

## BRIEF REPORT

 Hostility, Forgiveness, and Cognitive Impairment Over 10 Years in a  
National Sample of American Adults

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**Objective:** We examined the extent to which self-forgiveness and forgiveness of others moderated the association of hostility with changes in cognitive impairment over 10 years in a nationally representative sample of adults in the United States. **Method:** Participants were 1,084 respondents to the Americans' Changing Lives survey, a longitudinal study of American adults. Hostility, self-forgiveness, forgiveness of others, and cognitive impairment were measured at baseline, and cognitive impairment was assessed again at follow-up. Moderated multiple regression analyses tested whether self-forgiveness and forgiveness of others moderated the association of hostility with changes in cognitive impairment over time, controlling for baseline cognitive impairment and relevant sociodemographic and clinical factors. **Results:** As hypothesized, greater hostility levels at baseline predicted more cognitive impairment 10 years later,  $\beta = .08, p < .01$ . In addition, self-forgiveness at baseline moderated the association between baseline hostility and cognitive impairment at follow-up,  $\beta = -.07, p < .01$ . Decomposing this interaction revealed that hostility significantly predicted increased cognitive impairment at follow-up for individuals with low,  $\beta = .15, p < .001$ , and average,  $\beta = .08, p = .001$ , levels of self-forgiveness but not for persons with high levels of self-forgiveness,  $\beta = .03, p = .34$ . In contrast, forgiveness of others was not a significant moderator. **Conclusions:** Greater hostility is associated with the development of more cognitive impairment over 10 years, and being more self-forgiving appears to mitigate these hostility-related effects on cognition. Enhancing self-forgiveness may thus represent one possible strategy for promoting cognitive resilience in adulthood.

**Keywords:** hostility, forgiveness, cognition, aging, health

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Stress and coping theories of forgiveness posit that self-forgiveness and forgiveness of others represent cognitive-emotional processes that may buffer the negative effects that

traits like hostility have on health (Toussaint, Webb, & Hirsch, 2017). In the present study, we sought to extend the relatively small but growing body of work on this topic by examining the extent to which self-forgiveness and forgiveness of others moderate the association between hostility and changes in cognitive impairment in a large, 10-year longitudinal study of adults in the United States.

Hostility involves cynicism, mistrust, and expected mistreatment from others along with hostile explanations of other peoples' behavior (Smith, Glazer, Ruiz, & Gallo, 2004). Research has shown that hostility is associated with poorer outcomes on a variety of biological and clinical health indicators, including body mass index, waist-to-hip ratio, insulin resistance, lipid ratio, triglycerides, glucose levels, alcohol consumption, and smoking behavior (Bunde & Suls, 2006). Greater hostility has also been related to poorer cognitive functioning (Vitaliano et al., 2005), which itself is a critical factor affecting overall health and wellness. Hostility is not always associated

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with adverse cognitive outcomes, however, making it important to identify factors that moderate this association.

Forgiveness is one factor that may moderate the effects of hostility on cognitive function. Trait self-forgiveness represents the relatively stable tendency to forgo self-condemnation and focus on a more compassionate view of oneself by accepting one's wrongdoing, making reparations for harm done, and working toward self-improvement (Toussaint et al., 2017). Making reparations is an objective indicator of remorse that may signal intent to reconcile if others were harmed, and it also plays an important role in the self-forgiveness process because it reduces guilt and other self-condemning emotions and motivations (Toussaint et al., 2017). Because hostile individuals tend to offend others and consequently experience self-condemning emotions (e.g., guilt) and motivations (e.g., self-punishment; Mosher, O'Grady, & Katz, 1980), and because trait self-forgiveness reduces these emotional and motivational outcomes, people exhibiting high levels of trait self-forgiveness may be protected from the harmful influence that hostility typically has on health and cognitive function. Indeed, associations between anger expression and suicidal tendencies are weaker for persons with higher trait self-forgiveness (Hirsch, Webb, & Jeglic, 2012). Although self-forgiveness may thus mitigate the effects that negative emotions have on health, no studies to date have examined whether self-forgiveness moderates the relation between hostility and cognitive function.

In contrast with self-forgiveness, trait forgiveness of others is defined as the tendency to reduce negative—and increase positive—thoughts, feelings, and actions directed toward an offender (Toussaint, Shields, Dorn, & Slavich, 2016). Because hostile individuals are more likely to engage in negative interpersonal interactions that give rise to negative emotions that portend poor health, and because forgiveness of others reduces these negative reactions, persons with high levels of trait forgiveness of others may be protected from the harmful effects that hostility can have on health and cognitive function. Consistent with this possibility, associations between lifetime stress exposure and mental health problems are significantly weaker for persons exhibiting higher trait forgiveness (Toussaint et al., 2016). Like self-forgiveness, however, we know of no studies that have examined its moderating role in the association between hostility and cognitive function.

