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Rumination and Overgeneral Autobiographical Memory in Adolescents: An Integration of Cognitive Vulnerabilities to Depression

Elissa J. Hamlat,
Department of Psychology, Temple University, 1701 N. 13th St., Philadelphia, PA 19122, USA

Samantha L. Connolly,
Department of Psychology, Temple University, 1701 N. 13th St., Philadelphia, PA 19122, USA

Jessica L. Hamilton,
Department of Psychology, Temple University, 1701 N. 13th St., Philadelphia, PA 19122, USA

Jonathan P. Stange,
Department of Psychology, Temple University, 1701 N. 13th St., Philadelphia, PA 19122, USA

Lyn Y. Abramson, and
University of Wisconsin, Madison, Madison, WI, USA

Lauren B. Alloy
Department of Psychology, Temple University, 1701 N. 13th St., Philadelphia, PA 19122, USA

Elissa J. Hamlat: elissa.hamlat@temple.edu

Abstract

During adolescence, rates of depression dramatically increase and girls become twice as likely as boys to develop depression. Research suggests that overgeneral autobiographical memory and rumination are vulnerability factors for depressive symptoms in adolescence that may be triggered by stressful life events. The current longitudinal study included 160 early adolescents (M_{age} = 12.44 years, 60.0 % African American, 40.0 % Caucasian, and 56.2 % female). At baseline, adolescents completed measures of current depressive symptoms, rumination, and specificity of autobiographical memories. Approximately 9 months later, the adolescents completed measures of current depressive symptoms and stressful life events that had occurred between baseline and follow-up. Analyses indicated that girls with more overgeneral autobiographical memories in combination with higher levels of rumination were most vulnerable to experiencing increases in depressive symptoms following stressful life events. Additionally, retrieving more specific autobiographical memories appeared to buffer against the impact of negative life events on

Correspondence to: Elissa J. Hamlat, elissa.hamlat@temple.edu.

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depressive symptoms among both boys and girls. Memory specificity may play a protective role in depression risk, suggesting that memory specificity training interventions may prove beneficial for adolescents.

Keywords

Autobiographical memory; Depression; Rumination; Stress; Adolescent psychopathology

Introduction

Autobiographical memories include specific episodic memories of past events and more conceptual, self-relevant information (Williams et al. 2007; Williams and Broadbent 1986). A specific autobiographical memory is a memory that lasts less than 1 day and can include particular time and place information, (e.g., “Last Thanksgiving at my mother’s house, I ate too much pie and felt awful”; this event occurred on one particular day and it is straightforward to indicate when and where it happened). In contrast, overgeneral autobiographical memories are categorical and part of a general class of repeated events (e.g., “I used to play kickball every Tuesday”) or are extended and thus, last longer than 1 day (e.g., “When I was on a cruise this summer”). These last two examples are overgeneral as they did not take place on one specific day and it is more difficult to say exactly when or where they happened.

When asked to retrieve a specific memory in response to a cue word, individuals who are depressed often retrieve memories that are overgeneral and retrieve less specific autobiographical memories than individuals who are not depressed (Williams 1996). Subsequently, large effect sizes have been found for the association between depressed mood and overgeneral autobiographical memories with both clinical and non-clinical samples (Williams et al. 2007). Additionally, one study found that a high level of overgeneral autobiographical memory retrieval and a low level of specific autobiographical memory retrieval were better predictors of the course of a depressive episode than initial episode severity, rumination, self-esteem, and dysfunctional attitudes (Hermans et al. 2008). The present research examined the interactions between overgeneral autobiographical memory retrieval, stressful life events, and rumination in the prediction of depressive symptoms in early adolescents.

Overgeneral Autobiographical Memory as a Vulnerability to Depression

In addition to prolonging a depressive episode, overgeneral retrieval of autobiographical memories also may confer vulnerability to the onset of both depressive symptoms and episodes. A meta-analysis of existing prospective studies has found a small but significant effect of overgeneral autobiographical memories on the prospective prediction of depressive symptoms in adults (Sumner 2010). Additionally, adolescents at risk for developing depression (Kuyken and Dalgleish 2011) have more overgeneral retrieval styles. Although few longitudinal studies have examined overgeneral autobiographical memories as a predictor of depression in early adolescence, recent research has found that overgeneral autobiographical memories predicted the prospective development of depressive symptoms

in 12-year-old girls (Hipwell et al. 2011) and the onset of depressive episodes in never-depressed adolescents with a family history of depression (Rawal and Rice 2012). Although retrieving higher levels of overgeneral autobiographical memories may provide overall vulnerability to depression, cognitive vulnerability–stress theories of depression would imply that overgeneral autobiographical memories may be especially depressogenic when adolescents face stressful life events (Hankin and Abramson 2001).

The Effect of Overgeneral Autobiographical Memory on Depressive Symptoms in the Context of Stressful Life Events

A limited number of longitudinal studies have evaluated overgeneral autobiographical memories as a vulnerability to depression in interaction with stressful life events. Two studies have reported that low specificity of autobiographical memories predicted increases in depressive symptoms among college students who experienced stressful life events or hassles (Anderson et al. 2009; Gibbs and Rude 2004). Additionally, overgeneral autobiographical memories interacted with chronic interpersonal stress to predict the recurrence of depressive episodes in older adolescents with a history of major depressive disorder (Sumner et al. 2011) and interacted with emotional abuse to predict increases in depressive symptoms in early adolescents (Stange et al. 2013c). Depressive symptoms may be triggered when individuals with overgeneral retrieval styles encounter stressful life events as overgeneral autobiographical memories may impact negatively upon their problem-solving abilities (Williams 1996), particularly the ability to solve interpersonal problems, and lead to distress as a result of poor responses to life stress (Sumner et al. 2011). Thus, overgeneral autobiographical memories may imply difficulty recalling specific past experiences to inform decision-making (Belcher and Kangas 2014). When individuals with more overgeneral autobiographical memory are confronted with negative life events that require sophisticated problem-solving skills, they may be unable to use specific past experiences to help them resolve negative life events and so respond poorly (Sumner et al. 2011). Consequently, poor responses to life stress may lead to increases in depressive symptoms among these individuals.

