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Religiously or Spiritually-Motivated Forgiveness and Subsequent Health and Well-Being among Young Adults: An Outcome-Wide Analysis

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Abstract

This study performs an outcome-wide analysis to prospectively examine the associations of forgiveness (including forgiveness of others, self-forgiveness and divine forgiveness) with a range of psychosocial, mental, behavioral and physical health outcomes. Data from the Nurses' Health Study II and the Growing Up Today Study (Ns ranged from 5,246 to 6,994, depending on forgiveness type and outcome) with 3 or 6 years of follow-up were analyzed using generalized estimating equations. Bonferroni correction was used to correct for multiple testing. All models controlled for sociodemographic characteristics, prior religious service attendance, prior maternal attachment and prior values of the outcome variables. All forgiveness measures were positively associated with all psychosocial well-being outcomes, and inversely associated with depressive or anxiety symptoms. There was little association between forgiveness and behavioral or physical health outcomes. Forgiveness may be understood as a good itself, and may also lead to better subsequent mental health and psychosocial well-being.

Keywords

Forgiveness; Health; Well-being; Religion; Outcome-Wide Epidemiology

INTRODUCTION

Many world religions consider forgiveness as a virtue (Worthington & Sandage, 2016). While there is not a standard definition of forgiveness given its multifaceted nature,

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forgiveness has sometimes been considered as replacing of ill-will towards the offender with good-will (VanderWeele, 2018). Forgiveness can involve different subjects and objects. For example, one might forgive other individuals of the harm or wrong they have done (“forgiveness of other”); forgive oneself in the release of guilt and negative affect associated with one’s own past wrongdoings or personal failures (“self-forgiveness”); or perceive that one’s own wrongdoing has been forgiven by God (“divine forgiveness”) (Toussaint et al., 2015).

Religious teachings may help one to forgive. In Jewish and Christian beliefs, forgiveness of others is to imitate divine forgiveness: if someone is forgiven by God, he or she should forgive others. Divine forgiveness is also expected to facilitate self-forgiveness: one approach to self-forgiveness is to ask for God’s forgiveness (Ingersoll-Dayton & Krause, 2005). Forgiveness, in turn, may lead to a sense of peace for both the forgiver and the one forgiven (Worthington, 2005). Although forgiveness has more often been considered in religious contexts, it can of course also be important outside the context of religion (Worthington, 2005).

Forgiveness has, in fact, been hypothesized as a pathway linking religiousness/spirituality to health and well-being (Worthington & Sandage, 2016). The Interdisciplinary Conceptual Model posits three major determinants of forgiveness including religiousness, personality, and age. It also suggests five pathways leading from forgiveness to health including decreased negative experience, fewer risky behaviors, increased positive experience, improved social relationships, and enhanced spiritual well-being (Toussaint et al., 2015).

There have been increasing empirical studies that support forgiveness as a psychological asset leading to health and well-being. For instance, greater forgiveness has been linked to better psychological well-being (Worthington et al., 2018), fewer negative emotions and lower risk of mental illness (Toussaint et al., 2015), lower risk of substance use and better recovery (Toussaint et al., 2015), as well as greater self-rated health and fewer somatic symptoms in healthy populations (Toussaint et al., 2015) and healthier profiles in patient populations (Friedberg et al., 2015). While such prior studies have substantially advanced our understanding about forgiveness and health, they may be subject to certain methodological limitations. For instance, many observational studies were cross-sectional and used small convenience samples, and thus cannot establish evidence for the direction of causality. While there are a number of experimental studies (Wade et al., 2014), they tend to have relatively short follow-up. In the observational data, there is often limited control for confounders such as religiousness/spirituality and health-related characteristics. In addition, most research has focused on studying forgiveness of others in middle-aged or older adults, whereas evidence on self-forgiveness and divine forgiveness is more limited. These other aspects of forgiveness may operate through different mechanisms from other-forgiveness (Griffin et al., 2017; Kent et al., 2017). Moreover, prior work has examined a limited number of outcomes in separate studies. Examining multiple health and well-being outcomes simultaneously may help provide an integrative framework for understanding (VanderWeele, 2017a).

This study takes an outcome-wide analytic approach (VanderWeele, 2017b) to prospectively examine the associations of forgiveness with a wide range of psychosocial, mental, behavioral and physical health and well-being outcomes among young adults. Three aspects of forgiveness were examined including forgiveness of others, self-forgiveness and divine forgiveness. As an exploratory analysis, we also examined the extent to which the associations between divine forgiveness and various outcomes might be mediated through forgiveness of others and self-forgiveness. We hypothesized that each aspect of forgiveness would be positively associated with psychosocial, mental, behavioral and physical health and well-being separately.

METHODS

Sample

This study involved secondary data analysis of longitudinal data from both the Nurses' Health Study II (NHSII) and the Growing Up Today Study (GUTS). Study methods have previously been described in detail (Field et al., 1999; Solomon et al., 1997). NHSII was initiated in 1989 when 116,430 registered nurses (aged 25 to 42 years) were enrolled from across the U.S.. In 1996, NHSII participants with children aged between 9 and 14 years were invited to have their children participate in another cohort GUTS. A total of 16,882 GUTS participants completed questionnaires about their health. NHSII and GUTS participants have been followed up annually or biennially through mail or web-based questionnaires.

