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Childhood abuse and vulnerability to depression: Cognitive scars in otherwise healthy young adults

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Abstract

Models of depression vulnerability posit that negative early experiences, such as exposure to childhood abuse (CA), increase vulnerability to depression later in life. Though most victims of CA do not go on to develop depression, the question remains as to whether these individuals retain cognitive “scars” that may contribute to depression vulnerability. The present study examined the relationship between self-reported, retrospective CA cognitive vulnerability to depression in a carefully selected sample of young adults without current or past psychopathology. We measured cognitive vulnerability with both a self-report questionnaire, the Dysfunctional Attitudes Scale (DAS), and a measure of information processing bias, the Scrambled Sentences Test (SST). Self-reported severity of CA was associated with increased cognitive vulnerability to depression on both the DAS and SST. Vulnerability to depression as measured by the SST, but not by the DAS, prospectively predicted increases in depressive symptoms over a 6-month period. Scores on the SST also interacted with CA to predict increases in depressive symptoms. These findings demonstrate the pernicious effects of CA even in those without current or past psychopathology.

Keywords

childhood abuse; depression; vulnerability; dual process models

Cognitive models of depression (e.g., Beck, 1967; 2008) suggest that early negative childhood experiences, including physical and emotional neglect and physical, emotional, and sexual abuse, increase vulnerability to depression later in life. In fact, there is considerable evidence that childhood abuse (CA) is a risk factor for depression and other negative mental health outcomes (MacMillan et al., 2001; Widom, DuMont, & Czaja, 2007;

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Wright, Crawford, & Del Castillo, 2009, Gibb et al., 2001). There are also a number of studies suggesting that CA leads to increased depressogenic cognitive styles in childhood (e.g., Gibb & Abela, 2008) and that these styles mediate the relationship between CA and the onset of depression (Gibb, 2002; Cukor & McGinn, 2006).

Despite the strong relationship between CA and risk for depression, most individuals reporting abuse (i.e., 75–85%) do not go on to develop depression (MacMillian et al., 2010; Widom et al., 2007). However, cognitive theory predicts that these individuals with a history of CA may remain vulnerable to depression even if they have not manifested the disorder. While a number of studies have investigated cognitive vulnerability in individuals with current or past psychopathology (e.g., Alloy, Lipman, & Abramson, 1992; Haeffel et al., 2005, Riso et al., 2003), few studies have examined the question of whether otherwise healthy individuals continue to carry cognitive “scars” of CA. Van Harmelen and colleagues (2010) conducted one such study where they measured negative explicit and implicit self-associations in individuals with and without current and past psychopathology. They found that, regardless of psychopathology status, individuals with a history of CA displayed more negative implicit self-associations than those without a history of CA. Thus, there is evidence of an association between CA and negative cognitive processes, but only one prior study has examined the relationship between CA and cognitive vulnerability to depression in individuals without current or past psychopathology.

Dual process models of cognitive vulnerability to depression (e.g., Beevers, 2005; Haeffel et al., 2007) suggest that cognitive functioning is divided into two distinct but interacting processes: associative (automatic) and reflective (effortful). These models suggest that individuals who are vulnerable to depression demonstrate negatively biased associative processing, but may be able to correct or inhibit these negative automatic associations through reflective processing. However, when these individuals are exposed to a cognitive load or a stressor that reduces the capacity to engage in reflective processing, the negative associative processes are observable.

Interpretation of ambiguous material is one process that appears biased in depression. Indeed, depressed individuals interpret ambiguous stimuli as negative more frequently than their non-depressed counterparts (Mogg, Bradbury, & Bradley, 2006). Further, research on interpretation biases provides support for the dual process nature of cognitive vulnerability. The Scrambled Sentences Test (SST; Wenzlaff & Bates, 1998) is a unique tool to measure these biases as it allows one to empirically test interpretation at both the automatic and effortful level. Described in greater detail below, the SST contains a series of scrambled, six-word sentences. Individuals are instructed to select five of the six words in each scrambled sentence and to reorder these five words to form a statement. Individuals can reorder each scrambled sentence to form either a positive or a negative statement. The proportion of unscrambled negative sentences is used as a measure of negative interpretation biases. The SST is typically administered both with and without a cognitive load. The cognitive load is thought to inhibit effortful, reflective processing, thus allowing for improved assessment of automatic processing in the load condition.

