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Religion and Well-being: The Moderating Role of Culture and the Oxytocin Receptor (OXTR) Gene

Joni Y. Sasaki[1], Heejung S. Kim[1], and Jun Xu[2]

Abstract

Research suggests that religiosity, or the importance of religion in one's life, may be related to well-being, but little is known about how culture and genes may play a role in this relationship. Given that religion in a North American cultural context tends to emphasize social affiliation less than in an East Asian cultural context and that some people may be genetically predisposed to be more socially sensitive than others, the way religion is linked to well-being may depend on the interplay between cultural context and genetic make-up. The current study examined how culture (i.e., European Americans vs. Koreans) and a specific gene polymorphism (i.e., oxytocin receptor polymorphism rs53576) may interact to impact the association between religiosity and psychological well-being. Results showed that among people who were more genetically predisposed toward social sensitivity (i.e., G/G genotype), Koreans had greater psychological well-being if they were more religious; however, European Americans with the G/G genotype had lower psychological well-being if they were more religious. These findings suggest that religion may benefit well-being for those who are genetically predisposed to be socially sensitive but only to the extent that the cultural context provides adequate opportunities for social affiliation.

Keywords

culture, genes, oxytocin, OXTR, religiosity, well-being, health

Over the past two decades, research on religion and well-being has focused on whether and how religious involvement may be associated with mental and physical health outcomes (e.g., Seybold & Hill, 2001; see George, Larson, Koenig, & McCullough, 2000, for review). Although religiosity, or the importance of religion in one's life, may predict both positive and negative outcomes (Pearlin, 2002), research suggests that the link between religion and well-being is mostly positive (e.g., McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000; but see Pargament, Koenig,

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Tarakeshwar, & Hahn, 2001, for examination of the relationship between well-being and "religious struggle"—concerns about God's will or care).

However, the degree to which religion is associated with well-being may be impacted by many factors, of both nature and nurture. For questions surrounding complex social behaviors, such as why some people rely on religion in response to stressors and how they potentially benefit, it is important to investigate both biological and sociocultural factors of influence. Thus, in the present research, we aimed to examine the moderating role of genes and culture. Even the same religion may impact people differently depending on their cultural background (e.g., Sasaki & Kim, in press), and thus, culture may play a role in the relationship between religiosity and psychological well-being. Yet the way religion benefits people, if at all, may depend concurrently on their genetic susceptibility to particular traits or behaviors. Accordingly, the primary goal of this study is to investigate whether the interaction of cultural and genetic factors may have implications for the link between religion and well-being.

Cultural Shaping of Religion

Religion shares conceptual overlap with culture and, indeed, can be understood as a form of culture (Cohen, 2009), and yet religion and culture may also mutually influence each other. Our perspective is that religion transpires within a national culture, and instead of examining variation in specific religious teachings, we focus on religion more generally as a system of beliefs and practices within a community that surround faith in the divine. We conceptualize culture in terms of its specific assumptions, values, and practices that vary systematically across nations (e.g., Markus & Kitayama, 1991).

Cultural variations may have important implications for the way people use and benefit from religion. Certain aspects of religion, such as involvement in a fellowship or community, can be found across cultural contexts (Atran & Norenzayan, 2004) and yet may differ in emphasis (e.g., Sasaki & Kim, in press), and thus, the way people are impacted by religion may not be the same everywhere. Some of the assumed correlates of religiosity, such as political conservatism or well-being, seem to vary across groups of people. Research by Cohen et al. (2009) has found that racial background moderates the relationship between religiosity and political ideology such that for European Americans, religiosity predicts a more conservative political stance, whereas for Black and Latino Americans, this relationship is much weaker and at times completely absent. The potential benefits of religiosity may also differ depending on race. Levels of religiousness seem to be higher and more strongly related to well-being for African Americans than for European Americans, for instance (Ferraro & Koch, 1994; Pargament, 1997; St. George & McNamara, 1984). It is possible that religion provides benefits differently depending on the cultural context in which it is practiced, and thus, taking a cultural psychological perspective may help determine whether systematic differences in one's cultural context can affect the relationship between religion and well-being.

