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Is Forgiveness a Public Health Issue?

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Abstract. Recent empirical research has shown that forgiveness of others is associated with better mental, and possibly also physical, health. The paper will briefly consider the concept of forgiveness itself, review the evidence relating forgiveness and health, discuss forgiveness interventions and recently developed workbook interventions, touch on issues concerning the morality of forgiveness, and conclude with the consideration of whether, given the links between forgiveness and health and the availability of forgiveness interventions, forgiveness is an issue that ought to be addressed within public health.

Recent research has shown that forgiveness of others is associated with better mental, and possibly also physical, health (1-5). In what follows I will briefly consider the concept of forgiveness itself, review the evidence relating forgiveness and health, discuss forgiveness interventions and recently developed workbook interventions, touch on issues concerning the morality of forgiveness, and conclude with the consideration of, given the links between forgiveness and health and the availability of forgiveness interventions, whether forgiveness is an issue that ought to be addressed within public health.

Concept of Forgiveness

Forgiveness itself is generally understood as a victim's replacing ill-will towards the wrongdoer with good-will, or as the reducing negative thoughts, emotions, and behaviors towards the offender and replacing these with positive thoughts, emotions and behaviors (1-3). For example, forgiveness of someone who has insulted you may involve replacing a desire for that person to be dismissed from work, with a desire instead that the person change or reform. Distinctions are sometimes drawn between "decisional forgiveness," the behavioral intention to forgo revenge and to treat the offender as a person of value, and "emotional forgiveness," the replacement of negative unforgiving emotions with positive other-centered emotions, typically with the former preceding the latter (2).

Forgiveness is often distinguished as being different from condoning, reconciling, forgetting, forbearing, justifying, not demanding justice, and excusing (2,3,6,7). For example, after the 2015 shooting massacre at Emmanuel African Methodist Episcopal Church in South Carolina, relatives of those who were slain by Dylann Roof told him that they forgave him and were praying for him, while also expressing the extraordinary suffering he had caused. Such forgiveness did not mean foregoing legal proceedings, nor did it ignore what had taken place, but it was a movement of good-will of the members of the church and an expression of hope that he would repent, change, and realize the wrong he had done.

Evidence on Forgiveness and Health

Both observational studies using longitudinal analyses, and also randomized trials of forgiveness interventions, provide evidence for a causal link with health (1,4,5). Observational studies suggest that forgiveness is associated with lower levels of depression, anxiety, and hostility; reduced nicotine dependence and substance abuse; higher positive emotion; higher satisfaction with life; higher social support; and fewer self-reported health symptoms (1). The mechanisms are generally thought to be beneficial emotion regulation, with forgiveness being an alternative to maladaptive psychological responses like rumination and suppression. Most forgiveness research has been carried out with cross-sectional data where forgiveness and health are measured at the same time, making it difficult to assess causality, and to assess whether forgiveness affects health or whether it might be that health affects forgiveness.

There are however, a few longitudinal studies that have collected measures of forgiveness and health over time (1) so as to be able to look at whether changes in health precede or follow forgiveness. In our own research at the Harvard T.H. Chan School of Public Health, we have used data over several years on approximately six thousand young adults to examine these

questions (see Appendix paper). We found evidence that forgiveness of others was associated with better psychological well-being including higher life satisfaction, higher positive affect, and higher self-esteem as well as fewer depression and anxiety symptoms three years later, even after control for baseline physical and mental health. Similar associations also were found between having forgiven oneself, and having a sense of being forgiven by God, with psychological well-being and with mental health. However, we found relatively little evidence for an effect of forgiveness on physical health. The sample employed in this study was, however, relatively young and so it is possible that physical health issues were fairly uncommon overall, and that the effects of forgiveness on physical health may only emerge later in life.

Even stronger evidence for an effect of forgiveness on mental health comes from randomized trials of forgiveness interventions. Numerous forgiveness interventions have been developed and evaluated in randomized trials. A recent meta-analysis of 54 intervention studies suggested a fairly sizable average effect of these interventions on increasing forgiveness (4). The meta-analysis also found evidence for an effect of the forgiveness interventions on decreasing depression and anxiety, and on increasing hope. While the effects of forgiveness on physical health are not yet entirely clear, the effects on mental health are, from these randomized trials, now well established.

Forgiveness Interventions

Two prominent intervention classes are based on specific models of forgiveness including Enright's Process Model and Worthington's REACH Model. In Enright's Process Model (3), treatment takes place over twenty steps organized into four phases: uncovering negative feelings about the offense, deciding to pursue forgiveness for a specific instance, working towards understanding the offending person, and discovery of unanticipated positive outcomes and empathy for the forgiven person. Interventions using this model have been shown to be effective with groups as diverse as adult incest survivors, parents who have adopted special needs children, and inpatients struggling with alcohol and drug addiction. In Worthington's REACH model (2), each letter of "REACH" represents a component of the process: *Recall* the hurt one has experienced and the emotions associated with it; *Empathize* with the offender and take the other's perspective in considering reasons for action (without condoning the action or invalidating one's feelings); *Altruistic* gesture of recalling one's own shortcomings and realizing others have offered forgiveness; *Commitment* to forgive publicly; and *Hold* onto or maintain the forgiveness through times of uncertainty or through the returning of anger and bitterness.

Workbook Interventions

Although most of the forgiveness interventions require a trained professional, there is some preliminary evidence from a small randomized trial that even workbook forgiveness interventions, that can be done on one's own, are effective in bringing about forgiveness and perhaps in alleviating depression (Harper et at., 2014). Such workbooks are freely available online (http://www.evworthington-forgiveness.com/diy-workbooks). More research is needed, but if these workbook resources prove to be effective, the potential for outreach and promotion of both forgiveness and mental health, may be substantial and could have profound public health implications.

Morality of Forgiveness

Questions are sometimes raised as to when forgiveness is itself morally appropriate. In considering this question, it is again important to keep in mind that forgiveness is generally distinguished from condoning, reconciling, forgetting, forbearing, justifying, not demanding justice, and excusing (2,3,6,7). One can desire the good of the other without excusing or forgetting the wrongful action, or while still pursuing a just outcome.

For example, in 2016, a twenty-year old boy, while drunk, vandalized a mosque in Fort Smith, Arkansas. He subsequently asked for and received mercy and forgiveness from the mosque members (nyti.ms/2xlglFn). His actions were not justified, or excused, but the mosque members made clear that they forgave him and did not want to ruin his life. The case was nevertheless treated as a felony and bigotry by the courts even though the mosque members had asked for a lenient sentence.

With these distinctions in mind, arguments have been put forward by Margaret Holmgren that, provided the victim does not deny the wrong that was done and the implications of this and feelings about it, forgiveness, as the replacement of ill-will by compassion and good will for the offender, can take place; and that, moreover, provided these conditions are met, forgiveness is always appropriate and can take place regardless of whether the wrongdoer repents or asks for forgiveness (6). Forgiveness is again different from reconciliation.

In many theological and moral understandings of character and social relationships, forgiveness is of course also a good in and of itself. It is a form of love or goodwill toward the other (7). Provided denial of the wrongdoing and feelings associated with it are avoided, forgiveness allows for retaining self-respect, but also respects the wrong-doer as a moral agent who has failed; the perpetrator's perspective, even if confused, is acknowledged without the victim necessarily having responsibility for changing it. Forgiveness can free the victim from the past, does not make the victim dependent on the wrongdoer, and further promotes love, compassion, acceptance, and harmony in human relations. Such also seemed to be the case in the Fort Smith community with the mosque vandalism incident.

Such genuine forgiveness Holgrem argues, also respects morality because it acknowledges a wrong, it separates the "sin" and the "sinner", and it gives the wrongdoer space to change (6). Because of these things, forgiveness, it is argued, is thus not only compatible with respect for oneself, morality, and the wrongdoer as a moral agent, but it is, in fact, required by these things. This has potentially important implications as well in thinking about forgiveness at the population level as I will discuss below.

Care must of course be taken, however, not to confuse forgiveness with a restored relationship. This could be particularly problematic in contexts in which, if forgiveness is confused with restored relationship, this might facilitate dynamics of prolonged intimate partner violence (7). In other settings, however, forgiveness may be appropriate and desired but difficult to achieve and in these cases the forgiveness interventions may be of benefit.

Implications

If it is the case that forgiveness is strongly related to mental health, and possibly physical health as well, that the experience of being wronged is common, and that even do-it-yourself workbook interventions are available and effective, then one might make the case that forgiveness is a public health issue. To not address forgiveness is to leave many people trapped in resentment, in negative feelings, in rumination on the past, and in poorer health. If forgiveness, provided it is carried out in an appropriate manner, is always morally permissible, and perhaps even morally required, then large scale efforts to promote forgiveness on a national and international scales may be reasonable, important, and powerful. The evidence strongly suggests that forgiveness promotes mental health and possibly physical health as well. In addition, in many theological and moral understandings, forgiveness further promotes health in the broader sense of wholeness of the person: in growth of character, in spiritual well-being, and in restoration, when appropriate, of relationships.

With regard to promoting forgiveness, the research literature provides evidence that forgiveness can be facilitated at the individual-, couple-, or group- levels by various forgiveness interventions (2-5). These could be used with greater frequency. Large scale randomized trials to definitively establish the efficacy of forgiveness workbook intervention might be especially valuable given the potential for the easy dissemination and outreach of such workbook interventions. Thought might also be given as to whether it might be possible, using such workbook interventions, to cultivate forgiveness on national and international scale.

From a societal perspective, public health impact of an exposure or intervention is often assessed as a function of (i) how common the exposure or experience is and (ii) how large its effects are. It is both the case that being wronged is a common experience, and that the effects of forgiveness itself on health are substantial. On these grounds forgiveness should perhaps be viewed as a phenomenon that is not only of moral, theological, and relational significance, but of public health import as well.

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Appendix Paper: Religiously or Spiritually-Motivated Forgiveness and Health and Well-Being in Later Life: An Outcome-wide Analysis

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- Psychological Sciences: 2,000 words max for intro and discussion, footnotes, acknowledgements and appendices, and other parts do not count towards the word limit. The current version of this paper has 2,320 words for intro and discussion.
- Developmental Psychology: 4,000 words (typically for a single empirical study) or 8,000 words (more extended studies), including abstract, text and tables.

