

INTERACTIVE CONTRIBUTION OF PEER STRESS AND EXECUTIVE FUNCTION DEFICITS
IN PREDICTING ADOLESCENT DEPRESSION

BY

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DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Psychology
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2014

Urbana, Illinois

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ABSTRACT

Considering that cumulative exposure to stressful peer events may lead to increases in psychopathology, particularly depression, it is important to examine individual-level factors that may increase the likelihood of experiencing future negative outcomes. This research investigated the interactive contribution of peer stress and executive function (EF) deficits in predicting depressive symptoms across middle childhood (2nd grade) to early adolescence (6th grade). Sex differences were also examined in these relations. Youth (M age = 7.95, SD = .37; 267 girls, 227 boys) completed questionnaires and semi-structured interviews to assess peer stress and depression, respectively, and teachers completed the Behavior Rating Scale of Executive Function (BRIEF), a measure assessing everyday, typical performance in areas of EF. Interactions were examined for peer stress and specific EF deficits (i.e., working memory, planning/organization, inhibition, and shifting) in predicting depression. In the total sample, there were main effects of peer stress, planning/organization, and shifting, as well as sex and previous levels of depression. Notably, stressful peer events interacted with inhibition and shifting deficits to predict depression over time in girls only, such that higher levels of stress predicted more depressive symptoms in girls but not boys with high inhibition and shifting deficits. This study extends research on areas of vulnerability that moderate stressful experiences to lead to depression over time, in turn elucidating potential targets for interventions preventing negative psychological outcomes in youth.

Keywords: peer relations, executive functioning, depression

ACKNOWLEDGEMENTS

I would like to thank my advisor, Karen Rudolph, for her extremely helpful, thoughtful, and generous support and guidance thorough my time in graduate school. My committee members, Wendy Heller, Howard Berenbaum, Edelyn Verona, Philip Rodkin, and Brent Roberts, have been also wonderful and I thank them for their feedback and support. Finally, thank you to my loving husband Brian, as well as my family and friends, who have all been an invaluable source of motivation and inspiration throughout my time in Champaign.

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INTRODUCTION

The cumulative effects of peer stress may lead to increases in psychopathology over time and may contribute to development of depression in particular (Aseltine, Gore, & Colten, 1994; Hankin & Abramson, 2001; Hankin, Mermelstein, & Roach, 2007). Considering that not all youth show similar outcomes, youths' individual-level characteristics, such as deficits in executive function (EF), may reduce the ability of youth to deal adaptively with stressful peer events and may serve as vulnerability factors that heighten the likelihood of youth experiencing subsequent psychopathology. In particular, peer stress may interact with specific deficits in EF to lead to more depressive symptoms over time. In light of increases in depression occurring during early adolescence (Rudolph, Lambert, Clark, & Kurlakowsky, 2001), this study examined interactions between peer stress and EF from middle childhood (2nd grade) to early adolescence (6th grade), a developmental period during which the peer context becomes increasingly salient (Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006) and increased demands resulting from the middle-school transition put youth at higher risk for psychopathology (e.g., Rudolph et al., 2001).

Peer Stress from a Stressful Life Events Perspective

Peer stress has been emphasized in a variety of theories of psychopathology, including the development of depression (Rudolph, 2002). Stress within the peer domain can refer to individual events experienced with peers (e.g., a fight with a friend, a friend moving away, or not being invited to a party) as well as to the cumulative effect of exposure to different types of stressful peer events (e.g. interpersonal conflicts, loss of friendships) over a period of time. Considering that peer relationships play a significant role in youths' emotional and behavioral adjustment during the period from middle childhood to early adolescence (Parker et al., 2006), greater cumulative exposure to peer stress during this influential period may predispose youth to future depression. Experiencing stressful peer events may lead youth to focus excessively on their difficulties and negative emotions, leading to trouble concentrating, greater social withdrawal, and increases in depressive symptoms. Youth

may lose confidence in their ability to understand their peers' thoughts and actions, leading them to feel ineffective in their social experiences and demonstrate low self-worth, helplessness, and other symptoms of depression (Rudolph & Clark, 2001). Stressful peer events are associated with concurrent internalizing and depressive symptoms (Rudolph, 2002; Sontag, Graber, Brooks-Gunn, & Warren, 2008) and predict prospective increases in internalizing (Bakker, Ormel, Verhulst, & Oldehinkel, 2010) and depressive symptoms (Aseltine et al., 1994; Hankin & Abramson, 2001; Hankin et al., 2007) during adolescence. Considering not all youth experiencing peer stress show increases in psychopathology over time (McLaughlin, Hatzenbuehler, & Hilt, 2009), individual characteristics potentially contributing to vulnerability to depression were examined. In particular, youths' EF was thought to be one individual-level factor that may interact with peer stress to predict greater depression over time.

Executive Function Deficits Moderating Peer Stress

EF involves related but separable cognitive processes that operate on lower-level processes to regulate thoughts, feelings, and actions (Barkley, 1997). EFs allow for shifting of attention as needed, keeping information in mind for later use or manipulation (Best, Miller, & Jones, 2009; Miyake et al., 2000), planning and sequencing of behaviors counter to immediate interests, and organization of behaviors in line with goals (Anderson, 2002). Difficulties in specific domains of EF may reduce youths' ability to function adaptively after experiencing peer stress and may moderate associations between stressful peer events and future depression. Four specific deficits were examined that may be especially relevant to the development of depressive symptoms: working memory, planning/organization, inhibition, and shifting.

