The differential relation of childhood maltreatment to stress sensitization in adolescent and young adult depression

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Abstract

Childhood maltreatment has been shown to have a stronger etiological relation to depression onset in adolescence than in adulthood. We propose that a maltreatment history may more strongly sensitize individuals to the depressogenic effects of proximal stressful life events in adolescence compared to adulthood. In an amalgamated sample of 176 unipolar depressed adolescents (age 12–17) and emerging adults (age 18–29), we examined the moderating role of age group on the relation of childhood maltreatment to sensitization to stressors that occurred just prior to episode onset. Among adolescents, but not among adults, those with a maltreatment history reported a lower severity level of life events prior to episode onset than reported by those without such a history. Further, this relation was specific to emotional abuse, and not physical or sexual abuse. We suggest that the pathological mechanisms associated with translating childhood maltreatment to depression may differ across developmental periods.

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Major Depressive Disorder (MDD) is highly prevalent and is one of the leading contributors to disability worldwide (Ustun, Aysuño-Mateos, Chatterji, Mathers, & Murray, 2004). Adolescence is a particularly important age group to consider with respect to the etiology of MDD because it is during this developmental period that individuals often experience their first depressive episode (Hankin et al., 1998). The point prevalence of MDD in adolescence ranges from 3 to 8%, with lifetime rates reaching 20% by the end of adolescence (Zalsman, Brent, & Weersing, 2006). Such rates are high in comparison to preadolescence rates (Cohen et al., 1993; Costello et al., 1996; Kessler, Avenevoli, & Merikangas, 2001), and represent a substantial risk for subsequent psychopathology (Birmaher et al., 1996), including a more chronic and recurrent course (Rao et al., 1995; Weissman et al., 1999; Zisook et al., 2007). Despite the high prevalence of MDD in adolescence and its associated impairment, research on adolescent depression still lags behind that of adult depression. Similarities in the clinical picture of adolescent versus adult depression have been noted (Kovacs, 1996); however, significant differences in risk factors (e.g., Jaffee et al., 2002) and treatment response (e.g., Kaufman, Martin, King, & Charney, 2001) across the lifespan highlight the importance of not generalizing research findings within one developmental period to another.