INTRODUCTION

Major world religions consider forgiveness as an important virtue, and seek to promote forgiveness as a positive approach to resolve interpersonal conflicts and enhance well-being.[1] While there is not a standard definition of forgiveness given its complex nature, forgiveness has sometimes been referred to as "the overcoming of negative affect and judgement toward the offender, not by denying the right to such affect and judgement, but by endeavoring to view the offender with compassion, benevolence, and love while recognizing that he or she has abandoned the right to them".[2] Or more succinctly we might say that forgiveness is the replacing of ill-will towards the offender with good-will. Forgiveness can involve different subjects and objects. One might forgive other individuals of the harm or wrong they have done ("forgiveness of other"); one might forgive oneself in the release of guilt and negative affect associated with one's own past wrongdoings ("self-forgiveness"); one might have the perception that one's own wrongdoing has been forgiven by God ("divine forgiveness").[3, 4]

Religious faith may help one to forgive, as forgiveness is central to the teaching of many of the major religious traditions.[1] Forgiveness has, in fact, been hypothesized as one potential pathway linking religiousness/spirituality to health and well-being.[4] In Jewish and Christian beliefs, forgiveness of others is to imitate divine forgiveness: if somoneone 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.[2, 5] Forgiveness, in turn, can potentially lead to a sense of peace for both the forgiver and the one forgiven.[2] Although forgiveness has more often been considered in religious contexts, forgiveness can of course also be important and occur outside the context of religion.[6, 7]

In addition to the theological and philosophical reflection on forgiveneness, forgiveness has begun to receive increasing attention in the scientific literature across multiple disciplines such as psychology and public health.[3] Forgiveness has, for instance, been integrated into studies of positive psychological assets that lead to better health.[8] An Interdisciplinary Conceptual Model[3] has been proposed to help understand the relationship between forgiveness and health. The model posits three major determinants of forgiveness including religiousness, personality, and age. It also suggests five major pathways leading from forgiveness to health including decreased negative experience (e.g., anger, guilt, revenge), fewer risky health behaviors (e.g., substance use, risky sexual behaviors), increased positive experience (e.g., love, practice of virtue), improved social relationships (e.g., social support, relationship quality), and enhanced spiritual well-being (e.g., spirituality, peace). These mechanisms, in turn, lead to reduced physiological risk factors, and improved mental and physical health.[3] There are also other theoretical models to help understand effects of forgiveness on more specific health and well-being outcomes.[9-11]

There has been a growing body of empirical studies that offer some support for forgiveness as a protective factor for health and well-being.[3] For instance, greater forgiveness has been linked to better psychological well-being (e.g., life satisfaction, positive affect, optimism, self-esteem),[12-14] fewer negative emotions (e.g. anger, hostility, rumination, stress) and lower risk of mental illness (e.g., depression, anxiety).[4, 15, 16] There is also evidence linking greater forgiveness to better quality of life in patient populations.[17] Moreover, multiple dimensions of forgiveness have been related to lower risk of substance (e.g., smoking and alcohol) addiction and better recovery in both adolescents and adults.[11, 18, 19] An increasing number of studies have also suggested positive associations between forgiveness and physical

health. Specifically, greater forgiveness was related to higher self-rated health and fewer somatic symptoms in healthy populations [20] and healthier profiles in patient populations [17, 21, 22].

However, many of the existing empirical studies on forgiveness and health are methodologically relatively weak. Specifically, the vast majority of prior studies were cross-sectional and used small convenience samples, and thus cannot establish evidence for or the direction of causality between forgiveness and health. While there are a number of experimental intervention studies, they tend to have very short follow-up. In the observational data, there is often limited control for confounders such as religiousness or spirituality and baseline health-related characteristics. In addition, most prior research has focused on studying other-forgiveness in middle-aged or older adults, whereas the studies suggesting evidence that other aspects of forgiveness (e.g., self-forgiveness, divine forgiveness) may be related to health are more limited. These other aspects of forgiveness may also operate through different mechanisms from other-forgiveness. Moreover, prior work has only examined a limited number of outcomes in separate studies such that evidence remains scattered. Examining numerous outcomes across major domains of health and well-being simultaneously may help provide an integrative framework for understanding the effects of forgiveness.[24]

To provide additional insights into the roles of forgiveness in health and well-being, this study takes an outcome-wide analytic approach[25] to prospectively examine the association of forgiveness with a wide range of psychosocial, mental, behavioral and physical health and well-being outcomes in later life among young adults. Three aspects of forgiveness were examined including other-forgiveness, self-forgiveness and divine forgiveness. Based on prior evidence in young adults,[4] we hypothesized each aspect of forgiveness would be positively associated with psychosocial, mental, behavioral and physical health separately.

METHODS

Study Sample

This study used data from the Nurses' Health Study II (NHSII) and the Growing Up Today Study (GUTS). NHSII was initiated in 1989 when 116,430 registered nurses (aged between 25 and 42 years) were enrolled from across the U.S. and completed questionnaires about their health. In 1996, NHSII participants with children aged between 9 and 14 years were invited to have their children participate in another cohort GUTS. Around 16,882 male and female GUTS participants completed questionnaires about their health. NHSII and GUTS participants have been followed up annually or biennially through mail or web-based questionnaires.[26, 27]

The analytic samples for the present study were drawn from those who participated in the GUTS 2007 survey (n=9,860). Participants with missing data on the exposure variable were excluded (n=1,246 on forgiveness of others, n=1,231 on self-forgiveness, n=718 on divine forgiveness; those who reported not believing in God or a higher power n=1,550 were also removed from the analyses on divine forgiveness). Participants who had missing data on the outcome variable under investigation (n ranged from 1,631 to 2,675 on forgiveness of others, n ranged from 1,635 to 2,679 on self-forgiveness, n ranged from 1,470 to 2,346 on divine forgiveness, depending on outcome) were also removed from each analysis. Missing data on the covariates (n ranged from 0 to 1,255 on forgiveness of others, n ranged from 0 to 1,259 on self-forgiveness, n ranged from 0 to 1,308 on divine forgiveness) were imputed from 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 the non-missing data were used to impute missing information on the covariates. 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.

Measures

Table S1 shows the timeline of measurements of all variables. The exposure variables (forgiveness of others, self-forgiveness, divine forgiveness) were all assessed in the GUTS 2007 questionnaire wave. Since 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 questionnaire 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).

Exposures

Forgiveness of others. Religiously or Spiritually-motivated forgiveness of others (GUTS, 2007) was measured with one item from the validated Brief Multidimensional Measure of Religiousness/Spirituality Scale [28,29]: "Because of my spiritual or religious beliefs, I have forgiven those who hurt me". Response options ranged from 1(always or almost always) to 4 (never). Responses were reverse coded so and the bottom two categories were collapsed to reduce data sparsity (1: never and 2: seldom). Forgiveness of others was used as a three-level categorical variable (1: never or seldom, 2: often, 3: always/almost always).

Self-forgiveness. Religiously or Spiritually-motivated self-forgiveness (GUTS, 2007) was assessed with one question from the validated Brief Multidimensional Measure of Religiousness/Spirituality Scale[28, 29]: "Because of my spiritual or religious beliefs, I have forgiven myself for things that I have done wrong". Response categories ranged from 1(always or almost always) to 4 (never). Responses were reverse coded and the bottom two categories were collapsed to reduce data sparsity (1: never and 2: seldom). Self-forgiveness was used as a three-level categorical variable (1: never or seldom, 2: often, 3: always/almost always).

Divine forgiveness. Religiously or Spiritually-motivated divine forgiveness (GUTS, 2007) was assessed with one question from the validated Brief Multidimensional Measure of Religiousness/Spirituality Scale[28, 29]: "Because of my spiritual or religious beliefs, I know that God or a higher power forgives me". Response categories ranged from 1(always or almost always) to 5 (Do not believe in God or a higher power). Participants who reported not believing in God or a higher power were removed from analyses on divine forgiveness. Responses were reverse coded and the bottom two categories were collapsed to reduce data sparsity (1: never and 2: seldom). Divine forgiveness was used as a three-level categorical variable (1: never or seldom, 2: often, 3: always/almost always).

Outcomes

A wide range of psychological (life satisfaction, positive affect, self-esteem, emotional processing, emotional expression), physical (number of physical health problems: cancer, diabetes, high cholesterol, high blood pressure and asthma, overweight/obesity), mental (depression, anxiety) and behavioral health outcomes (overeating, eating disorder, cigarette smoking, frequent binge drinking, marijuana use, other illicit drug use, prescription drug misuse, sexually transmitted infections (STIs)) were examined. Table S2 summarized measurement of all outcomes variables. See the supplementary materials for details on each measurement.

Covariates

Sociodemographic characteristics

Demographic covariates include participant age (in years), sex (male, female), race (white, non-white) and geographic region (West, Midwest, South, Northeastern) (GUTS 2007). SES reported by the mothers include subjective social standing in the US and in the community assessed with validated scales[30] (both on a 10 point scale), and pretax household income (1: <$50,000, 2: $50,000-$74,999, 3: $75,000-$99,999, 4: ≥$100,000). We also accounted for census-tract level SES variables (NHSII 2001, geocoded data) including the college education rate (used as a continuous variable) and median income (1: <$50,000, 2: $50,000-$74,999, 3: $75,000-$99,999, 4: ≥$100,000) in the census tracts.

Prior values of the outcome variables

To reduce the possibility of reverse causation, prior values of the outcome variables were adjusted for whenever data were available. Specifically, adjustment was made for participants' prior weight status (GUTS 2005), prior depressive symptoms (GUTS 2007), prior smoking (GUTS 2005), prior frequent binge drinking (GUTS 2005), prior marijuana use (GUTS 2005), prior use of other illicit drugs than marijuana (GUTS 2007), prior prescription drug misuse (GUTS 2007), and prior history of STIs (GUTS 2005). Prior frequency of religious service attendance (never, less than once/week, at least once/week, GUTS 2005) was also adjusted for.

Statistical Analyses

All statistical analyses were performed in SAS 9.4. The distribution of participant characteristics were examined by levels of self-forgiveness, other-forgiveness and divine forgiveness and differences assessed with the analysis of variance and the chi-square tests.