Working memory. The working memory system involves the ability to hold information in mind for the purpose of manipulating it or following through with tasks (Miyake et al., 2000). This ability is essential for completing tasks that involve multiple steps, remembering the rules of an activity, and following a set of instructions or plans. Youth with working memory deficits may have

trouble remembering conversations, lose track of their activities, forget what they had planned to do, be unable to keep in mind rules for an activity or social situation, frequently switch plans, or fail to follow through with obligations. Considering that working memory may allow youth to create templates of social interaction, helping them respond in a socially adaptive manner to stressful events (Barkley, 2001), deficits in working memory may prevent youth from demonstrating coherent, effective, and socially appropriate responses to peer stress. After experiencing stressful peer events, youth with working memory deficits may have limited processing resources to deal with stress and reduced capacity to think about other topics outside of their negative emotions and thoughts related to the event. They may become easily overwhelmed by their emotions and fail to deal effectively with stressful events, leading to unresolved stress and continued or persistent distress. Youth with working memory deficits may also feel helpless or incompetent to deal with future peer stress, leading to increases in depressive symptoms such as low self-worth or inappropriate guilt. Although working memory deficits and difficulties manipulating information in memory are directly associated with depressive symptoms (Joormann & Gotlib, 2008; Joormann, Levens, & Gotlib, 2011), these deficits may also exacerbate the effects of peer stress and lead to increases in depression. In this study, we expected peer stress to interact with working memory deficits to predict depressive symptoms over time such that higher levels of stress would predict depressive symptoms more strongly in youth with high than low levels of working memory deficits.

Planning/organization. The planning/organization system involves the ability to manage demands of current or future tasks, plan and organize actions over time, and regulate behavior to follow through with plans (Gioia, Isquith, Guy, & Kenworthy, 2000a). Planning specifically involves the ability to anticipate future events, setting and developing goals, and determining effective methods or steps to accomplish them. Organizing involves bringing order to information, understanding key concepts, and making sense of large amounts of information presented. Youth with difficulties in these areas have trouble setting reasonable goals, determining steps to accomplish

goals, and grasping the overall structure or framework of information presented. Considering the ability to plan and problem solve in response to a task may enable youth to deal adaptively with social difficulties (Normandeau & Guay, 1998), youth with difficulties planning or organizing their thoughts or actions may have difficulty thinking step-by-step through the best course of action to minimize the impact of stress, alleviate or manage experiences, or come to resolutions when facing problems or frustrations with peers. As a result, they may not be able to effectively resolve stress and deal with problems in a systematic or organized manner. Difficulty forming a coherent plan of action (Eisenberg et al., 2009) may lead to feelings of helplessness, low self-worth, and other symptoms of depression, and difficulties with goal-setting and strategic problem solving have been found to predict depression over time in early adolescence (Brody & Ge, 2001).

Limited research supports the notion that planning/organization deficits moderate relations between peer stress and depressive symptoms. In one study, social problem-solving abilities moderated the concurrent association between negative life events and depressive symptoms in preadolescents (Goodman, Gravitt, & Kaslow, 1995). In addition, poorer problem-solving abilities moderated the impact of stressful life events on future depressive symptoms in college students (Nezu & Ronan, 1988). Although problem solving may involve several types of EF, it is generally conceptualized as part of the planning/organization dimension (e.g., Normandeau & Guay, 1998). In light of previous studies linking stressful life events, planning/organization deficits, and depressive symptoms, we expected peer stress to interact with planning/organization deficits to predict depression over time such that higher levels of stress would predict depressive symptoms more strongly in youth with high than low levels of planning/organization deficits.

Inhibition. Inhibition involves the ability to inhibit behavior and impulses, stop behaviors at the appropriate time, and generally control one's behavior (Barkley, 1997; Miyake et al., 2000; Nigg, 2000). Youth with inhibition deficits may be hyperactive, interrupt others, and be disruptive in group settings (Barkley, 1997). Although the construct of inhibition is multidimensional (Nigg, 2000), the

present study focused specifically on inhibition of behavior. When experiencing peer stress, youth with inhibition deficits may have difficulty controlling the manifestation of their internal experiences and behave in ways that alienate others (e.g., excessively seeking reassurance; Prinstein, Borelli, Cheah, Simon, & Aikins, 2005). Whereas intact inhibition may allow youth to display more competent responses to peer stress (e.g., Riggs, Blair, & Greenberg, 2003), inhibition deficits may lead to ongoing, unresolved stress and more difficulties with peers, leading to more depressive symptoms. Supporting this idea, constructs reflecting behavioral disinhibition (e.g., impulsivity) are associated with less prosocial, moral, and empathic behavior, impaired perspective taking, and more social and behavioral problems in elementary school (Fahie & Symons, 2003). In one prospective study, low effortful control (i.e., attention regulation and inhibition) predicted increases in internalizing symptoms from middle childhood to early adolescence (Lengua, 2006). Although this study measured inhibition deficits as part of the larger construct of effortful control, poor inhibition has been associated with depressive symptoms concurrently and over time in past studies (e.g., Rudolph, Troop-Gordon, & Llewellyn, 2013).

Limited research supports the notion that inhibition deficits moderate relations between peer stress and depressive symptoms. Lower levels of self-regulation (a composite of attention regulation, inhibition, and impulsivity) in elementary school have been found to moderate concurrent associations between high levels of stressful life events and internalizing problems (Lengua, 2002; Lengua & Long, 2002). In light of previous studies linking stressful life events, inhibition deficits, and depressive symptoms, we expected peer stress to interact with inhibition deficits to predict depression over time such that higher levels of stress would predict depressive symptoms more strongly in youth with high than low levels of inhibition deficits.