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Previous research using this task has shown that interpretation biases are cognitive markers of risk for depression. In support of dual process models, those at risk for depression show a greater proportion of negative unscrambled sentences than those with less risk for depression, but only under the load condition (Van der Does, 2005; Watkins & Moulds, 2007; Wenzlaff & Bates, 1998). In the no load condition, there are no differences between the groups in the proportion of negative sentences unscrambled. The SST is also associated with prospective risk for depression. A greater proportion of negative sentences unscrambled during the load condition, but not the no load condition, prospectively predicts increases in depression symptoms (Rude et al., 2002) and diagnosis of major depressive disorder 6 to 24 months later (Rude et al., 2003; Rude et al., 2010). In sum, interpretation biases appear to characterize depression and, at the automatic level, predict its development.

Self-reported dysfunctional attitudes have also been shown to predict future depression. For example, Hankin and colleagues (2004) recruited 216 undergraduate students and assessed depression symptoms, levels of dysfunctional attitudes, and self-reported negative life events across two time points separated by five weeks. Dysfunctional attitudes interacted with negative life events to predict Time 2 depression symptoms after controlling for Time 1 depression symptoms and Time 1 negative life events. Specifically, in the context of high levels of negative life events, those reporting greater levels of dysfunctional attitudes also reported more depression symptoms. Dysfunctional attitudes did not predict depressive symptoms at low levels of negative events. Dysfunctional attitude levels have also been shown to predict subsequent episodes of depression in a community sample of women (Rude et al., 2010). Dysfunctional attitudes also predict relapse/recurrence of depression in patients successfully treated with cognitive therapy (Jarrett et al., 2012). These findings support the notion that self-reported dysfunctional attitudes may predict future episodes of depression.

In addition, high levels of dysfunctional attitudes have been found to explain the link between CA and later development of depression. Gibb and colleagues (2001) combined scores on the DAS and Cognitive Style Questionnaire (CSQ) to recruit individuals at high and low cognitive risk for depression. They found that, when controlling for initial depressive symptoms, cognitive vulnerability status fully mediated the relationship between reported childhood emotional maltreatment and development of depression during a 2.5 year follow-up.

Certain types of maltreatment (namely emotional) are more strongly associated with vulnerability to psychopathology than others. For example, childhood emotional maltreatment (EM) is more strongly linked to negative inferential styles and dysfunctional attitudes than childhood physical (PM) or sexual maltreatment (SM) (Gibb, 2002; Gibb et al., 2004). Childhood EM also has a greater association with automatic self-depressed and self-anxiety associations (van Harmelen et al., 2010). Further, Gibb and colleagues (2001) found that childhood EM predicted depressive episodes across a 2.5-year follow-up. Childhood PM and SM failed to predict depressive episodes across this follow-up. Theoretical accounts of EM suggest that, within EM, abusers explicitly provide negative self-referential statements (e.g., “you are a failure”) to abuse victims. These explicit examples of negative self-referential thoughts may directly contribute to the formation and

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maintenance of negative cognitive schemas (Rose & Abramson, 1992). And as previously discussed, negative cognitive schemas characterize risk for psychopathology and help to explain its onset and maintenance (Beck, 1967).

Given the potential for CA to lead to depression vulnerability, even in the absence of current or past psychopathology, we examined the association between self-reported CA and responses to both the DAS and SST in a sample of young adults with no history of Axis I psychiatric disorders. In addition, we assessed depression symptoms 6-months after the initial baseline session to study the relationship between CA, cognitive vulnerability, and the course of depressive symptoms over time. In this study we sought to test the following four hypotheses:

1. Consistent with Beck's (1967) cognitive theory of depression, we predicted that individuals who reported greater levels of CA would demonstrate increased dysfunctional attitudes as measured by the DAS.
2. In line with dual process models of cognitive vulnerability (Beevers, 2005), we hypothesized that CA would be related to proportion of unscrambled negative sentences on the SST. The dual process model suggests that individuals who are vulnerable to depression may reflectively correct for any cognitive biases in the absence of a cognitive load, yet these biases may surface when cognitive resources are reduced. Thus, we predicted that those with greater CA would unscramble a greater proportion of negative sentences, but only in the cognitive load condition.
3. In line with previous findings on the differential effects of abuse type (e.g., Gibb et al., 2001), we predicted that childhood EM would correlate more strongly with our outcome variables (dysfunctional attitudes, interpretation biases, and depressive symptoms) than PM.
4. Consistent with prior work (Gibb et al., 2001), we hypothesized that increased cognitive vulnerability, as measured by the DAS and SST, would interact with CA to predict increased depressive symptoms over the course of 6 months. Specifically, we predicted that higher levels of CA combined with higher levels of cognitive vulnerability would predict increased depressive symptoms at the 6-month follow-up.