The primary analyses prospectively examined the association between forgiveness and a wide range of health and well-being outcomes in later life. Specifically, generalized estimating equations (GEE) were first used to regress each health and well-being outcome on forgiveness of others in separate models, adjusting for clustering by sibling status, and for covariates. Continuous outcomes were standardized (Mean=0, SD=1), so that effect sizes are reported in terms of standard deviations of the outcomes. Bonferroni correction was used to account for multiple testing. All models controlled for sociodemographic factors (participants' age, sex, race, geographic region, subjective SES reported by the mothers and census-tract level SES), prior religious service attendance frequency, as well as prior values of the outcome variables wherever data were available (participants' prior weight status, depressive symptoms, smoking, frequent binge drinking, marijuana use, other drug use, prescription drug misuses, and history of STIs). Next, the primary sets of models were reanalyzed with self-forgiveness and divine forgiveness as the exposure variables separately. As sensitivity analyses, we also reanalyzed the primary sets of models on all three forgiveness measures, stratified by prior religious attendance frequency.

We also performed exploratory analyses to examine whether divine forgiveness predicted forgiveness of others and self-forgiveness. Specifically, we regressed the top tertile of the forgiveness of others score and the top tertile of the self-forgiveness score on divine forgiveness separately, adjusting for all covariates. We also undertook exploratory analyses to assess the extent to which the associations between divine forgiveness and various outcomes, were mediated through forgiveness of others and self-forgiveness by including forgiveness of others and self-forgiveness with divine forgiveness both separately and simultaneously in the models, and assessing whether the associations between divine forgiveness and various outcomes were attenuated.

To assess robustness of the observed associations to unmeasured confounding [31, 32], sensitivity analyses were performed to assess the extent to which an unmeasured confounder would need to be associated with both the forgiveness exposure and each outcome to explain

away the observed association. For this we calculated E-values[32], 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

In the full analytic sample for self-forgiveness, participants were mostly white (93.26%), female (64.10%), and had high family SES (e.g., 41.76% of the mothers reported annual pretax household income as greater than $100, 000 in the NHSII 2001 questionnaire wave), with the mean age of 22.97 years (SD=1.71) at study baseline (GUTS 2007)(Table S3). Around 25% of the participants reported the highest level of self-forgiveness (always/almost always). The sample for analyses on forgiveness of others and divine forgiveness had similar characteristics.

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

Forgiveness, and health and well-being in later life

All three forgiveness measures were positively associated with psychological well-being and mental health in a similar pattern (Tables 2, S4, S5 and S6). Specifically, there were dose-response associations between greater forgiveness (including all three forgiveness measures) and all psychological well-being outcomes (e.g., life satisfaction, positive affect, self-esteem). Each forgiveness measure was also inversely associated with depressive and anxiety symptoms in a monotonic fashion. The effects of self-forgiveness were stronger than that of other-forgiveness and divine forgiveness.

However, there was little evidence of associations between any forgiveness measure and physical health or behavioral health outcomes (Tables 2, S4, S5 and S6). Specifically, 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 associated with lower risk of frequent binge drinking, and the top vs. bottom level of divine forgiveness was possibly related to lower risk of marijuana use, these associations did not remain statistically significant $p<.05$ after correction for multiple testing. The associations of forgiveness with other physical or behavioral health outcomes were mostly close to null.

In sensitivity analyses stratified by religious service attendance, the associations of all three forgiveness measures (top vs. bottom category) with psychological well-being held in almost all strata of religious attendance, with the exception that the effects of divine forgiveness did not reach statistical significance among participants who attendance religious services once/week or more (Tables S7-S9). In comparison, the associations with mental health outcomes were less consistent across categories of religious attendance frequency. Specifically, forgiveness of others was possibly inversely associated with depressive symptoms only in those who attended religious services, whereas the inverse associations with anxiety symptoms or diagnosis were evident in almost all strata of religious attendance; there is evidence that self-forgiveness is possibly related to fewer depressive or anxiety symptoms in all strata of religious attendance; whereas divine forgiveness is possibly associated with fewer depressive symptoms only among those who never attended religious services, and with fewer anxiety symptoms or anxiety disorders only in those who did attend religious services (Tables S7-S9).

Exploratory mediation analyses of divine forgiveness by forgiveness of others and self-forgiveness

Divine forgiveness was strongly positively associated with both forgiveness of others and self-forgiveness in a dose-response pattern even after covariate control (Table 4). The top vs. bottom level of divine forgiveness was associated with substantially higher likelihood of being in the top tertile of forgiveness of others (RR=6.33, 95% CI: 5.14, 7.81) and self-forgiveness (RR=10.58, 95% CI: 8.16, 13.72), adjusting for covariates.

Adding forgiveness of others and self-forgiveness to the models of divine forgiveness with various psychological well-being and mental health outcomes attenuated the associations (Table 5). Specifically, when forgiveness of others or self-forgiveness were included in models with and divine forgiveness, the association of divine forgiveness with psychological well-being outcomes 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, with the possible exception of life satisfaction and emotional expression.

Sensitivity analyses for unmeasured confounding

We calculated E-values[28] for the associations of all three forgiveness measures with various outcomes (Table 3), to estimate robustness of the observed 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 observed associations of forgiveness with psychosocial well-being and mental health outcomes were likely to be robust to unmeasured confounding. For example, in Table 3, to explain away the observed association between self-forgiveness and positive affect (β=0.40, 95% CI: 0.34, 0.47, as shown in Table 2), an unmeasured confounder that was associated with both self-forgiveness and positive affect by 2.23-fold each on the risk ratio scale, above and beyond the measured covariates, would suffice, but weaker confounding would not; and by 2.07-fold each to shift the lower confidence limit for this estimate to include the null value 0. As indicated in Table 3, similar strong unmeasured confounding between forgiveness and the psychological well-being and mental health outcomes would be needed to explain away the observed associations, suggesting that these associations are somewhat robust to unmeasured confounding.

DISCUSSION

Over recent years there has been growing interest in studying protective factors that enhance health and well-being, beyond the traditional approach that focuses on reducing risk factors and illness.[33, 34] 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 [24]. Once risk factors become established, it may be difficult to restore complete health and well-being. A more efficient and cost-effective to promote and maintain health and well-being may be to begin in early life to form health and psychological assets.[35] The present study adds to prior evidence suggesting forgiveness may be one of such psychological asset that could contribute to such an approach to prevention across various health and well-being outcomes.[3]

Congruent with prior evidence (predominantly cross-sectional studies), this study suggests higher levels of multiple forms of forgiveness (including self-, other- and divine forgiveness) are each associated with greater psychological well-being and lower risk of mental distress over a three -year follow-up period in young adults.[3] For example, consistent with one

prior study that used a national probability sample (N=709 young adults, cross-sectional),[4] the present study found that greater forgiveness is associated with substantially higher life satisfaction and fewer depressive/anxiety symptoms in later life, controlling for religious attendance. Effect sizes were larger compared to prior findings, which might be attributed to the longitudinal design of this study and longer follow-up (e.g., suggesting 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 compared to prior work. There are several possible explanations to help understand the contrary findings. For instance, the majority of prior work assessed physical health with self-rated health, self-reported somatic symptoms or physiological markers, whereas this study examined disease outcomes (e.g., cancer, diabetes) which may take a longer time to develop and become discernible, especially in a sample of young adults.[20, 36] As another example, prior work on forgiveness and substance use was mostly conducted in tobacco or alcohol addicts to examine effects of interventions on forgiveness and recovery from addiction.[11, 18, 19] 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 (use in healthy populations vs. recovery in addicts). The present study population also consisted entirely of children of nurses which may result in much lower rates of substance abuse. In addition, this study more rigorously controlled for confounders (e.g., religious attendance, prior values of the outcome variables), which may also account for the weaker effects of forgiveness observed in this work.

This study also adds to prior evidence that self-forgiveness may have stronger associations with a number of health outcomes in young adults compared to other-forgiveness and divine forgiveness.[4, 37] To help understand the patterns, prior researchers hypothesized that self-forgiveness may involve different emotional and cognitive processes from other-forgiveness.[37, 38] For instance, there is both theoretical and empirical evidence suggesting self-forgiveness is associated with the resolution of emotions of guilt, shame and anxiety, whereas other-forgiveness is related to the resolution of anger. Moreover some individuals may use harsher criteria in judging their own behaviors but be more sympathetic to others' failings, even when the offenses are identical. The absence of self-forgiveness may be also more distressing psychologically, demotivating self-care and health maintenance, compared to the lack of other-forgiveness.[37, 38] Self-forgiveness may be, therefore, be more strongly associated with psychological well-being. Interestingly, however, divine forgiveness is an extremely strong predictor of self-forgiveness and may be the most important pathway to it as our exploratory analysis seemed to suggest. Prior work has seldom examined divine forgiveness in relation to health. The exploratory mediation analyses here suggested that the effects of divine forgiveness on a number of psychological and mental health outcomes may be mediated through self-forgiveness and other-forgiveness. This result is only exploratory, however, as all forgiveness measures were assessed at the same time; it thus needs to be replicated in more rigorous analyses that have temporal separation of the forgiveness measures.

This study extends prior work in a number of important ways. First, it took an outcome-wide analytic approach that provides a broad picture of forgiveness in relation to a wide array of health and well-being outcomes simultaneously in a large sample, and helps to provide some empirical evidence for the Interdisciplinary Conceptual Model.[3] Second, to help fulfill prior calls for prospective studies on forgiveness and health,[3, 4] this longitudinal study with up to 3-

year follow-up helps to establish temporality and facilitates our understanding from a lifecourse perspective. Next, the present study rigorously controls for a number of major confounders such as religious attendance which has been shown to be related to a number of health and well-being outcomes, but has seldom been adjusted for in prior work on forgiveness and health.[3, 4] Since the dynamics between forgiveness and health are likely reciprocal,[39] this study is also one of the first that controls for prior values of the outcome variables, which may substantially reduce the possibility of reverse causation. It also performs sensitivity analyses to assess robustness of the observed associations to unmeasured confounding, which helps to provide further evidence for assessing causality. In addition, this study is also one of the few that examines the roles of multiple aspects of forgiveness in relation to health, and explores whether effects of divine forgiveness may be mediated through self-forgiveness and other-forgiveness.