Measures of forgiveness were included in the GUTS 2007 questionnaire; therefore, this year was considered as baseline for this study. Among participants who responded to the 2007 questionnaire wave ($n=9,860$), those with missing data on a forgiveness variable ($n=1,246$ on forgiveness of others, $n=1,231$ on self-forgiveness, $n=718$ on divine forgiveness) or on an outcome variable (n ranged from 1,631 to 2,675 on forgiveness of others, 1,635 to 2,679 on self-forgiveness, and 1,470 to 2,346 on divine forgiveness, depending on outcome) were removed from analyses involving those variables. Participants who reported not believing in God or a higher power ($n=1,550$) were also removed from all analyses on divine forgiveness. When data were missing for covariate variables (n ranged from 0 to 1,255 on forgiveness of others, 0 to 1,259 on self-forgiveness, and 0 to 1,106 on divine forgiveness), we imputed data from the previous questionnaire wave; if no such data were available, the mean values (for continuous variables) or values of the largest category (for categorical variables) of non-missing data were used for imputation. This yielded analytic samples of 5,939 to 6,983 (up to 2,678 were siblings) for analyses on forgiveness of others, 5,950 to 6,994 (up to 2,685 were siblings) for analyses on self-forgiveness, and 5,246 to 6,122 (up to 2,913 were siblings) for analyses on divine forgiveness, depending on outcome. This study was approved by the Institutional Review Board at the Brigham and Women's Hospital. All participants provided written informed consent.

Table S1 shows the timeline of measurement. The exposure variables (forgiveness of others, self-forgiveness, divine forgiveness) were assessed in the GUTS 2007 questionnaire wave. Because most of the outcomes were assessed in the GUTS 2010 questionnaire wave, we mainly used data on the outcomes from the 2010 wave; if the outcome was not assessed in the 2010 wave, we used data from the 2013 wave. The covariates were measured in the

GUTS 2005 or 2007 questionnaire wave (e.g., prior values of the outcomes variables) or the NHSII 2001 questionnaire wave (e.g., family socioeconomic status).

Measures

Forgiveness.—The three forgiveness items were from the psychometrically supported Brief Multidimensional Measure of Religiousness/Spirituality Scale (Harris et al., 2008). Items were preceded by the phrase “Because of my religious or spiritual beliefs...” and included the following: “I have forgiven myself for things that I have done wrong” (self-forgiveness), “I have forgiven those who hurt me” (other forgiveness), and “I know that God or a higher power forgives me” (divine forgiveness). Response options included 1 (*always or almost always*), 2 (*often*), 3 (*seldom*), and 4 (*never*). The item on divine forgiveness had one additional response category 5 (*do not believe in God or a higher power*), and participants who responded in this category were removed from all analyses on divine forgiveness. Responses were reverse coded and the bottom two categories (*never* and *seldom*) were collapsed to reduce data sparsity, resulting in a three-category variable (1: *never or seldom*, 2: *often*, 3: *always/almost always*).

Outcomes.—A wide range of psychological (i.e., life satisfaction, positive affect, self-esteem, emotional processing, emotional expression), physical (i.e., number of physical health problems, overweight/obesity), mental (i.e., depression, anxiety), behavioral health (i.e., binge eating, eating disorder, cigarette smoking, frequent binge drinking, marijuana use, other illicit drug use, prescription drug misuse, sexually transmitted infections [STIs], preventive physical exam, short sleep duration) and volunteering/civic engagement outcomes (time contributed to community, charity and a place of worship, and voting) measured 3 or 6 years later were examined. See Table S2 and the supplementary materials for details on each measurement.

Covariates.—We considered sociodemographic covariates including participant age (in years), gender (male, female), race (white, non-white) and area of residence (West, Midwest, South, Northeastern) derived from GUTS 2007 data. Maternal socioeconomic status (SES) and census-tract SES variables derived from NHSII 2001 data included mother’s subjective social standing in the US and in the community both assessed with validated scales on a 10-point scale (Giatti et al., 2012), pretax household income (1: <\$50,000, 2: \$50,000-\$74,999, 3: \$75,000-\$99,999, 4: \$100,000), and census tract rate of college graduates (used as a continuous variable) and median income (1: <\$50,000, 2: \$50,000-\$74,999, 3: \$75,000-\$99,999, 4: \$100,000) (both were derived from geocoded data). We also adjusted for prior religious service attendance (never, less than once/week, at least once/week) and prior maternal attachment (used as a continuous variable; measured with a validated 9-item scale (Jaccard & Dittus, 2000) that assessed offspring’s satisfaction with his/her relationship with the parents, $\alpha = .94$) both derived from GUTS 2005 data.

To reduce possibility of reverse causation, we also adjusted for prior values of the outcome variables whenever data were available (VanderWeele et al., 2016) including prior binge eating (2005), weight status (2005), depressive symptoms (2007), smoking (2005), frequent binge drinking (2005), marijuana use (2005), use of other illicit drugs (2007), prescription

drug misuse (2007), history of STIs (2005), use of preventive physical exam (2005), frequency of volunteering (2007) and status of registered to vote (2007).

Statistical Analyses

All statistical analyses were performed in SAS 9.4. We examined the association between prior or concurrent participant sociodemographic and psychosocial, mental, and physical health characteristics and each forgiveness variable using analysis of variance and the Chi-square test.