A recent set of studies has directly examined how culture may influence the way people use religion to cope (Sasaki & Kim, in press). Specifically, this research shows that in cultures that tend to prioritize personal agency, such as in the United States, religion (as evidenced by teachings in Christian churches, experimentally manipulated religious salience, and daily use of religious coping) is strongly associated with exercising secondary control (i.e., personal acceptance). However, in cultures that emphasize social relationships over personal agency, such as in East Asia, religion is more strongly associated with social affiliation (i.e., spending time and interacting with others in a community)[1] compared to the case of mainstream America. Building on this perspective that the way people use religion may vary systematically according to the cultural context, we expected cultural differences in the association between religiosity and well-being

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between those from European American and East Asian cultural contexts. We made this prediction given that cultures differ in the effect of religious participation on social affiliation (Sasaki & Kim, in press), which is known to predict psychological and physical well-being (Thoits, 1995; Wills, 1998). In conjunction with the cultural context, we also considered differences in "nature"—specifically, an individual's genetic predisposition—to examine how religiosity relates to psychological well-being.

Gene-Culture Interactions and Implications for the Link Between Religiosity and Psychological Well-Being

Recent contributions to gene-environment research suggest that people with the same genetic predispositions may experience different outcomes depending on their environment. That is, genes and the environment may interact to affect an array of psychological outcomes, including depression, anxiety, and stress reactivity (e.g., Bakermans-Kranenburg & van IJzendoorn, 2008; Caspi et al., 2003; Eisenberg, Campbell, Gray, & Sorenson, 2008; Kim-Cohen & Gold, 2009; Taylor et al., 2006; but see also Risch et al., 2009 and Uher & McGuffin, 2010, for debate regarding serotonin transporter polymorphism 5-HTTLPR). More recent research (e.g., Kim et al., 2010a, 2010b , in press) proposed a gene-culture interaction, suggesting that cultural contexts, as a form of social environment, can moderate psychological and behavioral outcomes of genetic predispositions. The present study builds upon this framework of gene-culture interactions. Genes may shape psychological predispositions, but culture might influence how these predispositions are behaviorally manifested, as cultures provide different contexts that afford opportunities and constraints for the development of psychological tendencies by presenting specific norms, rules, and guidelines (Kim & Markus, 1999; Shweder, 1991).

Given that genes and culture may interact to produce different outcomes, we propose a three-way interaction of genes, culture, and religiosity predicting well-being. In the present research, we focus specifically on the potential role of the oxytocin receptor gene (OXTR) polymorphism rs53576 in affecting how religion may be associated with psychological well-being among Koreans and European Americans. OXTR rs53576 is a single nucleotide polymorphism (SNP) in the oxytocin receptor gene, which is localized in single copy to chromosome 3 of the human genome (Gimpl & Fahrenholz, 2001). Recent studies have found that OXTR-deficient mice (i.e., with an experimentally "knocked-out" OXTR gene) exhibit deficits in social functioning (e.g., Takayanagi et al., 2005), and OXTR is also linked to prosocial decisions in humans (Israel et al., 2009), suggesting that OXTR is implicated in social interactions. There is evidence that individuals with two G alleles (vs. one or two A alleles) of OXTR rs53576 exhibit more sensitive parenting behavior (Bakermans-Kranenburg & van IJzendoorn, 2008), show more empathy (Rodrigues, Saslow, Garcia, John, & Keltner, 2009), and, in a sample of unipolar depression patients, is associated with higher separation anxiety (Costa et al., 2009). Moreover, the A allele of OXTR rs53576 is unrelated to insecure attachment among nonclinical populations (i.e., either attachment anxiety or avoidance; Gillath, Shaver, Baek, & Chun, 2008) but is linked to social impairments associated with autism (e.g., Wu et al., 2005). One interpretation of these findings is that people with the A allele for this OXTR polymorphism tend to be less socially sensitive and less concerned with social interactions than those with the G allele.

