlying the association between religiousness and lower substance use.

More broadly, the current investigation adds to a growing body of literature on the importance of understanding self-control processes within the context of religious beliefs and actions. For decades, some have argued that religion helps control people's behavior in order to foster harmonious relationships (Durkheim, 1912/1965). However, controlling one's behavior is not easy, and research indicates that it sometimes involves effortful regulation of one's impulses (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Schmeichel, Vohs, & Baumeister, 2003; Vohs & Schmeichel, 2003). By understanding why religiousness is associated with lower substance use, the current investigation may help to explain how religion obtains some of its associations with other measures of health (McCullough & Willoughby, 2009).

Limitations and Future Directions

The current studies provided consistent evidence that the well-established relationship between religiousness and lower substance use is mediated in part by self-control. Despite the consistency of these effects, some limitations may provide a springboard for future research.

One limitation is that six of our seven samples were comprised of Americans, who live in a culture that may be more religious compared to other cultures. For example, 96% of Americans have reported believing in God, as have 68% of Germans, 72% of the British, 62% of the French, and 60% of the Dutch (Inglehart, Basáñez, Díez-Medrano, Halman, & Luijkx, 2004). Therefore, one might argue that our results would not replicate in cultures marked by lower levels of religiousness. There are at least three reasons to doubt this possibility. First, the effects of religiousness on behavior are consistent across societies (e.g., Bushman, Ridge, Das, Key, & Busath, 2007; Weeden & Kurzban, 2013). Second, many religions, regardless of their popularity within or outside the United States, promote self-control among their followers, including the upkeep of one's health through abstaining from unhealthy food and beverages. Third, we observed a similar mediating effect of self-

control on lower substance use among Asians and Americans in Study 7.

A second limitation is that we focused our investigation on a variety of health behaviors related to substance use. We did not, however, investigate a possible mediating role of self-control in helping understand previously documented associations between religiousness and better psychological well-being, lower mortality risk, and other types of social behavior. For example, re-analysis of data from one study (Welch, Tittle, & Grasmick, 2006) suggested that self-control mediates the association of religiousness and lower levels of future criminal activity. Future research may examine whether self-control helps to explain part of why religious commitment is commonly associated with better health, well-being, and social behavior.

Another limitation lies in the strength of our mediating effects. Self-control reliably mediated the link between religiousness and lower substance use, but the size of its mediating effect was somewhat small. This is not surprising, given that mediating effects often fail to demonstrate large effect sizes (Preacher & Kelley, 2011; Shrout & Bolger, 2002). Other factors may play a role in mediating the association. One such factor is monitoring. Recent work demonstrates that higher levels of religiousness relate to greater monitoring of oneself in relation to goal striving (self-monitoring) and greater belief that a higher power is monitoring one's behavior (God monitoring), both of which in turn relate to more self-control (Carter, McCullough, & Carver, 2012). Future research may explore whether self- and God-monitoring can help not only explain the relationship between religiousness and self-control, but also how self-control acts as a mechanism underlying lower substance use.

A third limitation, which is not unique to this investigation, relates to our reliance on self-reported alcohol and drug use. Self-report measures of alcohol and drug use have demonstrated ample reliability and validity (Del Boca & Darkes, 2003; Harrison, 1997). However, it is possible that religious participants underreported their substance-use behavior as a means deflecting guilt, shame, or other negative emotions. Though sparse, existing evidence casts doubt on this possibility. For example, lower self-reports of cigarette use among religious individuals corresponds with their lower serum levels of the nicotine metabolite cotinine (Gillum, 2005; Shin, 1996). In addition, the results from Study 4 showed that both the cross-sectional and longitudinal associations between religiousness and lower alcohol use remained significant after controlling for social desirability. These findings contradict the alternative explanation that our results were due to a systematic bias in self-reports among highly religious participants.

A potential avenue for future research may involve understanding the biological underpinnings of our effects. For example, future research may examine whether the mediating effect of self-control on religiousness and lower substance use is a product of shared environmental influences, shared genetic influences, or some combination of the two. Both religiousness and self-control have genetic bases (L. B. Koenig, McGue, Krueger, & Bouchard, 2005; Yamagata et al., 2005), but it is not clear how they operate to predict substance use. In addition, religious cognition may be associated with activation in regions associated with executive functioning (e.g., dorsolateral, ventromedial, and ventrolateral prefrontal cortex, anterior cingulate cortex) when people are confronted with alcohol and drug-related stimuli, which may down-regulate activation in striatal reward circuits and may predict lower subsequent substance use (cf. Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007; Gilman, Ramchandani, Davis, Bjork, & Hommer, 2008).