This study is, however, subject to a number of limitations. First, while there has been no standard measure of forgiveness, this study assessed forgiveness with single-item questions which may not capture a full picture of the concept given its complex nature. These questions also queried about religiously or spiritually-motivated forgiveness specifically, which may have limited our understanding of forgiveness in 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, there was prior evidence suggesting 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.[39] There is also evidence suggesting not all aspects of forgiveness are protective for health such as proactive forgiveness,[4] which may need to be further investigated in future studies. Next, both forgiveness and the health outcomes were self-reported, which may be subject to social desirability bias and common methods bias. As a further limitation, participants in the GUTS cohort were predominantly White and their mothers all worked as nurses. Findings of this study, therefore, may not be applicable to other populations.

Prior studies have suggested that forgiveness is potentially modifiable. For instance, there has been evidence from randomized controlled trials indicating that forgiveness could be improved by theory-based interventions using methods of confrontation, release of anger and trying to understand the offender.[40] Such programs have also been linked to reduced negative emotions (e.g., less anger, anxiety),[40] improved psychological well-being (e.g., greater self-esteem),[40] better recovery from substance addiction (e.g., lower risk of drug use, higher self-efficacy in retaining from drinking),[41, 42] as well as healthier profiles in patient populations (e.g., less self-reported pain, greater adherence to treatment, fewer physical illness symptoms).[43-45] Such experimental studies, however, have often been conducted in small-samples of patient populations with short follow-up period, and the results remain rather mixed for physical health outcomes in particular.[3] More empirical studies on forgiveness and health are, therefore, needed to help understand whether/how different aspects of forgiveness are related to various health and well-being outcomes, so to better inform more targeted interventions.

Forgiveness represents one potential target for moral education, counselling and interventions to help maintain and improve individual health, family well-being and social harmony.[3] Forgiveness may also 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. While potential conflicts between forgiveness and other moral principles such as justice may need to be considered [2], forgiveness understood simply as the replacing of ill-will towards an offender with good-will need not be incompatible with seeking a just outcome. Further research

on forgiveness across disciplines is needed to understand its role in health and well-being at multiple levels, and to better inform more targeted and effective interventions and programs.

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Table 1. Distribution of participant characteristics by tertiles of self-forgiveness (N=8,629)

	Self-forgiveness			
	Never/Seldom (n=2,678)	Often (n=3,829)	Always/almost always (n=2,122)	*p*-value
Sociodemographic factors				
Age in years (range: 20-28, the 2007 wave), mean (SD)	22.92 (1.70)	23.02 (1.71)	22.95 (1.72)	.08
Gender (boy), %	37.22	39.67	23.11	<.001
Race (white), %	30.98	44.42	24.61	0.96
Geographic region				<.001
West, %	34.30	39.35	26.35	
Midwest, %	27.37	46.16	26.47	
South, %	24.89	47.60	27.50	
Northeast, %	36.36	43.38	20.26	
Mother's subjective SES in the US (range: 1-10), mean (SD)	7.19 (1.30)	7.13 (1.29)	7.19 (1.25)	0.15
Mother's subjective SES in the community (range: 1-10), mean (SD)	7.01 (1.57)	7.01 (1.53)	7.14 (1.54)	.009
Pretax household income				.004
<$50,000, %	28.57	44.46	26.97	
$50,000-$74,999, %	29.79	45.66	24.55	
$75,000-$99,999, %	29.85	44.71	25.44	
≥$100,000, %	34.08	43.05	22.88	
Census tract-level college education rate (range: 0% -84.71%), mean (SD)	34.74% (16.96%)	31.80% (15.98%)	30.27% (15.53%)	<.001
Census tract-level median income				<.001
<$50,000, %	26.60	45.72	27.69	
$50,000-$74,999, %	29.53	45.24	25.23	

$75,000-$99,999, %	36.35	41.97	21.68	
≥$100,000, %	39.66	41.36	18.98	
Prior health status or prior health behaviors				
Prior religious service attendance				<.001
Never, %	45.84	37.02	17.15	
Less than once/week, %	28.21	49.61	22.18	
At least once/week, %	13.30	49.09	37.61	
Prior depressive symptoms(range: 0-21), mean (SD)	6.56 (3.67)	5.62 (3.17)	4.64 (3.16)	<.001
Prior overweight or obesity, %	31.36	45.94	22.70	.11
Prior cigarette smoking, %	35.05	44.18	20.76	<.001
Prior frequent drinking, %	37.22	43.51	19.28	<.001
Prior marijuana use, %	39.21	41.42	19.37	<.001
Prior drug use other than marijuana, %	41.17	39.15	19.69	<.001
Prior prescription drug misuse, %	39.80	40.51	19.69	<.001
Prior history of STIs, %	32.97	47.20	19.83	.06

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 health and well-being in later life (N ranged from 5,246 to 6,994)

	Never/Seldom (Ref)	**Forgiveness of others** Always/almost always OR/RR/β (95% CI)	**Self-forgiveness** Always/almost always OR/RR/β (95% CI)	**Divine forgiveness** Always/almost always OR/RR/β (95% CI)
Psychological Well-being				
Life satisfaction	0.00	0.25 (0.18, 0.32)***	0.31 (0.24, 0.37)***	0.26 (0.19, 0.34)***
Positive affect	0.00	0.36 (0.29, 0.43)***	0.40 (0.34, 0.47)***	0.30 (0.23, 0.37)***
Self-esteem	0.00	0.22 (0.15, 0.29)***	0.40 (0.34, 0.47)***	0.30 (0.22, 0.37)***
Emotional processing	0.00	0.31 (0.24, 0.39)***	0.33 (0.26, 0.40)***	0.24 (0.17, 0.32)***
Emotional expression	0.00	0.24 (0.16, 0.31)***	0.35 (0.29, 0.42)***	0.27 (0.19, 0.34)***
Physical health				
Number of physical problems	0.00	0.03 (-0.04, 0.10)	0.00 (-0.07, 0.07)	-0.00 (-0.08, 0.07)
Overweight/obesity	1.00	0.97 (0.90, 1.05)	1.07 (0.99, 1.16)	1.09 (1.00, 1.18)*
Mental health				
Depressive symptoms	0.00	-0.15 (-0.21, -0.08)***	-0.18 (-0.24, -0.12)***	-0.13 (-0.20, -0.05)***
Depression diagnosis	1.00	0.91 (0.77, 1.08)	0.86 (0.73, 1.01)	0.91 (0.77, 1.06)
Anxiety symptoms	0.00	-0.18 (-0.25, -0.12)***	-0.23 (-0.29, -0.16)***	-0.14 (-0.21, -0.07)***
Anxiety diagnosis	1.00	0.83 (0.69, 1.01)	0.80 (0.67, 0.96)*	0.97 (0.81, 1.18)
Health Behaviors				
Binge eating	1.00	1.09 (0.53, 2.23)	0.54 (0.26, 1.10)	0.83 (0.42, 1.62)
Eating disorder	1.00	1.18 (0.69, 2.01)	0.71 (0.42, 1.21)	0.94 (0.55, 1.58)
Cigarette smoking	1.00	1.15 (1.03, 1.28)**	1.03 (0.93, 1.14)	0.97 (0.87, 1.08)
Frequent binge drinking	1.00	1.00 (0.90, 1.10)	0.88 (0.80, 0.97)*	0.93 (0.84, 1.02)
Marijuana use	1.00	0.98 (0.88, 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, 1.18)	1.08 (0.88, 1.31)	0.87 (0.69, 1.09)
Prescription drug misuse	1.00	0.86 (0.71, 1.04)	0.92 (0.78, 1.09)	0.92 (0.76, 1.11)
History of STIs	1.00	0.95 (0.79, 1.16)	0.87 (0.72, 1.05)	1.14 (0.94, 1.39)

Note: A sets of generalized estimating equation models were used to regress each outcome on each of the forgiveness measures separately. The full analytic sample was restricted to those who had valid data on self-forgiveness, forgiveness of others and divine forgiveness separately. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table 3. Robustness to unmeasured confounding (E-values[1]) 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	1.82	1.61	1.98	1.83	1.85	1.64
Positive affect	2.12	1.91	2.23	2.07	1.96	1.75
Self-esteem	1.74	1.59	2.23	2.02	1.96	1.75
Emotional processing	1.98	1.77	2.04	1.83	1.80	1.59
Emotional expression	1.80	1.59	2.09	1.93	1.88	1.67
Number of physical problems	1.20	1.00	1.00	1.00	1.00	1.00
Overweight/obesity	1.21	1.00	1.34	1.00	1.40	1.01
Depressive symptoms	1.56	1.39	1.64	1.48	1.50	1.27
Depression diagnosis	1.43	1.00	1.60	1.00	1.43	1.00
Anxiety symptoms	1.64	1.48	1.77	1.61	1.53	1.31
Anxiety diagnosis	1.70	1.00	1.81	1.25	1.21	1.00
Binge eating	1.40	1.00	3.11	1.00	1.70	1.00
Eating disorder	1.64	1.00	2.17	1.00	1.32	1.00
Cigarette smoking	1.57	1.21	1.21	1.00	1.21	1.37
Frequent binge drinking	1.00	1.00	1.53	1.21	1.36	1.00
Marijuana use	1.16	1.00	1.36	1.00	1.63	1.25
Any other illicit drug use	1.29	1.00	1.37	1.00	1.56	1.00
Prescription drug misuse	1.60	1.00	1.39	1.00	1.39	1.00
History of STIs	1.29	1.00	1.56	1.00	1.54	1.00

[a.] The E-values for effect estimates 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 to fully explain away the observed RR/OR/β as shown in Table 2, conditional on the measured covariates.

[b.] The E-values for the limit of the 95% confidence interval 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 to shift the confidence interval to include the null value 1, conditional on the measured covariates.

[1] VanderWeele, T. J., & Ding, P. (2017). *Sensitivity Analysis in Observational Research: Introducing the E-Value.* Ann Intern Med, 167(4), 268-274.