Considering the documented relationship of OXTR to social-oriented behaviors (e.g., Bakermans-Kranenburg & van IJzendoorn, 2008) and the culture-specific impact of religion on social affiliation (Sasaki & Kim, in press), OXTR is a relevant candidate gene in the current study. In summary, we investigate how religiosity may predict well-being differently depending on the interaction of culture and genetic predisposition toward social sensitivity.

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The Present Study

In this study, we examine how culture (i.e., European Americans vs. Koreans) and genes (i.e., A/A vs. A/G vs. G/G genotypes for OXTR) might interact to impact the way religiosity predicts psychological well-being. We expected that religiosity would predict greater psychological well-being (i.e., less psychological distress) but significantly more strongly if the cultural context emphasizes the social affiliative role of religion. That is, religiosity should be associated with greater psychological well-being for Koreans, whose cultural context more strongly emphasizes the social affiliation aspect of religious involvement compared to the U.S. cultural context (Sasaki & Kim, in press), and this effect should be evidenced by a two-way interaction of culture and religiosity. Importantly, we hypothesized that this interaction of culture and religiosity would be qualified by a three-way interaction of culture, OXTR genotype, and religiosity on psychological well-being such that the two-way Culture × Religiosity interaction would be particularly strong among those with the OXTR G allele, who are theorized to be more socially affiliative, whereas we predicted a weak or lack of relationship between religiosity and psychological well-being for people with the A allele, who are theorized to be less socially affiliative.

Method

Participants

There were 242 participants total in this study: 134 Koreans (63 females and 71 males; 54 community members and 80 college students; age: $M = 25.06$, $SD = 5.45$) from Seoul, Korea, and 108 European Americans (64 females and 44 males; 38 community members and 70 college students; age: $M = 25.68$, $SD = 11.85$) from Southern California.[2] About 53% of Koreans and 52% of European Americans reported a religious affiliation. Among Koreans, Christianity was the largest religious group ($n = 71$), followed by Buddhist ($n = 5$) and other faiths ($n = 2$).[3] The European American sample was also mostly Christian ($n = 34$), with some Jewish ($n = 13$), Buddhist ($n = 2$), Muslim ($n = 1$), and other faiths ($n = 6$).[4] Student participants were recruited through class announcements and flyers posted around the universities, and community participants were recruited among campus staff members and from adult education classes in both countries. As compensation, participants received either course credit or payment ($10 or 10,000 ₩ for students and $20 or 20,000 ₩ for community members).

Measures

Participants received informed consent at the beginning of the study, and consenting participants were given a questionnaire to complete with demographic items at the end. A Korean-English bilingual assistant translated the questionnaire into Korean, and an independent Korean-English bilingual assistant back-translated the questionnaire into English.

Religiosity. Religiosity was measured using a 10-item reliable, validated scale (Religious Commitment Inventory; Worthington et al., 2003; $\alpha = .93$ for Koreans; $\alpha = .96$ for European Americans). Example items include: "My religious beliefs lie behind my whole approach to life" and "I enjoy spending time with others of my religious affiliation." Participants responded on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores indicating higher religiosity.

Psychological distress. In order to assess psychological distress, the questionnaire included the Brief Symptoms Inventory (BSI; Derogatis & Spencer, 1982) and the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The BSI is a unidimensional measure (Piersma, Boes, & Reaume, 1994) in which participants reported how much each of 53 psychosomatic

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problems (e.g., feeling faintness or dizziness, nausea or upset stomach, trouble concentrating, feeling lonely) had bothered them in the past week on a scale from 0 (*not at all*) to 4 (*extremely*). The 10-item PSS measured level of stress perceived in the last month (e.g., "In the last month, how often have you felt nervous and 'stressed?'"), and participants responded on a scale from 0 (*never*) to 4 (*very often*). Scores on the BSI and PSS were highly correlated ($r = .61$, $p < .001$) and thus averaged to create a composite such that higher average scores indicated greater psychological distress or lower psychological well-being ($\alpha = .96$ for both Koreans and European Americans).