Rumination May Amplify the Impact of Overgeneral Autobiographical Memory on Depressive Symptoms

An additional vulnerability factor that has been related to overgeneral autobiographical memories is the cognitive process of rumination, in which individuals engage in repetitive, self-focused negative thought (Nolen-Hoeksema 1991). The Capture and Rumination, Functional Avoidance and Executive Function model (CaR–FA–X model; Williams et al. 2007) posits that individuals who ruminate may be more likely to engage in overgeneral autobiographical memories despite instructions to produce more specific memories, because of the cognitive load of engaging in ruminative thought (Williams et al. 2007). In addition, inducing a non-ruminative thinking style in previously depressed individuals has been shown to increase the retrieval of specific autobiographical memories and decrease overgeneral autobiographical memories (Watkins and Teasdale 2001). Similar to overgeneral autobiographical memory retrieval, rumination has been found to impair problem-solving abilities (Raes et al. 2005) and to be reliably associated with increases in

symptoms of depression in adults and adolescents (Nolen-Hoeksema et al. 2008; Rood et al. 2009).

Although no previous studies have evaluated the interactive relationship between rumination and overgeneral memory in the prediction of depressive symptoms, we would expect rumination in an individual with overgeneral memory to exacerbate the impact of overgeneral autobiographical memory retrieval and to result in further increases in depressive symptoms. The risk for depression conferred by the interaction of overgeneral autobiographical memory and stressful life events is likely to be amplified among high ruminators.

Effect of Overgeneral Autobiographical Memory, Rumination, and Stressful Events on Depressive Symptoms in Adolescents

The interaction between overgeneral autobiographical memories, rumination, and stressful life events may serve to generate and maintain depressive symptoms. Furthermore, as these mechanisms are not mutually exclusive, the interaction between overgeneral autobiographical memories, rumination, and stressful life events may serve to generate and maintain depressive symptoms. Those prone to rumination are more likely to ruminate after they experience stressful life events (Robinson and Alloy 2003) and the interaction of rumination and stress predicts the onset of depression in adolescents (Abela and Hankin 2011; Stange et al. 2013b). Given that increases in stressful life events (Ge et al. 1994; Rudolph and Hammen 1999; Shih et al. 2006) and rumination (Hampel and Petermann 2005; Jose and Brown 2008) occur during early adolescence, the interaction of overgeneral autobiographical memories, stress, and rumination may be particularly important to measure during this time, as early adolescents are encountering novel, interpersonal stressors (Ge et al. 1994) that may require somewhat sophisticated problem-solving. The impaired problem-solving abilities implicated in overgeneral autobiographical memories and rumination may predispose adolescents with both of these characteristics to experience depressive symptoms following negative life events. Although rumination has been shown to increase overgeneral autobiographical memories and depressive symptoms in adolescents experiencing their first episode of major depression (Park et al. 2004), to our knowledge, no studies have evaluated the interaction of rumination and overgeneral memory (or this interaction in the context of stressful life events) in the prediction of depressive symptoms.

Possible Gender Differences in the Effect of Overgeneral Autobiographical Memory, Rumination, and Stressful Events on Depressive Symptoms

According to epidemiological studies (e.g., Hankin et al. 1998; Hankin and Abramson 2001), the rise in depressive symptoms begins in early adolescence, with girls being twice as likely as boys to develop depression by the end of adolescence. Research has demonstrated that girls also experience greater levels of stressful life events and rumination (Ge et al. 1994; Hankin et al. 1998; Jose and Brown 2008) and develop a heightened sensitivity to interpersonal relationships in adolescence (Natsuaki et al. 2009). If both rumination and overgeneral autobiographical memory are related to deficits in interpersonal problem solving and adolescent girls experience greater levels of and are more reactive to interpersonal stressors (Charbonneau et al. 2009; Shih et al. 2006), the interaction of

rumination and overgeneral memory may have a more deleterious impact on adolescent girls. One recent study found a trend for adolescent girls to report more overgeneral memories than boys (Stange et al. 2013a); however, previous research indicated boys reported more overgeneral memories than girls (Heron et al. 2012) or found no difference in overgeneral memory retrieval between the sexes (Kuyken and Dalgleish 2011). Although gender differences in other cognitive vulnerabilities to depression have robust support (Charbonneau et al. 2009; Hankin et al. 1998; Hyde et al. 2008; Mezulis et al. 2011), gender differences in overgeneral autobiographical memory or in the relationship between overgeneral autobiographical memory and depression have not been established and are deserving of further research (Raes et al. 2012; Rawal and Rice 2012).

The Present Study

In the present study, we hypothesize that adolescents with a more overgeneral retrieval style of autobiographical memories who also are more inclined to ruminate will suffer increased symptoms of depression after experiencing higher levels of stressful life events. As there is no clear evidence that overgeneral autobiographical memory has a greater effect on depressive symptoms in girls, further research is needed to explore possible gender differences in overgeneral memory retrieval (Raes et al. 2012; Rawal and Rice 2012). However, girls are more likely than boys to experience depression, stressful life events, and rumination beginning in early adolescence (Ge et al. 1994; Hankin et al. 1998; Jose and Brown 2008). Thus, we also predict that the effect of the interaction of overgeneral autobiographical memories, stressful life events, and rumination on depressive symptoms will be stronger for girls than boys.

Method

Participants

Participants were part of the Temple University Adolescent Cognition and Emotion Project, a prospective longitudinal study investigating the emergence of depression and anxiety in adolescence. With Temple University IRB approval, Caucasian and African American male and female adolescents who were 12–13 years old (N = 232) and their mothers or primary female caretakers (referred to hereafter as mothers) were recruited from Philadelphia-area middle schools. Families were recruited through school mailings and follow-up phone calls inviting participation (approximately 68 % of the sample) and through advertisements placed in Philadelphia-area newspapers (approximately 32 % of the sample). In order to qualify for study participation, the adolescent had to be 12 or 13 years old, self-identify as Caucasian/White, African American/Black or Biracial (adolescents could be Hispanic if they also identified as White or Black), and have a mother/primary female caretaker willing to participate (approximately 97 % of female caregivers were the adolescents' mothers). Families were excluded if (1) there was no mother or primary female caretaker able to participate, (2) the adolescent or mother did not read or speak English well enough to participate, or (3) the adolescent or mother had severe cognitive impairment, psychosis, or any other medical or psychiatric problem preventing completion of the study assessments. Mothers provided written consent and adolescents provided written assent to participate in the study.