Table 4. 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 (0.02, 0.63)*
Always/almost always	6.33 (5.14, 7.81)***	10.58 (8.16, 13.72)***

Note: The analytic samples were restricted to those who had valid data on forgiveness of others, self-forgiveness, 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, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

The unadjusted proportion who are in the top terile 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 terile 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

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

	Divine Forgiveness (always/almost always vs. never/seldom) OR/RR/β (95% CI)				
	Never/Seldom Ref	Divine forgiveness	Divine forgiveness + Forgiveness of others	Divine forgiveness + Self-forgiveness	Divine forgiveness + Forgiveness of others + Self-forgiveness
Psychological Well-being					
Life satisfaction	0.00	0.26 (0.19, 0.34)***	0.21 (0.12, 0.29)***	0.13 (0.04, 0.22)**	0.13 (0.03, 0.22)**
Positive affect	0.00	0.30 (0.23, 0.37)***	0.19 (0.11, 0.27)***	0.12 (0.03, 0.20)**	0.08 (0.00, 0.17)
Self-esteem	0.00	0.30 (0.22, 0.37)***	0.23 (0.15, 0.32)***	0.07 (-0.01, 0.16)	0.08 (-0.01, 0.16)
Emotional processing	0.00	0.24 (0.17, 0.32)***	0.12 (0.03, 0.21)**	0.07 (-0.03, 0.16)	0.02 (-0.07, 0.12)
Emotional expression	0.00	0.27 (0.19, 0.34)***	0.20 (0.12, 0.29)***	0.10 (0.02, 0.19)*	0.10 (0.01, 0.19)*
Physical health					
Number of physical health problems	0.00	-0.00 (-0.08, 0.07)	0.00 (-0.08, 0.09)	0.01 (-0.08, 0.10)	0.01 (-0.09, 0.10)
Overweight/obesity	1.00	1.09 (1.00, 1.18)*	1.14 (1.04, 1.25)**	1.08 (0.99, 1.19)	1.12 (1.01, 1.24)*
Mental health					
Depressive symptoms	0.00	-0.13 (-0.20, -0.05)***	-0.08 (-0.16, 0.00)	-0.03 (-0.12, 0.05)	-0.02 (-0.11, 0.07)
Depression diagnosis	1.00	0.91 (0.77, 1.06)	0.94 (0.79, 1.13)	1.00 (0.83, 1.21)	1.01 (0.83, 1.23)
Anxiety symptoms	0.00	-0.14 (-0.21, -0.07)***	-0.08 (-0.16, 0.00)	-0.02 (-0.11, 0.06)	-0.01 (-0.09, 0.08)
Anxiety diagnosis	1.00	0.97 (0.81, 1.18)	1.08 (0.88, 1.32)	1.13 (0.91, 1.40)	1.17 (0.94, 1.46)
Health Behaviors					
Binge eating	1.00	0.83 (0.42, 1.62)	0.65 (0.31, 1.39)	1.21 (0.60, 2.44)	0.92 (0.44, 1.91)
Eating disorder	1.00	0.94 (0.55, 1.58)	0.80 (0.44, 1.45)	0.99 (0.56, 1.76)	0.91 (0.50, 1.68)
Cigarette smoking	1.00	0.97 (0.87, 1.08)	0.91 (0.80, 1.02)	0.99 (0.87, 1.12)	0.94 (0.82, 1.07)
Frequent binge drinking	1.00	0.93 (0.84, 1.02)	0.90 (0.80, 1.01)	0.98 (0.87, 1.11)	0.95 (0.84, 1.08)
Marijuana use	1.00	0.85 (0.76, 0.96)**	0.85 (0.74, 0.96)*	0.86 (0.75, 0.99)*	0.85 (0.74, 0.99)*
Any other illicit drug use	1.00	0.87 (0.69, 1.09)	0.91 (0.71, 1.18)	0.81 (0.62, 1.06)	0.85 (0.65, 1.12)
Prescription drug misuse	1.00	0.92 (0.76, 1.11)	0.93 (0.76, 1.15)	0.96 (0.77, 1.19)	0.95 (0.76, 1.20)

History of STIs	1.00	1.14 (0.94, 1.39)	1.18 (0.95, 1.48)	1.22 (0.97, 1.52)	1.24 (0.97, 1.57)

Note: The full analytic sample was restricted to those who had valid data on forgiveness of others, self-forgiveness and divine forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

SUPPLEMENTARY MATERIALS

Measures

Outcomes

Psychological Well-being

Life satisfaction. Life satisfaction over the past month was measured with one question from the validated Rand Mental Health Inventory [46]: "Have you felt happy, satisfied or please with your personal life?" (GUTS 2010). Response options ranged from 1: none of the time to 6: all of the time. Life satisfaction was considered as a continuous variable (mean=4.45, SD=1.00).

Positive affect. Positive affect over the past month was measured with 10 items from the validated Rand Mental Health Inventory[46] (e.g., "Have you felt calm and peaceful?") (GUTS 2010). Response categories ranged from 1 (none of the time) to 6 (all of the time). An overall score was created by summing responses across all items ($\alpha = 0.94$), ranging from 10 to 60 (mean=40.00, SD=8.68).

Self-esteem. Self-esteem was measured with the validated Rosenberg Self-esteem Scale [47, 48] which queried both positive and negative feelings towards oneself (e.g., "I feel that I have a number of good qualities", "At times I think that I am no good at all") (GUTS 2010). Response categories ranged from 1 (strongly agree) to 4 (strongly disagree). Items were reverse coded as necessary so that a higher score indicated greater self-esteem. An overall score was calculated by summing responses across all items ($\alpha = 0.90$, mean=33.78, SD=4.94, range = 10 to 40).

Emotional processing. Emotional processing was measured with the 4-item Emotional Processing Subscale from the validated Emotional Approach Coping Scale[49] (GUTS 2010). The extent to which participants seek to understand their emotions under stress were queried (e.g., "I take time to figure out what I am really feeling"). Response options ranged from 1 (not at all) to 4 (a lot). An overall score was created by summing responses across all items, with a higher score indicating greater emotional processing ($\alpha = 0.84$, mean=11.24, SD=2.76, range =4 to 16).

Emotional expression. Emotional expression was assessed with the 4-item Emotional Expression Subscale from the validated Emotional Approach Coping Scale[49] (GUTS 2010). The subscale queried the extent to which participants seek to express their emotions under stress (e.g., "I let my feelings come out freely"). Response options ranged from 1 (not at all) to 4 (a lot). An overall score was created by summing responses across all items, with a higher score indicating greater emotional expression ($\alpha = 0.91$, mean=10.69, SD=3.00, range =4 to 16).

Character/virtue

Physical Health

Number of physical health problems. Participants self-reported whether they had been told by a health care provider that they had the following conditions (yes, no) (GUTS 2010): cancer, diabetes, high cholesterol, high blood pressure and asthma. A summary score was created as the total number of reported conditions (mean=0.37, SD=0.59, range = 0 to 4).

Overweight or obese. Self-reported height (inches) and weight (pounds) were used to calculate body mass index (GUTS 2010). Overweight or obese was defined as BMI$\geq$ 25 kg/m^2. [50]

Mental Health

Depression. Depressive symptoms over the past week was assessed with the validated Center for Epidemiologic Studies Depression Scale (CES-D) (e.g., "I was bothered by things that usually don't bother me") (GUTS 2010).[51] Response categories ranged from 0 (rarely or none

of the time) to 3 (all of the time). Items were reverse scored as necessary with a higher score indicating more depressive symptoms. An overall score was created by summing responses across all items (α = 0.81, mean=7.16, SD=4.59, range =0 to 30). Participants were also asked to report whether they ever received a depression diagnosis (GUTS 2013).

Anxiety. Anxiety symptoms over the past week were assessed with nine items from the Worry/Sensitivity Subscale of the validated Revised Children's Manifest Anxiety Scale (RCMAS) (e.g., "I worry a lot of the time") (GUTS 2010). Response categories ranged from 0 (none of the time) to 5 (all of the time). Items were summed to create an overall score (α=0.93, mean=22.23, SD=8.32, range =9 to 54). Participants were also asked to report whether they ever received a diagnosis of anxiety disorder.

Behavioral Health

Binge eating. Frequency of eating a very large amount of food during the past year was queried: "In the past year, how often did you go on an eating binge?". Response categories ranged from 1 (never) to 5 (more than once a week). Those reported ever went on an eating binge were prompted to respond to a second question: "Did you feel out of control, like you couldn't stop even if you wanted to?" (yes, no). Those who reported both at least weekly episodes (4: once a week to 5: more than once a week) of eating binge and the feeling of out of control were considered as having binge eating (yes, no) (GUTS 2010).[52]

Eating disorder. Participants were asked to report whether they have ever been told by a health care provider that they had the following conditions: Anorexia, nervosa, bulimia nervosa, binge eating disorder, and other eating disorder. Those who reported any of these conditions were considered as having eating disorder diagnosis (GUTS 2013).

Cigarette smoking. A single question was used to assess cigarette smoking over the past year: "In the past 12 months, have you smoked a cigarette?" (yes, no) (GUTS 2010).

Frequent binge drinking. Binge drinking over the past year was assessed with a single question: "In the past 12 months, how many times did you drink 5 (male)/4 (female) or more alcoholic drinks over a few hours?". Categorical response options ranged from 1 (never) to 10 (37 or more times). Frequent binge drinking was defined as at least 12 episodes (7: 12 to 15 times to 10: 37 or more times) of binge drinking over the past year (GUTS 2010).[53]

Marijuana use. Marijuana use over the past 12 months was assessed with a single question: "In the past 12 months, how many times did you use marijuana?". Response categories ranged from 1 (never) to 6 (6 or more times/week). Responses were dichotomized as ever (2: once a month or less to 6: six or more times per week) and never (1: never) used marijuana over the past 12 months (GUTS 2010).

Illicit drug use other than marijuana. Use of the following illicit drugs over the past 12 months were queried: cocaine or crack, heroin, ecstasy, LSD/mushrooms or any other hallucinogen, crystal meth, or other amphetamines. Categorical response options ranged from 1 (not in the past 12 months) to 6 (16 or more times). Responses were dichotomized as never (1: not in the past 12 months) and ever use (2: 1 time to 6: 16 or more times) for each drug separately. Those who reported use of any of these drugs were considered as having illegal drug use other than marijuana over the past 12 months (GUTS 2010).