To address these gaps in the literature, we examined the extent to which self-forgiveness and forgiveness of others moderated the association between hostility and cognitive impairment using data drawn from the Americans' Changing Lives (ACL) survey, which includes a large, longitudinal, nationally representative sample of adults in the United States. Based on the research summarized above, we hypothesized that greater hostility at baseline would predict more cognitive impairment 10 years later and that this effect would be moderated by forgiveness, such that individuals exhibiting greater self-forgiveness and forgiveness of others at baseline would show weaker associations between their baseline hostility levels and cognitive impairment 10 years later as compared with those exhibiting less self-forgiveness and forgiveness of others at baseline.

## Method

### Participants

Participant data were drawn from waves four (i.e., baseline) and five (i.e., follow-up) of the ACL survey, which is described on the ACL website (House, 2014). The baseline response rate was 74% ( $N = 1,165$ ) and 93% of Wave 4 respondents persisted to Wave 5, yielding a final sample of 1,084 respondents. At baseline, women represented 61% of the sample. On average, participants were 57 years old ( $Mdn = 54$ ; range 41–87), had 13 years of education ( $Mdn = 13$ ; range 0–17), and earned \$41,393 per year in 1986 inflation-adjusted U.S. dollars ( $Mdn = \$30,945$ ; range \$2,258–1,701,975). Participants' race/ethnicity was White (71%), Black (23%), Hispanic (4%), and other (2%). Finally, rates of chronic illness were low: diabetes (6%), heart problems (4%), stroke (<1%), and cancer (1%). Attrition analyses and descriptive statistics for all of the study variables are summarized in the online Supplemental Material. The study was approved by the Institutional Review Board.

### Measures

**Hostility.** Hostility was assessed with a four-item scale developed from the cynical distrust subscale of the Cook-Medley Hostility scale (Cook et al., 1954), which demonstrates acceptable psychometric properties (Stavrova & Ehlebracht, 2016). An example item is, "I think most people would lie in order to get ahead." Participants responded using a 1 (*agree strongly*) to 4 (*disagree strongly*) scale, and responses were averaged (range = 1–4) and scored with higher values representing greater hostility. The inter-rater consistency was  $\alpha = .72$ .

**Forgiveness.** Forgiveness was assessed using three items. The self-forgiveness item emphasized making reparations for past mistakes, which is a key aspect of genuine self-forgiveness (Toussaint et al., 2017). It was developed by Mauger et al. (1992) and reads: "I often feel that no matter what I do now I will never make up for the mistakes I have made in the past." The forgiveness of others items emphasized grudges and forgiving hurts. The items ( $r = .38$ ) read: (a) "I have grudges that I have held onto for months or years," developed by Mauger et al. (1992), and (b) "I have forgiven those who have hurt me," developed by the Fetzer Institute (1999). Participants responded using a 1 (*agree strongly*) to 4 (*disagree strongly*) scale. Forgiveness of others items were averaged (range = 1–4) and all items were then scored with higher values representing greater forgiveness.

**Cognitive impairment.** Cognitive impairment was assessed using the 5-item Short Portable Mental Status Questionnaire (Xu, Thomas, & Umberson, 2016), which demonstrates acceptable psychometric properties (Assari & Lankarani, 2016). The scale evaluates individuals' accuracy of reporting the current date, day of the week, current and former president, and basic subtraction. Each question was scored as 1 (*incorrect*) or 0 (*correct*), and the scale score (range = 0–5) was calculated by summing the responses, with higher scores representing more cognitive impairment.

**Covariates.** Participants' baseline age, sex (male/female), race (White/Black), years of education, household size, household income (in 1986 inflation-adjusted U.S. dollars), religious importance, and baseline and follow-up number of chronic health prob-

lems (i.e., diabetes, heart problems, stroke, and cancer) were assessed in the ACL survey and included as *a priori* covariates in all models.