Although 232 adolescents completed the baseline assessment, 36 families declined further participation after the baseline visit; as a result, 196 adolescents completed all study measures at both baseline and follow-up assessments (an 84 % retention rate). Only adolescents with complete data on all study measures at both baseline and follow-up assessments were included in the present study. Of the 196 adolescents who completed the follow-up assessment, 36 adolescents had missing data on one or more measures; thus, list-wise deletion was used for a final sample of 160 adolescents. The 160 adolescents with complete data at both the baseline and follow-up assessments did not differ from the 72 adolescents not included in the final sample in: gender distribution ($\chi^2(1) = 1.17$, $p = .28$), racial distribution ($\chi^2(1) = 2.26$, $p = .13$) free lunch status ($\chi^2(1) < 0.01$, $p = .98$), mother-reported childhood stressors ($t = 0.45$, $p = .65$), depressive symptoms at baseline ($t = -1.55$, $p = .12$), rumination ($t = 0.69$, $p = .49$), or overgeneral ($t = 0.68$, $p = .14$) or specific ($t = -0.74$, $p = .46$) autobiographical memories.

The adolescent sample for the present analyses consisted of 160 adolescents ($M_{age} = 12.44$ years, $SD = 0.63$) who completed both a baseline assessment and a follow-up assessment approximately 9 months later. There was a wide range of socioeconomic backgrounds among the study sample (60.0 % African American, 40.0 % Caucasian, and 56.2 % male): 22.1 % of participants had annual family incomes less than $30,000, 39.6 % had incomes falling between $30,000–$59,999, 13.6 % had incomes falling between $60,000–$89,999, and 24.7 % had incomes above $90,000. Additionally, 51.2 % of the participants were eligible for subsidized school lunch, a measure of financial need that accounts for the number of dependents supported by a given family income.

Procedure

At baseline (Time 1), adolescents completed measures of current depressive symptoms, rumination, and specificity of autobiographical memories. Adolescents' mothers completed a questionnaire reporting on the occurrence of stressful life events that occurred in the adolescent's life prior to Time 1. At the follow-up assessment (Time 2) approximately 9 months later ($M = 8.56$; $SD = 2.68$), the adolescents completed measures of current depressive symptoms and all stressful life events that had occurred in their lives between Time 1 and Time 2. Trained interviewers questioned adolescents to obtain additional information on all reported events and whether the events met definitional criteria. Adolescents and mothers were compensated for their participation at all study visits.

Measures

Depressive Symptoms—The Children's Depression Inventory (CDI; Kovacs 1985) is a 27-item self-report questionnaire measuring affective, behavioral, and cognitive symptoms of depression in youth ages 7–17. All items are rated on a 0–2 scale and total scores range from 0 to 54. Higher scores indicate more depressive symptoms. The CDI has been found to be a reliable and valid measure of depressive symptoms in youth (Klein et al. 2005). Internal consistency in this sample was $\alpha = .88$ at Time 1 and $\alpha = .81$ at Time 2.

Rumination—The Children's Response Styles Questionnaire (CRSQ; Abela et al. 2004) is a self-report questionnaire that assesses children's cognitive responses to their sad or

dysphoric mood. The CRSQ measures three subscales of response styles: rumination, distraction, and problem-solving. Each of the 25 items is rated on a scale of 1–4, with higher scores indicating a greater tendency to employ that response style when experiencing depressed mood. The current study used only the rumination subscale. The CRSQ has shown good validity and moderate internal consistency in previous studies (Abela et al. 2004). Internal consistency for the rumination subscale at Time 1 in this sample was $\alpha = .84$.

Autobiographical Memory—A modified version of the Autobiographical Memory Task (AMT; Williams and Broadbent 1986) was used to assess the specificity of autobiographical memory (Stange et al. 2013a). In the original AMT, the experimenter verbally presented ten cue words (five negative and five positive) to the participant. Following the presentation of the word, the participant was given 60 s to retrieve the first specific memory that came to mind. Specific memories were defined as an event from one's life that occurred on a single day in a particular location (i.e., "I got a brown shirt as a gift from my parents last Monday in our house"; Williams and Broadbent 1986). Overgeneral memories were considered as the recollection of an event that was extended (occurred over more than 1 day), categorical (a general class of repeated events), or too general to be considered extended or categorical (e.g., "I like brown").

In the modified AMT used in the current study, neutral words were added to the current paradigm to evaluate whether the effects of overgeneral memory on depression were specific to recall of valenced cue words. Three positive, three negative, and three neutral words were selected based on previous versions of the AMT used with adolescents, with valenced words selected on the basis of high ratings of emotionality and neutral words based on low ratings of emotionality (Park et al. 2002; Williams et al. 2000). Prior to beginning the AMT, three practice trials were conducted with feedback regarding specificity. After practice, adolescents had sixty-seconds in which to respond to positive (*relieved*, *happy*, *proud*), negative (*failure*, *guilty*, *hopeless*), and neutral (*huge*, *nature*, *search*) cue words. Experimenters decided if each reported autobiographical memory met criteria to be coded as specific or overgeneral. Inter-rater reliability in a randomly selected 5 % of the sample (81 pairs of ratings) on whether a reported memory should be coded as overgeneral, specific or omission was $\kappa = .79$.

Life Events—The Adolescent Life Events Questionnaire (ALEQ; Hankin and Abramson 2002) is a self-report questionnaire designed to assess 63 negative life events that typically occur during adolescence, including events related to the familial, peer, and achievement domains. At Time 2, adolescents indicated all events that they experienced since the Time 1 assessment. Following completion of the ALEQ, adolescents completed the Life Events Interview (LEI; Safford et al. 2007), during which trained interviewers determined whether events endorsed on the ALEQ by adolescents met a priori definitional criteria and occurred during the outlined time period. Interviewers used a priori probes specific to each event to aid in determining event eligibility. Events not meeting the stringent criteria were disqualified in order to combat potential reporter bias. As is common in life events research, any life event items in dispute were discussed at weekly research team meetings so that a final consensus decision could be made. Qualifying events based on the LEI were totaled,

with higher scores indicating more exposure to stressors. Thus, scores are the total number of types of stressors that occurred, rather than frequency of events. Reliability and validity have been demonstrated for the ALEQ (e.g., Hankin 2008) and for the LEI (e.g., Safford et al. 2007).

Childhood Stressful Life Events—The Children's Life Events Scale (CLES; Crossfield et al. 2002) is a checklist of 50 negative events that children may be exposed to in their lifetime. The CLES is an expanded version of the previously established Source of Stress Inventory (Chandler 1981). Mothers' reports were used because children may have been too young to recall all events independently. CLES items include events in the following domains: negative emotional feedback, achievement failures, family difficulties, death of close family or friends, maltreatment (i.e., sexual, physical, emotional), and events suggesting inadequacy (e.g., acquired a physical deformity). Mothers were asked whether or not their child experienced each event in their lifetime and, if so, at what age the event occurred. Scores on the CLES range from 0 to 50, with higher scores indicating a greater number of negative events. The CLES has demonstrated predictive validity (Crossfield et al. 2002) and reliability (Hamilton et al. 2013) in prior studies.

