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## Early life stress moderates the relationship between age and prosocial behaviors

Robert Jesus Jirsaraie\*, Krista Wilke Ranby, David Scott Albeck

Department of Psychology, University of Colorado Denver, 1250 14th Street, Denver, CO, 80204, United States

### Abstract

**Background:** Several studies suggest that prosocial behaviors gradually increase with age, but others report that prosocial behaviors are fixed traits with only minor fluctuations throughout the lifespan. Early life stress may help explain these inconsistencies, as distinct types of stress have been negatively or positively associated with prosocial behaviors.

**Objective:** This current investigation used two studies to test whether distinct types of early life stress moderated the association between age and prosocial behavior.

**Participants and setting:** Study 1 recruited undergraduate students (n=69) between the ages of 18–35, and Study 2 was conducted on Amazon Mechanical Turk responders (n=499) whose ages ranged from 18-74.

**Methods:** Study 1 employed behavioral economic tasks to measure cooperation and charity, while Study 2 utilized an online survey to measure helping attitudes.

**Results:** Moderation analyses revealed the association between age and cooperation was significantly weakened by a history of family violence ( $\beta=-0.37, p=0.002$ ), community violence ( $\beta=-0.30, p=0.012$ ), emotional abuse ( $\beta=-0.27, p=0.026$ ), and an overall summary score of early life stress ( $\beta=-0.33, p=0.006$ ). The relationship between age and charity was only weakened by family violence ( $\beta=-0.24, p=0.048$ ). The association between age and helping attitudes was weakened by family violence ( $\beta=-0.10, p=0.023$ ), community violence ( $\beta=-0.13, p=0.003$ ), and physical neglect ( $\beta=-0.11, p=0.018$ ).

**Conclusions:** Collectively, these results suggest that some types of early life stress, especially exposure to violent environments, may reduce the likelihood of prosocial behaviors increasing throughout the lifespan. This study suggests that age-related effects on prosocial behaviors may not be universal, but rather depend on individual differences in childhood stress.

### Keywords

Aging; Trauma; Early life stress; Altruism; Prosocial behavior

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\*Corresponding author. Robert.Jirsaraie@ucdenver.edu (R.J. Jirsaraie).

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.chiabu.2019.104029>.

## 1. Introduction

### 1.1. Importance of prosocial behaviors

Prosocial behaviors are defined as “any voluntary actions that are intended to benefit others” (Batson & Powell, 2003). People who engage in prosocial behaviors are characterized as trustworthy, cooperative, and charitable. Those who receive prosocial acts clearly benefit, and previous literature suggests that the enactors of prosocial behavior may also experience numerous benefits (Post, 2005). Among adolescents, prosocial attitudes and behaviors have been associated with better social skills (Eisenberg et al., 1996), higher self-esteem (Laible, Carlo, & Roesch, 2004), and academic achievement (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000). In adulthood, acts of empathy, altruism, and community service have been positively associated with many physical and mental health benefits, such as greater overall well-being (Dulin & Hill, 2003), increased longevity (Oman, Thoresen, & McMahon, 1999), more resiliency to stress (Raposa, Laws, & Ansell, 2016), as well as lower rates of age-related illnesses (Schwartz, Meisenhelder, Ma, & Reed, 2003). Given these numerous benefits, it is important to understand predictors of prosocial behaviors across the lifespan.

### 1.2. Age-related changes in prosocial behaviors: inconsistent findings

The socioemotional selective theory suggests that prosocial behaviors develop gradually with age, which can be attributed to people prioritizing social motives over individual pursuits (Carstensen, Isaacowitz, & Charles, 1999). Numerous studies support this theory by demonstrating that prosocial behaviors emerge in school-aged children (Fabes, Carlo, Kupanoff, & Laible, 1999) and consistently increase through late adulthood (Bekkers, 2007; Sze, Gyurak, Goodkind, & Levenson, 2012). Matsumoto, Yamagishi, Li, and Kiyonari (2016) conducted a large study of 408 participants between the ages of 20–59 and used five of the most common behavioral economic tasks to measure prosocial behaviors. They revealed that age was positively associated with prosocial behaviors across all five experimental tasks, and similarly, age was negatively associated with attitudes about manipulating others for personal gain. These findings have been replicated using self-reports (Eisenberg, Lennon, & Roth, 1983; Seider, Shiota, Whalen, & Levenson, 2011) and additional variations of behavioral economic tasks (Lim & Yu, 2015; Beadle, Sheehan, Dahlben, & Gutchess, 2015; Sutter & Kocher, 2007), suggesting there is a robust relationship between age and prosocial behaviors.

An alternative viewpoint is that prosocial behaviors are relatively stable across the life span (Eisenberg et al., 2002; Rieger & Mata, 2015; Rushton & Sorrentino, 1981) or that only minor fluctuations occur (Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005). An important study conducted by Kettner and Waichman (2016) reported that elderly participants were more prosocial than young adults, but not when controlling for participants' prior knowledge of the behavioral economic tasks that are frequently used to measure prosocial behaviors. These findings suggest that older participants may behave more prosocially because they lack experience with behavioral economic tasks, but not because they intend to help others. This generation gap confounds the use of behavioral economic tasks to measure prosocial behaviors. The inconsistencies between these two

viewpoints indicates that the inclusion of additional variables might be necessary to better understand the association between age and prosocial behavior.