In particular, risk factors associated with depression onset may change in importance both with age and with the recurrent pathology of the illness. One compelling example of this is the depressogenic effect of childhood maltreatment, which appears to be stronger in childhood and adolescence than in adulthood (Brown, Cohen, Johnson, & Smailes, 1999; Hill, Pickles, 2002).
Rollinson, Davies, & Byatt, 2004; Jaffee et al., 2002). Childhood maltreatment is certainly closer in time to depression onset for children and adolescents than adults (Shanahan, Copeland, Costello, & Angold, 2011), and, indeed, some of the affected youngsters may be currently living in an environment characterized by family conflict (Brown et al., 1999). However, little to no empirical attention has been given to pathological mechanisms that may differentially translate childhood maltreatment to depression in childhood or adolescence versus adulthood. Understanding such pathological mechanisms is important as it may provide guidance to differential treatment approaches across developmental periods. An important mechanism that has been proposed to underlie the relation of early adversity, generally, to depression is heightened sensitivity to proximal stress. Consistent with Post's (1992) stress sensitization, or ‘kindling’, hypothesis, childhood adversity is proposed to lower the threshold of stress necessary to trigger depression onset, such that depression is triggered in the face of lower levels of proximal stressful life events (SLEs) than are required in those without early adversity (Monroe & Harkness, 2005). For example, in a cross-sectional study of adolescents, Harkness, Bruce, and Lumley (2006) found that those with a history of severe emotional, physical, and/or sexual abuse reported lower severity levels of SLEs prior to depression onset than those without such a history. Further, this relation was specific to SLEs that were independent of the adolescents’ own behaviour (e.g., grandmother suffers a stroke), which is consistent with evidence implicating independent events as central in the etiology of depression (e.g., Shrout et al., 1989; Stroud, Davila, Hammene, & Vrshek-Schallhorn, 2011). Similarly, in a prospective design, Rudolph and Flynn (2007) found that postpubertal girls and prepubertal boys with a history of parent—child separation, parental loss, or familial conflict were more likely to become depressed following lower levels of proximal stress than those without such histories. The effect of childhood adversity on the sensitization to later stress in adulthood has been less consistent. In a sample of adult twin pairs, Kendler, Kuhn, and Prescott (2004) found that women with sexual abuse histories were more likely than those without to develop MDD in response to recent severe SLEs. In contrast, in a sample of working-class mothers in London, no evidence was found to support the relation of early emotional, physical, or sexual abuse to increased prospective vulnerability to depression onset in the face of major proximal stressors (Bifulco, Brown, Moran, Ball, & Campbell, 1998). In terms of minor SLEs, which are particularly germane in the context of stress sensitization, Hammen, Henry, and Daley (2000) found that women with a history of one or more childhood adversities (e.g., family violence, parental alcoholism) became depressed in the face of lower levels of stress than those without such histories. This same pattern was observed in a sample of adults with a history of parental loss or separation (Slavich, Monroe, & Gotlib, 2011). In contrast, McLaughlin, Conron, Koenen, and Gilman (2010) found evidence for higher rates of MDD in men, but not women, with histories of ≥3 childhood adversities (e.g., physical abuse, violence toward mother, parental psychopathology) who were subsequently exposed to ≥3 recent minor SLEs. However, such a relation was not found among men with fewer than three minor SLEs. The current study is the first to directly test the hypothesis that childhood maltreatment has a stronger relation to the sensitization to proximal triggering SLEs in adolescence than in adulthood. We examined the relation of childhood maltreatment (CM; i.e., severe emotional, physical, and/or sexual abuse) to later stress sensitization in an amalgamated sample of 176 individuals in a current episode of a unipolar depressive disorder, ranging in age from 12 to 29. Within this age range we created two age groups that roughly correspond to lifespan stages of development, and have been used in previous accounts (Arnett, 2000; Harkness et al., 2010; Levinson, 1978): 1-adolescence (age 12–17) and 2-emerging adulthood (age 18–29). We chose to restrict our focus to emerging adulthood, rather than to adulthood more generally, since emerging adulthood is more similar to adolescence in terms of its proximity to the experience of CM than are other stages of adulthood. Since emerging adulthood essentially marks the transition from adolescence to adulthood, but is still developmentally different from adolescence in a number of ways (Arnett, 2000), it is our opinion that comparing adolescents to these young adults, specifically, would provide the most valid and stringent test of our main hypothesis, a test that is least confounded with the effect of chronic depression into later adulthood. Moreover, we chose to focus specifically on maltreatment, as opposed to adversity more generally, because maltreatment is one of the most powerful developmental risk factors in depression and has been found to mediate the effects of other adverse childhood experiences in the prediction of depression (Brown et al., 2007, 1999). Further, we chose to focus exclusively on a clinically depressed sample because stress sensitization is a mechanism proposed to help understand the progression of mood disorders across their longitudinal course (Post, 1992), and the sensitization effect is generally not observed in nondepressed individuals (e.g., Harkness et al., 2006). However, the stress sensitization hypothesis was originally proposed as a model of depression recurrence (see Post, 1992). Since depression recurs for approximately 35–50% of affected individuals (Eaton et al., 2008), and because emerging adults inevitably have had a longer opportunity to be depressed than adolescents, we controlled for number of previous depressive episodes in our models. We hypothesized that adolescents with a history of maltreatment would report a significantly lower level of SLEs in the most etiologically central 3-month proximal period prior to depression onset (Brown & Harris, 1989) than adolescents without this history. In contrast, we did not expect childhood maltreatment to be significantly associated with the level of SLEs prior to onset among emerging adults. Further, we predicted that this relation would be specific to independent, and not dependent, events. An additional novel contribution of the current study is our examination of the finegrained relations of emotional versus physical versus sexual abuse to stress sensitization in adolescent versus adult depression. This question is important because it may help to identify maltreated individuals who are most vulnerable to the depressogenic effects of stress. The depressogenic impact of specific types of abuse is not well-–agreed upon, with some support for emotional abuse as most strongly associated with onset (Brown, Craig, Harris, Handley, & Harvey, 2007a; Gibb, Chelminski, & Zimmerman, 2007; Hankin,
Participants included 176 individuals who met Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, American Psychiatric Association, 2000) criteria for a current episode of a non-bipolar mood disorder of less than two years’ duration. The duration criterion was included to maximize recall of SLEs that occurred prior to depressive episode onset (see Brown & Harris, 1978). All participants were drawn from one of three larger studies investigating the relation of stress to depression. Participants from Study 1 included 106 adolescents and emerging adults recruited through mental health agencies and local high schools in a small city in southeastern Ontario (see Harkness et al., 2006). Participants in Study 2 included 46 emerging adults recruited by way of advertisements and doctor referrals in a larger Ontario metropolitan area (see Bulmash, Harkness, Stewart, & Bagby, 2009). Participants in Study 3 included 24 emerging adult women recruited from community advertisements in a small city in the Pacific Northwest (see Harkness & Monroe, 2006). These prior reports give full details regarding recruitment procedures (see also Harkness et al., 2010). Exclusion criteria across all studies were the presence of a psychotic disorder, bipolar disorder, substance dependence, a medical condition that could cause depression, developmental disorder, or conduct disorder (latter two diagnoses relevant to adolescents). All participants had a minimum grade 7–education and were fluent in reading English. Descriptive characteristics of the samples by study site are presented in Table 1.