Method

Participants

Participants were 155 healthy young adults (*M* age = 18.8 years, *SD* = 1.6) recruited from introductory psychology classes at the University of Texas at Austin. Interviewers used structured clinical interviews to determine presence of current or past psychopathology. Exclusion criteria were presence of any current or past mood, anxiety, substance use, psychotic, or eating disorder. In addition, all participants had Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) scores of 15 or less (see Tables 1 and 2 for descriptive statistics). Participants partially fulfilled a research requirement by completing this study. All participants provided informed consent prior to participating in

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the study and the study procedures were approved by the institutional review board at the University of Texas at Austin.

Assessments

Structured Clinical Interview for DSM-IV—To assess exclusion criteria, the patient version of the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995) was administered at the time of study participation. Twenty percent of all interviews were rated by an independent assessor. Agreement between study and independent assessor was perfect for diagnoses for mood, anxiety, psychotic, and eating disorders ($\kappa = 1.0$). Agreement for substance dependence ($\kappa = .66$) and alcohol abuse ($\kappa = .79$) was acceptable.

Center for Epidemiological Studies-Depression Scale—The Center for Epidemiological Studies-Depression scale (CES-D; Radloff, 1977) is a frequently used 20-item, self-report measure of depressive symptomology. The CES-D has been found to have adequate internal consistency (current study $\alpha = .74$) and test-retest reliability (Devins, Orme, Costello, & Binik, 1988). A score of 16 or higher is considered depressed (Santor, Zuroff, Ramsay, Cervantes, & Palacios, 1995).

Childhood Trauma Questionnaire—The Childhood Trauma Questionnaire (CTQ; Bernstein et al., 1994) is a 28-item self-report questionnaire that assesses history of emotional, physical, and sexual abuse[1], and emotional and physical neglect. Participants rate the frequency at which an abusive or neglectful behavior occurred on a 1 (“Never True”) to 5 (“Very Often True”) Likert-type scale. The CTQ has good test-retest reliability across inpatient and community samples (Bernstein et al., 1994; Bernstein, Ahluvalia, Pogge, & Handelsman, 1997) and demonstrated good internal consistency in the current study ($\alpha = .83$). While self-report measures of abuse are subject to various biases (response biases, memory biases, interpretation biases, etc.), previous work has documented convergent validity between the CTQ and clinician-rated abuse interviews and good sensitivity and specificity of the CTQ for detecting CA when compared to a clinical interview (Bernstein et al, 1997; Bernstein & Fink, 1998). Consistent with prior research (Van Harmelen et al., 2010), items assessing physical abuse and neglect were combined into a single subscale assessing childhood physical maltreatment (PM; $\alpha = .71$) while items measuring emotional abuse and neglect were combined into a childhood emotional maltreatment (EM; $\alpha = .83$) subscale.

Dysfunctional Attitudes Scale—The original Dysfunctional Attitudes Scale (DAS; (Weissman & Beck, 1978) was originally a 100-item scale that is most often divided into two 40-item forms (A & B). Participants were randomized to complete either form A or form B. The DAS has good test-retest reliability (Weissman & Beck, 1978) and had good internal consistency in the current study (form A $\alpha = .89$; form B $\alpha = .87$).

[1]In the current sample, reported childhood sexual abuse was low ($M = 5.3$, $SD = 1.3$) and was not significantly correlated with DAS or SST scores or CESD scores at baseline or 6-month follow-up (all $r < .11$, $p > .19$). As a result, we do not examine sexual abuse in our analyses or discussion below.