### 1.3. Bi-directional associations between stress and prosocial behavior

Stress is an important construct to consider since it has been consistently related to prosocial behaviors (Sandi & Haller, 2015). Prior studies have revealed that certain types of stress can promote prosocial behaviors while other types might hinder prosocial development. Individually experienced traumas (i.e. maltreatment, neglect) can have either positive or negative effects. In contrast, stressful experiences that are shared across a group of people (i.e. natural disasters, collective violence, terrorist attacks) tend to increase prosocial behaviors. Therefore, it is important to delineate the specific relationships between multiple types of trauma and prosocial behaviors.

The notion that individually experienced stress was differentially associated with types of prosocial behaviors was first introduced by Larson and Moses (2017) who conducted one of the largest online surveys of high-school students (N=14,000). Their results suggested that childhood exposure to stress was positively related with stopping peer harassment but negatively associated with volunteering. Other research has suggested that abused and neglected children displayed less altruism and forgiveness (Kwok, Gu, & Cheung, 2017; Prino & Peyrot, 1994), whereas other quantitative and qualitative studies reported that lifetime trauma was positively associated with volunteering and helping behavior among undergraduate students (Frazier et al., 2012; Gillen, 2005).

Regarding collectively experienced stress, most studies have consistently reported that prosocial behaviors increase when a group of people encounter stressful conditions (Buchanan & Preston, 2014; Vinkers et al., 2013). This type of behavior has been coined the “tend-and-befriend” response (Taylor, 2006; von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012), and it has been observed immediately following terrorist attacks, collective violence, natural disasters, and even laboratory-induced stressful situations (Penner, Dovidio, Piliavin, & Schroeder, 2005; Suedfeld et al., 2005). Taken together, these studies indicate that distinct types of stressful and traumatic experiences can have varying effects on multiple dimensions of prosocial behavior, but neither of these studies have investigated how stressful experiences interact with age to predict prosocial behaviors.

### 1.4. Possible interaction between stress and age

Previous research suggests that different types of stress can have either positive or negative effects on prosocial behaviors, but most of the studies investigating individually experienced stress were conducted on school-aged children or undergraduate students. As a result, it is unknown whether stressful experiences in childhood have long-term effects on prosocial behaviors in adulthood. Further, inconsistent findings have been reported about whether prosocial behaviors increase with age, but prior studies have not accounted for early life or current life stress. Therefore, a possible explanation for these inconsistent findings is that early life stress may hinder prosocial development. The current investigation aimed to test this possibility by using two independent samples to explore whether early life stressful and traumatic experiences moderated age-related changes in prosocial behaviors.

## 2. Study 1

The initial study used two of the most common behavioral economic tasks to measure cooperation and charitability of undergraduate students. Early life stress was predicted to have the largest effect on prosocial behaviors, but current life stress was also measured to be controlled for in the multivariate analyses. Based on previous findings, it was hypothesized that (1) both cooperation and charitability would be positively associated with age and collective violence but negatively associated with all types of early life abuse and neglect. (2) the associations between age and both prosocial behaviors would be strengthened by collective violence but weakened by all forms of early life abuse and neglect.

## 3. Methods

### 3.1. Participants

The sample size of study 1 consisted of 69 undergraduate students (47 woman, 22 men) from a large metropolitan university located in western United States. Participant recruitment was initiated through flyers, university emails, and in-class announcements from multiple departments. The age range of participants was from 18 to 35 years ( $M=21.8$ ,  $SD=4.3$ ), and the distribution was positively skewed ( $+1.52$ ). Participants came from multiple ethnic groups: Caucasian 36%, Hispanic 23%, Asian 23%, Multi-Ethnic 11%, and Black 7%. Most participants were single (68%). Slightly more than half of the students were employed (54%) and reported an annual income of less than 25,000 (55%).

The protocol was approved by the university's Institutional Review Board and written informed consent was collected in-person. Participants completed the two experimental tasks to measure charitability and cooperation followed by two questionnaires that measured early life and current life stress. In total, the study took approximately 30 min to complete.

### 3.2. Prosocial measures

The Prisoner's Dilemma Game (Kuhlman & Marshello, 1975) and Dictator Game (Eckel & Grossman, 1996) were used to assess cooperation and charitability respectively. Both of these behavioral economic tasks were electronically programmed using the zTree software package (Fischbacher, 2007), which allowed participants to make decisions anonymously on a laboratory computer. Participants were presented with each task in random order to minimize order effects. Before participants began each experimental task, they were given verbal and written instructions followed by an opportunity to ask questions. Participants were also informed that they could receive from \$2.50 to \$17.50 depending on the collective decisions they made in both tasks. Please refer to the supplemental methods for more details about how the PDG and DG were implemented in this study.

### 3.3. Life stress assessments

Early life stress was measured using the Adverse Childhood Experiences Questionnaire – International Version (Organization, 2015), which is a 30-item retrospective assessment that assesses 13 specific traumas within the first 18 years of one's life. These specific traumas include physical abuse, emotional abuse, sexual abuse, family drug abuse, family

incarceration, family mental illness, family violence, parent separation/death, emotional neglect, physical neglect, bullying, community violence, and collective violence. Participants said whether they experienced (1) or did not experience (0) family drug abuse, family incarceration, family mental illness, and parent separation/death. Participants rated how frequently they experienced the other types of stress: many times (3), a few times (2), once (1), or never (0). A summary score of early life stress was calculated by taking the sum of specific types of trauma that participants had experienced at least once, ranging from 0 to 13. Participants that refused to answer questions were excluded from analyses of those specific types of trauma and the overall summary score of early life stress.