Prescription drug misuse. Use of the following drugs without a doctor's prescription over the past 12 months was queried: tranquilizers, pain killers, sleeping pills and stimulants. Categorical response options ranged from 1 (not in the past 12 months) to 6 (16 or more times). Responses were dichotomized as never (1: not in the past 12 months) and ever use (2: 1 time to 6:

16 or more times) for each drug separately. Those who reported use of any of these drugs were considered as having prescription drug misuse over the past 12 months (GUTS 2010).

Sexually transmitted infections (STIs). Participants were asked to report whether they ever received a diagnosis of chlamydia, HPV, genital warts or any STIs. Those who reported any of these diagnoses were considered as having STIs diagnosis (yes, no) (GUTS 2013).

Table S1. Timing of assessment of all variables in this study

GUTS (offspring assessment)				
	2005	2007	2010	2013
Exposures				
Forgiveness of others		√		
Self-forgiveness		√		
Divine forgiveness		√		
Outcomes				
Life satisfaction			√	
Positive affect			√	
Self-esteem			√	
Emotional processing			√	
Emotional expression			√	
Number of physical problems			√	
Overweight/obesity			√	
Depressive symptoms (past week)			√	
Anxiety symptoms (past week)			√	
Anxiety diagnosis (lifetime)				√
Depression diagnosis (lifetime)				√
Binge eating			√	
Eating disorder				√
Cigarettes smoking (past year)			√	
Frequent binge drinking (past year)			√	
Marijuana use (past-year)			√	
Other illicit drug use (past-year)			√	
Prescription drug misuse (past-year)			√	
History of STIs (past-year)				√
Covariates				
Age		√		
Sex		√		
Race		√		
Geographic regions		√		
Prior religious service attendance	√			
Prior depressive symptoms		√		
Prior weight status	√			
Prior smoking	√			
Prior frequent binge drinking	√			
Prior marijuana use	√			
Prior drug use other than marijuana		√		
Prior prescription drug misuse		√		
Prior history of STIs	√			

NHSII (maternal assessment)	
	2001
Subjective SES	√
Household income	√
Tract-level median income	√
Tract-level college education rate	√

Table S2. Assessment of all outcome variables in this study

Outcome variable	Questionnaire wave (GUTS)	Measurement	Range or categories
Life satisfaction	2010	One item from the Rand Mental Health Inventory "Have you felt happy, satisfied or please with your personal life"	Range: 1 (none of the time) to 6 (all of the time)
Positive affect	2010	Ten items from the Rand Mental Health Inventory	Range: 10 to 60
Self-esteem	2010	Rosenberg Self-esteem Scale	Range: 10 to 60
Emotional processing	2010	Emotional processing subscale from the Emotional Approach Coping Scale	Range: 4 to 16
Emotional expression	2010	Emotional expression subscale from the Emotional Approach Coping Scale	Range: 4 to 16
Number of physical health problems	2010	Total number of the following conditions reported: had ever been told by a health care provider that they had cancer, diabetes, high cholesterol, high blood pressure or asthma	Ranged from 0 to 4 in GUTSI and 0-3 in GUTSII
Overweight/obesity	2010	BMI≥25 as kg/m2 as overweight or obese	Yes, no
Depressive symptoms	2010	Center for Epidemiologic Studies Depression Scale	Ranged: 10 to 30
Depression diagnosis	2013	Ever been told by a healthcare provider that they had depression	Yes, no
Anxiety symptoms	2010	9 items from the Worry/Sensitivity Subscale of the Revised Children's Manifest Anxiety Scale	9 to 54
Anxiety diagnosis	2013	Ever been told by a healthcare provider they had anxiety	Yes, no
Binge eating	2010	A two-part question was used. The first question queried about overeating: "How often did you eat a very large amount of food during the past year". Those who reported overeating at least occasionally were asked to respond to a second question: "Did you feel out of control, like you couldn't stop eating even if you wanted to stop". Participants were considered as a binge eater if they reported overeating at least weekly and experiencing loss of control while overeating.	Yes, no
Eating disorder	2013	One item: "Have you ever been told by a health care provider that you had the following conditions: Anorexia, nervosa, bulimia nervosa, binge eating disorder, and other eating disorder. Those who reported any of the conditions were considered as having eating disorder diagnosis	Yes, no
Cigarettes smoking	2010	One item: "In the past 12 months, have you smoked a cigarette"	Yes, no

Frequent binge drinking	2010	One item: “In the past 12 months, how many times did you drink 5 (for male)/4(for female) or more alcoholic drinks over a few hours”, with at least 12 episodes of binge drinking as the cutoff to define frequent binge drinking	Yes, no
Marijuana use	2010	One item: “In the past 12 months, how many times did you use marijuana”. Responses were dichotomized as never or ever.	Yes, no
Other illicit drug use	2010	Participants reported frequency of use of the following drugs in the past 12 months: cocaine or crack, heroin, ecstasy, LSD/mushrooms or any other hallucinogen, crystal meth, or other amphetamines. Those who reported use of any of the drugs were considered as having other illicit drug use.	Yes, no
Non-medical prescription drug use	2010	Participants reported their frequency of use of the following drugs without a doctor’s prescription over the past 12 months: tranquilizers, pain killers, sleeping pills and stimulants. Those who reported use of any of the drugs were considered as having non-medical prescription drug use.	Yes, no
History of STIs	2013	Participants reported whether they had been told by a health care provider that they had chlamydia, HPV, genital warts or any STIs. Those who reported any of the conditions were considered as having STIs diagnosis	Yes, no

Table S3. Distribution of participant characteristics in the full analytic sample (N=8,629)

	Questionnaire wave	Mean (SD) or %
Sociodemographic factors (covariates)		
Age in years (range: 20-28)	2007	22.97 (1.71)
Gender (boy), %	2007	35.90
Race (white), %	2007	93.26
Geographic region	2007	
West, %		16.06
Midwest, %		34.57
South, %		16.45
Northeast, %		32.92
Mother's subjective SES in the US (range: 1-10)	2001	7.17 (1.28)
Mother's subjective SES in the community (range: 1-10)	2001	7.04 (1.54)
Pretax household income	2001	
<$50,000, %		12.37
$50,000-$74,999, %		23.43
$75,000-$99,999, %		22.44
≥$100,000, %		41.76
Census tract-level college education rate (range: 0% -84.71%)	2001	32.34% (16.27%)
Census tract-level median income	2001	
<$50,000, %		23.40
$50,000-$74,999, %		48.24
$75,000-$99,999, %		20.85
≥$100,000, %		7.51
Forgiveness of others (exposure)	2007	
Never/Seldom		23.71
Often		50.81
Always/almost always		25.48
Self-forgiveness (exposure)	2007	
Never/Seldom		31.03
Often		44.37
Always/almost always		24.59
Divine forgiveness (exposure)	2007	
Never/Seldom		18.75
Often		29.53
Always/almost always		51.71

Psychological well-being (outcomes)		
Life satisfaction, (range: 1-6)	2010	4.45 (1.00)
Positive affect, (range: 10-60)	2010	40.00 (8.68)
Self-esteem, (range: 10-40)	2010	33.78 (4.94)
Emotional processing, (range: 4-16)	2010	11.24 (2.76)
Emotional expression, (range: 4-16)	2010	10.69 (3.00)
Physical health (outcomes)		
Number of physical problems, (range: 0-4)	2010	0.37 (0.59)
Overweight/obesity, %	2010	36.77
Mental health (outcomes)		
Depressive symptoms over the past week, (range: 0-30)	2010	7.16 (4.59)
History of depression diagnosis, %	2013	17.14
Anxiety symptoms over the past week, (range: 9-54)	2010	22.23 (8.32)
History of anxiety diagnosis , %	2013	13.93
Health behaviors (outcomes)		
Binge eating, %	2010	1.24
Eating disorder, %	2013	2.26
Ever cigarette smoking over the past 12 months, %	2010	23.54
Frequent binge drinking over the past 12 months, %	2010	29.70
Marijuana use over the past 12 months, %	2010	23.86
Other illegal drug use over the past 12 months, %	2010	8.04
Prescription drug misuse over the past 12 months, %	2010	12.06
History of STIs, %	2013	13.10
Prior health status or prior health behaviors (covariates)		
Prior religious service attendance	2005	
Never, %		36.53
Less than once/week, %		37.59
At least once/week, %		25.88
Prior depressive symptoms over the past year, (range: 0-4)	2007	5.67 (3.41)
Prior overweight or obesity , %	2005	29.26
Prior cigarette smoking , %	2005	35.10
Prior frequent binge drinking , %	2005	26.48
Prior marijuana use (past 12-month), %	2005	30.14
Prior drug use other than marijuana (past 12-month), %	2007	10.75
Prior prescription drug misuse (past 12-month), %	2007	17.21
Prior history of STIs, %	2005	6.44

Table S3A. Distribution of participant characteristics by tertiles of forgiveness of others (N=8,614)

	Forgiveness of others			
	Never/Seldom (n=2,044)	Often (n=4,376)	Always/almost always (n=2,194)	*p*-value
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
Gender (boy), %	28.39	47.35	24.26	<.001
Race (white), %	23.34	50.86	25.80	.006
Geographic region				<.001
West, %	26.86	46.71	26.43	
Midwest, %	19.94	52.80	27.26	
South, %	18.16	53.64	28.20	
Northeast, %	28.99	49.26	21.75	
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, %	23.89	49.26	26.86	
$50,000-$74,999, %	21.14	52.17	26.69	
$75,000-$99,999, %	22.88	52.78	24.34	
≥$100,000, %	26.48	48.90	24.62	
Census tract-level college education rate (range: 0% -84.71%), mean (SD)	34.70% (17.00%)	31.97% (16.11%)	30.85% (15.63%)	<.001
Census tract-level median income				<.001
<$50,000, %	19.43	52.63	27.93	
$50,000-$74,999, %	22.75	50.99	26.26	