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Scrambled Sentences Test—The Scrambled Sentences Test (SST; Wenzlaff & Bates, 1998) measures participants' inclination to interpret ambiguous information in a negative or positive manner. The SST is composed of a series of 40 scrambled sentences that is divided into two equivalent forms containing 20 sentences. Each scrambled sentence consists of six words, and individuals are asked to re-order five of the six words to make a logical, grammatically correct sentence. Each set of words can be re-ordered to create a positive or negative sentence. For example, the words "the looks very future dismal bright" can be re-ordered to read "the future looks very dismal" (negative) or "the future looks very bright" (positive). In the current study, participants were instructed to write a number, one through five, over a word to denote its order in the newly formed sentence and they first practiced the task with two sentences that each had two emotionally-neutral, correct unscrambled forms to ensure that they understood the instructions. Participants were given 2.5 minutes for each block of 20 sentences and were asked to unscramble as many sentences as possible during this time. Participants were randomly assigned to complete either the first or second block under a cognitive load, which involved remembering a 6-digit number while completing the task. To help ensure that participants complied with the cognitive load, participants were asked to report the 6-digit number after completing the block of sentences. The percentage of negative sentences correctly unscrambled out of total sentences correctly unscrambled was calculated for each condition (cognitive load and no load) and constitutes the SST score.

Procedure

Mass pre-testing identified participants who scored less than 4 on the short-form of the Beck Depression Inventory (BDI-SF; Beck, Rial, & Rickels, 1974). Upon arrival to the laboratory, trained interviewers administered the SCID to confirm the absence of any current or past Axis I psychopathology. Participants meeting diagnostic criteria for a current or past mood, anxiety, psychotic, substance use, or eating disorder were excluded as were participants currently taking a psychotropic medication. Participants then completed questionnaires including the CES-D, CTQ, and DAS. Participants were randomly assigned to receive either form A or B of the DAS. Then, participants completed the SST. The order of the 2 blocks of 20 sentences and the order of the cognitive load condition were randomized and counterbalanced across participants.

Data Analytic Strategy

In order to explore the results we tested our hypotheses in the following manner. First, we examined correlations between CA and markers of cognitive vulnerability to depression (to test hypotheses 1, 2, and 3). Due to significant relationships between CA, DAS, SST and current depressive symptoms (see Results, below), we followed up our initial analyses by examining the cross-sectional mediational relationship between CA, cognitive vulnerability, and baseline depression scores. For these analyses we examined bivariate correlations and used hierarchical linear regression to examine the mediational effects. The significance of the indirect effect was further probed with the PRODCLIN program (MacKinnon et al., 2007), which is a powerful method for testing indirect effects. PRODCLIN tests mediational effects without some of the problems inherent in other methods of testing for mediation (e.g. inflated rates of Type I error, see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002),

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and examines the product of the unstandardized path coefficients divided by the pooled standard error of the path coefficients ($\alpha\beta/\sigma_{\alpha\beta}$) and a confidence interval is generated. If the values between the upper and lower confidence limits include zero, this suggests the absence of a statistically significant mediation effect.

We also examined the relation between cognitive vulnerability to depression, its interaction with CA, and changes in depressive symptoms over 6 months (to test hypothesis 4). These analyses consisted of hierarchical linear regression analyses exploring changes in depression from baseline to follow-up after accounting for initial level of depression. We further examined the indirect effect with the PRODCLIN program. All analyses were conducted in SPSS version 20.

Results

Participant Characteristics

Gender and racial/ethnic composition of the sample can be seen in Table 1. Sample means and standard deviations for measures of depression symptoms, self-reported CA, and cognitive vulnerability can be seen in Table 2. Seventy participants (45.2% of the total sample) completed the 6-month follow-up assessment of depression symptoms. There were no significant differences between follow-up completers and non-completers on CES-D scores ($t(153) = 1.75$, $p = .082$). Similarly, there were no significant differences between completers and non-completers in CTQ, DAS, or SST scores (all $t < 1$, all $p > .49$).

Associations between CA and Cognitive Vulnerability to Depression

To examine baseline assessment relationships among the constructs we examined two-tailed bivariate correlations, which are displayed in Table 2. Examination of these variables indicated that self-reported history of CA was related to DAS scores (r=.18, p =.025) and negative sentences unscrambled in the SST cognitive load condition (r=.21, p=.01), but not SST in the no load condition (r=.11, p>.1). However, when these correlations were compared using Fischer R to Z transformations, the correlation between CA and SST load condition was not significantly larger than the same correlation with the SST in the no load condition (Z=.90, p>.05).