DNA Extraction and Genotyping

Participants provided saliva or cheek swab samples for DNA analysis after completing the questionnaire packet. Saliva samples were collected with the Oragene collection device (Genotek) and stored at room temperature, and cheek swab samples were collected using the Orasure oral specimen collection device and stored at –20 °C for 3 to 4 months until processing. DNA extraction was conducted using the Puregene DNA purification kit (Gentra Systems, Inc., Minneapolis, MN). DNA concentrations were read from a spectrophotometer and equalized across samples by diluting highly concentrated samples with water. Genotyping of OXTR rs53576 was conducted using a commercially available TaqMan SNP Genotyping assay containing forward and reverse primers, as well as two allele-specific probes conjugated with either the VIC or FAM reporter dye. Each Polymerase Chain Reaction (PCR) mixture consisted of the DNA template, SNP-specific Genotyping assay, and TaqMan Genotype Master Mix (ABI). DNA amplification was performed in 96-well plates on an ABI 7500 Real-Time PCR machine following the PCR conditions recommended by the SNP probe manufacturer. Following DNA amplification, the allelic discrimination program (ABI) generated a genotype plot in which samples were separated into four clusters, representing the AA, GG, AG, and undetermined genotypes. Samples were run in duplicate, and in all cases duplicates were consistent.

Results

Genotype Distributions

Koreans and European Americans differed in their genotype distributions of OXTR. There was a lower proportion of G/G genotypes among Koreans (57 A/A, 55 A/G, & 22 G/G) than among European Americans, who had a lower proportion of A/A genotypes (13 A/A, 41 A/G, & 54 G/G), $\chi^2(2, N = 242) = 40.85$, $p < .001$. Past investigations have found similar distributions (Bakermans-Kranenburg & IJzendoorn, 2008, for European Americans; Wu et al., 2005, for Asians). Hardy-Weinberg equilibrium was established for both Korean, $\chi^2(2, n = 134) = 1.90$, $p = .387$, and European American samples, $\chi^2(1, n = 108) = 1.38$, $p = .502$. In addition, there were no significant gender differences in genotype distributions for either Koreans, $\chi^2(2, n = 134) = 0.16$, $p = .922$, or European Americans, $\chi^2(2, n = 108) = 3.94$, $p = .139$.

Religiosity Equivalence by Culture and OXTR Genotype

We conducted a two-way analysis of variance (ANOVA) to test whether religiosity differed by culture (European American vs. Korean) and OXTR genotype (AA vs. AG vs. GG). The analysis showed that there was not a significant cultural difference in religiosity, $F(1, 236) = 1.50$, $p = .222$, between European Americans ($M = 2.70$, $SD = 1.60$) and Koreans ($M = 3.16$, $SD = 1.75$). Religiosity also did not differ by OXTR genotype, $F(2, 236) = 1.14$, $p = .323$ (A/A:

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Table 1. Moderated Hierarchical Regression Analysis of Culture, OXTR, and Religiosity as Predictors of Negative Health Outcomes

Step	R^2	*b*	ß	*p*
1. Culture		.11	.11	.143
OXTR.A (A/A vs. A/G & G/G)		–.02	–.02	.826
OXTR.G (G/G vs. A/G & A/A)		.01	.01	.919
Religiosity	.010	–.01	–.03	.689
2. Culture	—	.72	.70	.002
OXTR.A (A/A vs. A/G & G/G)	—	–.20	–.18	.098
OXTR.G (G/G vs. A/G & A/A)	—	.07	.06	.433
Religiosity	—	.02	.08	.730
Culture × OXTR		–.24	–.46	.020
OXTR × Religiosity		.02	.12	.518
Culture × Religiosity	.066	–.11	–.313	.010
3. Culture	—	.48	.47	.062
OXTR.A (A/A vs. A/G & G/G)	—	–.14	–.13	.250
OXTR.G (G/G vs. A/G & A/A)	—	.01	.01	.920
Religiosity	—	–.12	–.38	.239
Culture × OXTR	—	–.12	–.23	.306
Culture × Religiosity	—	.11	.32	.342
OXTR × Religiosity	—	.08	.55	.055
Culture × OXTR × Religiosity	.081	–.11	–.59	.046

M = 3.05, *SD* = 1.78; A/G: *M* = 3.14, *SD* = 1.77; G/G: *M* = 2.63, *SD* = 1.48), and there was no interaction of culture and OXTR on religiosity, $F(2, 236) = 0.38$, $p = .682$. Thus, religiosity equivalence was established across cultures and OXTR genotypes in this sample.