**Data Analysis**

Hypotheses were tested using moderated multiple regression analyses. Step 1 of each model included baseline levels of hostility, self-forgiveness, forgiveness of others, and cognitive impairment, and the sociodemographic and clinical covariates listed above. Then, in Step 2, we entered the Hostility  $\times$  Self-Forgiveness/Forgiveness of Others interaction terms (in separate models) to predict cognitive impairment at follow-up. All variables were first examined for possible outliers and skew. Household income was significantly skewed, so log-transformed values were used in analyses. Original values were used for all of the other variables, given their relatively normal distributions and lack of outliers.

**Results**

Descriptive statistics and bivariate correlations are presented in Supplemental Tables 1 and 2, respectively. As hypothesized, results revealed that greater hostility at baseline was associated with more cognitive impairment at follow-up,  $\beta = .08, p < .01$ ; in contrast, baseline self-forgiveness,  $\beta = -.04, p = .08$ , and baseline forgiveness of others,  $\beta = -.01, p = .86$ , were unrelated to cognitive impairment at follow-up. Moreover, as shown in Figure 1, we found that participants' levels of hostility at baseline interacted with their baseline trait self-forgiveness levels to significantly predict their degree of cognitive impairment at follow-up,  $\beta = -.07, p < .01$ . Decomposing this interaction revealed that greater hostility at baseline was associated with more cognitive impairment 10 years later for individuals 1 SD below the mean on baseline self-forgiveness,  $\beta = .15, p < .001$ , and for individuals at

the mean on baseline self-forgiveness,  $\beta = .08, p = .001$ . As hypothesized, however, hostility levels at baseline were unrelated to levels of cognitive impairment at follow-up for individuals 1 SD above the mean on baseline self-forgiveness,  $\beta = .03, p = .34$ , thus indicating that self-forgiveness may mitigate the harmful effect that hostility has on cognitive function over time.

In contrast, forgiveness of others did not moderate the relation between baseline hostility and levels of cognitive impairment at follow-up,  $\beta = .03, p = .29$ . Moreover, the moderating effect of forgiveness on the association between hostility and changes in cognitive function over time was significantly stronger for self-forgiveness than for forgiveness of others,  $t = 3.54, p < .001$ .

**Discussion**

Despite an abundance of research on factors that predict changes in cognitive function over time, very little is known about the role that forgiveness might play in structuring these effects. To address this issue, we examined how hostility, self-forgiveness, and forgiveness of others predict changes in cognitive function in a large, nationally representative sample of adults in the United States. Greater hostility at baseline was associated with developing more cognitive impairment over 10 years. Moreover, as hypothesized, self-forgiveness moderated this effect, such that baseline hostility levels significantly predicted cognitive impairment at follow-up for persons with low and average levels of self-forgiveness at baseline but not for those with high levels of self-forgiveness at baseline. These effects were robust while controlling for levels of cognitive impairment at baseline, in addition to age, sex, race, education, household size and income, religious importance, and number of chronic health problems at both baseline and follow-up. Contrary to hypotheses, forgiveness of others did not moderate the association of hostility with changes in cognitive impairment over time.