We analyzed the prospective associations between forgiveness and subsequent health and well-being outcomes using generalized estimating equations (GEE), adjusting for clustering by sibling status. We separately examined the association of each type of forgiveness with each health and well-being outcome, controlling for sociodemographic factors, prior religious service attendance, prior maternal attachment as well as prior values of the outcome variables wherever data were available. Continuous outcomes were standardized (Mean=0, Standard Deviation=1), so that effect sizes are reported in terms of standard deviations of the outcome. Bonferroni correction was used to account for multiple testing. As sensitivity analyses, we reanalyzed the primary sets of models, stratified by prior religious service attendance.

We performed exploratory analyses to examine whether divine forgiveness predicted forgiveness of others and self-forgiveness. We regressed the top tertile of forgiveness of others and the top tertile of self-forgiveness on divine forgiveness separately, adjusting for covariates. We also undertook exploratory analyses to assess the extent to which the associations between divine forgiveness and various outcomes might be mediated through forgiveness of others and self-forgiveness. We included forgiveness of others and self-forgiveness with divine forgiveness both separately and simultaneously in the models, and assessed whether the associations between divine forgiveness and various outcomes were attenuated (Jiang & VanderWeele, 2015). While divine forgiveness may be conceptually prior to forgiveness of others and self, these analyses are only exploratory as all three forgiveness variables were measured at the same time.

To assess robustness of the observed associations to unmeasured confounding (Ding & VanderWeele, 2016; VanderWeele & Ding, 2017), sensitivity analyses were performed to assess the extent to which an unmeasured confounder would need to be associated with both the exposure and each outcome to explain away the observed associations. For this we calculated E-values (VanderWeele & Ding, 2017), defined as the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to fully explain away the observed exposure-outcome association.

RESULTS

Descriptive Analyses

The analytic samples for all three forgiveness variables consisted of participants that were primarily white, higher percentage female, and mostly had high family SES, with the mean

baseline age of 22.97 years ($SD=1.71$) (Table S3). Around 25% of participants reported the highest level (always/almost always) of forgiveness of others and self, while over 50% reported that level of divine forgiveness.

Participant characteristics by levels of forgiveness of others are shown in Table 1, and by self-forgiveness and divine forgiveness in Table S3A and Table S3B.

Forgiveness, and Health and Well-Being

In adjusted analyses, all three forgiveness measures were positively associated with psychological well-being, mental health and a number of the volunteering/civic engagement outcomes in a monotonic pattern (Tables 2, S4, S5, and S6). Specifically, each forgiveness measure was positively associated with all psychological well-being outcomes, and inversely associated with depressive and anxiety symptoms. The associations of self-forgiveness were stronger than forgiveness of others and divine forgiveness. Greater forgiveness was also related to greater engagement in serving a place of worship and possibility more time contributed to charity (Tables S4-S6). However, there was little evidence of associations between any forgiveness measure and physical health or behavioral health outcomes, except that the top vs. bottom level of self-forgiveness was associated with lower risk of short sleep duration. Although there was suggestive evidence that the top vs. bottom level of forgiveness of others was possibly associated with higher risk of cigarette smoking, the top vs. bottom level of self-forgiveness was possibly related to lower risk of frequent binge drinking, and the top vs. bottom level of divine forgiveness was possibly associated with lower risk of marijuana use, these associations did not reach $p < .05$ after correction for multiple testing. The associations with other physical or behavioral health outcomes were mostly close to null.

In analyses stratified by prior religious service attendance, the forgiveness measures were generally again associated with psychosocial well-being and mental health, with relatively little association with physical health and health behaviors, though the magnitudes did vary by extent of service attendance (Tables S7-S9).

Exploratory Mediation Analyses of Divine Forgiveness by Forgiveness of Others and Self-Forgiveness

Divine forgiveness was positively associated with both forgiveness of others and self-forgiveness in a monotonic pattern after covariates control (Table 3). Adding forgiveness of others and self-forgiveness to the models attenuated the associations of divine forgiveness with various psychological well-being and mental health outcomes (Table 4). When forgiveness of others or self-forgiveness was included in the models with divine forgiveness separately, the association of divine forgiveness with psychological well-being and mental health outcomes were attenuated but often not reduced to the null. When both forgiveness of others and self-forgiveness were included in the models, the divine forgiveness associations were further attenuated, and almost all close to null (Table 4, Table S10).

Sensitivity Analyses for Unmeasured Confounding

We calculated E-values (VanderWeele & Ding, 2017) for the associations of forgiveness (top vs. bottom level) with various outcomes (Table 5), to assess robustness of the associations to unmeasured confounding. E-values are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to fully explain away an observed exposure-outcome association. There was moderate evidence suggesting the associations of forgiveness with psychosocial well-being and mental health outcomes were likely robust to unmeasured confounding. For example, in Table 5, to explain away the association between self-forgiveness and positive affect ($\beta=0.37$, 95% CI: 0.31, 0.44, as shown in Table 2), an unmeasured confounder associated with both high self-forgiveness and high positive affect by 2.15-fold each on the risk ratio scale, above and beyond the measured covariates, would suffice, but weaker confounding would not; and by 1.99-fold each to shift the lower confidence limit for this estimate to include the null value. As indicated in Table 5, similarly strong unmeasured confounding between forgiveness and other psychological and mental health outcomes would be needed to explain away the observed associations, suggesting that these associations are somewhat robust to unmeasured confounding.