Culture × OXTR Genotype × Religiosity Interaction

A moderated hierarchical regression analysis was conducted to test the hypothesis that the association between religiosity and psychological distress would be moderated by the interaction of genes and culture. Specifically, we predicted a Culture × Religiosity interaction, which would be strongest among those with the OXTR G/G genotype, or those more concerned with social affiliation behaviors. In Step 1 of the regression, OXTR (dummy code OXTR.A: A/A = 1, A/G and G/G = 0; dummy code OXTR.G: G/G = 1, A/G and A/A = 0), culture (dummy code: European American = 0, Korean = 1), and religiosity (centered) were entered simultaneously. All two-way interactions were entered simultaneously on Step 2, and the three-way interaction of OXTR, culture, and religiosity was entered on Step 3.

First, in Step 1 of the regression, we found that none of the individual predictors (i.e., OXTR, culture, and religiosity) were significantly associated with psychological distress (see Table 1 for betas and *p* values). Next, Step 2 showed no interaction between OXTR and religiosity (ß = .12, $p = .518$) and an unexpected interaction between OXTR and culture (ß = –.46, $p = .020$) in predicting psychological distress. As expected, the interaction of culture and religiosity was significant (ß = –.31, $p = .010$) such that religiosity predicted less psychological distress for Koreans (ß = –.19, $p = .027$) but marginally more distress for European Americans (ß = .17, $p = .076$). Importantly, these two-way interactions were qualified by the hypothesized three-way

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interaction of OXTR, culture, and religiosity in Step 3 (ß = –.59, p = .046) (main two- and three-way interactions in bold in Table 1).[5] To examine the nature of this three-way interaction, we regressed psychological distress on culture and religiosity split by OXTR (i.e., culture and religiosity was entered on Step 1, and the interaction of culture and religiosity was entered on Step 2). This analysis showed that there was no interaction of culture and religiosity for people with A/A (ß = –.18, p = .495) or A/G genotypes (ß = –.13, p = .522). Religiosity did not significantly predict psychological distress for Koreans or European Americans with either A/A or A/G genotypes (ps ranged from .146 to .987). However, for those with G/G genotypes, who tend to be more socially oriented, a significant Culture × Religiosity interaction effect emerged as predicted (ß = –.53, p = .001; medium effect size: f^2 = .17) such that religiosity predicted more psychological distress for European Americans (ß = .39, p = .004; medium effect size: f^2 = .17) and less psychological distress for Koreans (ß = –.43, p = .044; medium-large effect size: f^2 = .23) (see Figure 1).

Discussion

In this study, the results showed the hypothesized three-way interaction of culture, OXTR genotype, and religiosity on psychological well-being. Regardless of cultural background, religiosity did not seem to predict psychological well-being for those who were genetically predisposed to be less concerned about social affiliation. However, for those who were more genetically predisposed toward social sensitivity, religiosity predicted greater psychological well-being, but only if they lived in a cultural context where religion tends to prioritize social affiliation (i.e., Korea). This same pattern of results did not occur for people in a cultural context where religion emphasizes social affiliation less than other values (i.e., mainstream America), and in fact, it seems that religiosity predicted greater psychological distress for them.