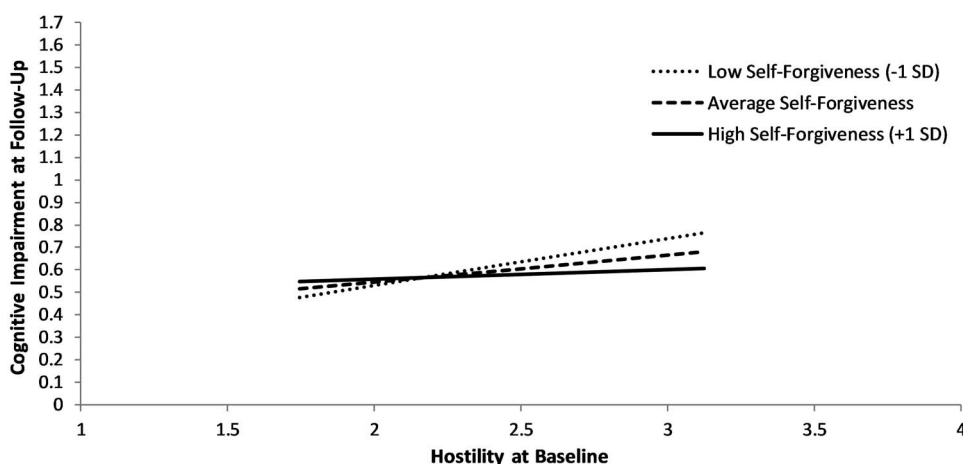


Figure 1. Self-forgiveness buffers the negative effect of hostility on changes in cognitive impairment over 10 years. Decomposing the significant Hostility  $\times$  Self-Forgiveness interaction ( $\beta = -.07, p < .01$ ) revealed that, while controlling for levels of cognitive impairment at baseline in addition to several sociodemographic and clinical factors, hostility at baseline predicted levels of cognitive impairment at follow-up for individuals 1 SD below the mean on baseline self-forgiveness,  $\beta = .15, p < .001$ , and for those at the mean on baseline self-forgiveness,  $\beta = .08, p = .001$ , but not for persons 1 SD above the mean on self-forgiveness,  $\beta = .03, p = .34$ . High levels of self-forgiveness thus appear to mitigate the negative effect that hostility has on cognitive function over time. The y-axis spans 2 SD of respondents' scores on the cognitive impairment scale ( $N = 1,084$ ).

Stress and coping theories of self-forgiveness and forgiveness of others posit that self-forgiveness and forgiveness of others should provide health-protective effects (Toussaint et al., 2017). To date, however, no studies have tested these predictions in the context of cognitive function. The present findings address this gap and show that self-forgiveness (but not forgiveness of others) seemingly protects individuals against the deleterious effect that hostility can have on cognitive function over time. This result is consistent with a meta-analysis showing stronger beneficial effects of self-forgiveness versus forgiveness of others in relation to health (Davis et al., 2015). As a result, it is possible that self-forgiveness is a relatively more beneficial coping style for adults, at least insofar as cognitive function is concerned.

The magnitude of the mitigating effect that self-forgiveness had on hostility in predicting cognitive impairment in this study is seemingly small ( $f^2 = .007$ ). To put these findings into context, though, the size of this moderation effect is similar to moderation effects commonly observed in clinical research (Frazier, Tix, & Barron, 2004). Moreover, the Alzheimer's Association and Mayo Clinic presently recommend exercise as a leading strategy for treating mild cognitive impairment, and a meta-analysis of 14 randomized controlled trials (i.e., Gates, Fiatarone Singh, Sachdev, & Valenzuela, 2013) recently found that the magnitude of the mitigating effect of exercise on mild cognitive impairment ( $d = 0.17$ , converted to  $f^2 = .007$ ) was identical to the magnitude of the beneficial effect that self-forgiveness had on cognitive impairment in the present study ( $f^2 = .007$ ). Self-forgiveness may thus have beneficial effects for cognitive health that are similar to those observed for exercise.

Although this study was not designed to elucidate mechanisms linking hostility and cognitive impairment, hostility may heighten individuals' cardiovascular, neuroendocrine, and inflammatory responses to interpersonal stressors in ways that can affect human cognition and health (Smith et al., 2004). One possibility, therefore, is that self-forgiveness may mitigate the negative effect that hostility has on cognitive function in part by modifying how people biologically respond to interpersonal stressors. Future mechanistic research is needed to test this possibility and others.

Several limitations should be noted. First, as often occurs with large surveys, measurement of the key constructs (i.e., hostility, forgiveness) was limited. In particular, self-forgiveness is a multifaceted construct, and although a key aspect of self-forgiveness was assessed (i.e., desire to make reparations), other aspects of self-forgiveness (e.g., emotional, behavioral, and cognitive responses) were not measured. Additionally, hostility and forgiveness were assessed at baseline only, precluding us from examining how levels of these factors change over time. Second, the sample was relatively young and cognitive impairment levels were relatively low, which could limit the study's generalizability. Third, the study did not elucidate mechanisms underlying the associations observed. Additional research is thus needed to identify multilevel processes linking hostility, self-forgiveness, and cognition. Finally, the study was not experimental and causality cannot be assumed. To address these issues, future research could improve the measurement of key constructs, sample older or more cognitively impaired adults, assess processes like inflammation that affect cognition (Shields, Moons, & Slavich, 2017; Slavich, 2015), and use a self-forgiveness intervention to detect causal effects.

In conclusion, this is the first study we know of to show that associations between individuals' hostility levels and changes in cognitive impairment over time are moderated by self-forgiveness. Whereas hostility predicted the development of cognitive impairment for persons exhibiting low and moderate levels of self-forgiveness at baseline, no such effect was observed for those exhibiting high levels of self-forgiveness. These findings support the stress and coping theory of self-forgiveness and suggest that self-forgiveness may help mitigate the negative cognitive health consequences typically associated with hostility. Enhancing self-forgiveness may thus represent one possible strategy for promoting cognitive resilience and healthy aging. At the same time, additional research is needed to examine causal effects in older adulthood and to elucidate mechanisms underlying these effects.

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