Measures

Diagnoses

Participants in Study 1 were administered the child and adolescent version of the Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman, Birmaher, Brent, Rao, & Ryan, 1996). Participants in Studies 2 and 3 were administered the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/P; First, Spitzer, Gibbon, & Williams, 2002). The K-SADS and the SCID-I/P are semi-structured interviews used to determine present and past DSM-IV diagnoses. Both have demonstrated excellent reliability and validity in their respective populations (Ambrosini, 2000; Williams et al., 1992). Both interviews began with a demographic overview. Occupational status was coded by two raters on an 8-point scale according to the Hollingshead Index of Social Position (Hollingshead, 1975). In cases of disagreement, a consensus rating was achieved, which was used in analyses. For the adolescents, the highest of the parents’ Hollingshead ratings was used.

In all studies, interviews were administered by advanced graduate students in clinical psychology or licensed clinical psychologists who were trained to “gold standard” reliability status (see Grove, Andreasen, McDonald-Scott, Keller, & Shapiro, 1981). In order to achieve this status, interviewers had to observe interviews being conducted by gold standard interviewers, conduct these interviews while being observed by gold standard interviewers, and match diagnoses on at least three consecutive interviews. All interviewers received ongoing supervision and case review by a licensed clinical psychologist. The primary diagnoses of participants were as follows: (1) MDD (n = 151); (2) Dysthymia (n = 9); (3) Adjustment disorder with depressed mood (n = 5); and (4) Depressive disorder not otherwise specified (n = 11). Sixty-two (35.2%) participants met criteria for at least one comorbid disorder (see Table 1).

Table 1

<table>
<thead>
<tr>
<th>Demographic and clinical variables by study site.</th>
<th>Study 1 (n = 106)</th>
<th>Study 2 (n = 46)</th>
<th>Study 3 (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M/SD)</td>
<td>16.08/1.87&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23.11/3.26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24.33/3.46&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sex: Female (n/%)</td>
<td>77/72.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36/78.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24/100&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hollingshead index (M/SD)</td>
<td>3.81/1.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.26/1.86</td>
<td>5.00/2.11&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Number of episodes (M/SD)</td>
<td>1.58/1.29&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.72/3.69&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.08/5.75&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BDI score (M/SD)</td>
<td>25.80/12.23</td>
<td>29.11/8.30</td>
<td>30.63/10.06</td>
</tr>
<tr>
<td>Comorbidity: Present (n/%)</td>
<td>48/45.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7/15.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7/29.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>Note</sup>: Superscripts represent significant group differences (p < .05).

<sup>a</sup> Beck Depression Inventory.

<sup>1</sup> The nine participants who met criteria for dysthymia were all adolescents based on the DSM-IV duration criterion of dysthymia for children and adolescents of 1 year.

<sup>2</sup> Results of the primary analyses excluding the 26 participants who did not meet full diagnostic criteria for MDD were unchanged (available upon request).
reported both emotional and physical abuse, 18 (13%) reported both emotional and sexual abuse, 16 reported both physical and sexual abuse were 28.4% (range 10.7% to 41.6%), based on the CECA manual, which contains hundreds of examples and rating rules. Kappa coefficients ranged from .86 to 1.00 across studies (e.g., Harkness et al., 2006). All interviewers and raters received extensive training and supervision in the Bedford College procedures for rating CM by the second author.

Because the distributions of the CECA variables were skewed with relatively few participants reporting moderate or marked maltreatment, each variable was dichotomized into ‘severe’ (1-marked or 2-moderate) or ‘nonsevere’ (3-some or 4-little/none) levels (see Bifulco et al., 1998; Brown, Craig, Harris, Handley, & Harvey, 2007a, 2007b). In the full sample, 46.0% (n = 81) of participants reported a history of severe overall maltreatment. The percentages of participants who reported severe emotional (i.e., severe antipathy and/or indifference and/or psychological abuse), physical, or sexual abuse were 28.4% (n = 50), 25.0% (n = 44), and 20.5% (n = 36), respectively. These categories are not mutually exclusive and, as is typical, there was significant comorbidity among the CM experiences (e.g., McGee, Wolfe, Yuen, Wilson, & Carnochan, 1995), with phi coefficients ranging between .228 and .393. Specifically, among the 81 participants who reported an abuse history, 26 (19%) reported both emotional and physical abuse, 18 (13%) reported both emotional and sexual abuse, 16 reported both physical and sexual abuse (12%), and 11 (8%) reported all three types of abuse.

Life Events and Difficulties Schedule (LEDS-II; Bifulco et al., 1989; adolescent version, Frank, Matty, & Anderson, 1997)

The LEDS is a semi-structured, contextual interview and rating system that assesses recent SLEs in ten domains: education, occupation, housing, finances, role changes, legal, health, romantic relationships, other relationships, and deaths. It is important to note that the LEDS does not assess for the maltreatment variables covered by the CECA. Since stress sensitization is a theory of depression onset, we focused on SLEs that occurred in the 3-month pre-onset period (Brown & Harris, 1989).