There was an unexpected finding that religiosity was associated with marginally more psychological distress for European Americans overall, but this effect was driven by European Americans with the G/G genotype of OXTR. The relationship between religiosity and psychological distress was nonsignificant for European Americans with A/A or A/G genotypes. This pattern might have occurred because of the presence of a psychological discrepancy for G/G European Americans. That is, it seems that religious European Americans enjoy affiliating with their religious community, given that the Religious Commitment Inventory includes a few items directly assessing this tendency. That they enjoy these activities, however, may not translate into an increased sense of community and affiliation, perhaps due to religion's relatively weaker emphasis on social affiliation in this cultural context (Sasaki & Kim, in press). It is possible that European Americans with the G/G genotype might experience some discrepancy between what they would like to receive from religious involvement and what they perceive their actual social resources to be, and this discrepancy might lead to lower psychological well-being.

Another noncentral but intriguing finding is the significant difference in genotype distributions between the two cultures. As speculated by Kim et al. (2010b), the lower frequency of G/G genotypes in Korea may be linked to the culture's relative de-emphasis on emotional support seeking, and conversely, the higher frequency of G/G genotypes in the U.S. may be linked to an American preference for this type of support. One interesting possibility is that religion may serve the function of countering certain natural tendencies within a culture. Because East Asians tend to be more hesitant to seek support, religious involvement might have developed the association with social affiliation in the context of a collectivistic culture, which in turn may provide them with necessary social resources, primarily benefiting well-being for those who are genetically predisposed to be concerned about these resources (i.e., G/G genotypes). However, European Americans commonly seek emotional support in times of distress, and therefore, there

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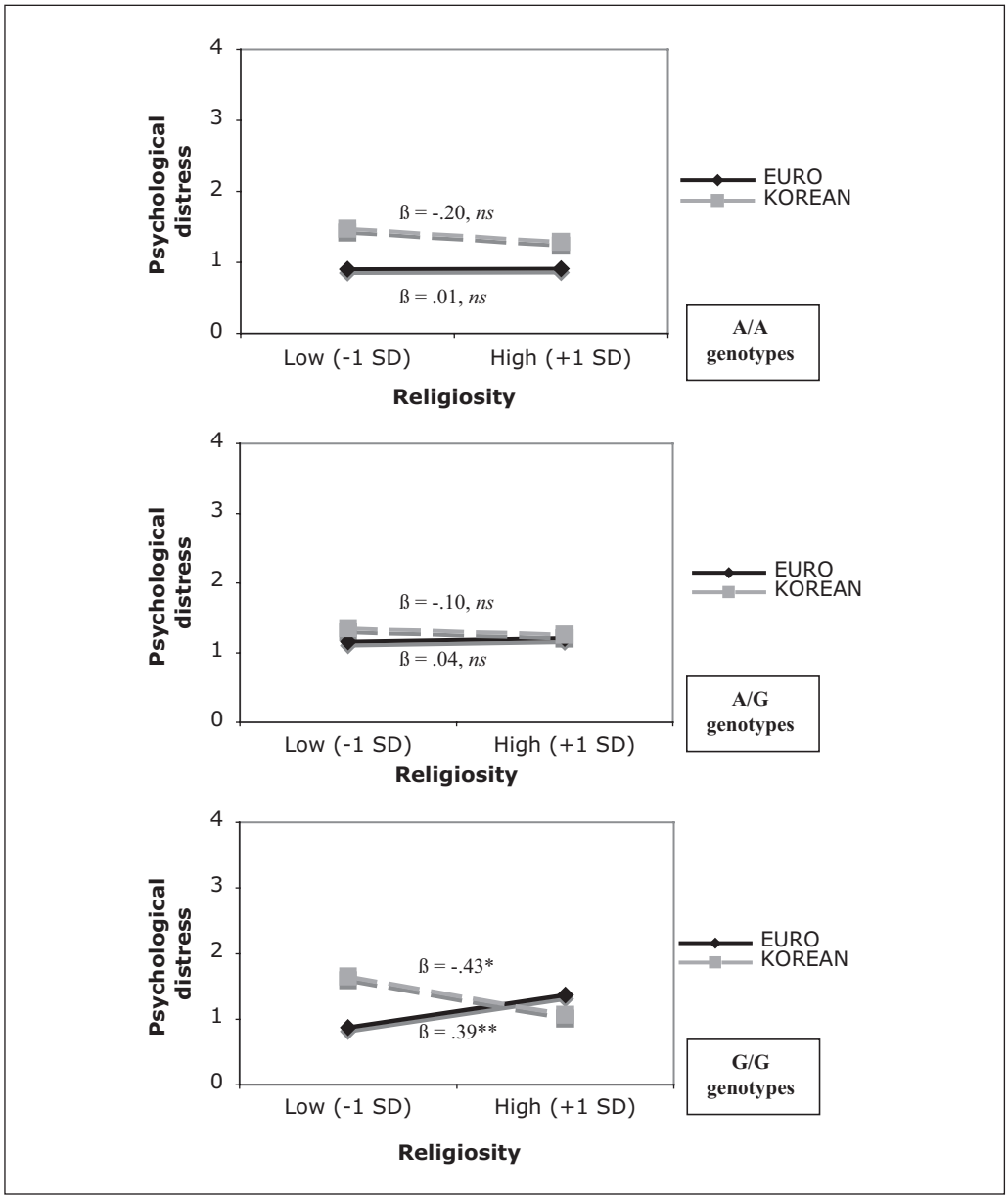