DISCUSSION

There has been growing interest in studying protective factors that enhance well-being, beyond the traditional approach that focuses on reducing risk factors and illness (Seligman, 2008). There has also been increasing emphasis on examining not only mental and physical health but also measures of happiness, life satisfaction, and psychological well-being (VanderWeele, 2017a). This study suggests that forgiveness may be one such psychological asset that could contribute to better functioning across multiple health and well-being outcomes.

Congruent with prior evidence (predominantly cross-sectional studies) (Toussaint et al., 2015), this study suggests that greater religiously- or spiritually-motivated forgiveness (including self-, other- and divine forgiveness) are associated with greater psychosocial well-being and lower risk of mental distress over 3 or 6 years of follow-up in young adults. For example, consistent with a prior cross-sectional study that used a national probability sample of 709 young adults (Toussaint et al., 2001), this study suggested greater forgiveness is prospectively associated with higher life satisfaction and fewer depressive or anxiety symptoms, controlling for prior religious attendance. Effect sizes were larger compared to prior findings, which might be attributed to the longitudinal design and longer follow-up of this study (e.g., the effects of forgiveness may accumulate over time).

This study, however, found weaker evidence for the associations of forgiveness with physical health and health behaviors than prior work. There are several possible explanations. For instance, most prior work assessed physical health with self-rated health, self-reported somatic symptoms or physiological markers (Cheadle & Toussaint, 2015). However, in this study we examined disease outcomes (e.g., cancer, diabetes) that may take a longer time to develop and become discernible, especially in a sample of young adults. As another example, prior work on forgiveness and substance use was mostly conducted in individuals

with tobacco or alcohol use disorders to examine effects of forgiveness interventions on recovery (Webb & Jeter, 2015). In comparison, this study examined forgiveness in relation to subsequent smoking, binge drinking and drug use within a community sample. It is possible that effects of forgiveness on substance use, if any, may vary by stage of substance use. This study also consisted entirely of children of nurses, which resulted in lower rates of substance use as compared to the general population of young adults (Johnston et al., 2017).

This study also adds to prior evidence that self-forgiveness may have stronger associations with some health outcomes in young adults compared to other-forgiveness and divine forgiveness (Macaskill, 2012). Self-forgiveness may involve different emotional and cognitive processes from forgiveness of others (Macaskill, 2012). There is evidence suggesting self-forgiveness is associated with the resolution of emotions of guilt, shame and anxiety (Griffin et al., 2016), whereas forgiveness of others is related to the resolution of anger (Enright, 2015). Some individuals may use harsher criteria in judging their own behaviors but may be more sympathetic to others' failings, even when the offenses are identical. The absence of self-forgiveness may be also more distressing psychologically and demotivating for self-care, as compared to the lack of other-forgiveness (Macaskill, 2012). Self-forgiveness may, therefore, be more strongly associated with psychological well-being. Interestingly, however, our exploratory analyses suggest that divine forgiveness is an extremely strong predictor of self-forgiveness and may be the most important pathway to it, and that the associations of divine forgiveness with a number of psychological and mental health outcomes might be mediated through self-forgiveness and other-forgiveness. This result is only exploratory, however, as all forgiveness measures were assessed concurrently; it thus needs to be replicated in more rigorous analyses that have temporal separation of the forgiveness measures.

This study is, however, subject to certain limitations. First, forgiveness was assessed with single-item questions. This clearly does not capture a full picture of the concept given its multi-faceted nature. These questions also queried specifically about religiously- or spiritually-motivated forgiveness, which likely limited their relevance among individuals who do not hold religious/spiritual beliefs. Second, this study did not examine forgiveness in specific contexts or potential modifying factors of the forgiveness and health associations. For instance, personality factors, motivation of forgiveness, severity of the offense and subsequent behaviors of the offender may all be relevant for understanding the dynamics between forgiveness and health (Lawler et al., 2005). Third, the temporal and causal operation of forgiveness is not clearly specifiable in most assessments. For example, someone who has few grudges or offenses to contend with will necessarily infrequently forgive. Forgiveness is simply not called for. On the other hand, one who might be beset by offenses on all sides might be almost always forgiving; however, the sheer number of offenses that must be dealt with might elevate the person's levels of unforgiveness far above one who has little to forgive and almost never forgives when offended. Fourth, both forgiveness and health were self-reported, which may be subject to social desirability and common methods bias. As a further limitation, the participants were predominantly white and their mothers all worked as nurses. Findings of this study, therefore, may not be generalizable to other populations.

Prior studies have suggested that even though forgiveness is not currently practiced often, forgiveness is potentially modifiable. Evidence from randomized controlled trials indicates that forgiveness could be improved using methods of confrontation, release of anger and trying to understand the offender (Wade et al., 2014). Such programs have been linked to reduced negative emotions, improved psychological well-being, and better recovery from substance use disorders (Scherer et al., 2011; Wade et al., 2014; Elliott, 2015). Such experimental studies, however, have often been conducted in small-samples of patient populations with short follow-up, and results remain rather mixed for physical health outcomes (Toussaint et al., 2015).