Advanced graduate students in clinical psychology interviewed participants. Interviewers were trained to obtain contextual information regarding the events and to not query about participants’ subjective reactions to a stressor or the effect of the stressors on participants’ depression. A research assistant listened to the audiotaped interviews and prepared brief vignettes to summarize each event, which were presented to a team of 2–4 raters who rated the severity of each event, using the adolescent and adult LEDS manuals to base their ratings. The LEDS manuals include over 5000 examples as well as explicit rules and criteria for rating SLEs to provide anchoring and standardization of the ratings.

Life events were rated for their level contextual severity on a 4-point scale (1 = marked, 2 = moderate, 3 = some, 4 = little/ none). Pairwise comparisons among raters ranged from $k = .76$ to $k = .94$ (Harkness et al., 2006; Harkness & Monroe, 2006). Discrepancies among raters were discussed and a consensus rating was used in analyses. Life events were also rated for independence based again on the LEDS manuals. Across studies, raters achieved perfect consensus for independence ratings.

We ran two sets of analyses below. In the first set of analyses, we conceptualized stress in terms of ‘cumulative severity scores’ for independent and dependent events separately. This definition of stress has been used before in the studies that form the conceptual and empirical basis of the current paper (see Hammen et al., 2000; Harkness et al., 2006). To calculate these scores, we reverse coded the contextual severity scores for each event so that higher scores represented greater severity. Then, the scores were summed over the number of independent or dependent events in the 3-month period prior to onset. These values could be as low as zero for those with no events. In the second set of analyses, we conceptualized stress in terms of the presence versus absence of an independent or dependent SLE of at least “some” contextual threat in the 3-month period prior to onset. Specifically, if an individual is particularly sensitized to stress, then depression should onset in the face of relatively minor stressors and, thus, we hypothesized that adolescents with a history of maltreatment would be less likely than those without to have a threatening event prior to onset.

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3 Four adolescents were experiencing current emotional abuse at the time of participation in this study. Because it is possible that these four individuals may have reported fewer SLEs as assessed by the LEDS due to ongoing maltreatment, we ran our analyses below with these four adolescents excluded. The results were unchanged (available upon request).
Procedure

Ethical approval was obtained for each of the studies from which the current participants were drawn from the Research Ethics Boards of the respective institutions. Written informed consent was provided by all participants and by a parent or guardian for participants under age 18. In Study 1, participants engaged in two 2-hour assessments separated by one week. During session 1, adolescents were administered the K-SADS interview and questionnaires. During session 2, they received the LEDS and the CECA interviews. In Study 2, women participated in one 3-hour assessment in which the SCID-I/P was administered first, followed by questionnaires and the LEDS and CECA interviews. Participants in Study 3 were part of a treatment trial; therefore, the timing of interview administration differed in this study. Prior to receiving treatment, participants completed the SCID-I/P and questionnaires. Following 16 weeks of treatment (i.e., either cognitive-behavioural therapy, interpersonal therapy, or antidepressant medication), participants were administered the LEDS and the CECA interviews, with the LEDS interview covering the period from 6 months prior to onset of the index episode through the treatment trial. For each study, the diagnostic interview was administered prior to the LEDS and CECA interviews to prevent bias in the diagnosis of depression.

Data analysis

To address the primary study hypotheses we conducted two sets of analyses. First, we ran a series of four 2 (age group: adolescence, emerging adulthood) x 2 (maltreatment: presence, absence) Analyses of Covariance (ANCOVA) with cumulative independent stress severity as the dependent variable, and age group and the four maltreatment variables (overall CM, emotional abuse, physical abuse, sexual abuse), respectively, as the independent variables. A further four 2 x 2 ANCOVAs were run with cumulative dependent stress severity as the dependent variable and the same age group and maltreatment variables included as independent variables. The ANCOVA procedure used Type III sum of squares to account for intercorrelations among the independent variables and unequal cell sizes. Significant interactions were followed up by pairwise comparisons between means. Total number of previous depressive episodes was entered as a covariate in all models.

Second, we ran a series of four logistic regression analyses with the presence versus absence of an independent SLE as the criterion variable and number of previous depressive episodes, age group and overall CM, emotional abuse, physical abuse, or sexual abuse, respectively, and their interactions with age group entered as predictors. A final series of four similar logistic regression models were run with the presence versus absence of a dependent SLE as the criterion variable. Significant interactions effects were followed up by chi-squared tests. SPSS statistical software was used for all models.

Results

Site differences

As indicated in Table 1, and as per the definition of the studies, sex ($\chi^2[2, N = 176] = 8.50, p = .014$) and age ($F[2, 173] = 182.21, p < .001$, partial $\eta^2 = .678$) were both significantly differentially distributed across study sites. Further, participants in Study 1 ran a significantly higher socioeconomic status (lower Hollingshead rating) than those in Study 3, $F(2, 169) = 3.95, p = .021$, partial $\eta^2 = .045$. Participants in Study 3 reported significantly more depressive episodes than those in Studies 1 and 2, $F(2, 173) = 23.04, p < .001$, partial $\eta^2 = .210$. Finally, participants in Study 1 and Study 3 were more likely to have a comorbid diagnosis than participants in Study 2, $\chi^2(2, N = 176) = 13.16, p = .001$.