Current life stress was measured by the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1994). This scale consists of ten items pertaining to perceived stress within the past month, which assesses the frequency of stressful feelings and thoughts on a 5-point Likert scale. The sum of each item was calculated to create a summary score of current life stress ranging from 0 to 40, with higher scores indicating more stress.

### 3.4. Statistical analysis

All statistical analyses were completed using R version 3.5.1 (R Development Core Team, 2018). Before computing primary analyses, variables were tested for normality using Q-Q plots, all variables of interest were mean-centered, and multivariate outliers were examined using the Mahalanobis distance for all models predicting prosocial behavior. Bivariate and multivariate analyses were conducted to test for any direct effects predicting prosocial behaviors. Moderation analyses were used to test the hypotheses that age-related changes in prosocial behavior would be moderated by specific early life traumas. Lastly, all significant interaction effects were further analyzed by simple slope analyses (Aiken, West, & Reno, 1991) using the “jtools” package (Long, 2017) to test and visualize the moderating effects of a given early life stressor.

## 4. Results

### 4.1. Preliminary analysis

All variables of interest for Sample 1 were normally distributed with skewness values ranging from  $-0.62$  to  $-0.01$ , except age was positively skewed at  $+1.52$ . This sample had higher amounts of early life stress ( $M=7.0$ ,  $SD=2.5$ ) and current life stress ( $M=21$ ,  $SD=7.7$ ) compared to previous studies (Dietrich, Verdolini Abbott, Gartner-Schmidt, & Rosen, 2008; Felitti et al., 1998). Further analyses suggested that early life and current life stress were associated ( $r=0.25$ ,  $p=0.04$ ), but the early life stress summary score was not related to any demographic variables ( $p's>0.11$ ). The most common types of early life trauma were emotional neglect (85%), family violence (83%), and bullying (82%), while the least reported were collective violence (19%), family incarcerations (23%), and drug abuse (29%).

Regarding prosocial behaviors, a positive relationship was found between charitability and cooperation ( $r=0.26$ ,  $p=0.02$ ). Participants were significantly more charitable ( $M=3.8$ ,  $SD=1.5$ ) than cooperative ( $M=3.6$ ,  $SD=1.4$ ), as indicated by a paired sample *t*-test

( $d=0.141(68)=6.0$ ,  $p < 0.001$ ). Considering demographics variables other than age, charitability differed by sex ( $d=0.54$ ,  $t(31)=2.1$ ,  $p=0.05$ ) as females donated more money ( $M=4.2$ ,  $SD=1.3$ ) than males ( $M=3.4$ ,  $SD=1.8$ ). There were not any other demographic variables (except age) that were associated with cooperation ( $p's > 0.09$ ). Sex was included as a covariate in the multivariate analyses given the reported sex-difference in charitability.

#### 4.2. Bivariate analysis

As shown in Table S1, bivariate analyses were conducted to determine if the variables of interest had direct associations with prosocial behaviors. Contrary to our hypotheses, neither age nor collective violence was positively associated with prosocial behaviors ( $p's > 0.07$ ). Further abuse and neglect were not negatively associated with prosocial behaviors ( $p's > 0.13$ ). One negative effect was found between charitability and family incarcerations ( $r=-0.31$ ,  $p=0.05$ ). Two positive effects predicting cooperation were approaching statistical significance: age ( $r=0.22$ ,  $p=0.06$ ) and parent/separation death ( $r=0.30$ ,  $p=0.06$ ).

#### 4.3. Multivariate analyses

Previous studies have separately reported that age, sex, and multiple types of trauma are differentially associated with prosocial behaviors, yet there has not been a study that has analyzed these variables together or reported their collective influence on prosocial behaviors. For this reason, we conducted two multiple linear regressions with age, sex, and all 13 early life traumas as predictors of each prosocial behavior. The overall model did not significantly predict cooperation ( $r^2=0.28$ ;  $F(15,51)=1.35$ ,  $p=0.21$ ) or charitability ( $r^2=0.28$ ;  $F(15,51)=1.32$ ,  $p=0.23$ ). Table S2 displays the t-statistics for each predictor. Interestingly, the multivariate analyses revealed three significant associations that partially supported our hypotheses; cooperation was positively associated with age ( $\beta=0.32$ ,  $p=0.03$ ) and negatively associated with emotional neglect ( $\beta=-0.35$ ,  $p=0.02$ ) and collective violence ( $\beta=-0.31$ ,  $p=0.04$ ).

#### 4.4. Interaction effects predicting charitability

Moderation analyses were conducted to test the hypotheses that early life traumas would either strengthen or weaken the association between age and charitability. As shown in Table 1 and Fig. 1, only one negative interaction between age and family violence was found to significantly predict charitability and remained significant even when controlling for sex, income, and ethnicity. This interaction effect was further analyzed by a simple slope analysis, which revealed that age and charitability were associated at  $-1$  SD below the mean of family violence, but this relationship did not persist at the mean or  $+1$  SD above the mean (Table 2).