Data Analysis

We conducted hierarchical linear regressions to evaluate whether sex, the number of overgeneral autobiographical memories, rumination, and life stress would interact to predict depressive symptoms at follow-up, controlling for initial depressive symptoms. Given that support repeatedly has been found for a one-factor model of overgeneral autobiographical memories (e.g., Griffith et al. 2009; Heron et al. 2012), we did not expect to find valence effects for our cue words and conducted analyses using the total number of overgeneral memories and specific memories to all (positive, negative and neutral) cue words (Sumner 2010). Continuous predictor variables were centered at their means prior to the creation of interaction terms (Aiken and West 1991). In Step 1, baseline CDI scores were entered, thus creating a residual score reflecting change in depressive symptoms from baseline to follow-up. Free lunch status, age at baseline, race, time between baseline and follow-up, and childhood stressful life events experienced before baseline were also controlled for in Step 1. In Step 2, we entered main effects of sex, overgeneral autobiographical memories, rumination, and life events. In Step 3, the two-way interaction terms between each of the four main effect variables were entered and in Step 4, the three-way interaction terms between the four variables were entered. Finally, in Step 5, the four-way interaction term between sex, overgeneral autobiographical memories, rumination, and life events was entered. Analyses were then repeated with the number of specific memories as the independent variable in place of overgeneral autobiographical memories.

Results

Descriptive Analyses

Correlations between variables are displayed in Table 1. Depressive symptoms at both Time 1 and Time 2 were correlated with rumination and with stressful life events between Time 1 and Time 2; however, depressive symptoms at either time point were not correlated with

either the number of overgeneral or the number of specific autobiographical memories. As expected, the number of overgeneral autobiographical memories and the number of specific autobiographical memories were negatively correlated with each other.

As shown in Table 2, there were no differences between girls and boys on depressive symptoms at Time 1 or Time 2, number of overgeneral or specific autobiographical memories, rumination, or childhood stressful life events occurring before Time 1. However, girls reported experiencing significantly more stressful life events between Time 1 and Time 2 compared to boys.

Prospective Analyses

A significant four-way interaction emerged between sex, overgeneral autobiographical memories, rumination, and life events predicting depressive symptoms at follow-up (Table 3). To probe the form of this four-way interaction, we tested for lower order effects using the commonly accepted a priori-defined cutoffs of 1 SD above and below the mean of each continuous predictor variable (Aiken and West 1991; for means and standard deviations, see Table 1). Among boys, there was not a significant three-way interaction between overgeneral autobiographical memories, rumination and life events ($t = -1.36$, $p = .18$), but among girls there was a significant three-way interaction between overgeneral autobiographical memories, rumination and life events ($t = 2.87$, $p = .005$). As hypothesized, among girls with lower overgeneral autobiographical memories, there was not a significant two-way interaction between rumination and life events ($t = -1.20$, $p = .23$). However, among girls with higher overgeneral autobiographical memories, there was a significant twoway interaction between rumination and life events ($t = 3.37$, $p = .001$), such that life events predicted increases in depressive symptoms among girls with higher levels of rumination ($t = 5.75$, $p < .001$), but not among those with lower levels of rumination ($t = -0.30$, $p = .76$; Fig. 1). Thus, higher rumination appeared to exacerbate the impact of life events on depressive symptoms for girls with more overgeneral autobiographical memories, whereas lower rumination appeared to buffer the impact of negative life events on depressive symptoms among girls with more overgeneral autobiographical memories. In other words, girls with more overgeneral autobiographical memories in combination with higher levels of rumination were most vulnerable to experiencing increases in depressive symptoms following stressful life events.

There was not a significant four-way interaction between sex, number of specific memories, rumination, and stressful life events ($t = 1.41$, $p = .16$), or a three-way interaction between number of specific memories, rumination, and stressful life events ($t = -0.85$ $p = .40$; results available upon request). However, controlling for baseline depressive symptoms, free lunch status, age at baseline, race, time between baseline and follow-up, stressful life events experienced before baseline, sex, and rumination, there was a significant two-way interaction between specific memories and life events (Table 4). Life events predicted increases in depressive symptoms among adolescents with less specific memories ($t = 4.04$, $p < .001$), but not among those with more specific memories ($t = 1.64$, $p = .10$; Fig. 2). Thus, higher specific memories appeared to buffer against the impact of negative life events on depressive symptoms among both boys and girls.

Discussion

Adolescence is a critical period of development characterized by major psychological changes, including a dramatic increase in rates of depression, particularly among girls (Hankin et al. 1998; Hankin and Abramson 2001). Given this information, it is crucial to investigate potential factors that may confer risk for the development of depression during adolescence, and that may demonstrate more potent effects in girls. One area of research has examined the role of overgeneral autobiographical memory retrieval as a vulnerability for depression, finding that individuals who retrieve more broad, conceptual memories about themselves display impaired problem-solving and future decision-making abilities, which may impart risk for the development of depression when individuals are confronted with negative life events (Belcher and Kangas 2014; Sumner et al. 2011; Williams 1996). In addition to life stress exacerbating the effects of overgeneral autobiographical memory, it is possible that additional cognitive vulnerabilities to depression such as rumination may interact with overgeneral autobiographical memory to increase the likelihood of increases in depressive symptoms. Although girls demonstrate increased levels of life stress and rumination in adolescence (Ge et al. 1994; Jose and Brown 2008), gender differences in overgeneral autobiographical memory during adolescence have yet to be explored fully. Given this information, it is important to study the interplay between overgeneral autobiographical memory, life stress, and rumination in predicting depression during adolescence, and the potential gender differences that may arise as a result. Findings from this research will help to identify risk factors for depression and to inform innovative prevention and intervention programs (e.g., aimed to address autobiographical memory retrieval in youth).