Shifting. The shifting, or attentional control dimension, involves the ability to control attention and move freely between situations, tasks, and activities (Miyake et al., 2000). It is involved in the ability to make transitions, tolerate change, switch attention between tasks, and change focus to

new topics. Youth with shifting deficits may have difficulty with transitions, demonstrate inflexible problem-solving and rigidity in their thinking or behavior, and fixate on certain topics or interests. Considering that shifting attention to new tasks or stimuli enables youth to move on from negative emotion and reduce their distress (e.g., Harman, Rothbart, & Posner, 1997), youth with shifting deficits facing peer stress may become stuck in a negative mind-set, dwelling on unpleasant thoughts and events (Raver, Blackburn, Bancroft, & Torp, 1999). They may have trouble focusing their attention away from their negative emotions and feel consumed by stress, failing to effectively resolve stressful events and experiencing depressive symptoms such as trouble concentrating or low self-worth. Similar to a shifting deficit, cognitive inflexibility is associated with rumination (i.e., excessive focus on depressive symptoms and their possible causes and consequences; Davis & Nolen-Hoeksema, 2000), which is related to depressive symptoms concurrently (Nolen-Hoeksema, Stice, Wade, & Bohon, 2007) and over time (Roelofs et al., 2009) in children and adolescents. Considering attention regulation, attentional control, and shifting abilities in middle childhood are directly predictive of internalizing symptoms over time (Lengua, 2003), shifting deficits may also moderate the effects of stressful peer events and exacerbate their impact on future depressive symptoms. In this study, we expected peer stress to interact with shifting deficits to predict depression over time such that higher levels of stress would predict depressive symptoms in youth with high than low levels of shifting deficits.

Sex Differences in Stress-Depression Links

Sex differences in relations between stressful peer events, EF deficits, and depression were also examined. In light of research indicating that girls experience more depressive symptoms than boys in the face of peer stress (Hankin et al., 2007; Rudolph, 2002), we predicted that sex would moderate the effects of stressful peer events on future depression. Moreover, when faced with peer stress, girls with EF deficits may engage in more aversive behaviors than boys, such as excessive reassurance seeking (Prinstein et al., 2005), and put additional stress on their social relationships.

Considering girls' stronger need for interpersonal connectedness and affiliation compared to boys (Rose & Rudolph, 2006), girls may consequently evaluate themselves more negatively and experience more depressive symptoms such as low self-worth and hopelessness (Rose & Rudolph, 2006). In this study, we expected that sex differences would moderate relations between peer stress, EF, and depression, with stronger predictions of depression in girls compared to boys.

Overview of Study

The proposed study used a prospective design to test the hypothesis that cumulative exposure to stressful peer events would interact with specific EF deficits to predict depressive symptoms over time. Specifically, we expected interactive contributions of peer stress and working memory deficits, planning/organization deficits, inhibition deficits, and shifting deficits in predicting future depression. In addition, we hypothesized that stressful peer events would more strongly predict depressive symptoms in girls than boys, and that the interactions between peer stress and specific EF deficits would yield stronger predictions of depression in girls than boys.

This study examined symptoms of major depressive disorder [MDD] and dysthymic disorder [DD] in measuring levels of depression in youth. Comprehensive assessments of study constructs were used for depression (semi-structured interview) and EF (a teacher report of EF deficits, as reflected in behavioral observations of youth). In particular, EF deficits were measured using the Behavior Rating Scale of Executive Function (BRIEF), which assesses everyday, typical performance in areas of EF and is sensitive to EF difficulties encountered in everyday life (Denckla, 2002). This measure is distinguished from performance-based tasks, which are thought to measure maximal, or optimal performance in areas of EF (Toplak, West, & Stanovich, 2013). Although maximal EF capacity is generally assessed through examining youths' behaviors in response to circumscribed demands, usually over a short interval of time (e.g., during a performance-based task), typical EF functioning is thought to be captured through the observation and measurement of everyday behaviors. Importantly, difficulties representative of youths' functioning during day-to-day

tasks or circumstances may leave a stronger impact on emotional adjustment than difficulties demonstrated during discrete, time-limited periods, particularly when youth are experiencing ongoing peer stress. Effects were investigated over an important developmental period (2nd – 6th grade) during which the peer context begins to assume an increasingly salient role in children’s lives (Parker et al. 2006) and individual differences in EF have already emerged (Best et al., 2009). In light of relations between low socioeconomic status (SES), stressful life events (Bradley & Corwyn, 2002), and internalizing symptoms (Keiley, Lofthouse, Bates, Dodge, & Petit, 2003), as well as between intelligence (IQ) and EF (Friedman et al., 2008), our analyses adjusted for SES (reflected in subsidized lunch status) and cognitive ability (reflected in academic performance). We also adjusted for negative emotionality in light of the possibility that items on our EF measure captured aspects of this temperament dimension (e.g., “Acts upset by a change of plans.” “Becomes upset with new situations.”). Finally, in addition to investigating objective levels of stress experienced by youth, we examined interactions between EF and youths’ subjective experiences of stressors in light of previous debates in the field regarding the implications of measuring youths’ perceptions or appraisals of stressors, as well as the role of perceptions in affecting future adjustment (e.g., Hankin et al., 2007; Rudolph & Hammen, 1999).

METHOD

Participants and Procedures

Participants included 494 youth (267 girls, 227 boys; M age = 7.95, SD = .37) and their teachers. Youth were from various ethnic groups (66.4% White, 33.6% minority) and were diverse in socioeconomic class (37.8% received a subsidized school lunch). For the initial recruitment, consent forms were distributed to families of 724 eligible 2nd graders across schools in several Midwestern towns. Of the original families, 80% (576) consented to participate, and an additional 60 3rd graders were added the following year for a total of 636 participants. Parents provided written consent for youth and teachers to participate, and youth provided verbal assent. Of the 636 families, 494 (78%) participated in a diagnostic interview in 6th grade. Participants and nonparticipants in the interview did not differ in sex, $\chi^2(1) = .73$, ns , or ethnicity (white vs. minority), $\chi^2(1) = .07$, ns . Compared to participants, nonparticipants were slightly older ($M = 12.02$, $SD = .38$ vs. $M = 11.94$, $SD = .40$, $t(634) = 2.30$, $p < .05$) and less likely to have reduced lunch status, $\chi^2(1) = 7.19$, $p < .01$, but the study still included a socioeconomically diverse sample representative of the geographical area.