$75,000-$99,999, %	28.34	49.33	22.33	
≥$100,000, %	30.60	48.07	21.33	
Prior health status or prior health behaviors				
Prior religious service attendance				<.001
Never, %	39.81	45.12	15.07	
Less than once/week, %	19.60	57.11	23.29	
At least once/week, %	6.09	51.10	42.81	
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, %	24.15	52.38	23.47	.04
Prior cigarette smoking, %	28.00	50.11	21.88	<.001
Prior frequent drinking, %	30.27	50.00	19.73	<.001
Prior marijuana use, %	31.30	48.66	20.05	<.001
Prior drug use other than marijuana, %	34.53	46.91	18.56	<.001
Prior prescription drug misuse, %	31.88	48.70	19.42	<.001
Prior history of STIs, %	22.84	54.96	22.20	.17

Table S3B. Distribution of participant characteristics by tertiles of divine forgiveness (N=7,592)

	Divine forgiveness			
	Never/Seldom (n=1,425)	Often (n=2,241)	Always/almost always (n=3,926)	*p*-value
Sociodemographic factors				
Age in years (range: 20-28, the 2007 wave), mean (SD)	22.90 (1.68)	23.01 (1.71)	22.98 (1.72)	0.14
Gender (boy), %	22.62	29.29	48.09	<.001
Race (white), %	18.63	29.89	51.48	.02
Geographic region				<.001
West, %	23.41	24.22	52.38	
Midwest, %	14.32	29.90	55.79	
South, %	13.44	25.41	61.15	
Northeast, %	24.32	33.64	42.04	
Mother's subjective SES in the US (range: 1-10), mean (SD)	7.24 (1.30)	7.13 (1.30)	7.14 (1.25)	.02
Mother's subjective SES in the community (range: 1-10), mean (SD)	7.01 (1.59)	7.00 (1.52)	7.08 (1.51)	.08
Pretax household income				<.001
<$50,000, %	15.62	27.69	56.69	
$50,000-$74,999, %	16.98	30.24	52.77	
$75,000-$99,999, %	17.07	30.07	52.86	
≥$100,000, %	22.01	30.33	47.67	
Census tract-level college education rate (range: 0% -84.71%), mean (SD)	35.32% (16.96%)	32.51% (16.11%)	29.85% (15.35%)	<.001
Census tract-level median income				<.001
<$50,000, %	14.67	28.68	56.65	
$50,000-$74,999, %	17.33	29.26	53.41	

$75,000-$99,999, %	24.38	30.13	45.49	
≥$100,000, %	26.84	32.51	40.64	
Prior health status or prior health behaviors				
Prior religious service attendance				<.001
Never, %	37.02	33.81	29.17	
Less than once/week, %	15.05	33.96	50.98	
At least once/week, %	4.07	18.05	77.89	
Prior depressive symptoms(range: 0-21), mean (SD)	6.45 (3.71)	5.93 (3.21)	5.19 (3.31)	<.001
Prior overweight or obesity, %	17.01	31.02	51.96	0.05
Prior cigarette smoking, %	22.50	32.68	44.82	<.001
Prior frequent drinking, %	23.97	35.64	40.39	<.001
Prior marijuana use, %	29.39	32.39	38.22	<.001
Prior drug use other than marijuana, %	35.36	29.42	35.22	<.001
Prior prescription drug misuse, %	27.86	30.87	41.27	<.001
Prior history of STIs, %	17.91	36.57	45.52	.003

Table S4. Forgiveness of others and health and well-being in later life (N ranged from 5,939 to 6,983)

	Forgiveness of others		
	Never/Seldom (Ref)	Often OR/RR/β (95% CI)	Always/Almost always OR/RR/β (95% CI)
Psychological Well-being			
Life satisfaction	0.00	0.11 (0.04, 0.17)***	0.25 (0.18, 0.32)***
Positive affect	0.00	0.16 (0.10, 0.22)***	0.36 (0.29, 0.43)***
Self-esteem	0.00	0.11 (0.05, 0.17)***	0.22 (0.15, 0.29)***
Emotional processing	0.00	0.16 (0.10, 0.23)***	0.31 (0.24, 0.39)***
Emotional expression	0.00	0.12 (0.06, 0.19)***	0.24 (0.16, 0.31)***
Physical health			
Number of physical problems	0.00	0.03 (-0.03, 0.09)	0.03 (-0.04, 0.10)
Overweight/obesity	1.00	0.98 (0.91, 1.04)	0.97 (0.90, 1.05)
Mental health			
Depressive symptoms	0.00	-0.09 (-0.14, -0.03)**	-0.15 (-0.21, -0.08)***
Depression diagnosis	1.00	1.00 (0.88, 1.14)	0.91 (0.77, 1.08)
Anxiety symptoms	0.00	-0.08 (-0.14, -0.02)**	-0.18 (-0.25, -0.12)***
Anxiety diagnosis	1.00	0.93 (0.80, 1.08)	0.83 (0.69, 1.01)
Health Behaviors			
Binge eating	1.00	1.24 (0.71, 2.16)	1.09 (0.53, 2.23)
Eating disorder	1.00	1.07 (0.68, 1.67)	1.18 (0.69, 2.01)
Cigarette smoking	1.00	1.03 (0.94, 1.12)	1.15 (1.03, 1.28)**
Frequent binge drinking	1.00	1.02 (0.95, 1.10)	1.00 (0.90, 1.10)
Marijuana use	1.00	0.95 (0.87, 1.03)	0.98 (0.88, 1.10)
Any other illicit drug use	1.00	0.98 (0.83, 1.15)	0.95 (0.76, 1.18)
Prescription drug misuse	1.00	1.09 (0.95, 1.25)	0.86 (0.71, 1.04)
History of STIs	1.00	0.94 (0.81, 1.10)	0.95 (0.79, 1.16)

Note: The full analytic sample was restricted to those who had valid data on forgiveness of others. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table S5. Self-forgiveness and health and well-being in later life (N ranged from 5,950 to 6,994)

	Self-forgiveness		
	Never/Seldom (Ref)	Often OR/RR/β (95% CI)	Always/Almost always OR/RR/β (95% CI)
Psychological Well-being			
Life satisfaction	0.00	0.15 (0.10, 0.21)***	0.31 (0.24, 0.37)***
Positive affect	0.00	0.19 (0.14, 0.25)***	0.40 (0.34, 0.47)***
Self-esteem	0.00	0.22 (0.16, 0.28)***	0.40 (0.34, 0.47)***
Emotional processing	0.00	0.18 (0.12, 0.24)***	0.33 (0.26, 0.40)***
Emotional expression	0.00	0.17 (0.11, 0.23)***	0.35 (0.29, 0.42)***
Physical health			
Number of physical problems	0.00	0.02 (-0.03, 0.08)	0.00 (-0.07, 0.07)
Overweight/obesity	1.00	1.03 (0.96, 1.09)	1.07 (0.99, 1.16)
Mental health			
Depressive symptoms	0.00	-0.11 (-0.17, -0.06)***	-0.18 (-0.24, -0.12)***
Depression diagnosis	1.00	0.93 (0.82, 1.05)	0.86 (0.73, 1.01)
Anxiety symptoms	0.00	-0.12 (-0.18, -0.07)***	-0.23 (-0.29, -0.16)***
Anxiety diagnosis	1.00	0.88 (0.77, 1.01)	0.80 (0.67, 0.96)*
Health Behaviors			
Binge eating	1.00	0.64 (0.39, 1.07)	0.54 (0.26, 1.10)
Eating disorder	1.00	0.87 (0.58, 1.30)	0.71 (0.42, 1.21)
Cigarette smoking	1.00	0.98 (0.90, 1.06)	1.03 (0.93, 1.14)
Frequent binge drinking	1.00	0.98 (0.91, 1.06)	0.88 (0.80, 0.97)*
Marijuana use	1.00	0.95 (0.87, 1.03)	0.93 (0.84, 1.03)
Any other illicit drug use	1.00	1.07 (0.91, 1.27)	1.08 (0.88, 1.31)
Prescription drug misuse	1.00	1.03 (0.90, 1.18)	0.92 (0.78, 1.09)
History of STIs	1.00	1.06 (0.91, 1.22)	0.87 (0.72, 1.05)

Note: The full analytic sample was restricted to those who had valid data on self-forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table S6. Divine forgiveness and health and well-being in later life (N ranged from 5,246 to 6,122)

	Divine forgiveness		
	Never/Seldom (Ref)	Often OR/RR/β (95% CI)	Always/Almost always OR/RR/β (95% CI)
Psychological Well-being			
Life satisfaction	0.00	0.09 (0.02, 0.17)*	0.26 (0.19, 0.34)***
Positive affect	0.00	0.09 (0.02, 0.17)*	0.30 (0.23, 0.37)***
Self-esteem	0.00	0.13 (0.06, 0.21)***	0.30 (0.22, 0.37)***
Emotional processing	0.00	0.08 (-0.00, 0.15)	0.24 (0.17, 0.32)***
Emotional expression	0.00	0.11 (0.03, 0.19)**	0.27 (0.19, 0.34)***
Physical health			
Number of physical problems	0.00	-0.05 (-0.13, 0.02)	-0.00 (-0.08, 0.07)
Overweight/obesity	1.00	1.05 (0.96, 1.14)	1.09 (1.00, 1.18)*
Mental health			
Depressive symptoms	0.00	-0.10 (-0.18, -0.03)**	-0.13 (-0.20, -0.05)***
Depression diagnosis	1.00	0.83 (0.71, 0.98)*	0.91 (0.77, 1.06)
Anxiety symptoms	0.00	-0.07 (-0.14, 0.01)	-0.14 (-0.21, -0.07)***
Anxiety diagnosis	1.00	1.05 (0.87, 1.26)	0.97 (0.81, 1.18)
Health Behaviors			
Binge eating	1.00	0.91 (0.47, 1.75)	0.83 (0.42, 1.62)
Eating disorder	1.00	1.13 (0.66, 1.94)	0.94 (0.55, 1.58)
Cigarette smoking	1.00	0.92 (0.82, 1.02)	0.97 (0.87, 1.08)
Frequent binge drinking	1.00	1.09 (0.99, 1.20)	0.93 (0.84, 1.02)
Marijuana use	1.00	0.95 (0.85, 1.06)	0.85 (0.76, 0.96)**
Any other illicit drug use	1.00	1.00 (0.81, 1.23)	0.87 (0.69, 1.09)
Prescription drug misuse	1.00	1.07 (0.89, 1.27)	0.92 (0.76, 1.11)
History of STIs	1.00	1.09 (0.90, 1.33)	1.14 (0.94, 1.39)