The current study sought to investigate the roles of overgeneral autobiographical memory, rumination, and stressful life events in the development of depressive symptoms in a community sample of adolescents. Indeed, among girls with more overgeneral autobiographical memories, stressful life events predicted increases in depressive symptoms when coupled with higher levels of rumination; this effect was not found among girls with lower levels of rumination. Additionally, no significant interaction between overgeneral autobiographical memories, rumination, and stressors was found for boys. These findings suggest that rumination, when accompanied by higher levels of overgeneral autobiographical memories in girls, may lead to increases in depressive symptoms following stress, and that low levels of rumination may protect against the development of depressive symptoms among girls with higher levels of overgeneral autobiographical memories when they experience negative life events. An additional finding indicated that specific autobiographical memory retrieval appeared to buffer against depressive symptoms in the face of stressful life events for both adolescent boys and girls. Although no interaction was found with rumination for either sex, adolescents who generated less specific autobiographical memories were more likely to display increased depressive symptoms when confronted with life stress compared to those who retrieved more specific autobiographical memories. Together, these findings emphasize that generating more overgeneral and less specific autobiographical memories may confer vulnerability to the development of depressive symptoms. This study is the first to demonstrate interactions

between the specificity of autobiographical memories, rumination, and life stress in predicting depressive symptoms in a community sample of youth.

Incorporating Rumination and Overgeneral Autobiographical Memory into Vulnerability–Stress Models of Depression

Previous studies found that overgeneral autobiographical memories interacted with life stress to predict depressive symptoms in non-clinical samples of college students (Anderson et al. 2009; Gibbs and Rude 2004) as well as adolescents (Stange et al. 2013a). In addition to the interaction with life stress, overgeneral autobiographical memories also interacted with rumination to predict depressive symptoms in the current study; this finding, to our knowledge, has not been previously reported. Although previous research has demonstrated the detrimental role of overgeneral autobiographical memories in currently depressed or previously depressed adolescents (Kuyken and Dalgleish 2011; Park et al. 2002), comparatively little research has examined the role of overgeneral autobiographical memories as a vulnerability factor in non-clinical samples of adolescents. It is particularly important to study the interaction of overgeneral autobiographical memories with negative life events in an adolescent sample, given the increases in frequency and magnitude of life stress during this developmental period (Ge et al. 1994). The contributing role of rumination is also important to identify in an adolescent population, given that this thinking style has been found to increase during this stage of development (Hampel and Petermann 2005; Jose and Brown 2008), and the evidence that rumination exacerbates the effects of cognitive vulnerabilities on depression (e.g., Ciesla and Roberts 2007; Ciesla et al. 2011; Robinson and Alloy 2003; Stange et al. 2013c). Together, this combination of high stress, rumination, and overgeneral autobiographical memories predicted increased depressive symptoms within our current non-clinical sample of early adolescents. Incorporating rumination and overgeneral autobiographical memories together into models of vulnerability to depression might aid in the identification of which adolescents are most likely to experience increases in depressive symptoms following stressful life events.

Gender Differences in the Effect of Overgeneral Autobiographical Memory on Depressive Symptoms

In the current study, the detrimental processes of overgeneral autobiographical memories and rumination together were found to be predictive of increased depressive symptoms in adolescent girls confronted with higher levels of life stress. These findings indicate that overgeneral memory may serve as an additional vulnerability factor through which adolescent girls display increased rates of depression. However, there were no overall gender differences in levels of overgeneral autobiographical memories or rumination in the current sample; it was only in interaction that higher levels of these vulnerability factors were revealed to influence girls differentially. Although we did not directly assess problem solving in the current study, it is possible that the impaired problem-solving abilities implicated in both overgeneral autobiographical memories and rumination played an important role in increasing depressive symptoms following negative life events. It will be important to study these relationships at later stages of adolescence to assess for potential changes as well as to understand better at what stage of adolescence overgeneral

autobiographical memories may become more relevant to understanding depression among males.

Additionally, our results demonstrated the buffering role of specific autobiographical memories; both boys and girls who generated more specific memories were less likely to display increases in depressive symptoms when confronted with life stress compared to those with less specific memories. Memory specificity is related to more effective problem-solving and future planning (Belcher and Kangas 2014). These findings emphasize the potential benefit of training individuals to become adept at retrieving specific autobiographical memories. Studies of specific autobiographical memory training programs have shown increases in specific memory retrieval following intervention in adults and adolescents (Neshat-Doost et al. 2012; Raes et al. 2009), as well as decreases in depressive symptoms in adolescents (Neshat-Doost et al. 2012). Current findings suggest that memory specificity may play a protective role for adolescents and thus, memory-training interventions should be explored further.

Limitations and Strengths of the Study

The current study was limited by several factors. Depressive symptoms were obtained through self-report questionnaires instead of through diagnostic interview, which would have allowed for a more objective assessment of depression. The inter-rater reliability of the memory specificity coding and the percentage of randomly selected ratings used to calculate reliability (5 % of the sample, 81 pairs of ratings) were both relatively low. This randomly selected sample was rated and re-rated no more than 6 months since interviewer training; however, the relatively low α of .79 is a limitation that could have prevented us from observing some findings (e.g., a three-way interaction between specific memories, life events, and rumination). In addition, the current analyses did not control for factors such as IQ and verbal fluency, which may influence individuals' memory retrieval abilities (Williams et al. 2007). Increased retrieval of overgeneral autobiographical memories also has been linked to the experience of trauma and may serve as a form of emotional avoidance (Williams et al. 2007). Given that the current study did not control for full trauma history, the extent to which overgeneral autobiographical memories were uniquely related to depressive symptoms was unclear. However, our analyses did control for mother-reported childhood life stressors, which included experiences of physical and sexual abuse. Although previous research found that overgeneral autobiographical memory conferred more vulnerability to depression among Caucasian girls than African American girls (Hipwell et al. 2011; Stange et al. 2013a), we did not examine racial differences in the relationship between overgeneral autobiographical memories and depressive symptoms; this is an important area to be addressed in future research. Alternate explanations for our results should also be considered. Although it is possible that depressive symptoms could lead to overgeneral autobiographical memories, this alternative would not explain the findings of this study because overgeneral memory at baseline was used to predict increases in depressive symptoms at follow-up controlling for baseline depressive symptoms. Additionally, the current study was designed to examine whether overgeneral autobiographical memory and rumination interacted to predict increases in depressive symptoms over time when adolescents experienced high levels of stressful life events; thus,

overgeneral autobiographical memory and rumination were both assessed at baseline and it is not possible from the current study to determine whether rumination increases overgeneral autobiographical memory. A good extension of the study would be to probe the development of the directional relationship between overgeneral autobiographical memory and rumination during adolescence.