While potential tensions between forgiveness and other moral principles such as justice may need to be considered, forgiveness understood simply as the replacing of ill-will towards an offender with good-will need not be incompatible with seeking a just outcome (Wolterstorff, 2011). Forgiveness may be seen as a good in itself with the replacing of ill-will with good-will as a form of love, and an opportunity, when appropriate, for a restored relationship (Stump, 2006; Aquinas); it may also, as seen here, lead to better mental health and psychosocial well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1. Distribution of participant characteristics by tertiles of forgiveness of others (N=8,614)

	Forgiveness of others			p-value
	Never/Seldom (n=2,044)	Often (n=4,376)	Always/almost always (n=2,194)	
Sociodemographic factors				
Age in years (range: 20-28, the 2007 wave), mean (SD)	22.94 (1.69)	22.99 (1.71)	22.98 (1.73)	0.53
Male, %	43.00	33.50	34.23	<.001
White, %	91.84	93.37	94.29	.006
Area of residence, %				<.001
West	18.16	14.75	16.65	
Midwest	29.07	35.98	37.04	
South	12.58	17.36	18.20	
Northeast	40.19	31.91	28.10	
Mother's subjective SES in the US (range: 1-10), mean (SD)	7.16 (1.31)	7.13 (1.28)	7.24 (1.27)	0.009
Mother's subjective SES in the community (range: 1-10), mean (SD)	6.98 (1.61)	7.01 (1.54)	7.17 (1.49)	<.001
Pretax household income, %				.002
<\$50,000	12.27	12.06	13.14	
\$50,000-\$74,999	20.61	24.23	24.76	
\$75,000-\$99,999	21.26	23.36	21.52	
\$100,000	45.86	40.35	40.58	
Census tract college education rate (range: 0% -84.71%), mean (SD)	34.70% (17.00%)	31.97% (16.11%)	30.85% (15.63%)	<.001
Census tract median income, %				<.001
<\$50,000	19.13	24.20	25.63	
\$50,000-\$74,999	46.28	48.45	49.79	
\$75,000-\$99,999	24.90	20.25	18.29	
\$100,000	9.69	7.11	6.29	
Prior religious service attendance				
Prior religious service attendance, %				<.001
Never	61.89	32.18	21.69	
Less than once/week	31.39	41.95	34.54	
At least once/week	6.73	25.87	43.77	

	Forgiveness of others			p-value
	Never/Seldom (n=2,044)	Often (n=4,376)	Always/almost always (n=2,194)	
Prior maternal attachment				
Maternal attachment (range: 9-45), mean (SD)	36.66 (7.54)	37.73 (7.11)	38.83 (6.73)	<.001
Prior health status or prior health behaviors				
Prior depressive symptoms (range: 0-21), mean (SD)	6.42 (3.62)	5.72 (3.31)	4.86 (3.21)	<.001
Prior overweight or obesity, %	30.05	30.00	26.96	.04
Prior binge eating, %	2.48	1.97	2.05	.44
Prior cigarette smoking, %	41.56	34.45	30.18	<.001
Prior frequent drinking, %	33.87	25.95	20.56	<.001
Prior marijuana use, %	40.14	28.59	23.78	<.001
Prior drug use other than marijuana, %	15.61	9.95	7.86	<.001
Prior prescription drug misuse, %	23.03	16.53	13.15	<.001
Prior history of sexually transmitted infections, %	6.27	6.94	5.63	.17
Prior past-year routine (preventive) physical exam, %	59.74	61.54	61.04	.45
Prior frequency of volunteering (range: 1-4), mean (SD)	1.66 (0.86)	1.83 (0.83)	2.02 (0.91)	<.001
Prior status of registered to vote, %	86.84	89.57	91.74	<.001

Note: ANOVA or chi-square tests were used to examine the mean levels (SD) of the characteristic or proportion of individuals within each sense of mission category with that characteristic.

Table 2.

Forgiveness of others, self-forgiveness, divine forgiveness and subsequent health and well-being (N ranged from 5,246 to 6,994 ^a)