When the CTQ was broken down into childhood physical (CTQ-PM) and emotional (CTQ-EM) maltreatment subscales, the associations changed somewhat. Physical maltreatment had a significant association with the SST cognitive load condition (r=.19, p=.019), but it was not significantly associated with the no load condition (r= −.01, p>.05), CES-D, or DAS (both p>.1). However, in this instance the correlation between PM and SST load condition was significantly larger than the same correlation with the SST no load condition (Z=1.67, p<.05). On the other hand, EM was not related to either SST cognitive load or no load conditions (ps>.1), but it was significantly associated with baseline depression symptoms (r=.16, p=.041) and DAS (r=.22, p=.007).

Regarding cognitive vulnerability factors and baseline depression symptoms, there was a significant relationship between DAS score and depression symptoms (r=.22, p=.008).

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However, there were no significant relationships between baseline depression symptoms and SST in the load (r=.14, p=.09) or no load conditions (r=.07, p>.1).

Mediation of Abuse on Baseline Depression Symptoms by Dysfunctional Attitudes

Given the significant associations between CA and DAS scores as well as between DAS scores and baseline symptoms of depression, we examined whether DAS scores mediated the relationship between CA and baseline CES-D scores. Using regression analyses, first we examined the effects of CA on baseline CES-D. This finding was not significant (β=.12, t=1.48, p=.14). This did not necessarily indicate that a mediational relationship did not exist, however, as MacKinnon and colleagues (2007) have suggested that effects of a source variable on an outcome variable can still flow through the mediator variable, even if a direct effect is not present. In support of continuing the mediation analyses, the remaining components of the mediation analysis were significant, with CA predicting DAS scores (β=.18, t=2.27, p<.05, r^2=.03), and DAS scores predicting baseline CES-D scores (β=.22, t=2.71, p<.01, r^2=.05).

We were able to further probe the mediational model with the PRODCLIN program. The unstandardized path coefficients and standard errors of the path coefficients for the indirect effect of were entered into PRODCLIN to yield lower and upper 95% confidence limits of .0014 and .0642. This finding indicated a significant mediational relationship, with the effects of CA contributing to baseline symptoms of depression through dysfunctional attitudes.

This mediational relationship was then examined for both childhood EM and PM. Childhood EM significantly predicted DAS (β=.22, t=2.75, p<.01, r^2=.05), and as stated above there was a significant DAS association with baseline CES-D. Unlike the previous mediation, there was a significant relationship between childhood EM and baseline CES-D (β=.16, t=2.06, p<.05, r^2=.03), and when including DAS in the model the relationship maintained significance (β=.19, t=2.31, p<.05, r^2=.03) while the EM and CES-D association was fully attenuated (β=.13, t=1.60, p>.05). This mediational model was supported by significant PRODCLIN 95% confidence interval limits of .002 and .087. A mediational relationship between childhood PM and baseline CES-D via DAS was also explored. However, the first step of the mediation approach was not supported as PM did not significantly predict DAS (β=.07, t=.89, p>.05). Thus EM, but not PM, appeared to predict baseline symptoms of depression via dysfunctional attitudes.

Changes in Depression after 6-Months

In order to examine changes in depression symptoms from the first assessment to the 6-month follow-up, we used hierarchical linear regression analysis to predict changes in depression from baseline to follow-up, which takes into account the magnitude of depression symptoms at follow-up, as well as change relative to the first assessment. To calculate change scores we subtracted the baseline score from the follow-up score on the CES-D for each participant. Due to a significant correlation between depression symptoms at both assessments (r=.41, p<.001),we controlled for initial level of depression. Because only 70

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out of 155 (45%) completed the follow-up assessment[2], the analysis included only those participants with data at baseline and follow-up.

The first step of the regression analysis indicated that baseline depression was a significant predictor of change in depression scores (B=−.47, t=−4.13, p<.001), as would be expected. As with the cross-sectional data, no relationship was found between CA and change in depressive symptoms (*B*=.21, t=1.84, p>.05). These results did not change when EM (*B*=.21, t=1.99, p=.051) or PM (*B*=.01, t=.05, p>.05) subscales were used as predictors instead of the CTQ total score. Similarly, DAS scores did not predict change in depression (*B*=.19, t=1.68, p>.05), nor was there an interaction between DAS, CA, and change in depression (*B*=−14, t=−.29, p>.05).