Figure 1. Effect of Culture and Religiosity on Psychological Distress by OXTR Genotype
*p < .05. **p < .01. ***p < .001.

may be less of a need for religion to function as a source of social affiliation. As a result, religion may not provide as much of a benefit to well-being in this context. This speculation is related to the idea that cultural values may compensate for psychological risk and tendencies among genetically susceptible populations (see Chiao & Blizinsky, 2009).

There are a few limitations of the present study. First, due to the correlational nature of these data, an alternate explanation for our findings is that some people may become more involved in

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religion in response to psychological distress, and thus, psychological distress may lead people to cope using religion. Second, it is important to note that the measure of psychological well-being that we used in the present study is one of many different ways of measuring this construct. Some research on religiosity and well-being outcomes has measured the onset of physical illnesses (e.g., Comstock & Partridge, 1972) or longevity as indicators of health (e.g., Strawbridge, Cohen, Sherma, & Kaplan, 1997), and others have examined mental illness prevention as health (e.g., see Worthington, Kurusu, McCullough, & Sandage, 1996, for review). While we obtained the present pattern of results using an index of general psychological distress, it is possible that measuring more specific health problems may produce different results. In addition, using a more objective measure of well-being (e.g., clinical diagnosis) may yield a different pattern of results from using a more subjective measure as in the present study. Thus, future research may test whether these findings generalize to more objective measures and specific health indices or acute illnesses.

The results of this study have important implications for the way we study religion and psychological well-being. The literature on religion and well-being may be enriched by moving beyond conclusions that religion either does or does not benefit well-being and toward uncovering information about *the conditions under which* religion may lead to better psychological adjustment. Had an investigation of OXTR and religiosity been conducted in each culture separately, two entirely opposite conclusions may have been drawn from the data: G/G genotypes tend to benefit from religiosity (i.e., Korean results), and G/G genotypes tend to be harmed from religiosity (i.e., European American results). However, taking these findings together, the results can be more clearly understood from a cultural psychological approach by considering the particular cultural contexts in which the results occur. The relationship between religiosity and well-being is highly complex, and the results from this study show that incorporating insights from cultural psychology together with perspectives from molecular biology may bring us to a clearer understanding of how religion's association with harms or benefits may be qualified by both nature and nurture.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Notes

1. The concept of social affiliation differs from active seeking of social support, which has been found to be less common and less beneficial in an Asian cultural context (Kim, Sherman, & Taylor, 2008). Social affiliation in Sasaki and Kim (in press) and in the present paper refers to having community and a social network.
2. Participants completed reported measures as a part of a larger set of questionnaires. For other reports from this data set, see Kim et al. (2010a, 2010b).
3. One Korean participant declined to report a religious affiliation.
4. Controlling for religious affiliation did not significantly change the main results in this study.
5. The three-way interaction of OXTR, culture, and religiosity remained significant ($p = .032$) even after controlling for gender.

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