The study involved five annual assessments from the 2nd (Wave 1 [W₁]) through 6th (Wave 5 [W₅]) grade. Of the 494 participants who had diagnostic interviews of depression at W₅, 446 had child reports of depressive symptoms at W₁, 486 had child reports of stressful peer events at W₁, W₂, W₃, or W₄, and 483 had teacher reports of EF at W₅. Youth with complete data on all measures ($n = 417$) did not significantly differ from those missing data on any measure at any wave in sex, $\chi^2(1) = .02$, ns , ethnicity, $\chi^2(1) = .67$, ns , or subsidized lunch status, $\chi^2(1) = 3.54$, ns . Compared to youth with complete data, youth with missing data were slightly older at W₅ ($M = 12.08$, $SD = .54$ vs. $M = 11.91$, $SD = .36$, $t(492) = 3.37$, $p < .01$). Data imputation was conducted using a linear regression approach within the Missing Value Analysis module in *SPSS Statistics Version 20* to estimate missing values for all variables.

In the winter of each year, graduate/undergraduate students and trained project staff administered questionnaires during two classroom sessions. Questionnaires were read aloud to small groups of 3 – 4 students in 2nd-5th grade as participants recorded responses. For participants moved from the area, questionnaires were mailed and usually completed at school with teacher supervision. Teacher surveys were distributed at the end of fall semester and returned to a locked box at school to ensure confidentiality. Youth received small gifts as tokens of appreciation for participation, and teachers received monetary reimbursements for completed surveys and honorariums for participating classrooms. In 6th grade, interviews were administered in person or by phone by graduate students or a post BA-level research assistant, and youth received a gift card as compensation.

Measures

Table 1 displays descriptive statistics, psychometrics, and intercorrelations for the measures. Appendices A-E provide individual items and/or sample questions for each measure.

Stressful peer events. At W₁ through W₄, youth completed the Stressful Peer Events Questionnaire to assess youths' cumulative exposure to negative events within the peer domain. Three items (e.g., "A friend died.") and a rating scale for appraisal of events were adapted from a life events inventory developed by Robinson and colleagues (Robinson, Garber, & Hilsman, 1995). Four additional items (e.g., "You had a physical fight with another kid.") were taken from another life events measure in preadolescents (Rudolph et al., 2001) that modified several questions from the original measure (Robinson et al., 1995) to be relevant to peers. Several new items were created to tap additional types of stressful peer events (e.g., "You were not invited to a party that you wanted to go to."). The final measure included 13 items assessing youths' exposure to specific stressful peer events since the beginning of the school year. Youth circled *Yes* or *No* to indicate whether the event happened to them and, if so, rated "How bad was it for you?" on a 5-point scale (*Not Bad at All* to *Horrible*). To reduce response bias and obtain an estimate of objective levels of stress experienced by youth, scores were computed by multiplying each event endorsed by the average severity rating for

all participants experiencing the event. The sum of endorsed events, weighted by their average severity, was totaled over four years of elementary school such that higher scores represented greater cumulative stress exposure. Scoring for subjective stress followed the same procedures except that endorsed events were weighted by the original severity rating given by each participant rather than the average severity across participants. Validity has been demonstrated for negative life event inventories forming the basis of this measure (e.g., Rudolph et al., 2001) and for negative event checklists in the peer domain (Aseltine et al., 1994; Sontag et al., 2008). Finally, life events checklists show reliability (e.g., test-retest stability; Johnson & McCutcheon, 1980).

Executive function (EF). At W_5 , teachers completed four subscales of the Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000a) to assess behavioral manifestations of youths' EF. The original measure includes 86 items separable into eight clinical and two validity scales. Four subscales were selected for this study based on hypotheses about relevant aspects of EF: Working Memory (10 items; e.g., "Forgets what he/she is doing."); Plan/Organize (12 items; e.g., "Does not plan ahead for school assignments."); Inhibit (10 items; e.g., "Has trouble putting the brakes on his/her actions."); and Shift (8 items; e.g., "Thinks too much about the same topic."). Each item was rated on a 3-point scale (1 = *Never a Problem* to 3 = *Often a Problem*). Subscale scores were computed as the mean of items within each subscale. This measure has high reliability, as indicated by good internal consistency (Gioia & Isquith, 2004) and adequate inter-rater and test-retest reliability (Gioia, Isquith, Guy, & Kenworthy, 2000b). The measure also shows strong ecological validity (Denckla, 2002) and well-established construct validity, including high convergent and divergent validity with other teacher rating scales of behaviors (Gioia et al., 2000a; Gioia et al., 2000b) for the subscale scores (e.g., Joyner, Silver, & Stavinoha, 2009; Semrud-Clikeman, Walkowiak, Wilkinson, & Butcher, 2010). Factor analyses (e.g., Gioia & Isquith, 2004) demonstrate support for each of the eight subscales of the BRIEF in samples from both the general population and clinical populations (Gioia et al., 2000a; Gioia & Isquith, 2004; Reddy, Hale, & Brodzinsky, 2011;

Slick, Lautzenhiser, Sherman, & Eryl, 2006), as well as across both parent and teacher reports (Gioia, Isquith, Retzlaff, & Espy, 2002). Finally, the measure has been tested and used in preschool-age children to adults (e.g., Christ, Kanne, & Reiersen, 2010).

Clinical assessment of depression. At W₅, interviewers administered an interview modified from the Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), a structured, clinical interview allowing researchers to make diagnoses of psychiatric disorders according to the DSM-IV or ICD-10 (Sheehan et al., 1998). The interview has high reliability and high correspondence (Sheehan et al., 2010) with the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Epidemiologic Version-5 (K-SADS-E; Orvaschel, 1995). Interviewers assessed for symptoms of MDD and DD. The MINI-KID was modified to allow interviewers to ask detailed follow-up questions about the timing, duration, and context of symptoms. Interviewers assigned ratings on a scale modified from a yes/no rating to a 2-point scale to enable symptom ratings of subthreshold severity: 0 = Symptom absent, 1 = Symptom present at subthreshold levels (i.e., failed to meet required threshold for duration or severity under DSM-IV criteria), 2 = Symptom present at diagnostically significant levels. Finally, several categories of symptoms were divided into two separate prompts to increase the range of reported number and severity of symptoms. For example, cognitive symptoms of MDD consisted of separate prompts for low self-worth and excessive/inappropriate guilt, allowing participants to endorse zero, one, or both symptoms at either threshold or subthreshold severity. The modified interview was administered individually to youth (and some caregivers¹) to assess youths' levels of depression.