Demographic and clinical characteristics of the full sample

Frequencies of participants in each age group were as follows: 1-adolescence (ages 12–17; $n = 82$); 2-emerging adulthood (ages 18–29; $n = 94$). Descriptive characteristics of the full sample stratified by age group are presented in Table 2. There was a significantly higher proportion of females in the emerging adult group than in the adolescent group, $\chi^2(1, N = 176) = 4.50$, $p = .034$.

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive statistics of demographic and clinical variables stratified by age group.</td>
</tr>
<tr>
<td>Age (M/SD)</td>
</tr>
<tr>
<td>Sex: Female (n/%)</td>
</tr>
<tr>
<td>Hollingshead index (M/SD)</td>
</tr>
<tr>
<td>Number of episodes (M/SD)</td>
</tr>
<tr>
<td>BDI score (M/SD)</td>
</tr>
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</table>

*Note. Superscripts represent significant differences between group means ($p < .05$). BDI = Beck Depression Inventory.
Emerging adults experienced significantly more episodes of depression, $F(1, 176) = 5.91, p = .016$, partial $\eta^2 = .033$, than adolescents. Finally, adolescents were more likely to have a comorbid diagnosis than emerging adults, $\chi^2(1, N = 176) = 8.31, p = .004$.

The descriptive statistics of the main study variables by age group are presented in Table 3. No demographic or clinical variables were significantly related to the SLE variables. As such, only total number of previous depressive episodes was entered as a covariate in all models below.

The relation of CM and age group to stress sensitization: cumulative severity score

The first set of four ANCOVA models below included independent event severity as the dependent variable. The independent variables were age group and overall CM, emotional abuse, physical abuse, and sexual abuse, respectively. The second set of four ANCOVA models included dependent event severity as the dependent variable, along with the same age group and abuse variables as in the first set of models as the independent variables.

Independent SLEs

The ANCOVA model examining the effects of severe overall maltreatment and age group on independent event severity revealed a significant interaction of overall CM and age group, $F(1, 171) = 4.83, p = .029$, partial $\eta^2 = .027$. As indicated in Fig. 1A, pairwise comparisons between means revealed that among adolescents, those with a history of severe overall CM reported significantly lower severity levels of independent SLEs prior to depression onset than did those without such a history, $F(1, 171) = 4.08, p = .045$, partial $\eta^2 = .023$. In contrast, the difference in the severity level of independent SLEs between maltreated and non-maltreated individuals did not approach significance for those in the emerging adult group ($p = .295$, partial $\eta^2 = .006$). Bootstrapped confidence intervals (95% CI), computed by sampling 1000 times from our distribution, supported the robustness of this interaction ($\beta = 1.32, SE = 0.60, p < .001, CI_{95} = 0.141–2.47$; Howell, 2007).

The second model also revealed a significant interaction of severe emotional abuse and age group, $F(1, 171) = 6.59, p = .011$, partial $\eta^2 = .037$. As shown in Fig. 1B, and consistent with the above analysis with overall CM, pairwise comparisons between means revealed that among adolescents, those with a history of severe emotional abuse reported a trend for lower severity levels of independent SLEs prior to depression onset than did those without such a history, $F(1, 171) = 3.70, p = .056$, $\eta^2 = .021$. In contrast, the difference in the severity level of independent SLEs between emotionally maltreated and non-maltreated individuals did not approach significance for those in the emerging adult group ($p = .091$, partial $\eta^2 = .017$). Bootstrapped confidence intervals (95% CI) supported the robustness of this interaction ($\beta = 1.69, SE = 0.69, p = .014, CI_{95} = 0.410–3.11$).

The third model failed to reveal significant main effects of severe physical abuse ($p = .076$, partial $\eta^2 = .018$) or age group ($p = .927$, partial $\eta^2 < .001$), or a significant physical abuse by age group interaction ($p = .794$, partial $\eta^2 < .001$). The fourth model also failed to reveal significant main effects of severe sexual abuse ($p = .776$, partial $\eta^2 < .001$) and age group ($p = .409$, partial $\eta^2 = .004$), or a significant interaction of sexual abuse and age group ($p = .231$, partial $\eta^2 = .008$).

Dependent SLEs

The ANCOVA model examining the effects of severe overall maltreatment and age group on dependent event severity revealed a significant interaction of overall CM and age group, $F(1, 171) = 4.52, p = .035$, partial $\eta^2 = .026$. As indicated in Fig. 2, pairwise comparisons between means revealed that among emerging adults, those with a history of severe overall CM reported significantly higher severity levels of dependent SLEs prior to depression onset than did those without such a history, $F(1, 171) = 6.58, p = .011$, partial $\eta^2 = .037$. In contrast, the difference in the severity level of dependent SLEs between maltreated and non-maltreated adolescence was not significant ($p = .633$, partial $\eta^2 = .001$). Bootstrapped confidence intervals (95% CI) supported the robustness of this interaction ($\beta = 1.53, SE = 0.70, p = .031, CI_{95} = 0.06–2.88$).