#### 4.5. Interaction effects predicting cooperation

As shown in Table 1 and Fig. 2, the association between age and cooperation was significantly weakened by multiple types of trauma, including emotional abuse, community violence, family violence, and the summary score of early life stress. When controlling for sex, race, and income all four interaction effects remained significant. Simple slopes analyses revealed that the association between age and cooperation persisted at  $-1$  SD below

the mean and at the mean, but all four relationships waned at +1 SD above the mean of each type of trauma (Table 2)

## 5. Study 2

The initial findings from Study 1 suggested that the association between age and prosocial behaviors was weakened by some types of early life trauma, especially family violence. However, the limited sample size and skewed distribution of age resulted in limited statistical power. Study 2 was conducted to test whether the initial findings would be replicated on a larger sample with different demographics and another paradigm of measuring prosocial behaviors. Study 2 hypothesized that (1) helping attitudes would be positively associated with age and negatively associated with emotional neglect and multiple forms of violence, and (2) the association between age and helping attitudes would be weakened by the experience of family violence, community violence, emotional abuse, and the summary score of early life stress.

## 6. Methods

### 6.1. Participants

Sample 2 consisted of 499 individuals (270 woman, 227 men, 2 unknown) who were recruited through the Amazon Mechanical Turk (mTurk). The sample ranged from 18 to 74 years of age ( $M=39.6$ ,  $SD=14.6$ ). Approximately 56% of the sample completed a bachelor's degree or higher postgraduate study, while 14% percent completed an associate degree, and 20% completed some college credits but no degree. Most participants were Caucasian (69%), followed by Asian (11%), Black (7%), Hispanic (6%), Multi (5%), and Native American (2%). An equal number of people were either married (40%) or single (40%), and the remaining people were either in a committed relationship (18%) or divorced (2%). Most participants were employed (83%) and reported an annual income of less than \$25,000 (32%).

mTurk has been found to be a reliable source for data collection (Buhrmester, Kwang, & Gosling, 2011), but nonetheless, an additional quality control question was included in the surveys. Participants were asked to select a desired arbitrary response, so we could ensure they were reading the questions carefully. Only the participants that answered correctly were included in this sample. Participants in sample 2 completed two questionnaires to measure early life stress and helping attitudes, which took an average of 2 min to complete. Data collection and protocols were approved by the university's Institutional Review Board.

### 6.2. Prosocial measure

The Helping Attitude Scale (Nickell, 1998) was used to measure prosocial behaviors of mTurk responders. This scale is a 20-item measure of respondents' beliefs, feelings, and behaviors about helping others. Each item is answered on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), and a summary score ranging from 20 to 100 was created from summing the items. Higher scores indicated participants had a stronger attitude to help others. The item where participants were most likely to have a strong helping attitude was finding enjoyment in helping someone ( $M=4.0$ ,  $SD=1.0$ ), while

the least common helping attitude was reported about offering to help with school or community activities ( $M=2.9$ ,  $SD=1.3$ ).

### 6.3. Life stress assessments & statistical analyses

The Adverse Childhood Experiences Questionnaire – International Version (Organization, 2015) was used again to measure the frequency of stressful experiences before the age of 18. The 13 specific types of trauma and summary score of early life stress were calculated and analyzed using the same technique as described in Study 1. All statistical analyses were also conducted using the same software, packages, and models as reported in Study 1.

## 7. Results

### 7.1. Preliminary analyses

Every variable of interest in Study 2 was normally distributed with skewness values ranging from  $-0.28$  to  $0.18$ . The participants in Study 2 reported fewer early life stressful experiences ( $M=5.9$ ,  $SD=3.3$ ) compared to the first study ( $M=7.0$ ,  $SD=2.5$ ), and an independent samples  $t$ -test suggested this difference was significant ( $d=0.37$ ,  $t(106)=3.1$ ,  $p=0.002$ ). Additional analyses of the early life stress summary score revealed a negative relationship with age ( $r=-0.12$ ,  $p=0.01$ ), and sex was approaching significance ( $d=0.18$ ,  $t(425)=1.8$ ,  $p=0.07$ ) with females experiencing more stress ( $M=6.2$ ,  $SD=3.5$ ) than males ( $M=5.6$ ,  $SD=3.1$ ). Early life stress also differed by race ( $\eta^2=0.03$ ,  $F(5,424)=2.6$ ,  $p=0.03$ ) with Native Americans experiencing the most early life stress ( $M=8.5$ ,  $SD=3.3$ ), which was significantly greater than Asians ( $p=0.05$ ), Caucasians ( $p=0.01$ ), and Multi-racial groups ( $p=0.03$ ). Similar early life stress levels were reported for African Americans ( $M=6.7$ ,  $SD=3.5$ ) and Hispanics ( $M=6.8$ ,  $SD=3.1$ ), which were also significantly higher than Caucasians ( $p < 0.05$ ). Lastly, early life stress also differed by income ( $\eta^2=0.03$ ,  $F(4,41)=2.6$ ,  $p=0.03$ ) with participants reporting an income between \$34-49,000 experiencing more early life stress ( $M=6.8$ ,  $SD=3.4$ ) than those making above \$50,000 ( $M=5.3$ ,  $SD=3.3$ ;  $p=0.003$ ). The most common reported early life traumas were bullying (86%), emotional neglect (76%), and family violence (71%), while the least common were family incarcerations (15%), collective violence (25%), and sexual abuse (28%).