¹ A number of youth were unwilling to provide information for interviews. In these cases, caregivers were interviewed to provide information, either instead of or in addition to youth. Of the 494 participants with interview data available, 474 were administered to youth only, 30 were administered to caregivers only, and 8 were administered to both youth and caregivers. For interviews in which both types of data were available, consensual diagnoses were assigned using a best-estimate approach (Klein, Ouimette, Kelly, Ferro, & Riso, 1994).

Coding took place through consultation with a psychology faculty member with a Ph.D. in clinical psychology. Ratings for symptoms in the past year were summed within each diagnosis (e.g., MDD) and across diagnostic categories (i.e., MDD + DD) to create continuous scores for depression. For multiple episodes of MDD in the past year, symptoms were added across episodes to indicate total MDD symptoms. Higher ratings reflected more severe symptoms within a single diagnosis and/or presence of symptoms from separate episodes and/or separate depressive disorders (for a similar approach, see Hammen, Shih, Altman, & Brennan, 2003). Consistent with use of a continuous index, contemporary conceptualizations, derived in part from taxometric analyses, suggest depression is best represented on a dimensional continuum (Hankin, Fraley, Lahey, & Waldman, 2005). Providing evidence for concurrent validity, continuous scores for depression were significantly correlated ($r = .73, p < .001$) with scores on the Short Mood and Feelings Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995). Independent coding of 119 interviews by an advanced graduate student in clinical psychology yielded strong inter-rater reliability (one-way random-effects ICC = .94).

Self-report of depression. Because clinical interview data were not available at W_1 , a self-report measure of depressive symptoms was used to adjust for prior levels of depression. Youth completed the SMFQ (Angold et al., 1995), which includes 13 items assessing depressive symptoms (e.g., “I felt unhappy or miserable.”). The response format was modified from a 3- to 4-point scale (*Not at All* to *Very Much*) to provide a format similar to other study questionnaires (see also Lau & Eley, 2008). Scores were computed as the mean of items. This measure shows significant correlations with the Children’s Depression Inventory and the Diagnostic Interview Schedule for Children (Angold et al., 1995), and differentiates depression from other psychiatric disorders (Thapar & McGuffin, 1998).

Academic performance. At W_1 , teachers provided ratings of youths’ academic performance in 4 specific subject areas (i.e., English, Math, Science, and Social Studies). Each item was rated on a

5-point scale (1 = *Far Below Grade Level* to 5 = *Far Above Grade Level*). Scores were computed as the mean of ratings across subject areas, with higher scores reflecting better performance.

Negative emotionality. At W₄, youth completed the negative emotionality subscale of the Temperament in Middle Childhood Questionnaire (Simonds, Kieras, Rueda, & Rothbart, 2007). The measure includes 25 items that assess susceptibility to experiencing heightened negative emotions, including sadness (10 items; e.g., “I become tearful when I’m tired.”) and anger (7 items; e.g. “I get angry when I have trouble with a task.”), and difficulty being soothed once aroused, (8 items; e.g., “I have a hard time calming down when I am upset.”). Each item was rated on a 5-point scale (1 = *Almost Always Untrue* to 5 = *Almost Always True*). Scores for negative emotionality were computed by averaging the means of the three subscales. This measure has high reliability and stability (Rothbart, Ahadi, Hershey, & Fisher, 2001) and demonstrates significant correlations with parent reports of negative emotionality (e.g., Lengua, 2003), behavioral observations of youth (Wilson, 2006), and computer assessments (Simonds et al., 2007). Factor analyses of the negative emotionality subscale demonstrate a unitary structure and factorial invariance over time, and also support a distinction between negative emotionality and related constructs, such as depression (Sugimura & Rudolph, 2012). Divergent validity is further supported by minimal content overlap with measures of depressive symptoms (e.g., the SMFQ; Angold et al., 1995), as well as differential stability of constructs, with negative emotionality demonstrating higher stability than depressive symptoms (Sugimura & Rudolph, 2012).

RESULTS

Main Effects of Sex

A series of *t*-tests was conducted to examine sex differences. Compared to boys, girls showed significantly higher levels of W_4 negative emotionality ($M = 2.64, SD = .77$ vs. $M = 2.30, SD = .66, t = 5.24, p < .001, d = .48$) and W_5 depression ($M = 2.82, SD = 5.87$ vs. $M = 1.44, SD = 3.12, t = 3.19, p = .002, d = .29$). Compared to girls, boys showed significantly higher levels of working memory deficits ($M = 1.55, SD = .57$ vs. $M = 1.36, SD = .51, t = 3.74, p < .001, d = .35$), planning/organization deficits ($M = 1.56, SD = .59$ vs. $M = 1.40, SD = .55, t = 3.09, p = .002, d = .28$), and inhibition deficits ($M = 1.45, SD = .59$ vs. $M = 1.21, SD = .42, t = 5.32, p < .001, d = .47$). No significant sex differences were found for W_1 depression ($t = .92, p = .36$), lunch status ($t = 1.18, p = .24$), academic performance ($t = .47, p = .64$), $W_1 - W_4$ peer stress ($t = .99, p = .32$), or shifting deficits ($t = 1.84, p = .07$).

Overview of Primary Analyses

The primary analyses were conducted using hierarchical multiple regressions. Each analysis adjusted for initial levels of depression, as well as subsidized lunch status, academic performance, and negative emotionality. Predictors and covariates were mean-centered. Stress x EF interactions were represented by the product of the mean-centered stress and EF variables.