**Table 3** Childhood maltreatment and stressful life event variables stratified by age group.

<table>
<thead>
<tr>
<th></th>
<th>Adolescence (n = 82)</th>
<th>Emerging adulthood (n = 94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Maltreatment: Yes (n/%)</td>
<td>34/41.5</td>
<td>47/50.0</td>
</tr>
<tr>
<td>Emotional abuse: Yes (n/%)</td>
<td>20/24.4</td>
<td>30/31.9</td>
</tr>
<tr>
<td>Physical abuse: Yes (n/%)</td>
<td>19/23.2</td>
<td>25/26.6</td>
</tr>
<tr>
<td>Sexual abuse: Yes (n/%)</td>
<td>11/13.4</td>
<td>25/26.6</td>
</tr>
<tr>
<td>Cumulative severity of independent events (M/SD)</td>
<td>1.07/1.77</td>
<td>1.10/2.11</td>
</tr>
<tr>
<td>Independent event of at least “some” severity: Yes (n/%)</td>
<td>24/29.3</td>
<td>25/26.6</td>
</tr>
<tr>
<td>Cumulative severity of dependent events (M/SD)</td>
<td>1.11/1.71</td>
<td>2.02/2.82</td>
</tr>
<tr>
<td>Dependent event of at least “some” severity: Yes (n/%)</td>
<td>14/17.1</td>
<td>33/35.1</td>
</tr>
</tbody>
</table>

*Note.* As the childhood maltreatment and stress variables were the main variables analyzed in the models of this study, our preliminary analyses did not include a test for simple differences in each of these variables across age groups. Group differences in these variables were assessed only in the full ANCOVA and logistic regression models.
The remaining models, which looked separately at maltreatment types, failed to find a significant interaction between maltreatment type and age group (emotional abuse: \( p = .375, \) partial \( \eta^2 = .005 \); physical abuse: \( p = .704, \) partial \( \eta^2 = .001 \); sexual abuse: \( p = .224, \) partial \( \eta^2 = .009 \)).

Fig. 1. Relation of age group and maltreatment (A: overall maltreatment; B: emotional abuse) to the cumulative severity level of independent stressful life events.

The relation of CM and age group to stress sensitization: presence versus absence of stress

The first set of four logistic regression models below included the presence versus absence of an independent SLE as the dependent variable. The independent variables were age group and overall CM, emotional abuse, physical abuse, and sexual abuse, respectively. The second set of four logistic regression models included the presence versus absence of a dependent SLE as the independent variable, along with the same age group and abuse variables as in the first set of models as the independent variables.

Independent SLEs

The logistic regression model examining the predictive value of severe emotional abuse and age group on the presence of independent stress revealed that, compared to the constant model, the overall model was statistically significant, \( \chi^2(4, N = 176) = 10.77, p = .029, \) Nagelkerke \( R^2 = .086. \) After controlling for total number of depressive episodes, only the interaction of severe emotional abuse and age group made a significant contribution to prediction (\( \beta = 2.88, \) Wald \( \chi^2 = 6.07, p = .014, \) OR = 17.78, 95% CI [1.80, 175.44]). Consistent with predictions, among adolescents, those with a history of severe emotional abuse were significantly more likely to report the absence of an independent SLE of at least “some” severity than those without such a history (95% vs. 62.9%), \( \chi^2(1, N = 82) = 7.53, p = .006, \) OR = 11.24, 95% CI [1.41, 90.91]. Among emerging adults, there was no difference in the presence versus absence of independent SLEs between maltreated and non-maltreated individuals (\( p = .311, \) OR = .61).

The remaining logistic regression models, which looked separately at overall CM, physical abuse, and sexual abuse, respectively, were not significantly different from the constant model (overall CM: \( p = .126; \) physical abuse: \( p = .108; \) sexual
Dependent SLEs

The logistic regression model examining the predictive value of severe physical abuse and age group on the presence of dependent stress revealed that, compared to the constant model, the full model was statistically significant, $\chi^2(4, N = 176) = 10.07, p = .039$, Nagelkerke $R^2 = .081$. After controlling for total number of depressive episodes, only the main effect of age group made a significant contribution to prediction ($\beta = .896$, Wald $\chi^2 = 4.26, p = .039$, OR = 5.02, 95% CI [1.05, 24.6]), demonstrating that emerging adults were significantly more likely than adolescents to report the presence of a dependent SLE of at least “some” severity. Similarly, the model looking at severe sexual abuse was also significant, $\chi^2(4, N = 176) = 11.58, p = .021$, Nagelkerke $R^2 = .093$. Again, the main effect of age group was the only significant predictor, $\beta = .874$, Wald $\chi^2 = 4.34, p = .037$, OR = 5.46, 95% CI [1.05, 5.74].