When comparing helping attitudes to demographic variables other than age, significant differences were found between groups of marital status ( $\eta^2=0.02$ ,  $F(3,492)=4.1$ ,  $p=0.007$ ) and sex ( $d=0.24$ ,  $t(493)=2.6$ ,  $p=0.01$ ). Post-hoc Tukey test revealed that females ( $M=72.8$ ,  $SD=17.7$ ) tended to have stronger helping attitudes than males ( $M=68.9$ ,  $SD=15.7$ ;  $p=0.01$ ), as did widows ( $M=68.3$ ,  $SD=17.8$ ) compared to participants that were single ( $M=82.1$ ,  $SD=17.7$ ;  $p=0.003$ ). Given the significant differences in stress across multiple demographic variables, multivariate analyses controlled for these variables.

### 7.2. Bivariate analyses

As hypothesized helping attitudes strongly increased with age ( $\beta=0.30$ ,  $p < 0.001$ ) and decreased with emotional neglect ( $\beta=-0.14$ ,  $p < 0.001$ ; Table S1). When controlling for sex, race, marital status, and income, both age and emotional neglect remained directly associated with helping attitudes.



### 7.3. Multivariate analyses

A multiple regression was conducted with age, sex, and the 13 specific early life traumas predicting helping attitudes. As shown in Table S2, the significant effects from the bivariate analyses remained associated with helping attitudes: age ( $\beta=0.29$ ,  $p < 0.001$ ) and emotional neglect ( $\beta=-0.16$ ,  $p=0.003$ ). An F-test indicated that the overall model significantly predicted helping attitudes ( $r^2=0.13$ ;  $F(15,414)=4.05$ ,  $p < 0.001$ ).

### 7.4. Interaction effects predicting helping attitudes

As displayed in Table 1 and Fig. 3, the association between age and helping attitudes was moderated by family violence, community violence, and physical neglect. These interaction effects remained significant when controlling for sex, race, marital status, and income. Although each of three types early life traumas weakened the relationship between age and helping attitudes, simple slope analyses revealed the association remained significant at all levels of each type of traumatic experience (Table 2).

## 8. Discussion

### 8.1. Associations between age and prosocial behavior

Findings of the current study partially replicated those of previous reports and revealed novel interaction effects of age and stress on prosocial behaviors. Consistent with numerous studies (Fabes et al., 1999; Matsumoto, Yamagishi, Li, & Kiyonari, 2016), age was strongly associated with cooperation and helping attitudes in the multivariate analyses; however, age did not predict charitability in the multivariate or bivariate analyses, which aligns with other studies that suggest prosocial behaviors are stable traits with little fluctuations (Eisenberg et al., 2002; Rieger & Mata, 2015). The present findings support the notion that some facets of prosocial behavior increase with age, while other dimensions like charitability are more stable. However, since Bekkers (2007) and Sze et al. (2012) both utilized a similar paradigm with greater statistical power and found that older participants donate significantly more money to charities, it is plausible that a confound may better explain the insignificant findings from Study 1. Most notably, the first study had a relatively small sample size with a small age range that was positively skewed. Therefore, it is plausible that if Study 1 had included more participants at older ages, then there would have been enough statistical power to detect age-related effects for all prosocial behaviors.

### 8.2. Associations between stress and prosocial behaviors

In the multivariate analyses, only two types of early life traumas were differentially associated with distinct forms of prosocial behaviors. The few significant relationships in these analyses were expected, as stressful events will likely have a stronger effect immediately following the experience rather than years or decades later. Nonetheless, it was hypothesized that collective violence would be positively associated with prosocial behaviors since most reports indicated that prosocial actions increase immediately following terrorist attacks, wars, and natural disasters (Staub & Vollhardt, 2008). In the present study, collective violence was negatively associated with cooperation and not related to other forms of prosocial behavior, suggesting that the increases in prosocial behavior following

collectively experienced traumas might be short-term or do not transfer outside the context of helping the affected victims. As hypothesized, emotional neglect negatively predicted cooperation and helping attitudes. These findings build upon prior studies by showing that emotional neglect can have more long-term effects on prosocial behavior that extend into adulthood. In the bivariate and moderation analyses, we did not find any direct effects that current life stress has on the prosocial behaviors of Sample 1, despite current life and early life stress being significantly associated. These results suggest that in addition to the amount of stress and type of stressor, the timing of when the stressful events occurred may be important for understanding its impact on prosocial behaviors.

### 8.3. Interaction effects that predict prosocial behaviors

A moderation analyses revealed that multiple early life traumas negatively moderated the relationship between age and certain types of prosocial behaviors. Family violence was the most robust moderator as significance was found across all prosocial measures between both studies, followed by community violence which was associated with cooperation and helping attitudes. These findings were unexpected as most research has primarily focused on physical or mental neglect and abuse, but a closer look at the literature revealed that exposure to community violence has long-term implications on prosocial behaviors and aggression (Keresteš, 2006). Therefore, the strongest moderator that has been found to weaken the association between age and prosocial behaviors is growing up in a threatening environment, where observing prosocial actions may be less common both in the family and in the community. Given these findings, a potential method to encourage prosocial development throughout the life span may be to provide more parenting resources and social support to children in communities with high rates of crime or violence.