First, the three-way interactions between peer stress, EF, and sex were examined. Covariates (W_1 depression, lunch status, academic performance, and W_4 negative emotionality) were entered at the 1st step, main effects (peer stress, EF, and sex) were entered at the 2nd step, two-way interactions (stress x EF, EF x sex, stress x sex) were entered at the 3rd step, and three-way interactions (stress x EF x sex) were entered at the 4th step. Significant three-way interactions were interpreted using the slopes difference test outlined by Dawson and Richter (2006). Slope difference tests were calculated for the following contrasts: girls vs. boys at high (+ 1 *SD*) levels of EF, girls vs. boys at low (-1 *SD*) levels of EF, high vs. low EF within girls only, and high vs. low EF within boys only.

Unstandardized regression equations were decomposed and graphed by solving for peer stress predicting depression at high and low levels of EF. Table 2 presents results from the three-way interactions.

Regressions Examining Objective Stress

Working memory. In the regression examining working memory, there were significant positive main effects of W_1 depression, W_4 negative emotionality, stress, and sex, and a significant stress x sex interaction (Table 2). As shown in Figure 1, higher levels of peer stress predicted more depressive symptoms in girls ($B = .06, t = 4.22, p < .001$) but not boys ($B = .02, t = 1.16, p = .25$). Because this interaction appeared similar across analyses involving individual EF subscales and simple slope tests were similar in size and significance, only the graph for working memory is shown.

Planning/organization. In the regression examining plan/organize, there were significant positive main effects of W_1 depression, W_4 negative emotionality, stress, plan/organize, and sex, and a significant stress x sex interaction (Table 2).

Inhibit. In the regression examining inhibit, there were significant positive main effects of W_1 depression, W_4 negative emotionality, stress, and sex, a significant stress x sex interaction, and a significant stress x inhibit x sex interaction (Table 2). As shown in Figure 2, decomposition of the significant three-way interaction revealed that peer stress predicted more depressive symptoms in girls ($B = .07, t = 3.71, p < .001$) but not boys ($B = .00, t = -.06, p = .95$) with high inhibition deficits, with significantly greater effects for girls than boys (slope difference test: $t = 2.84, p < .01$). In addition, peer stress significantly predicted depressive symptoms in girls ($B = .04, t = 2.32, p = .02$) but not boys ($B = .03, t = 1.66, p = .10$) with low inhibition deficits, with no significant difference in effects between sexes (slope difference test: $t = 0.22, p = .83$). There were no significant differences at high vs. low levels of inhibition deficits for girls ($t = 1.41, p = .16$) or boys ($t = -1.34, p = .18$).

Shift. In the regression examining shift, there were significant positive main effects of W_1

depression, W_4 negative emotionality, stress, shift, and sex, significant shift x sex and stress x sex interactions, and a significant stress x shift x sex interaction (Table 2). As shown in Figure 3, decomposition of the significant three-way interaction revealed that peer stress predicted more depressive symptoms in girls ($B = .07, t = 4.58, p < .001$) but not boys ($B = .01, t = .29, p = .77$) with high shifting deficits, with significantly greater effects for girls than boys (slope difference test: $t = 2.93, p = .004$). In addition, peer stress significantly predicted depressive symptoms in girls ($B = .03, t = 2.06, p = .04$) but not boys ($B = .03, t = 1.71, p = .09$) with low shifting deficits, with no significant difference in effects between sexes (slope difference test: $t = -.01, p = .99$). Moreover, we found significantly greater effects at high than low levels of shifting deficits for girls ($t = 2.06, p = .04$) but not boys ($t = -1.17, p = .24$).

Regressions Examining Subjective Stress

Working memory. In the regression examining working memory deficits, there was a nonsignificant stress x working memory x sex interaction, which was consistent with our results for objective stress (Table 3).

Planning/organization. In the regression examining plan/organize deficits, there was a significant stress x plan/organize x sex interaction (Table 3). Decomposition of the significant three-way interaction revealed that peer stress predicted more depressive symptoms in girls ($B = .06, t = 4.18, p < .001$) but not boys ($B = -.01, t = -.90, p = .37$) with high plan/organize deficits, with significantly greater effects for girls than boys (slope difference test: $t = 3.69, p < .001$). In addition, peer stress significantly predicted depressive symptoms in girls ($B = .03, t = 2.01, p = .05$) but not boys ($B = .02, t = .93, p = .35$) with low plan/organize deficits, with no significant difference in effects between sexes (slope difference test: $t = .53, p = .60$). There were no significant differences at high vs. low levels of plan/organize deficits for girls ($t = 1.67, p = .10$) or boys ($t = -1.34, p = .18$). These findings were in contrast to our results for objective stress, in which we found a nonsignificant stress x plan/organize x sex interaction.

Inhibit. In the regression examining inhibition deficits, there was a significant stress x inhibit x sex interaction (Table 3). Decomposition of the significant three-way interaction revealed that peer stress predicted more depressive symptoms in girls ($B = .07, t = 4.41, p < .001$) but not boys ($B = -.01, t = -.62, p = .54$) with high inhibition deficits, with significantly greater effects for girls than boys (slope difference test: $t = 3.81, p < .001$). Peer stress did not significantly predict depressive symptoms in girls ($B = .02, t = 1.65, p = .10$) or boys ($B = .02, t = .84, p = .40$) with low inhibition deficits, with no significant difference in effects between sexes (slope difference test: $t = 0.38, p = .71$). Differing from our findings for objective stress, there were significant differences at high vs. low levels of inhibition deficits for girls ($t = 2.41, p = .02$) but not boys ($t = -1.09, p = .28$). In summary, the results for inhibition deficits were similar to those for objective stress, with one exception: For objective stress, we did *not* find significant differences at high vs. low levels of inhibition deficits for girls.