	Never/Seldom (Ref)	Forgiveness of others Always/almost always OR/RR/ β (95% CI) ^b	Self-forgiveness Always/almost always OR/RR/ β (95% CI) ^b	Divine forgiveness Always/almost always OR/RR/ β (95% CI) ^b
Psychological Well-being				
Life satisfaction	0.00	0.23 (0.16, 0.30) ***	0.29 (0.22, 0.35) ***	0.25 (0.17, 0.32) ***
Positive affect	0.00	0.33 (0.26, 0.40) ***	0.37 (0.31, 0.44) ***	0.28 (0.21, 0.35) ***
Self-esteem	0.00	0.20 (0.13, 0.26) ***	0.38 (0.31, 0.44) ***	0.28 (0.21, 0.35) ***
Emotional processing	0.00	0.29 (0.22, 0.37) ***	0.32 (0.25, 0.39) ***	0.23 (0.15, 0.31) ***
Emotional expression	0.00	0.23 (0.15, 0.30) ***	0.34 (0.27, 0.41) ***	0.25 (0.18, 0.33) ***
Physical health				
Number of physical health problems	0.00	0.01 (-0.06, 0.08)	0.00 (-0.07, 0.06)	-0.01 (-0.08, 0.06)
Overweight/obesity	1.00	0.97 (0.89, 1.05)	1.08 (1.00, 1.16)	1.09 (1.00, 1.19) *
Mental health				
Depressive symptoms	0.00	-0.14 (-0.20, -0.07) ***	-0.17 (-0.23, -0.11) ***	-0.12 (-0.19, -0.04) ***
Depression diagnosis	1.00	0.92 (0.77, 1.09)	0.86 (0.73, 1.01)	0.90 (0.76, 1.05)
Anxiety symptoms	0.00	-0.18 (-0.25, -0.11) ***	-0.22 (-0.28, -0.16) ***	-0.14 (-0.21, -0.06) ***
Anxiety diagnosis	1.00	0.82 (0.68, 0.99) *	0.81 (0.67, 0.97) *	0.97 (0.80, 1.17)
Health Behaviors				
Binge eating	1.00	0.96 (0.44, 2.12)	0.52 (0.25, 1.08)	0.62 (0.31, 1.23)
Eating disorder	1.00	1.15 (0.67, 1.98)	0.71 (0.42, 1.19)	0.85 (0.50, 1.43)
Cigarette smoking	1.00	1.16 (1.04, 1.29) **	1.03 (0.93, 1.14)	0.97 (0.87, 1.08)
Frequent binge drinking	1.00	1.00 (0.91, 1.10)	0.89 (0.80, 0.97) *	0.93 (0.84, 1.03)
Marijuana use	1.00	0.99 (0.89, 1.10)	0.93 (0.84, 1.03)	0.85 (0.76, 0.96) **
Any other illicit drug use	1.00	0.95 (0.76, 1.19)	1.08 (0.88, 1.31)	0.86 (0.69, 1.08)
Prescription drug misuse	1.00	0.85 (0.70, 1.03)	0.92 (0.78, 1.09)	0.90 (0.74, 1.08)
Sexually transmitted infections	1.00	0.96 (0.79, 1.16)	0.88 (0.73, 1.06)	1.14 (0.94, 1.38)
Routine (preventive) physical exam	1.00	1.00 (0.94, 1.06)	1.05 (1.00, 1.11)	1.02 (0.96, 1.09)

	Never/Seldom (Ref)	Forgiveness of others Always/almost always OR/RR/ β (95% CI) ^b	Self-forgiveness Always/almost always OR/RR/ β (95% CI) ^b	Divine forgiveness Always/almost always OR/RR/ β (95% CI) ^b
Short sleep duration	1.00	1.02 (0.89, 1.18)	0.81 (0.71, 0.92)***	0.99 (0.86, 1.15)
Volunteering and civic engagement				
Contributed time to community	0.00	0.06 (-0.02, 0.13)	0.00 (-0.07, 0.07)	-0.01 (-0.09, 0.06)
Contributed time to charity	0.00	0.11 (0.04, 0.18)**	0.03 (-0.04, 0.10)	-0.04 (-0.11, 0.03)
Contributed time to places of worship	0.00	0.36 (0.30, 0.42)***	0.29 (0.23, 0.35)***	0.44 (0.38, 0.50)***
Voted in the 2008 President election	1.00	0.99 (0.96, 1.02)	1.02 (0.99, 1.04)	0.97 (0.94, 1.00)

OR, odds ratio; RR, risk ratio; CI, confidence interval.

* p<0.05 before Bonferroni correction;

** p<0.01 before Bonferroni correction;

*** p<0.05 after Bonferroni correction (the p value cutoff for Bonferroni correction=0.05/25 outcomes=0.002)

^aThe full analytic sample was restricted to those who had valid data on self-forgiveness, forgiveness of others and divine forgiveness measures were assessed in the 2007 questionnaire wave). The actual sample size for each analysis varies depending on the number of missing values on each outcome (assessed in the 2010 or 2013 questionnaire wave) under investigation. Missing data on the covariates were imputed from previous questionnaire years; if no such data were available, missing were imputed with the mean values (continuous variables) or values of the largest category (categorical variables) of the non-missing data.

^bA sets of generalized estimating equation models were used to regress each outcome on each of the forgiveness measures separately, adjusting for clustering by siblings. The effect estimates were OR (binomial distribution, rare outcome defined as the prevalence<10%), RR (Poisson distribution, non-rare event defined as prevalence>=10%), or β (continuous outcomes were all standardized at mean=0, standard deviation=1; the continuous outcomes were all indented). If the reference value is "0", it indicates the effect estimate is "0"; if the reference value is "1", it indicates the effect estimate is either RR or OR. All models controlled for participants' age, race, sex, area of residence, their mother's report of SES (subjective SES, household income, census tract college education rate, and census tract median income), participants' prior religious service attendance, prior maternal attachment, prior values of the outcome variables (prior depressive symptoms, prior binge eating, prior overweight/obesity, prior smoking, prior drinking, prior marijuana use, prior use of other illicit drugs, prior prescription drug misuse, prior history of sexually transmitted infections, prior routine physical exam, prior frequency of volunteering, prior voting registration status).

Table 3.

Forgiveness of others and self-forgiveness by divine forgiveness, adjusting for covariates (N =7,571)

	Top tertile of forgiveness of others RR (95% CI)	Top tertile of self-forgiveness RR (95% CI)
Divine forgiveness		
Never/Seldom	Ref	Ref
Often	1.38 (1.09, 1.76)**	1.38 (1.01, 1.87)*
Always/almost always	6.23 (5.05, 7.69)***	10.51 (8.11, 13.64)***

Note: The analytic samples were restricted to those who had valid data on forgiveness of others, self-forgiveness, and divine forgiveness. Poisson regression models with log link were used to estimate risk ratio (RR), adjusting for clustering by sibling status.