Although not as robust, our hypotheses that forms of abuse and neglect would be moderators of the association between age and prosocial behaviors were partially supported. Age-related changes in helping attitudes was moderated by physical neglect, and emotional neglect trending in the same direction for helping attitudes and cooperation. Additionally, the early life stress summary score moderated the association between age and cooperation and was trending in the same direction for helping attitudes. Collectively, these findings suggest that the positive age-related effects on prosocial behavior may not be universal but subjected to individual differences depending on one's amount of stressful experiences before the age of 18. It is possible that early life stress was a confounding variable among studies that did not find a significant association between age-related changes and prosocial behavior.

### 8.4. Limitations

In addition to the limited statistical power and demographics of Study 1, there were other limitations which can be built upon by future research. Regarding the prosocial measures, by conducting 10 trials of the PDG, some participants may have learned that they were matched with an autonomous tit-for-tat schema. This confound is exacerbated by the fact that participants' prior knowledge of the experimental tasks was not measured, but since Study 1 had a small age range it was unlikely that older participants were less familiar with the experimental tasks, as reported in prior studies (Kettner & Waichman, 2016). Additionally, the early life stress questionnaire was designed to measure the frequency of stressful events

and the different types of traumas, but not the intensity of each experience or the exact timing of events before the age of 18. Further, since this was a retrospective assessment it is plausible that participants' long-term memory may have introduced unwanted variation, especially with older participants whose responses may have been less accurate. Therefore, more in-depth assessments of prosocial behavior and early life stress are needed to further determine which features of stress are most detrimental to different types of prosocial behaviors.