Note: The full analytic sample was restricted to those who had valid data on divine forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior religious service attendance, and prior values of the outcome variables (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table S7. Forgiveness of others (always/almost always vs. never/seldom) and health and well-being in later life, stratified by frequency of religious service attendance (N ranged from 5,939 to 6,983)

		Stratified by religious service attendance		
	Never/Seldom (Ref)	Never (n=3,016) OR/RR/β (95% CI)	Less than once/week (n=2,313) OR/RR/β (95% CI)	At least once/week (n=1,654) OR/RR/β (95% CI)
Psychological Well-being				
Self-esteem	0.00	0.17 (0.07, 0.26)***	0.24 (0.12, 0.35)***	0.36 (0.13, 0.60)***
Emotional processing	0.00	0.30 (0.19, 0.41)***	0.24 (0.11, 0.38)***	0.57 (0.37, 0.77)***
Emotional expression	0.00	0.27 (0.16, 0.38)***	0.17 (0.05, 0.30)**	0.36 (0.14, 0.57)***
Life satisfaction	0.00	0.25 (0.15, 0.36)***	0.25 (0.13, 0.37)***	0.25 (0.02, 0.48)*
Positive affect	0.00	0.35 (0.25, 0.45)***	0.40 (0.28, 0.53)***	0.41 (0.19, 0.63)***
Physical health				
Number of physical problems	0.00	0.04 (-0.07, 0.14)	0.03 (-0.10, 0.15)	0.09 (-0.11, 0.29)
Overweight/obesity	1.00	0.99 (0.88, 1.11)	1.01 (0.88, 1.15)	0.96 (0.73, 1.26)
Mental health				
Depressive symptoms	0.00	-0.10 (-0.20, 0.00)	-0.13 (-0.24, -0.01)*	-0.29 (-0.50, -0.07)**
Depression diagnosis	1.00	0.87 (0.68, 1.10)	0.98 (0.71, 1.35)	0.66 (0.42, 1.05)
Anxiety symptoms	0.00	-0.15 (-0.25, -0.05)**	-0.23 (-0.35, -0.10)***	-0.18 (-0.39, 0.03)
Anxiety diagnosis	1.00	0.87 (0.66, 1.13)	1.05 (0.75, 1.47)	0.46 (0.28, 0.74)***
Health Behaviors				
Cigarette smoking	1.00	1.16 (1.02, 1.32)*	1.21 (0.98, 1.49)	0.96 (0.65, 1.41)
Frequent binge drinking	1.00	0.92 (0.81, 1.05)	1.09 (0.92, 1.28)	1.22 (0.79, 1.91)
Marijuana use	1.00	0.99 (0.87, 1.13)	1.09 (0.89, 1.32)	0.87 (0.49, 1.52)
Any other illicit drug use	1.00	1.02 (0.79, 1.32)	0.92 (0.58, 1.47)	0.48 (0.11, 2.08)
Prescription drug misuse	1.00	0.94 (0.73, 1.19)	0.79 (0.55, 1.14)	0.71 (0.33, 1.50)
History of STIs	1.00	1.08 (0.85, 1.38)	0.93 (0.66, 1.31)	0.96 (0.41, 2.24)

Note: The full analytic sample was restricted to those who had valid data on self-forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior health status or prior health behaviors (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table S8. Self-forgiveness (always/almost always vs. never/seldom) and health and well-being in later life, stratified by frequency of religious service attendance (N ranged from 5,950 to 6,994)

		Stratified by religious service attendance		
	Never/Seldom (Ref)	Never (n=3,022) OR/RR/β (95% CI)	Less than once/week (n=2,317) OR/RR/β (95% CI)	At least once/week (n=1,655) OR/RR/β (95% CI)
Psychological Well-being				
Life satisfaction	0.00	0.30 (0.20, 0.40)***	0.31 (0.19, 0.43)***	0.30 (0.14, 0.46)***
Positive affect	0.00	0.38 (0.28, 0.47)***	0.45 (0.33, 0.56)***	0.39 (0.24, 0.55)***
Self-esteem	0.00	0.36 (0.27, 0.45)***	0.41 (0.31, 0.52)***	0.49 (0.33, 0.66)***
Emotional processing	0.00	0.34 (0.24, 0.45)***	0.34 (0.22, 0.46)***	0.37 (0.21, 0.54)***
Emotional expression	0.00	0.38 (0.28, 0.48)***	0.33 (0.22, 0.45)***	0.39 (0.23, 0.55)***
Physical health				
Number of physical problems	0.00	-0.01 (-0.11, 0.08)	0.04 (-0.08, 0.16)	0.01 (-0.15, 0.16)
Overweight/obesity	1.00	1.10 (0.99, 1.23)	1.07 (0.94, 1.22)	1.11 (0.89, 1.38)
Mental health				
Depressive symptoms	0.00	-0.14 (-0.23, -0.05)**	-0.23 (-0.34, -0.13)***	-0.21 (-0.35, -0.06)**
Depression diagnosis	1.00	0.89 (0.71, 1.11)	0.86 (0.64, 1.16)	0.73 (0.49, 1.09)
Anxiety symptoms	0.00	-0.14 (-0.24, -0.04)**	-0.30 (-0.41, -0.19)***	-0.27 (-0.42, -0.11)***
Anxiety diagnosis	1.00	0.85 (0.66, 1.09)	0.99 (0.73, 1.34)	0.50 (0.32, 0.80)**
Health Behaviors				
Cigarette smoking	1.00	0.99 (0.87, 1.13)	1.20 (0.99, 1.44)	0.83 (0.57, 1.21)
Frequent binge drinking	1.00	0.88 (0.77, 1.00)*	0.95 (0.82, 1.11)	0.78 (0.54, 1.14)
Marijuana use	1.00	0.89 (0.78, 1.01)	1.17 (0.97, 1.41)	0.52 (0.31, 0.88)*
Any other illicit drug use	1.00	1.11 (0.89, 1.39)	1.19 (0.78, 1.80)	0.30 (0.08, 1.05)
Prescription drug misuse	1.00	0.99 (0.80, 1.23)	0.77 (0.57, 1.06)	0.84 (0.43, 1.64)
History of STIs	1.00	1.07 (0.84, 1.36)	0.79 (0.57, 1.09)	0.46 (0.23, 0.93)*

Note: The full analytic sample was restricted to those who had valid data on self-forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior health status or prior health behaviors (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)

Table S9. Divine forgiveness (always/almost always vs. never/seldom) and health and well-being in later life, stratified by frequency of religious service attendance (N ranged from 5,246 to 6,122)

		Stratified by religious service attendance		
	Never/Seldom (Ref)	Never (n=2,292) OR/RR/β (95% CI)	Less than once/week (n=2,199) OR/RR/β (95% CI)	At least once/week (n=1,631) OR/RR/β (95% CI)
Psychological Well-being				
Life satisfaction	0.00	0.33 (0.22, 0.43)***	0.21 (0.08, 0.33)***	0.06 (-0.19, 0.32)
Positive affect	0.00	0.35 (0.25, 0.45)***	0.27 (0.14, 0.39)***	0.19 (-0.05, 0.44)
Self-esteem	0.00	0.29 (0.19, 0.39)***	0.30 (0.17, 0.42)***	0.29 (0.01, 0.57)*
Emotional processing	0.00	0.28 (0.17, 0.39)***	0.19 (0.06, 0.32)**	0.15 (-0.09, 0.39)
Emotional expression	0.00	0.31 (0.20, 0.41)***	0.21 (0.09, 0.33)***	0.27 (0.03, 0.50)*
Physical health				
Number of physical problems	0.00	-0.06 (-0.16, 0.04)	0.04 (-0.10, 0.17)	0.07 (-0.15, 0.29)
Overweight/obesity	1.00	1.10 (0.97, 1.24)	1.12 (0.97, 1.30)	1.09 (0.72, 1.65)
Mental health				
Depressive symptoms	0.00	-0.12 (-0.22, -0.02)*	-0.12 (-0.24, 0.00)	-0.17 (-0.40, 0.06)
Depression diagnosis	1.00	0.97 (0.76, 1.24)	0.92 (0.70, 1.22)	0.72 (0.44, 1.20)
Anxiety symptoms	0.00	-0.08 (-0.18, 0.02)	-0.22 (-0.35, -0.10)***	-0.14 (-0.37, 0.09)
Anxiety diagnosis	1.00	0.98 (0.74, 1.30)	1.17 (0.85, 1.60)	0.55 (0.33, 0.93)*
Health Behaviors				
Cigarette smoking	1.00	0.97 (0.83, 1.14)	0.99 (0.80, 1.21)	0.74 (0.48, 1.14)
Frequent binge drinking	1.00	0.86 (0.73, 1.01)	1.08 (0.92, 1.27)	0.86 (0.53, 1.40)
Marijuana use	1.00	0.88 (0.75, 1.03)	0.94 (0.77, 1.15)	0.51 (0.29, 0.89)*
Any other illicit drug use	1.00	0.85 (0.61, 1.19)	1.03 (0.66, 1.61)	0.36 (0.06, 1.99)
Prescription drug misuse	1.00	0.90 (0.67, 1.21)	0.84 (0.60, 1.18)	1.57 (0.62, 3.95)
History of STIs	1.00	1.19 (0.91, 1.56)	1.21 (0.86, 1.68)	0.59 (0.26, 1.31)

Note: The full analytic sample was restricted to those who had valid data on divine forgiveness. The actual sample size for each analysis varies depending on the number of missing values on each outcome under investigation.

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 (standardized effect size for continuous outcomes).

All models controlled for participants' age, race, sex, geographic region, their mother's report of SES (subjective SES, household income, residential tract-level college education rate, and tract-level median income), participants' prior health status or prior health behaviors (prior depressive symptoms, overweight/obesity, smoking, drinking, marijuana use, other drug use, prescription drug misuse, history of STIs).

*p<0.05, **p<0.01, ***p<0.05 (after Bonferroni correction, the p value cutoff for Bonferroni correction is p<0.0026)