When the proportion of negative sentences unscrambled in both the load and no load SST conditions were simultaneously entered into the analysis, there was a significant interaction between SST in the cognitive load condition and change in depression (*B*=.37, t=3.60, p<.01). This finding indicated that individuals who unscrambled more negative sentences in the SST load condition experienced increased depression at the follow-up assessment compared to baseline. There was no interaction for the no-load condition with change in depression (*B*=.17, t=1.58, p>.05). There was a significant interaction with SST load and CA predicting change in depression (*B*=.52, t=2.51, p<.05), such that those reporting more CA and with higher SST load scores had increased levels of depression at follow-up. This interaction was not significant for the no-load condition. These results are summarized in Table 3. This interaction demonstrated that depression vulnerability interacted with CA to predict changes in depression scores. The analysis was examined with EM and PM, and a significant interaction was found for EM (B=.47, t=2.93, p<.01) but not PM (B=−.29, t=−1.49, p>.05).

To further examine the effects of abuse on changes in depression, we ran an additional mediational model on the relation between CA, SST, and changes in depression score from baseline to follow-up. In this model CA predicted the mediator, SST in the load condition (β=.20, p=.014), and SST in the load condition significantly predicted changes in depression symptoms at follow-up while controlling for both baseline depression symptoms and DAS score (β =.34, p=.002). This mediation analysis, which accounted for the shared variance from DAS scores, was further supported by a significant PRODCLIN analysis with a confidence interval range of .007 to 1.07. Thus, these findings suggest that the effects of CA may lead to increased cognitive vulnerability to depression, which may contribute to development of increased depressive symptoms over time.

Discussion

This study examined the relationship between childhood abuse (CA) and cognitive vulnerability to depression in a carefully selected sample of healthy young adults. Consistent

[2]Because a significant portion of the sample did not present for follow-up, we re-examined the mediational analyses while including a dummy coded variable for only the group that presented for follow-up as a covariate, to address potential differences between the two groups. Analyses indicated that even after including this covariate, CA continued to significantly predict DAS (*B*=.18, t=2.25, p<.05), and DAS continued to predict depression while controlling for CA (*B*=.20, t=2.47, p<.05). PRODCLIN also indicated a significance range that did not include zero (.0001 - .06), supporting the indirect effect. This finding suggests that the mediational effects were not simply a function of a unique characteristic for those who presented for follow-up.

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with cognitive theories of depression vulnerability (e.g., Beck, 1967; 2008), and supporting our first hypothesis, self-reported history of higher levels of CA was associated with increased endorsement of dysfunctional attitudes on the Dysfunctional Attitudes Scale (DAS). We also found that higher levels of CA were associated with negatively biased processing as measured by the Scrambled Sentences Test (SST) but only under a cognitive load condition. This finding is consistent with dual-process models of depression vulnerability (e.g., Beevers, 2005; Haeffel et al., 2007) and our second hypothesis. We found that CA was positively correlated with negatively biased processing at the automatic level (load condition), yet when cognitive resources allow for reflective processing (no load condition), this relationship disappears. However, it should also be noted that these two correlations were not significantly different from each other. Thus, this result should be interpreted cautiously.

When CA was separated into emotional maltreatment (EM) and physical maltreatment (PM), EM was positively correlated with baseline depressive symptoms. We found that scores on our self-report measure of cognitive vulnerability (DAS) were also positively correlated with baseline depressive symptoms. Further, DAS scores mediated the relationship between EM and baseline depressive symptoms. Somewhat surprisingly, EM was not related to SST scores in either the load or no load conditions. In addition, PM was not related to baseline depression, DAS scores, or SST in the no load condition. Unexpectedly, PM was related to SST in the load condition. These results provide partial support for our hypothesis that EM would be more strongly associated with depression and cognitive vulnerability.

Our experimental measure of cognitive vulnerability (SST) was not associated with baseline depressive symptoms under the load or no load conditions. Interestingly, however, SST scores in the load condition predicted change in depression symptoms; individuals who unscrambled a greater proportion of negative sentences in the load condition demonstrated greater increases in depression over 6 months. DAS scores did not predict change in depression. Thus, we found partial support for our fourth hypothesis in that cognitive vulnerability as measured by the SST in the load condition, but not the DAS, predicted increases in depressive symptoms.