### 8.5. Future directions

Considering this is one of the first investigations of the interaction between age and early life stress as predictors of prosocial behavior throughout the lifespan, it is necessary for future studies to replicate these findings with different sample demographics. Future studies with longitudinal designs could mitigate many of the limitations of the current study while also being able to analyze within-person variation. Given that engaging in prosocial behaviors may mitigate the negative effects of acute stress (Raposa et al., 2016), collecting data from multiple time points would help to differentiate short-term effects from the long-term trends. These findings could potentially elucidate whether stressful childhood events lead to different developmental trajectories of prosocial behaviors, or whether developing prosocial characteristics may increase one's ability to cope with stressful conditions. Understanding these outcomes could further explain the inconsistencies that have been found across studies and eventually lead to interventions that would be conducive for prosocial development or resiliency to early life stress.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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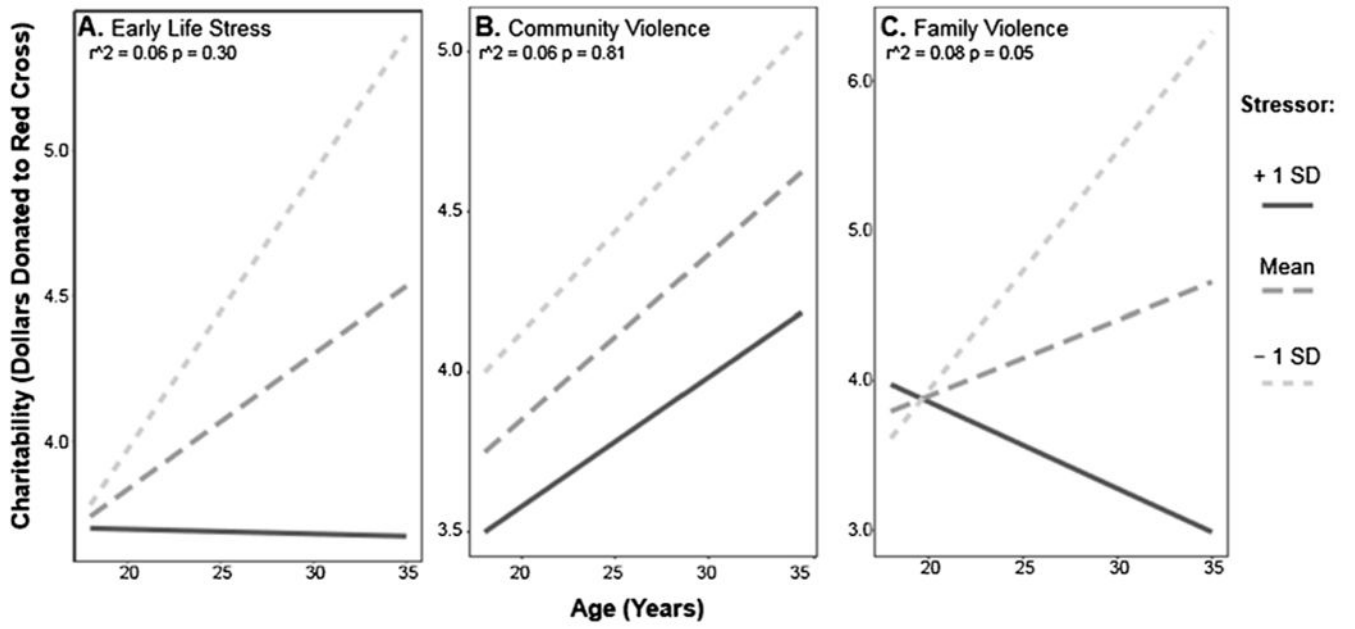
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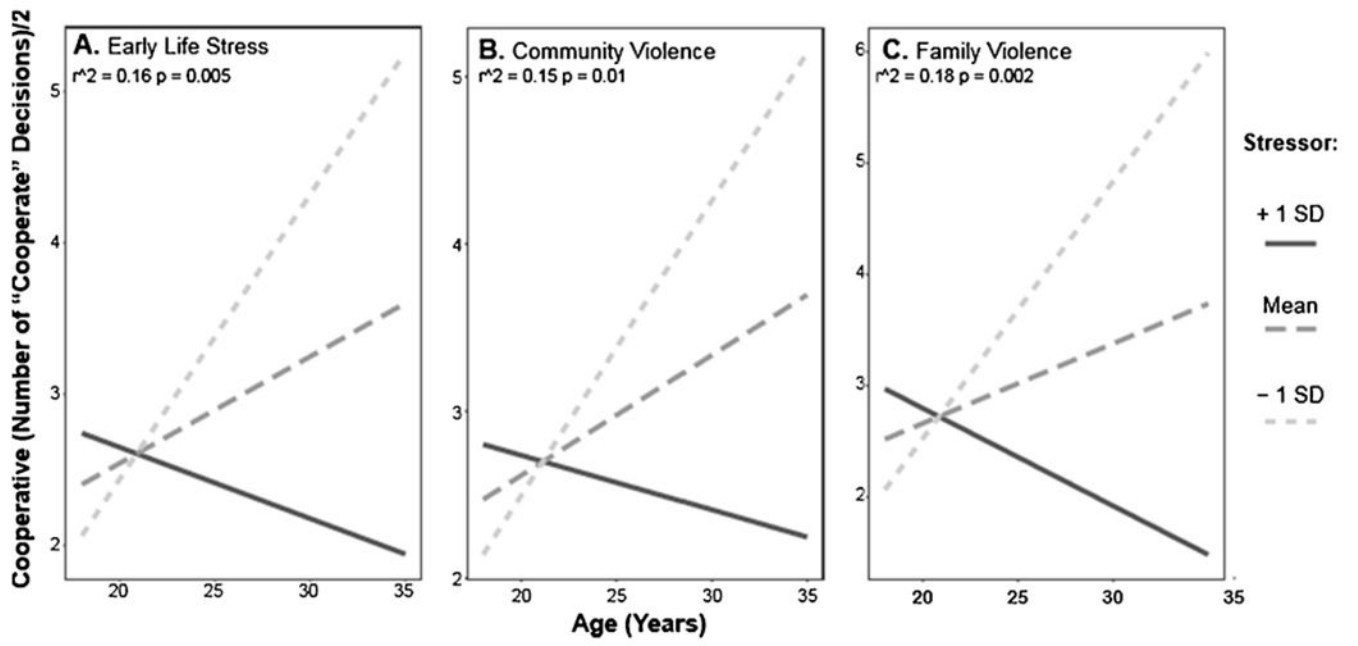
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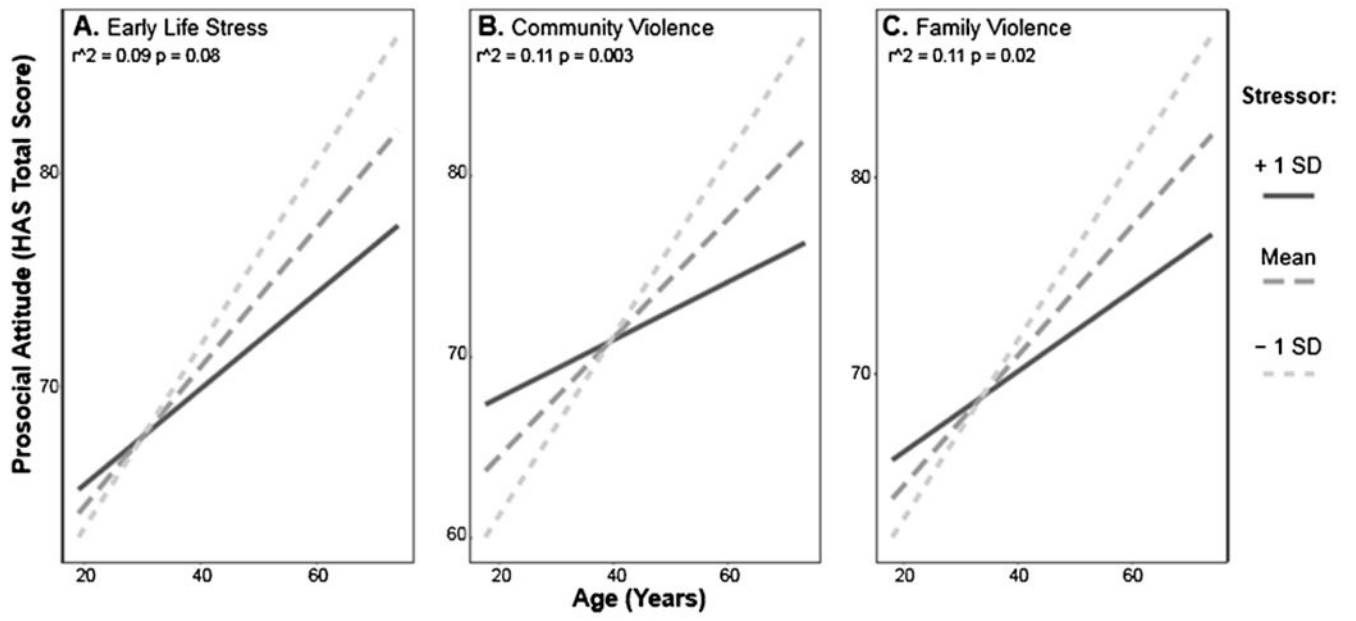