Finally, although the models examining overall CM and severe emotional abuse, respectively, were also significant (overall CM: $\chi^2(4, N = 176) = 14.05, p = .007$, Nagelkerke $R^2 = .112$; emotional abuse: $\chi^2(4, N = 176) = 10.02, p = .040$, Nagelkerke $R^2 = .081$), in both models, there was no significant interaction of maltreatment to age group (overall CM: $p = .229$, OR = 2.47; emotional abuse: $p = .616$, OR = 1.53), nor significant main effects of maltreatment (overall CM: $p = .932$, OR = 1.05; emotional abuse: $p = .770$, OR = .81) or age group (overall CM: $p = .425$, OR = 1.51; emotional abuse: $p = .076$, OR = 1.24).

Discussion

Consistent with the stress sensitization hypothesis, adolescents with a history of severe maltreatment reported a significantly lower severity level of independent SLEs prior to depression onset, and were less likely to have an independent SLE of at least some threat prior to onset, than adolescents without such a history. Novel in the current study, this relation was significant only for the adolescents, and was robust when controlling for differences between age groups in depression history. Further, this relation was only significant for severe emotional abuse and was not seen for physical or sexual abuse. These findings suggest that the pathological mechanisms associated with translating CM to depression in adolescence may differ from those in adulthood. In particular, adolescents with a history of CM may be more strongly sensitized to independent SLEs that are central to triggering depression than are adults with a similar history. As such, these findings may help in understanding why CM is more strongly predictive of depression onset in adolescence than in adulthood, as well as why emotional abuse has emerged as more strongly predictive of depression in adolescence than either physical or sexual abuse (Brown et al., 2007a; Gibb et al., 2007; Hankin, 2005).

Although the precise mechanisms mediating the relation of emotional abuse to later stress sensitization in adolescent depression were not the focus of the current study, several complementary mechanisms may be in operation. For example, CM is associated with the development of negative cognitive schemas and negative attributional styles (Allen & Tarnowski, 1989; Gibb et al., 2001; Harter, 2000; Wenninger & Ehlers, 1998), which mediate the relation of CM to depression (e.g., Feiring, Taska, & Lewis, 2002; Lumley & Harkness, 2007, 2009), Gibb's (2002) meta-analytic results suggest that among adolescents, in particular, emotional abuse is more strongly related to negative schemas than are physical or sexual abuse, possibly because experiences of emotional abuse provide the maltreated adolescent with more explicit information that can serve the formation of the sorts of depressive cognitions that prime an enhanced depressogenic response to SLEs (e.g., “I am bad/stupid/worthless/ugly”; Gibb & Coles, 2005; Rose & Abramson, 1992).
Further, adolescents with a history of CM show greater reactivity of the hypothalamic-pituitary-adrenal (HPA) axis in response to induced stressors than those without an abuse history (e.g., Harkness, Stewart, & Wynne-Edwards, 2011; Rao, Hammen, Ortiz, Chen, & Poland, 2008), and, thus, this neurobiological mechanism may in part mediate a heightened sensitization to SLEs in adolescents with CM. However, to our knowledge, there have been no studies comparing, in a fine-grained manner, the effects of different types of early maltreatment on the developing neurobiological stress response system, nor have there been any studies directly comparing the effects of maltreatment on the neurobiological response to stress between adolescence and adulthood. In adolescence, a maltreatment history is obviously more proximal in time to the SLEs that trigger depression onset than in adulthood. As such, CM may play a more direct role in shaping the manner in which adolescents make meaning of, and react to, triggering stressors. In contrast, by adulthood, the psychological and biological mechanisms underlying stress sensitization may have been further shaped by experiences outside of the childhood family context. Therefore, these intervening contextual factors may begin to play a stronger role in driving individuals’ sensitivity to the stressors that trigger depression in adulthood.

Consistent with previous findings (Harkness et al., 2006), we found that the relation of maltreatment to stress sensitization in our adolescent sample was specific to independent SLEs. As we have argued previously (Harkness et al., 2006), some have maintained that independent SLEs are more central to the etiology of depression than dependent events (e.g., Shrout et al., 1989; Stroud et al., 2011; c.f., Brown & Harris, 1986). It is also important to note that in the current sample, many of the events that were rated for adolescents as independent (e.g., moving to a new city, financial loss, parents’ separation) would have been rated as dependent in an adult sample that is not ‘yoked’ to parents. Indeed, there is evidence that adolescents report a significantly higher number of independent events than do adults (Harkness et al., 2010). Therefore, it is possible that there is a wider range of events that would be rated as independent in adolescence than in adulthood, and those rated as dependent may simply be less impactful (see Harkness et al., 2006). This possibility is speculative, however, and further studies that provide fine-grained examinations of the etiological relation of types of events to depression across development are required.