Our study is one of the few to investigate the effects of CA on cognitive vulnerability to depression and symptom trajectory in a carefully selected healthy sample. Our findings support previous research suggesting that CA is associated with negative cognitive styles (Gibb, Abramson, & Alloy, 2004; Gibb & Abela, 2008), which place individuals at an increased risk for depression (Gibb & Alloy, 2006). More specifically, our results are consistent with those of van Harmelen and colleagues (2010) indicating that a history of CA is associated with both implicit and explicit negative self-associations. Their study and ours provide the first evidence that CA does indeed leave cognitive “scars” even in the absence of current or past psychopathology. This suggests that, even in individuals without current or past psychopathology, CA results in a lasting vulnerability to emotional disorders such as depression.

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Our findings were partially consistent with past research (Gibb, Alloy, Abramson, & Marx, 2003; van Harmelen et al., 2010) suggesting that childhood EM is more strongly associated with cognitive vulnerability than PM. We found that EM was more strongly associated with explicit negative attitudes as measured by the DAS. However, PM was more strongly associated with negative automatic processing as measured by the SST under the load condition. These differences may arise from the fact that EM provides explicit negative self-associations (e.g., *you are worthless*), which are the types of negative cognitions assessed by the DAS. In contrast, PM does not necessarily provide explicit negative associations, but may result in a more general negative automatic bias. This would explain the stronger association between PM and negative automatic processing as measured by the SST under a cognitive load. Yet, prior work has shown that EM predicts implicit negative bias as well as explicit negative bias (van Harmelen et al., 2010). The key may be that the IAT used by van Harmelen and colleagues (2010) specifically measures automatic *self-associations* while the SST measures more general negative automatic processing. So, it may be that EM is more crucial to negative processing related to the self while PM leads to a more general negative automatic bias. Further research is necessary to test the specific relationships between different components of CA and negative cognitive processes.

We also found that performance on the SST under a cognitive load prospectively predicted changes in depression symptoms over the course of 6-months. Individuals who unscrambled a greater proportion of negative sentences demonstrated greater increases in depression symptoms over the 6-month period. This finding supports previous research demonstrating the utility of the SST under a cognitive load in predicting future depression (Rude et al., 2002; 2003; 2010). In addition, ours is the first study we are aware of that demonstrates an interaction between CA, cognitive vulnerability, and future depression in a carefully selected, psychiatrically healthy sample. These results are consistent with past research that has demonstrated a meditational role of cognitive vulnerability between childhood EM and current distress (Hankin, 2005; Wright et al., 2009) and between EM in adolescence and future increases in depression (Liu et al., 2009).

Our results offer further support for dual-process models of depression vulnerability (e.g., Beevers, 2005; Haeffel et al., 2007). Only the results of the SST administered under a cognitive load prospectively predicted increases in depression over 6-months, whereas Dysfunctional Attitude Scale (DAS) scores and results of the SST under no load were associated with current symptoms of depression, but did not predict increases in depression. Individuals with a history of CA may be able to use reflective processing to modify initial, automatic negative cognitive processing, but the imposition of a cognitive load reduces cognitive resources resulting in an inability to implement reflective processing and thus allows for observation of the automatic, negative cognitive processes.

However, it should also be noted that our findings are somewhat inconsistent with those of Haeffel and colleagues (2007), who found that their implicit measure of depression vulnerability (a self-worth Implicit Associations Test) predicted current symptoms of depression, whereas their explicit measure (the Cognitive Style Questionnaire) predicted future symptoms of depression. In contrast, our implicit measure (the SST under load condition) better predicted change in depression and our explicit measure (the DAS)

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predicted current symptoms of depression but not change in depression. We hesitate to speculate too much on the potential reasons for this contrast due to the fact that our study and Haeffel and colleagues used different implicit measures. Future research might compare different implicit and explicit measures of depression vulnerability and their relationships to current and future symptoms of depression.

Our investigation of the relationship between CA and cognitive vulnerability to depression using a psychologically healthy sample has both strengths and limitations. Our results with a healthy sample may not generalize to a sample with current or past psychopathology. In addition, our results may underestimate the strength of the association between CA, cognitive vulnerability, and depressive symptoms. However, our study provides the opportunity to investigate whether CA results in “scars” of cognitive vulnerability in a sample that is otherwise psychologically very healthy and highlights the pernicious effects of CA even in the absence of overt psychopathology.