Conclusion

The current work offered consistent evidence that some of religiosity's effect on lower substance use was mediated by self-control. Religious rituals and activities mirror self-control processes in multiple ways. They can be costly, effortful, and even painful, consuming much of one's time and energy. However, religiousness and self-control also foster physical, mental, and relational well-being. By understanding the role of religiousness in promoting self-control, researchers will better understand why religiousness is reliably associated with lower substance use.

References

Abbey, A. (2002). Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol, 63*(Suppl. 14), 118–128.

Arasteh, K., Des Jarlais, D. C., & Perlis, T. E. (2008). Alcohol and HIV sexual risk behaviors among injection drug users. *Drug and Alcohol Dependence, 95,* 54–61. doi:10.1016/j.drugalcdep.2007.12.008

Audrain-McGovern, J., Rodriguez, D., Epstein, L. H., Cuevas, J., Rodgers, K., & Wileyto, E. P. (2009). Does delay discounting play an etiological role in smoking or is it a consequence of smoking? *Drug and Alcohol Dependence, 103,* 99–106. doi:10.1016/j.drugalcdep.2008.12.019

Babor, T. F., Higgins-Biddle, J. C., Saunders, M. G., & Monteiro, J. B. (2001). *AUDIT—The Alcohol Use Disorders Identification Test: Guidelines for use in primary care* (2nd ed.). Geneva, Switzerland: World Health Organization.

Back, S. E., Payne, R. L., Simpson, A. N., & Brady, K. T. (2010). Gender and prescription opioids: Findings from the National Survey on Drug Use and Health. *Addictive Behaviors, 35,* 1001–1007. doi:10.1016/j.addbeh.2010.06.018

Baier, C. J., & Wright, B. R. E. (2001). If you love me, keep my commandments: A meta-analysis of the effect of religion on crime. *Journal of Research in Crime and Delinquency, 38,* 3–21. doi:10.1177/0022427801038001001

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74,* 1252–1265. doi:10.1037/0022-3514.74.5.1252

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation*. San Diego, CA: Academic Press.

Benda, B. B., Pope, S. K., & Kelleher, K. J. (2006). Church attendance or religiousness: Their relationship to adolescents' uses of alcohol, other drugs, and delinquency. *Alcoholism Treatment Quarterly, 24,* 75–87. doi:10.1300/J020v24n01_05

Borsboom, D., Mellenbergh, G. J., & van Heerden, J. (2003). The theoretical status of latent variables. *Psychological Review, 110,* 203–219. doi:10.1037/0033-295X.110.2.203

Brady, K. T., Back, S. E., & Greenfield, S. (Eds.). (2009). *Women and addiction: A comprehensive handbook*. New York, NY: Guilford Press.

Brefczynski-Lewis, J. A., Lutz, A., Schaefer, H. S., Levinson, D. B., & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. *Proceedings of the National Academy of Sciences, USA, 104,* 11483–11488. doi:10.1073/pnas.0606552104

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Per-*

sonality and Social Psychology, 84, 822–848. doi:10.1037/0022-3514.84.4.822

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18,* 211–237. doi:10.1080/10478400701598298

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6,* 3–5. doi:10.1177/1745691610393980

Bushman, B. J., Ridge, R. D., Das, E., Key, C. W., & Busath, G. L. (2007). When God sanctions killing: Effect of scriptural violence on aggression. *Psychological Science, 18,* 204–207. doi:10.1111/j.1467-9280.2007.01873.x

Carter, E. C., McCullough, M. E., & Carver, C. S. (2012). The mediating role of monitoring in the association of religion with self-control. *Social Psychological and Personality Science, 3,* 691–697. doi:10.1177/1948550612438925

Christiansen, P., Cole, J. C., & Field, M. (2012). Ego depletion increases ad-lib alcohol consumption: Investigating cognitive mediators and moderators. *Experimental and Clinical Psychopharmacology, 20,* 118–128. doi:10.1037/a0026623

Conner, B. T., Stein, J. A., & Longshore, D. (2009). Examining self-control as a multidimensional predictor of crime and drug use in adolescents with criminal histories. *The Journal of Behavioral Health Services & Research, 36,* 137–149. doi:10.1007/s11414-008-9121-7

Cooper, M. L. (2002). Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol, 63*(Suppl. 14), 101–117.

Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine, 69,* 560–565. doi:10.1097/PSY.0b013e3180f6171f

Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction, 98*(Suppl. 2), 1–12. doi:10.1046/j.1359-6357.2003.00586.x

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

Diener, E., Tay, L., & Myers, D. G. (2011). The religion paradox: If religion makes people happy, why are so many dropping out? *Journal of Personality and Social Psychology, 101,* 1278–1290. doi:10.1037/a0024402

Durkheim, E. (1965). *The elementary forms of religious life*. New York, NY: The Free Press. (Original work published 1912)

Ellison, C. G., & Anderson, K. L. (2001). Religious involvement and domestic violence among U.S. couples. *Journal for the Scientific Study of Religion, 40,* 269–286. doi:10.1111/0021-8294.00055

Fergusson, D. M., Horwood, L. J., & Swain-Campbell, N. (2002). Cannabis use and psychosocial adjustment in adolescence and young adulthood. *Addiction, 97,* 1123–1135. doi:10.1046/j.1360-0443.2002.00103.x

Fincham, F. D., Lambert, N. M., & Beach, S. R. H. (2010). Faith and unfaithfulness: Can praying for your partner reduce infidelity? *Journal of Personality and Social Psychology, 99,* 649–659. doi:10.1037/a0019628

Ford, J. A., & Hill, T. D. (2012). Religiosity and adolescent substance use: Evidence from the National Survey on Drug Use and Health. *Substance Use & Misuse, 47,* 787–798. doi:10.3109/10826084.2012.667489

Francis, L. J., & Penny, G. (2013). Gender differences in religion. In V. Saroglou (Ed.), *Religion, personality, and social behavior* (pp. 313–337). New York, NY: Psychology Press.

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature, 40,* 351–401. doi:10.1257/jel.40.2.351

Gartner, J., Larson, D. B., & Allen, G. (1991). Religious commitment and mental health: A review of the empirical literature. *Journal of Psychology and Theology, 19,* 6–25.

Geisner, I. M., Larimer, M. E., & Neighbors, C. (2004). The relationship between alcohol use, related problems, and psychological distress: Gender as a moderator in a college sample. *Addictive Behaviors, 29,* 843–848. doi:10.1016/j.addbeh.2004.02.024

Gillum, R. F. (2005). Frequency of attendance at religious services and cigarette smoking in American women and men: The Third National Health and Nutrition Examination Survey. *Preventive Medicine, 41,* 607–613. doi:10.1016/j.ypmed.2004.12.006

Gilman, J. M., Ramchandani, V. A., Davis, M. B., Bjork, J. M., & Hommer, D. W. (2008). Why we like to drink: A functional magnetic resonance imaging study of the rewarding and anxiolytic effects of alcohol. *The Journal of Neuroscience, 28,* 4583–4591. doi:10.1523/JNEUROSCI.0086-08.2008

Gorsuch, R. L. (1995). Religious aspects of substance abuse and recovery. *Journal of Social Issues, 51,* 65–83. doi:10.1111/j.1540-4560.1995.tb01324.x

Green, L., & Myerson, J. (2004). A discounting framework for choice with delayed and probabilistic rewards. *Psychological Bulletin, 130,* 769–792. doi:10.1037/0033-2909.130.5.769

Hallfors, D. D., Waller, M. W., Ford, C. A., Halpern, C. T., Brodish, P. H., & Iritani, B. (2004). Adolescent depression and suicide risk: Association with sex and drug behavior. *American Journal of Preventive Medicine, 27,* 224–231.

Harrison, L. (1997). The validity of self-reported drug use in survey research: An overview and critique of research methods. *NIDA Research Monograph, 167,* 17–36.

Heppner, W. L., Kernis, M. H., Lakey, C. E., Campbell, W. K., Goldman, B. M., Davis, P. J., & Cascio, E. V. (2008). Mindfulness as a means of reducing aggressive behavior: Dispositional and situational evidence. *Aggressive Behavior, 34,* 486–496. doi:10.1002/ab.20258

Hill, T. D., & McCullough, M. E. (2008). Religious involvement and the intoxication trajectories of low-income urban women. *Journal of Drug Issues, 38,* 847–862. doi:10.1177/002204260803800309

Humphreys, K., & Gifford, E. (2006). Religion, spirituality and the troublesome use of substances. In W. R. Miller & K. Carroll (Eds.), *Rethinking substance abuse: What the science shows and what we should do about it* (pp. 257–274). New York, NY: Guilford Press.