The current study has significant strengths. It included a large, diverse community sample of early adolescents, at an age at which the development of gender differences in depression and the spike in depression levels have not emerged fully. The study also considered the interaction of overgeneral autobiographical memories, rumination, and the experience of negative life events in the prediction of depressive symptoms. Particularly within non-clinical samples, it is important to assess whether combinations of vulnerability factors may need to be experienced together to lead to increases in depressive symptoms, as was found in the current study. An additional strength of the current research was its examination of gender differences in these vulnerability factors as predictors of depressive symptoms. Although it has generally been established that girls experience higher levels of stressful life events and rumination during adolescence, the current study also suggests that higher levels of overgeneral autobiographical memories may confer risk for the development of depressive symptoms. Finally, the current research was strengthened by its use of a prospective, longitudinal design, in which initial levels of overgeneral autobiographical memories and rumination were found to interact with life events experienced over a given time period to predict change in depression at followup. This design allows for a more targeted analysis of the effect of vulnerability factors in predicting change in depressive symptoms over time.

Future Directions

Extensions of this research may seek to further investigate the specific mechanisms through which rumination, overgeneral autobiographical memories, and life events contribute to the development of depressive symptoms. For example, it is possible that brooding, considered to be the most maladaptive subtype of rumination, may be most likely to contribute to the effects of this interaction (Romero et al. 2013). Additionally, it may be advantageous to utilize self-discrepant cue words in future overgeneral autobiographical memory paradigms. Self-discrepant designs, in which individuals must generate memories based on words that they have rated to be desirable but unlike themselves, may strengthen the relationship between ruminative thought processes and overgeneral autobiographical memories (Wessel et al. 2013). Also, it would be informative to assess whether the degree to which individuals played a role in their experience of life stress. It is possible that events that were more dependent on the individual would be more likely to interact with overgeneral autobiographical memory and rumination to predict depression when compared to independent life events (Hammen 1991). Finally, as we have speculated that decreases in problem-solving abilities may be at least partly responsible for the effect of rumination, overgeneral autobiographical memories, and life events on the development of depressive symptoms, it would be useful to examine problem solving as a mediator of this effect.

Our results suggest that particularly within a non-clinical sample, it may be necessary for several vulnerability factors to interact in order to lead to increases in depressive symptoms in adolescents. Findings support the body of literature suggesting that overgeneral autobiographical memories may serve as a precursor to the development of depression and suggest that increased memory specificity protects against increases in depressive symptoms among adolescents experiencing negative life events. Future research should continue to probe the role of these vulnerability factors, especially in interaction with each other, as predictors of depressive symptoms during the crucial developmental period of adolescence.

Conclusion

The current research revealed important relationships between rumination, overgeneral autobiographical memory retrieval, and life stress in predicting depressive symptoms in early adolescents. Specifically, it was found that among girls with higher levels of overgeneral autobiographical memories, stressful life events predicted increases in depressive symptoms when combined with higher levels of rumination. Additionally, both boys and girls who generated less specific memories were more likely to display increased depressive symptoms when confronted with life stress compared to those with more specific memories, suggesting that specific memory retrieval may serve as a protective factor against depressive symptoms in adolescents. Together, these findings emphasize that generating more overgeneral and less specific memories may serve as a vulnerability factor for the development of depressive symptoms in a community sample of youth, particularly when in combination with higher levels of life stress and rumination.

The current research makes an important contribution to the study of vulnerability factors for depression during adolescence, a period characterized by dramatic spikes in rates of the disorder, especially among girls (Hankin et al. 1998; Hankin and Abramson 2001). It has been established that adolescents, especially girls, experience increased rates of negative life events (Ge et al. 1994; Rudolph and Hammen 1999, Shih et al. 2006) and rumination (Jose and Brown 2008). However, little research has examined (1) ways in which these vulnerabilities may interact with overgeneral autobiographical memory in adolescents and (2) potential gender differences that may exist within these relationships (Heron et al. 2012; Stange et al. 2013a; Raes et al. 2012; Rawal and Rice 2012). Our findings significantly advance this literature, suggesting the importance of targeting overgeneral autobiographical memory as a risk factor for the development of depression in adolescents, in combination with vulnerabilities such as life stress and rumination. Although only preliminary evidence currently exists (Neshat-Doost et al. 2012), our findings suggest that further exploration is warranted in the development of specific memory training interventions for adolescent populations as a way to target and prevent increases in depressive symptoms during this sensitive developmental period. Overall, the current research emphasizes the necessity of considering the role of overgeneral autobiographical memory as a vulnerability for depression, particularly in interaction with other risk factors, among adolescent populations.

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Biographies

Elissa J. Hamlat is a doctoral student in Clinical Psychology at Temple University. Her major research interests include biological, psychological, and social risk factors that may lead to depression in adolescents, as well as the use of cognitive bias modification as an intervention for depression.

Samantha L. Connolly is a doctoral student in Clinical Psychology at Temple University. Her major research interests include the development of executive functioning and cognitive vulnerabilities for depression in adolescents, with a particular focus on ruminative response styles.

Jessica L. Hamilton is a doctoral student in Clinical Psychology at Temple University. Her major research interests include the role of stress and cognitive, affective, and biological vulnerabilities as risk factors for internalizing disorders among adolescents.

Jonathan P. Stange is a doctoral student in Clinical Psychology at Temple University. His major research interests include cognitive vulnerability–stress models of mood disorders and inflexible response styles to stress.

Lyn Y. Abramson is the Sigmund Freud Professor of Psychology at the University of Wisconsin-Madison. She received her doctorate in Clinical Psychology from the University of Pennsylvania. Her major research interests include the cognitive, psychosocial, biological, and developmental processes in the onset, course, and intervention of depression and bipolar disorder.

Lauren B. Alloy is Professor and Joseph Wolpe Distinguished Faculty in Psychology and Director of Clinical Training at Temple University. She received her doctorate in Experimental and Clinical Psychology from the University of Pennsylvania. Her major research interests include cognitive, psychosocial, developmental, and, recently, neurobiological processes in the onset and course of depression and bipolar disorder.