**Fig. 1.**  
 Interaction Effects from the Dictator Game.



**Fig. 2.**  
 Interaction Effects from the Prisoner's Dilemma Game.





**Fig. 3.**  
Interaction Effects from the Helping Attitude Scale.

**Table 1**

Interaction effects of age by stressors to predict prosocial measures from both studies.

Stressor	Study 1 DG: Charitability	Study 1 PDG: Cooperation	Study 2 HAS: Helping Attitude
ACE: ELS Summary Score	$\beta(63) = -0.13$	$\beta(63) = -0.33^{***}$	$\beta(428) = -0.08^{\sim}$
ACE: Physical Abuse	$\beta(63) = 0.18$	$\beta(63) = -0.03$	$\beta(484) = -0.06$
ACE: Emotional Abuse	$\beta(63) = -0.16$	$\beta(63) = -0.27^*$	$\beta(486) = -0.07^{\sim}$
ACE: Sexual Abuse	$\beta(63) = -0.02$	$\beta(63) = 0.01$	$\beta(477) = -0.05$
ACE: Family Drug Use	$\beta(65) = -0.13$	$\beta(65) = -0.22$	$\beta(485) = -0.01$
ACE: Family Incarceration	$\beta(65) = -0.16$	$\beta(65) = 0.07$	$\beta(484) = -0.05$
ACE: Family Mental Illness	$\beta(65) = -0.27^{\sim}$	$\beta(65) = -0.29^{\sim}$	$\beta(485) = -0.03$
ACE: Family Violence	$\beta(64) = -0.24^*$	$\beta(64) = -0.37^{***}$	$\beta(491) = -0.10^*$
ACE: Parent Separation/Death	$\beta(65) = -0.08$	$\beta(65) = -0.07$	$\beta(486) = -0.03$
ACE: Emotional Neglect	$\beta(63) = 0.02$	$\beta(63) = -0.24^{\sim}$	$\beta(494) = -0.08^{\sim}$
ACE: Physical Neglect	$\beta(64) = 0.07$	$\beta(64) = -0.04$	$\beta(481) = -0.11^{**}$
ACE: Bullying	$\beta(64) = -0.02$	$\beta(64) = -0.24$	$\beta(486) = -0.02$
ACE: Community Violence	$\beta(64) = -0.03$	$\beta(64) = -0.30^{**}$	$\beta(483) = -0.13^{***}$
ACE: Collective Violence	$\beta(64) = 0.23$	$\beta(64) = -0.11$	$\beta(479) = -0.05$

Notes: Interaction analyses of age by the summary score of early life stress and all 13 specific stressors are reported.  $\beta$  (standardized regression coefficient) and degrees of freedom are presented for each interaction analysis. Asterisks are used to represent p-values:

$\sim$  (p 0.10),

\* (p 0.05),

\*\* (p 0.01),

\*\*\* (p 0.005).

**Table 2**

Simple slope analyses on significant interaction effects from both studies.

Stressor	Level of Stress	Study 1 DG: Charitability	Study 1 PDG: Cooperation	Study 2 HAS: Helping Attitude
Family Violence	+1 SD	$\beta(64) = -0.17$	$\beta(64) = -0.27$	$\beta(491) = 0.17^{**}$
	Mean	$\beta(64) = 0.15$	$\beta(64) = 0.23^*$	$\beta(491) = 0.29^{***}$
	-1 SD	$\beta(64) = 0.47^*$	$\beta(64) = 0.73^{***}$	$\beta(491) = 0.39^{***}$
Community Violence	+1 SD	–	$\beta(65) = 0.10$	$\beta(483) = 0.14^*$
	Mean	–	$\beta(65) = 0.23^*$	$\beta(483) = 0.28^{***}$
	-1 SD	–	$\beta(65) = 0.56^{***}$	$\beta(483) = 0.45^{***}$
Physical Neglect	+1 SD	–	–	$\beta(481) = 0.17^*$
	Mean	–	–	$\beta(481) = 0.30^{***}$
	-1 SD	–	–	$\beta(481) = 0.43^{***}$
Emotional Abuse	+1 SD	–	$\beta(63) = -0.04$	–
	Mean	–	$\beta(63) = 0.25^*$	–
	-1 SD	–	$\beta(63) = 0.55^*$	–
Early Life Stress Summary Score	+1 SD	–	$\beta(63) = -0.15$	–
	Mean	–	$\beta(63) = 0.23^{**}$	–
	-1 SD	–	$\beta(63) = 0.60^{***}$	–

Notes: Simple slope analyses were only conducted on significant interaction effects from Table 1.  $\beta$  (standardized regression coefficient) and degrees of freedom are presented for each level of the simple slope analyses. Asterisks were used to represent p-values:

~ (p 0.10),

\* (p 0.05),

\*\* (p 0.01),

\*\*\* (p 0.005).