These results should be interpreted with some additional limitations in mind. First, the retrospective nature of the assessment of CA allows for the possibility that, rather than CA leading to increased cognitive vulnerability, individuals with greater cognitive vulnerability to depression are more likely to remember or endorse CA than those without such vulnerability. Or, some other underlying third factor could influence both the retrospective reporting of CA and cognitive vulnerability to depression. However, due to our use of a carefully selected sample of healthy young adults without current or past psychopathology, we are more confident in eliminating history of psychopathology or co-morbid conditions as such a third factor. Similarly, due to the nature of our sample, CA was not associated with current depressive symptoms and symptoms were not related to measures of cognitive vulnerability to depression.

Also, we experienced notable drop out (55%) from our initial assessment to our 6-month follow-up. It is possible that differences between those who dropped out and those who did not systematically biased our findings at 6-months. This possibility is mitigated by the fact that there were no significant differences between follow-up completers and non-completers in severity of CA, depression symptoms, or measures of cognitive vulnerability. Regardless, results of the follow-up should be interpreted in light of this low retention rate. It is also important to note that the current study used a questionnaire measure of CA rather than a clinician-administered structured interview. Finally, while it is unlikely that individuals in our sample would qualify for a personality disorder diagnosis, we should point out that we did not assess for personality pathology and thus it is possible that unmeasured personality pathology has impacted our findings.

To our knowledge, this is the first study to demonstrate that measures of cognitive vulnerability to depression interact with CA to prospectively predict increases in depression symptoms. In addition, we are only the second study (with van Harmelen et al., 2010) to show the relationship between CA and cognitive “scars” in a sample that carefully screened out individuals with any history of psychopathology. These results suggest that abuse history may prove to be an important marker in targeting depression prevention efforts in populations without overt psychopathology. This study also highlights the pernicious effects

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of CA in that, even in psychologically healthy individuals, a history of abuse confers increased vulnerability to depression.

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Table 1

Participant Characteristics

Sample Characteristics (n = 155)	n	%
Gender		
Women	83	53.5
Race/ethnicity		
American Indian/Native American	1	0.6
Asian	27	17.4
Black/African American	8	5.2
Caucasian/White	79	51.0
Hispanic/Latino	37	23.9
Multiple	1	0.6
None of the above	1	0.6
Did not answer	1	0.6

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Table 2

Measures at Baseline Assessment

	1	2	3	4	5	6	7	8
1. CTQ total	--							
2. CTQ-PM	.65**	--						
3. CTQ-EM	.91**	.38**	--					
4. DAS	.18*	.07	.22**	--				
5. SST no load	.11	.07	.14	.26**	--			
6. SST load	.21*	.19*	.15	.16*	.16*	--		
7. CES-D baseline	.12	−.01	.16*	.22**	.07	.14	--	
8. CES-D follow-up	.18	.00	.23†	.28*	.27*	.39**	.41**	--
Mean	30.11	11.40	13.37	114.41	.15	.16	5.45	5.97
SD	5.21	1.83	3.92	24.70	.14	.14	3.56	4.09

Note. n = 150 except for CES-D follow-up where n = 70.

† = .05

* p<.05;

** p<0.01;

CTQ = Childhood Trauma Questionnaire, PM = Physical Maltreatment subscale, EM = Emotional Maltreatment Subscale, DAS = Dysfunctional Attitudes Scale, CES-D = Center for Epidemiological Studies-Depression Scale, SST = Scrambled Sentences Test

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Table 3

Predicting Changes in CES-D Depression Symptoms from T1 to T2 (N=70)

Variable	Step F	ΔR^2	β	t	R_p
CES-D Baseline	17.05**	.22	−.47	−4.13**	−.56
CTQ Total	10.56**	.04	.21	1.84	−.10
No Load	10.40**	.16	.17	1.58	.19
Load			.37	3.60**	.07
CTQ*No Load	8.58**	.06	−08	−44	.08
CTQ*Load			.52	2.51*	.44

* =p<.05,

** p<.01;

CES-D= center for epidemiological studies – depression scale, CTQ= childhood trauma questionnaire, Load = cognitive load condition of the scrambled sentences test, No Load = scrambled sentences test score without a cognitive load