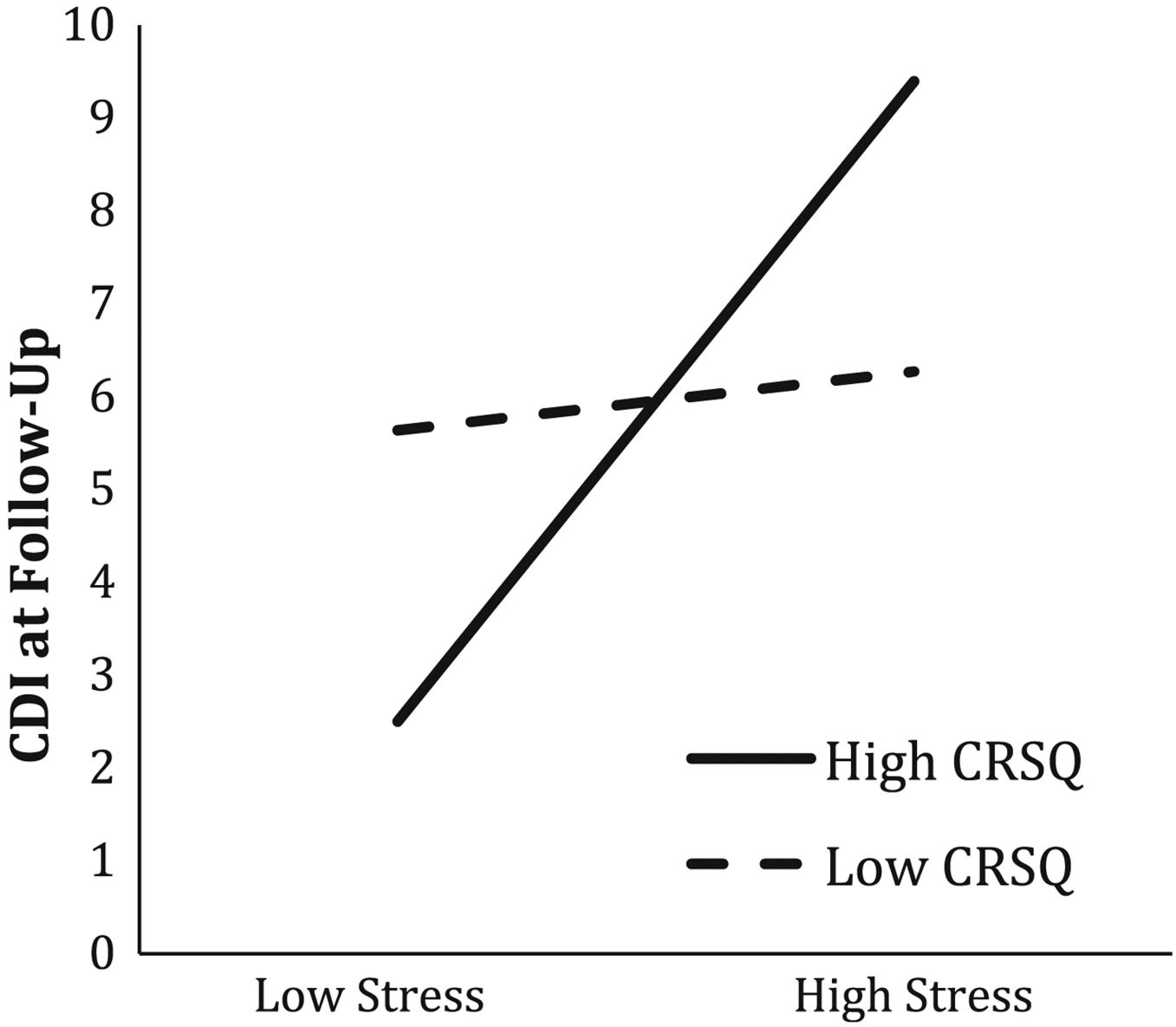

Fig 1.
Depressive symptoms at follow-up for girls with higher OGM as a function of rumination and stress

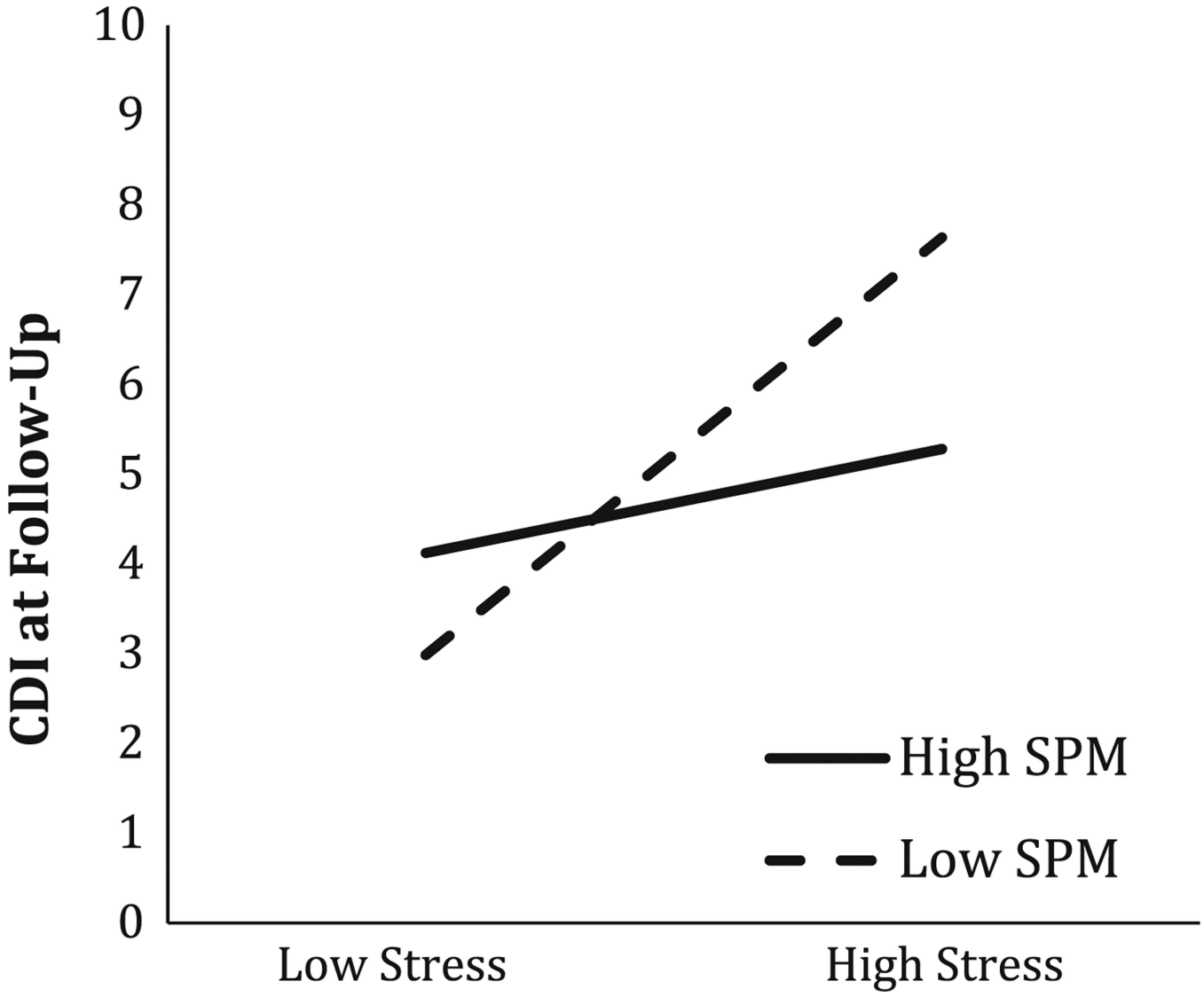

Fig 2.
Depressive symptoms at follow-up as a function of specific memories and stress