Inglehart, R., Basáñez, M., Díez-Medrano, J., Halman, L., & Luijkx, R. (2004). *Human beliefs and values: A cross-cultural sourcebook based on the 1999–2002 values surveys*. Buenos Aires, Argentina: Siglo Veintiuno Editores.

Inzlicht, M., & Tullett, A. M. (2010). Reflections on God: Religious affirmations can reduce neurophysiological response to errors. *Psychological Science, 21,* 1184–1190. doi:10.1177/0956797610375451

Islam, S. M. S., & Johnson, C. A. (2003). Correlates of smoking behavior among Muslim Arab-American adolescents. *Ethnicity & Health, 8,* 319–337. doi:10.1080/1355785031000163172 2

Johnson, T. J., Sheets, V. L., & Kristeller, J. L. (2008). Identifying mediators of the relationship between religiousness/spirituality and alcohol use. *Journal of Studies on Alcohol and Drugs, 69,* 160–170.

Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (1991). *Trends in drug use and associated factors among American high school students, college students, and young adults: 1975–1989*. Ann Arbor, MI: Institute for Social Research.

Jones, S. E., Oeltmann, J., Wilson, T. W., Brener, N. D., & Hill, C. V. (2001). Binge drinking among undergraduate college students in the United States: Implications for other substance use. *Journal of American College Health, 50,* 33–38. doi:10.1080/07448480109595709

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York, NY: Dell.

Kahler, C. W., Read, J. P., Wood, M. D., & Palfai, T. P. (2003). Social environmental selection as a mediator of gender, ethnic, and personality effects on college student drinking. *Psychology of Addictive Behaviors, 17,* 226–234. doi:10.1037/0893-164X.17.3.226

Kapner, D. A. (2008). *Alcohol and other drugs on campus: The scope of the problem*. Newton, MA: The Higher Education Center for Alcohol and Other Drug Abuse and Violence.

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

Kim-Spoon, J., Farley, J. P., Holmes, C., Longo, G. S., & McCullough, M. E. (2014). Processes linking parents' and adolescents' religiousness and adolescent substance use: Monitoring and self-control. *Journal of Youth and Adolescence, 43,* 745–756. doi:10.1007/s10964-013-9998-1

Kim-Spoon, J., McCullough, M. E., Bickel, W. K., Farley, J. P., & Longo, G. S. (2014, February 5). Longitudinal associations among religiousness, delay discounting, and substance use initiation in early adolescence. *Journal of Research on Adolescence*. Advance online publication. doi:10.1111/jora.12104

Kirby, K. N., & Maraković, N. N. (1996). Delay-discounting probabilistic rewards: Rates decrease as amounts increase. *Psychonomic Bulletin & Review, 3,* 100–104. doi:10.3758/BF03210748

Koenig, H. G., McCollough, M. E., & Larson, D. B. (2001). *Handbook of religion and health*. doi:10.1093/acprof:oso/9780195118667.001.0001

Koenig, L. B., McGue, M., Krueger, R. F., & Bouchard, T. R. (2005). Genetic and environmental influences on religiousness: Findings for retrospective and current religiousness ratings. *Journal of Personality, 73,* 471–488. doi:10.1111/j.1467-6494.2005.00316.x

Kollins, S. H. (2003). Delay discounting is associated with substance abuse in college students. *Addictive Behaviors, 28,* 1167–1173. doi:10.1016/S0306-4603(02)00220-4

Koopmans, J. R., Slutske, W. S., van Baal, G. C. M., & Boomsma, D. I. (1999). The influence of religion on alcohol use initiation: Evidence for a genotype × environment interaction. *Behavior Genetics, 29,* 445–453. doi:10.1023/A:1021679005623

Lambert, N. M., Fincham, F. D., DeWall, C. N., Pond, R. S., & Beach, S. R. H. (2013). Shifting towards cooperative tendencies and forgiveness: How partner-focused prayer transforms motivation. *Personal Relationships, 20,* 184–197.