All models controlled for participants' age, race, sex, area of residence, their mother's report of SES (subjective SES, household income, census tract college education rate, and census tract median income), participants' prior religious service attendance, prior maternal attachment, prior values of the outcome variables (prior depressive symptoms, prior binge eating, prior overweight/obesity, prior smoking, prior drinking, prior marijuana use, prior use of other illicit drugs, prior prescription drug misuse, prior history of sexually transmitted infections, prior routine physical exam, prior frequency of volunteering, prior voting registration status).

The unadjusted proportion who are in the top tertile for forgiveness of others across the different levels of divine forgiveness is as follows: Never or seldom (6.27%), Often (8.85%), always/almost always (44.39%).

The unadjusted proportion who are in the top tertile for self-forgiveness across the different levels of divine forgiveness is as follows: Never or seldom (4.02%), Often (5.45%), always/almost always (44.67%).

*
p<0.05,

**
p<0.01,

p<0.001

Exploratory mediation analysis of divine forgiveness by forgiveness of others and self-forgiveness and subsequent health and well-being (N ranged from 5,231 to 6,106)^a

Table 4.

	Never/Seldom Ref	Divine forgiveness	Divine forgiveness + Forgiveness of others	Divine forgiveness + Self-forgiveness	Divine forgiveness + Forgiveness of others + Self-forgiveness
		OR/RR/ β (95% CI) ^b			
Psychological Well-being					
Life satisfaction	0.00	0.25 (0.17, 0.32)***	0.20 (0.11, 0.28)***	0.12 (0.03, 0.21)**	0.12 (0.03, 0.21)*
Positive affect	0.00	0.28 (0.21, 0.35)***	0.17 (0.09, 0.25)***	0.10 (0.02, 0.19)*	0.07 (-0.01, 0.16)
Self-esteem	0.00	0.28 (0.21, 0.35)***	0.22 (0.14, 0.30)***	0.06 (-0.02, 0.15)	0.07 (-0.02, 0.16)
Emotional processing	0.00	0.23 (0.15, 0.31)***	0.11 (0.02, 0.20)*	0.06 (-0.04, 0.15)	0.02 (-0.08, 0.11)
Emotional expression	0.00	0.25 (0.18, 0.33)***	0.19 (0.11, 0.28)***	0.10 (0.01, 0.18)*	0.09 (0.00, 0.18)
Physical health					
Number of physical health problems	0.00	-0.01 (-0.08, 0.06)	0.00 (-0.09, 0.09)	0.00 (-0.09, 0.09)	0.00 (-0.09, 0.10)
Overweight/obesity	1.00	1.09 (1.00, 1.19)*	1.14 (1.04, 1.26)**	1.08 (0.99, 1.19)	1.12 (1.01, 1.24)*
Mental health					
Depressive symptoms	0.00	-0.12 (-0.19, -0.04)***	-0.07 (-0.15, 0.01)	-0.03 (-0.11, 0.06)	-0.02 (-0.10, 0.07)
Depression diagnosis	1.00	0.90 (0.76, 1.05)	0.93 (0.78, 1.11)	0.99 (0.83, 1.20)	1.00 (0.82, 1.21)
Anxiety symptoms	0.00	-0.14 (-0.21, -0.06)***	-0.07 (-0.15, 0.01)	-0.02 (-0.11, 0.06)	-0.01 (-0.09, 0.08)
Anxiety diagnosis	1.00	0.97 (0.80, 1.17)	1.08 (0.88, 1.33)	1.12 (0.91, 1.39)	1.17 (0.94, 1.46)
Health Behaviors					
Binge eating	1.00	0.62 (0.31, 1.23)	0.51 (0.24, 1.05)	0.87 (0.42, 1.78)	0.69 (0.34, 1.43)
Eating disorder	1.00	0.85 (0.50, 1.43)	0.74 (0.41, 1.33)	0.89 (0.50, 1.58)	0.83 (0.46, 1.52)
Cigarette smoking	1.00	0.97 (0.87, 1.08)	0.90 (0.80, 1.02)	0.98 (0.87, 1.11)	0.93 (0.82, 1.06)
Frequent binge drinking	1.00	0.93 (0.84, 1.03)	0.90 (0.80, 1.01)	0.98 (0.88, 1.11)	0.95 (0.84, 1.08)
Marijuana use	1.00	0.85 (0.76, 0.96)**	0.84 (0.74, 0.96)*	0.86 (0.75, 0.98)*	0.85 (0.74, 0.98)*
Any other illicit drug use	1.00	0.86 (0.69, 1.08)	0.90 (0.70, 1.16)	0.80 (0.62, 1.04)	0.84 (0.64, 1.10)
Prescription drug misuse	1.00	0.90 (0.74, 1.08)	0.91 (0.74, 1.12)	0.93 (0.74, 1.16)	0.93 (0.74, 1.17)