A further novel finding of this study that was not hypothesized was that emerging adults with a history of CM reported a significantly higher severity level of dependent SLEs prior to onset than those without. Although this finding requires replication to confirm its robustness, it is in line with previous studies showing that a history of CM is associated with the generation of SLEs (Hankin, 2005; Harkness, Lumley, & Truss, 2008). That is, individuals with a maltreatment history may create environmental contexts that engender dependent SLEs (e.g., interpersonal conflicts, rejection). The mechanisms mediating stress generation in those with CM are likely similar to those promoting stress sensitivity, including negative personality and cognitive schema networks, and disrupted social networks (see Hammen, 2006). Indeed, the generation of and sensitivity to SLEs have been proposed as complementary mechanisms that make CM a ‘double-threat’ in promoting depression vulnerability (Harkness & Lumley, 2007; Harkness et al., 2008). Emerging adulthood is a developmental period that marks the transition from adolescence to adulthood (Arnett, 2000). It has been proposed that emerging adults are not quite ‘true’ adults because they have not reached the milestones typically associated with adult status (e.g., marriage, parenthood), yet they are not adolescents, as they are much freer from parental control, with more opportunities for independent exploration (Arnett, 2000). We suggest that emerging adults with a history of maltreatment may experience particular difficulty navigating this period of transition, leaving them vulnerable to generating SLEs (see also Harkness et al., 2010).

The results of this study should be considered in light of the following limitations. First, age was categorized into groups, which may have resulted in a loss of statistical power (Chen, Cohen, & Chen, 2007). However, we reasoned that there are natural discontinuities in the age distribution that are inconsistent with, and would be obscured by, operationalizing it as a linear variable. Indeed, the age groups included in this study have been conceptualized as different stages of life (Arnett, 2000; Cohen, Kasen, Chen, Hartmark, & Gordon, 2003; Schulenberg, Maggs, & O’Malley, 2003; Spear, 2000). Second, although our sample size was large for a study using contextual stress measures and a clinically diagnosed sample, it did not allow us to examine more fine-grained developmental differences within our broad age groups, such as among early, middle, and later adolescence (e.g., Braet, Vlieberghe, Vandeveneire, Theuwis, & Bosmans, 2012). These are important groups to examine in future research given their unique psychopathological features (e.g., Shanahan et al., 2011). Similarly, our sample size precluded the examination of gender differences as the further stratification of our models by gender resulted in unacceptably low cell sizes. This is a particularly important question for future studies using larger samples that specifically recruit young males with a history of maltreatment, as there is evidence to suggest that the pathological effect of abuse may differ between males and females (e.g., Schraedley, Gotlib, & Hayward, 1999). Furthermore, the high degree of comorbidity among the types of maltreatment, which is a limitation of all studies of childhood maltreatment (Edwards, Holden, Felitti, & Anda, 2003; McGee et al., 1995), prevented an analysis of the unique effect of each maltreatment type after accounting for the effects of the other types. Futures studies with large epidemiological samples are required to investigate this issue.

Finally, this study relied on retrospective self-reports of CM and SLEs, which can be subject to bias. To address bias, the CECA and LEDS interviews probe for both positive and negative contextual detail. In addition, interviewers are trained to not query about participants’ emotional reaction to stressors or the relation of stressors to depression. Furthermore, ratings are based on manualized examples that raters use to justify their decisions, helping to ensure standardization. Particularly important in the current context, longitudinal research has found reports of past experiences, including a history of maltreatment, to be largely accurate and relatively stable across time when intensive interviews and investigator-based ratings are used (e.g., Dube, Williamson, Thompson, Felitti, & Anda, 2004; Maughan, Pickles, & Quinton, 1995; McNally,
(2003). Contextual interview and rating systems are not completely immune from recall biases, however, with evidence that memories of minor stressors degrade over long recall intervals such as would have been the case for some participants in the current study (Brown & Harris, 1982; Paykel, 1997). Nevertheless, there is extensive documentation that the LEDS and CECA have superior validity and reliability over self-report questionnaire assessments of environmental experiences (e.g., Brewin, Andrews, & Gotlib, 1993; Brown, Craig, Harris, Handley, & Harvey, 2007b; Brown & Harris, 1989; Duggal et al., 2000; McQuaid, Monroe, Roberts, Kupfer, & Frank, 2000).

The current study is the first to demonstrate that CM, and in particular emotional abuse, is associated with lower severity levels of independent SLEs prior to depression onset in adolescence but not in adulthood. Theoretically, these results are important as they suggest that the effect of emotional abuse on the sensitization to proximal SLEs may be specific to adolescence and, thus, other pathological processes may be responsible for driving stress sensitization in older age groups. Further, these results may have important clinical implications as they suggest that different interventions that address the role of stress in depression may be relevant during different developmental periods. In particular, depressed adolescents with emotional maltreatment histories may require strategies that help them to temper their heightened depressogenic response to stress and promote resilience. In contrast, depressed young adults with maltreatment histories may benefit from strategies that identify the ways in which they are contributing in a maladaptive manner to their environment. More generally, we suggest that a focus on stress and stress processes early in depression treatment may prove useful in reducing the risk of recurrence and preventing what is often a lifelong course of illness.

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References