Table 1

Descriptive statistics and bivariate correlations among study variables (N = 160)

	Variable	1	2	3	4	5	6	7
1	CDI T1	–						
2	CDI T2	.60***	–					
3	#OGM T1	.02	.05	–				
4	#SPM T1	−.07	−.01	−.56***	–			
5	CRSQ T1	.48***	.31***	.05	−.01	–		
6	#NLE T2	.27***	.43***	−.05	.14	.14	–	
7	CLES T1	.02	.08	.01	.12	−.04	.09	–
	M	6.43	4.95	0.73	7.36	24.58	10.38	7.92
	SD	6.50	5.02	1.12	1.80	7.33	6.47	3.60

CDI = Children's Depression Inventory; T1 = Time 1; T2 = Time 2; #OGM = Number of overgeneral autobiographical memories; #SPM = Number of specific autobiographical memories; CRSQ = Rumination ubscale of the Children's Response Style Questionnaire; #NLE = Number of Negative Life Events; CLES = Children's Life Events Scale

*** $p < .001$;

** $p < .01$;

* $p < .05$

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Table 2

Participant characteristics by sex

Variables	Female (N = 90) *M* (SD)	Male (N = 70) *M* (SD)	*t*	*d*
CDI T1	7.24 (7.33)	5.39 (5.11)	1.88	0.29
CDI T2	5.48 (5.67)	4.26 (3.97)	1.60	0.25
#OGM T1	0.59 (1.10)	0.90 (1.13)	1.75	0.28
#SPM T1	7.57 (1.88)	7.09 (1.67)	1.68	0.27
CRSQ T1	24.89 (7.64)	24.17 (6.96)	0.61	0.10
#NLE T2	11.63 (6.99)	8.76 (5.36)	2.85**	0.46
CLES T1	8.08 (3.49)	7.71 (3.75)	0.63	0.10

CDI = Children's Depression Inventory; T1 = Time 1; T2 = Time 2; #OGM = Number of overgeneral autobiographical memories; #SPM = Number of specific autobiographical memories; CRSQ = Rumination subscale of the Children's Response Style Questionnaire; #NLE = number of negative life events; CLES = Children's Life Events Scale

*** $p < .001$;

** $p < .01$;

* $p < .05$

Table 3

Sex, overgeneral autobiographical memories, rumination, and stressful life events predicting depressive symptoms for adolescents (N = 160) at Time 2

	Variable	β	*SE*	*t*	ΔR^2	f^2
Step 1	CDI T1	.43	.05	8.62***	.48***	.91
	Lunch	−.57	.61	−0.93		
	Time	< .01	< .01	1.03		
	Age at T1	.26	.45	0.56		
	CLES T1	.01	.08	0.16		
	Race	−.70	.64	−1.09		
Step 2	Sex	−.14	.60	−0.23	.08***	.17
	OGM T1	.62	.37	1.66		
	CRSQ T1	−.03	.06	−0.53		
	NLE T2	.16	.06	2.77**		
Step 3	OGM × NLE	.08	.06	1.39	.04*	.10
	CRSQ × NLE	.01	.01	1.77		
	CRSQ × OGM	.07	.05	1.38		
	Sex × NLE	.03	.10	0.25		
	Sex × OGM	−.20	.55	−0.37		
	Sex × CRSQ	.16	.08	1.94		
Step 4	Sex × CRSQ × NLE	< .01	.01	0.27	.01	.02
	Sex × OGM × NLE	−.01	.10	−0.09		
	CRSQ × OGM × NLE	.03	.01	2.87 **		
	Sex × CRSQ × OGM	−.14	.09	−1.52		
Step 5	Sex × CRSQ × OGM × NLE	−.05	.02	−2.64**	.02**	.05

Linear regressions were conducted to estimate results (β = standardized coefficient; SE = standard error; *t* = Student's *t* score; ΔR^2 = change in R^2 represents percentage of variance accounted for at each step; f^2 = Cohen's *f*). Coefficients were derived from Step 5 of the final regression model. CDI = Children's Depression Inventory; T1 = Time 1; Lunch = eligibility for free lunch; Time = days between T1 and T2; CLES = Children's Life Events Scale; OGM = Number of overgeneral autobiographical memories; CRSQ = Rumination subscale of the Children's Response Style Questionnaire; NLE = Number of negative life events. Lunch is coded with ineligible (0) and eligible (1) for free lunch. Sex is coded with female (0) and male (1). Race is coded with Caucasian (0) and African American (1)

*** $p < .001$;

** $p < .01$;

* $p < .05$

Table 4

Specific autobiographical memories, and stressful life events predicting depressive symptoms for adolescents (N = 160) at Time 2

	Variable	*B*	*SE*	*t*	ΔR^2	f^2
Step 1	CDI T1	.40	.05	7.97***	.48***	.93
	Lunch	−.33	.62	−0.54		
	Time	< .01	< .01	0.77		
	Age at T1	.15	.45	0.32		
	CLES T1	.04	.08	0.47		
	Race	−.63	.63	−1.00		
	Sex	−.26	.59	−0.45	.07***	.15
	CRSQ T1	.05	.04	1.17		
Step 2	SPM T1	−.18	.16	−1.15		
	NLE T2	.23	.05	4.66***		
Step 3	SPM × NLE	−.08	.03	−2.91**	.02**	.06

Linear regressions were conducted to estimate results (β = standardized coefficient; SE = standard error; *t* = Student's *t* score;ΔR^2 = change in R^2 represents percentage of variance accounted for at each step; f^2 = Cohen's *f*). Coefficients were derived from Step 4 of the final regression model. CDI = Children's Depression Inventory; T1 = Time 1; Lunch = eligibility for free lunch; Time = days between T1 and T2; CLES = Children's Life Events Scale; SPM = Number of specific autobiographical memories; NLE = Number of negative life events. Lunch is coded with ineligible (0) and eligible (1) for free lunch. Sex is coded with female (0) and male (1). Race is coded with Caucasian (0) and African American (1)

*** $p < .001$;

** $p < .01$;

* $p < .05$