Shift. In analyses examining shifting deficits, there was a significant stress x shift x sex interaction (Table 3). Decomposition of the significant three-way interaction revealed that peer stress predicted more depressive symptoms in girls ($B = .06, t = 4.89, p < .001$) but not boys ($B = -.00, t = -.28, p = .78$) with high shifting deficits, with significantly greater effects for girls than boys (slope difference test: $t = 3.73, p < .001$). Moreover, we found significantly greater effects at high than low levels of shifting deficits for girls ($t = 2.92, p = .004$) but not boys ($t = -1.10, p = .27$). Differing from our results for objective stress, peer stress did not significantly predict depressive symptoms in girls ($B = .02, t = 1.39, p = .17$) or boys ($B = .02, t = 1.02, p = .31$) with low shifting deficits, with no significant difference in effects between sexes (slope difference test: $t = .06, p = .95$). In summary, the results for shifting deficits were similar to those for objective stress, with the exception of finding significant prediction of depression in girls with low shifting deficits for objective stress.

DISCUSSION

This study used a measure of EF reflecting everyday, typical performance to examine interactive contributions of stressful peer events and specific EF deficits in predicting future depression. We also examined sex differences in these relations. Our results revealed main effects of W_1 depression, peer stress, sex, planning/organization, and shifting in the total sample. We also found a significant interaction between peer stress and sex such that higher levels of stress predicted more depressive symptoms in girls but not boys. Moreover, a significant interaction was found for inhibition and shifting deficits such that peer stress predicted future depressive symptoms in girls but not boys with high levels of deficits.

Main Effects and Interactions for Objective Stress

Main effects for peer stress and EF were found in the total sample such that stressful peer events and two specific EF deficits (i.e., planning/organization and shifting) predicted future depressive symptoms. In addition, depression at W_1 , negative emotionality, and sex each predicted more depressive symptoms over time in the total sample. These findings are consistent with previous research indicating relations between peer stress and future depression (e.g., Aseltine et al., 1994; Hankin & Abramson, 2001; Hankin et al., 2007), as well as between specific EF deficits and depression (e.g., Lengua, 2003). In addition, past depression (e.g., Tram & Cole, 2006) and sex (Hankin & Abramson, 2001) are strong predictors of future depression, and negative emotionality has been found to contribute to internalizing symptoms over time (Eisenberg et al., 2009). Each of these variables may individually heighten youths' vulnerability to developing future depression. Although previous studies have found associations between depression and both inhibition (e.g., Rudolph et al., 2013) and working memory (e.g., Joormann & Gotlib, 2008), we did not find main effects for these EF deficits. Importantly, we did find interactions with stress for inhibition, suggesting that inhibition deficits impact depression by moderating stress-depression links. Finally, considering that the majority of studies on working memory and depression are in adults (e.g.,

Joormann & Gotlib, 2008; Joormann et al., 2011), it is possible that working memory deficits may not lead to depression until later in development.

In addition, we found an interaction between peer stress and sex such that higher levels of stress predicted more depressive symptoms in girls but not boys. Consistent with past research (e.g., Hankin et al., 2007; Rudolph, 2002), girls' stronger need for peer approval and maintaining relationships (Rose & Rudolph, 2006) may lead them to perceive themselves negatively when failing to resolve peer stressors (Dodge, 1993). Compared to boys, girls react with stronger negative affect to peer stress (Rudolph, 2002) and may ruminate more in response to stress, leading to greater depression (e.g., Hankin et al., 2007; Nolen-Hoeksema et al., 2007; Rudolph, 2002; Rudolph, Flynn, Abaied, Groot, & Thompson, 2009; Rudolph & Hammen, 1999).

Peer stress interacted with shifting deficits to predict more depressive symptoms such that higher levels of stress predicted more depressive symptoms in girls but not boys with high shifting deficits. Moreover, for girls only, there were significantly greater effects at high versus low levels of shifting deficits. These findings are consistent with our hypothesis predicting interactive contributions of peer stress and shifting deficits in predicting future depression, as well as our expectation of stronger predictions of depression in girls. When faced with peer stress, girls with shifting deficits may become stuck on unpleasant thoughts and events (Raver et al., 1999), experiencing depressive symptoms such as trouble concentrating or low self-worth. In addition, cognitive inflexibility is associated with increased rumination (Whitmer & Banich, 2007), which is related to depressive symptoms in childhood and adolescence (Nolen-Hoeksema et al., 2007; Roelofs et al., 2009). Moreover, there are greater associations between rumination and future depressive symptoms in females compared to males in past studies (e.g., Butler & Nolen-Hoeksema, 1994), potentially accounting for our findings in girls but not boys. Finally, girls with difficulties shifting attention after peer stress may exhibit behaviors that alienate others (e.g., excessive reassurance-seeking; e.g., Prinstein et al., 2005), eliciting even more peer disapproval, rejection, and relationship

stress (Nolen-Hoeksema et al., 2007; Rose & Rudolph, 2006) and leading to increases in depressive symptoms.

We found similar results for inhibition such that peer stress interacted with inhibition deficits to predict more depressive symptoms, with higher levels of stress predicting more depressive symptoms in girls but not boys with high inhibition deficits. These findings are consistent with our hypothesis predicting an interaction between peer stress and inhibition, as well as our expectation of stronger predictions of depression in girls. When experiencing peer stress, girls with inhibition deficits may fail to act in a regulated manner with peers and may show less competent responses to peer stress, leading to ongoing difficulties and depressive symptoms such as low self-worth. Our results are consistent with previous studies finding moderating effects of inhibition on associations between peer stress and internalizing symptoms (e.g., Lengua, 2002; Lengua & Long, 2002). In contrast to our results for shifting deficits, we did not find significantly greater effects at high versus low levels of inhibition deficits for girls. Considering that impulsivity and other uninhibited behaviors are more normative in boys (Tiet, Wasserman, Loeber, McReynolds, & Miller, 2001), girls with difficulty inhibiting their responses after stressful peer events may exhibit behaviors such as aggression, violating social and gender norms, and eliciting harsh judgments from peers. In contrast, boys with similar EF deficits who fail to resolve peer stress may experience less negative peer evaluations, relationship dissolution, and subsequent depression.