	Divine Forgiveness (always/almost always vs. never/seldom)			
	Never/Seldom Ref	Divine forgiveness	Divine forgiveness + Forgiveness of others	Divine forgiveness + Self-forgiveness
Sexually transmitted infections	1.00	1.14 (0.94, 1.38)	1.18 (0.94, 1.48)	1.21 (0.97, 1.52)
Routine (preventive) physical exam	1.00	1.02 (0.96, 1.09)	1.03 (0.96, 1.11)	0.99 (0.92, 1.07)
Short sleep duration	1.00	0.99 (0.86, 1.15)	0.98 (0.83, 1.15)	1.13 (0.96, 1.33)
Volunteering/civic engagement				
Contributed time to community	0.00	-0.01 (-0.09, 0.06)	-0.06 (-0.15, 0.02)	-0.05 (-0.13, 0.04)
Contributed time to charity	0.00	-0.04 (-0.11, 0.03)	-0.11 (-0.19, -0.03)**	-0.07 (-0.16, 0.01)**
Contributed time to places of worship	0.00	0.44 (0.38, 0.50)***	0.35 (0.28, 0.42)***	0.39 (0.32, 0.46)***
Voted in the 2008 President election	1.00	0.97 (0.94, 1.00)	0.96 (0.93, 0.99)*	0.95 (0.91, 0.98)**

OR, odds ratio; RR, risk ratio; CI, confidence interval.

* p<0.05 before Bonferroni correction;

** p<0.01 before Bonferroni correction;

*** p<0.005 after Bonferroni correction (the p value cutoff for Bonferroni correction=0.05/25 outcomes=0.002)

^aThe full analytic sample was restricted to those who had valid data on self-forgiveness, forgiveness of others and divine forgiveness separately (all forgiveness measures were assessed in the 2007 questionnaire wave). The actual sample size for each analysis varies depending on the number of missing values on each outcome (assessed in the 2010 or 2013 questionnaire wave) under investigation. Missing data on the covariates were imputed from previous questionnaire years; if no such data were available, missing were imputed with the mean values (continuous variables) or values of the largest category (categorical variables) of the non-missing data.

^bA set of generalized estimating equation models were used to estimate OR (binomial distribution, rare outcome defined as the prevalence<10%), RR (Poisson distribution, non-rare event defined as prevalence>=10%), or β (continuous outcomes were all standardized at mean=0, standard deviation=1; the continuous outcomes were all indented), adjusting for clustering by sibling status. If the reference value is "0", it indicates the effect estimate is β ; if the reference value is "1", it indicates the effect estimate is either RR or OR. All models controlled for participants' age, race, sex, area of residence, their mother's report of SES (subjective SES, household income, census tract college education rate, and census tract median income), participants' prior religious service attendance, prior maternal attachment, prior values of the outcome variables (prior depressive symptoms, prior binge eating, prior overweight/obesity, prior smoking, prior drinking, prior marijuana use, prior use of other illicit drugs, prior prescription drug misuse, prior history of sexually transmitted infections, prior routine physical exam, prior frequency of volunteering, prior voting registration status).

Table 5.

Robustness to unmeasured confounding (E-values) for assessing the causal associations between forgiveness (always/almost always vs. never/seldom) and health and well-being.

	Forgiveness of others		Self-forgiveness		Divine forgiveness	
	For effect estimate ^a	For CI limit ^b	For effect estimate ^a	For CI limit ^b	For effect estimate ^a	For CI limit ^b
Life satisfaction	1.77	1.56	1.93	1.77	1.82	1.61
Positive affect	2.04	1.83	2.15	1.99	1.90	1.69
Self-esteem	1.69	1.53	2.18	2.01	1.90	1.69
Emotional processing	1.93	1.72	2.01	1.80	1.77	1.56
Emotional expression	1.77	1.56	2.07	1.91	1.82	1.61
Number of physical health problems	1.11	1.00	1.00	1.00	1.11	1.00
Overweight/obesity	1.21	1.00	1.37	1.00	1.40	1.00
Depressive symptoms	1.53	1.36	1.61	1.45	1.47	1.24
Depression diagnosis	1.39	1.00	1.60	1.00	1.46	1.00
Anxiety symptoms	1.64	1.48	1.74	1.59	1.53	1.31
Anxiety diagnosis	1.74	1.11	1.77	1.21	1.21	1.00
Binge eating	1.25	1.00	3.26	1.00	2.61	1.00
Eating disorder	1.57	1.00	2.17	1.00	1.63	1.00
Cigarette smoking	1.59	1.72	1.21	1.00	1.21	1.00
Frequent binge drinking	1.00	1.00	1.50	1.21	1.36	1.00
Marijuana use	1.11	1.00	1.36	1.00	1.63	1.25
Any other illicit drug use	1.29	1.00	1.37	1.00	1.60	1.00
Prescription drug misuse	1.63	1.00	1.39	1.00	1.46	1.00
Sexually transmitted infections	1.25	1.00	1.53	1.00	1.54	1.00
Routine/preventive physical exam	1.00	1.00	1.28	1.00	1.16	1.00
Short sleep duration	1.16	1.00	1.77	1.39	1.11	1.00
Contributed time to community	1.30	1.00	1.00	1.00	1.11	1.00
Contributed time to charity	1.45	1.20	1.20	1.00	1.23	1.00
Contributed time to places of worship	2.12	1.96	1.93	1.77	2.35	2.18
Voted in the 08 Presidential election	1.11	1.00	1.16	1.00	1.21	1.00

^aThe E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to fully explain away the observed associations of forgiveness (always/almost always vs. never or seldom) with various outcomes as shown in Table 2.

^bThe E-values for the limit of the 95% confidence interval (CI) closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to shift the confidence interval to include the null value.