Lambert, N. M., Fincham, F. D., Marks, L. D., & Stillman, T. F. (2010). Invocations and intoxication: Does prayer decrease alcohol consumption? *Psychology of Addictive Behaviors, 24,* 209–219. doi:10.1037/a0018746

Leino, E. V., Romelsjo, A., Shoemaker, C., Ager, C. R., Allebeck, P., Ferrer, H. P., . . . Kniep, S. (1998). Alcohol consumption and mortality: II. Studies of male populations. *Addiction, 93,* 205–218. doi:10.1046/j.1360-0443.1998.9322055.x

Longo, D. A., & Peterson, S. M. (2002). The role of spirituality in psychosocial rehabilitation. *Psychiatric Rehabilitation Journal, 25,* 333–340. doi:10.1037/h0095004

Mazur, J. E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin, & H. Rachlin (Eds.), *Quantitative analyses of behavior* (Vol. 5, pp. 55–73). Hillsdale, NJ: Erlbaum.

McCullough, M. E., Friedman, H. S., Enders, C. K., & Martin, L. M. (2009). Does devoutness delay death? Psychological investment in religion and its association with longevity in the Terman sample. *Journal of Personality and Social Psychology, 97,* 866–882. doi:10.1037/a0016366

McCullough, M. E., Hoyt, W. T., Larson, D. B., Koenig, H. G., & Thoresen, C. E. (2000). Religious involvement and mortality: A meta-analytic review. *Health Psychology, 19,* 211–222. doi:10.1037/0278-6133.19.3.211

McCullough, M. E., & Willoughby, B. L. B. (2009). Religion, self-regulation, and self-control: Associations, explanations, and implications. *Psychological Bulletin, 135,* 69–93. doi:10.1037/a0014213

Miller, W. R. (1998). Researching the spiritual dimensions of alcohol and other drug problems. *Addiction, 93,* 979–990. doi:10.1046/j.1360-0443.1998.9379793.x

Muthén, L. K., & Muthén, B. (2004). *Mplus user's guide*. Los Angeles, CA: Author.

Nezlek, J. B. (2001). Multilevel random coefficient analyses of event and interval contingent data in social and personality psychology research. *Personality and Social Psychology Bulletin, 27,* 771–785. doi:10.1177/0146167201277001

Nezlek, J. B. (2011). *Multilevel modeling for social and personality psychology*. Thousand Oaks, CA: Sage.

Oberlin, B. G., & Grahame, N. J. (2009). High-alcohol preferring mice are more impulsive than low-alcohol preferring mice as measured in the delay discounting task. *Alcoholism: Clinical and Experimental Research, 33,* 1294–1303. doi:10.1111/j.1530-0277.2009.00955.x

Pearson, M. R., Kite, B. A., & Henson, J. M. (2013). Predictive effects of good self-control and poor regulation on alcohol-related outcomes: Do protective behavioral strategies mediate? *Psychology of Addictive Behaviors, 27,* 81–89. doi:10.1037/a0028818

Pontin, J. (2007, March 25). Artificial intelligence, with help from the humans. *The New York Times*. Retrieved from http://www.nytimes.com

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891. doi:10.3758/BRM.40.3.879

Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods, 16,* 93–115. doi:10.1037/a0022658

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., & Congdon, R. T. (2000). HLM (Version 6.8) [Computer software]. Lincolnwood, IL: Scientific Software International.

Regnerus, M. D., & Elder, G. H. (2003). Religion and vulnerability among low-risk adolescents. *Social Science Research, 32,* 633–658. doi:10.1016/S0049-089X(03)00027-9

Reynolds, B., Patak, M., Shroff, P., Pensold, R. B., Melanko, S., & Duhig, A. M. (2007). Laboratory and self-report assessments of impulsive behavior in adolescent daily smokers and nonsmokers. *Experimental and Clinical Psychopharmacology, 15,* 264–271. doi:10.1037/1064-1297.15.3.264

Rounding, K., Lee, A., Jacobson, J. A., & Ji, L.-J. (2012). Religion replenishes self-control. *Psychological Science, 23,* 635–642. doi:10.1177/0956797611431987

Sanderson, S. K., & Roberts, W. W. (2008). *The evolutionary forms of the religious life: A cross-cultural, quantitative analysis*. New York, NY: Wiley.

Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85,* 33–46. doi:10.1037/0022-3514.85.1.33

Sedikides, C., & Gebauer, J. E. (2010). Religiosity as self-enhancement: A meta-analysis of the relation between socially desirable responding and religiosity. *Personality and Social Psychology Review, 14,* 17–36. doi:10.1177/1088868309351002

Shin, S. R. (1996). A study of the relationship between adolescent's self-reported cigarette smoking and urine cotinine level. *Journal of Korean Adult Nursing, 9,* 495–504.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7,* 422–445. doi:10.1037/1082-989X.7.4.422

Sobell, L. C., & Sobell, M. B. (1992). Timeline Follow-Back: A technique

for assessing self-reported alcohol consumption. In R. Z. Litten & J. P. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biological methods* (pp. 41–72). doi:10.1007/978-1-4612-0357-5_3

Spilka, B., Hood, R. W., Jr., Hunsberger, B., & Gorsuch, R. (2003). *The psychology of religion* (3rd ed.). New York, NY: Guilford Press.

Stoltenberg, S. F., Batien, B. D., & Birgenheir, D. G. (2008). Does gender moderate associations among impulsivity and health-risk behaviors? *Addictive Behaviors, 33,* 252–265. doi:10.1016/j.addbeh.2007.09.004

Strahan, R., & Gerbasi, K. C. (1972). Short, homogeneous versions of the Marlowe–Crowne Social Desirability Scale. *Journal of Clinical Psychology, 28,* 191–193. doi:10.1002/1097-4679(197204)28:2<191::AID-JCLP2270280220>3.0.CO;2-G

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72,* 271–324. doi:10.1111/j.0022-3506.2004.00263.x

Thompson, E. R., & Phua, F. T. T. (2005). Reliability among senior managers of the Marlowe–Crowne Short-Form Social Desirability Scale. *Journal of Business and Psychology, 19,* 541–554. doi:10.1007/s10869-005-4524-4

Vohs, K. D., & Schmeichel, B. J. (2003). Self-regulation and the extended now: Controlling the self alters the subjective experience of time. *Journal of Personality and Social Psychology, 85,* 217–230. doi:10.1037/0022-3514.85.2.217

Walker, C., Ainette, M. G., Wills, T. A., & Mendoza, D. (2007). Religiosity and substance use: Test of an indirect-effect model in early and middle adolescence. *Psychology of Addictive Behaviors, 21,* 84–96. doi:10.1037/0893-164X.21.1.84

Weeden, J., & Kurzban, R. (2013). What predicts religiosity? A multinational analysis of reproductive and cooperative morals. *Evolution and Human Behavior, 34,* 440–445. doi:10.1016/j.evolhumbehav.2013.08.006

Weisbuch-Remington, M., Mendes, W. B., Seery, M. D., & Blascovich, J. (2005). The nonconscious influence of religious symbols in motivated performance situations. *Personality and Social Psychology Bulletin, 31,* 1203–1216. doi:10.1177/0146167205274448

Welch, M. R., Tittle, C. R., & Grasmick, H. G. (2006). Christian religiosity, self-control and social conformity. *Social Forces, 84,* 1605–1623. doi:10.1353/sof.2006.0075

Williamson, D. (1990). Drinking: A sobering look at an enduring Princeton pastime. *Princeton Alumni Weekly, 90,* 14–19.

Wills, T. A., Ainette, M. G., Stoolmiller, M., Gibbons, F. X., & Shinar, O. (2008). Good self-control as a buffering agent for adolescent substance use: An investigation in early adolescence with time-varying covariates. *Psychology of Addictive Behaviors, 22,* 459–471. doi:10.1037/a0012965

Worthington, E. L., Jr., Wade, N. G., Hight, T. L., Ripley, J. S., McCullough, M. E., Berry, J. W., . . . O'Connor, L. (2003). The Religious Commitment Inventory—10: Development, refinement, and validation of a brief scale for research and counseling. *Journal of Counseling Psychology, 50,* 84–96. doi:10.1037/0022-0167.50.1.84

Yamagata, S., Takahashi, Y., Kijima, N., Maekawa, H., Ono, Y., & Ando, J. (2005). Genetic and environmental etiology of effortful control. *Twin Research and Human Genetics, 8,* 300–306. doi:10.1375/twin.8.4.300

Received June 17, 2013
Revision received December 12, 2013
Accepted April 8, 2014 ■