Contrary to our hypotheses, we did not find interactions between peer stress and two specific EF deficits (i.e., working memory and planning/organization deficits). However, we did find direct effects of planning/organization deficits on depression. It is possible that planning/organization deficits increase depressive symptoms regardless of youths' stress levels, or it may be that other types of stress, such as family or noninterpersonal (e.g., academic) stressors, may interact with higher working memory and planning/organization deficits to predict depression in youth.

Findings for Subjective Stress

In addition to examining objective levels of stress, we examined interactions between EF deficits and youths' subjective experience of stressors in predicting depression. Replication was found for two of the EF deficits (i.e., inhibition and shifting) such that subjective peer stress predicted depression in girls but not boys with high EF deficits. In addition, we found a significant interaction for planning/organization deficits such that subjective peer stress predicted more depressive symptoms in girls but not boys with high planning/organization deficits. Compared to boys, girls with difficulties planning or organizing their thoughts or actions may become more emotionally overwhelmed by the perceived stressfulness of their circumstances, likely due to girls' heightened focus on relationships and greater need for interpersonal connection (Rose & Rudolph, 2006). They may fail to view the larger picture or context of stressful events and have difficulty breaking down problems step-by-step, leading to feelings of helplessness, low self-worth, and other symptoms of depression. Consistent with our results indicating interactions in girls but not boys, a previous study by Schraedley and colleagues found stronger associations between perceived stress and depression in girls compared to boys (Schraedley, Gotlib, & Hayward, 1999). Although the aforementioned study failed to replicate this finding when looking at objective number of life events, our study did find an interaction between objective stress and sex. Future studies may validate whether interaction patterns for objective stress and subjective stress are consistently similar in the prediction of depression.

Implications for Theory/Research and Intervention/Prevention

These findings contribute to research demonstrating areas of vulnerability to depression, in line with diathesis-stress models (e.g., Hankin & Abramson, 2001). Our results identify specific, individual-level characteristics that may explain youths' varied outcomes in response to stress. In addition, all relevant main effects and interactions for objective stress were replicated when examining subjective stress, and one additional interaction for planning/organization was found for subjective stress. Finally, the three-way interactions for inhibition and shifting deficits were

significant across analyses for both objective and subjective stress, demonstrating the robustness of these findings. Our measurement approach of assessing EF through observation of typical behaviors is sensitive to EF difficulties encountered in everyday life (Denckla, 2002) and also circumvents the “task impurity problem,” or the difficulty of separating EFs from other cognitive processes involved in performance-based EF measures (Miyake et al., 2000). Finally, this study elucidates potential points of intervention for preventing depression. Targeted EF interventions, such as EF coaching in elementary school, may help youth maintain a positive trajectory and reduce negative outcomes after experiencing stressful peer events. In particular, targeting inhibition and shifting deficits may be effective in preventing future depression in girls.

Limitations and Future Directions

Despite these contributions, several limitations should be noted. First, although a significant minority of our sample reported depressive symptoms, the majority of participants did not experience diagnostic-level depression. In light of evidence for the dimensional nature of depressive symptoms (Hankin et al., 2005), replication in youth with more severe symptoms would be expected. However, future research needs to test the generalizability of these findings. Second, although our dual-informant (child, teacher) approach reduces reporter biases and is a strength of the study, each construct was assessed through only one informant. Notably, sex differences in levels of disclosure may result from girls being more comfortable disclosing personal problems than boys (Rose et al., 2012) and reporting more depressive symptoms. Behavioral ratings of EF are also subject to biases in observations based on the informants’ knowledge of the subject, which may result in negative or positive “halo effects” (Denckla, 2002). To note, teacher ratings of EF have established validity (e.g., Gioia et al., 2000a; Gioia & Isquith, 2004) and our measure has been validated across multiple observers (Gioia et al., 2000a). Nevertheless, future studies may use multi-informant, multi-method approaches to establish the validity of our findings across informants.

Although the BRIEF may circumvent the “task impurity problem” related to performance-

based tasks, capturing broad or global behavioral manifestations of EF using this measure may restrict the identification of specific EF processes (Gioia et al., 2002). In addition, the BRIEF does not measure maximal, or optimal performance in areas of EF (Toplak et al., 2013), and it is possible that youth may mobilize EF reserves when responding to stressful peer events (as opposed to demonstrating typical performance). Examining relations between stress, EF, and depression using performance-based tasks may be an important consideration in future studies.

Additional studies may examine whether differential outcomes are found depending on stressor domain. In our study, stressful events with peers were more strongly predictive of depression in girls than in boys. Although our study found no differences in levels of peer stress across sex, other studies suggest boys experience fewer interpersonal (e.g., peer, family) and more noninterpersonal (e.g., academic) stressors than girls (e.g., Rudolph & Hammen, 1999), and the latter may be more predictive of depression in boys.

Another important research direction is potential mediators through which stress and EF impact subsequent adjustment. Poorer social-emotional competence (e.g., Bierman et al., 2008) and biases in processing social information related to EF deficits may mediate the development of depression after youth experience peer stress. Likewise, youths' coping resources may be affected by EF deficits, leading them to respond to stress in adaptive or maladaptive ways over time and resulting in heightened or reduced risk for future depression (e.g., Nezu & Ronan, 1988; Sontag et al., 2008). Finally, although we investigated the direct effect of youths' subjective reports of stress on future depression, additional studies may examine whether youths' perceptions of stress mediate the relations between objective stress, EF, and depression over time.

This study extends research on areas of vulnerability that moderate stressful experiences to lead to depression over time. Considering peer relationships are extremely important for development (Parker et al., 2006), these findings expand our understanding of individual-level factors that may

affect youth's adjustment, and elucidate potential targets for interventions preventing depression in youth.

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TABLES

Table 1

Descriptives and Intercorrelations Among the Variables

Measure	M^A	SD^A	M^B	a	1	2	3	4	5	6	7	8	9	10
1. W ₁ Depression	1.72	.67	1.74	.88	--	.12	-.24***	.26***	.33***	.14*	.14*	.21**	.16*	.21**
2. W ₁ Lunch Status	.38	.49	.38	---	.05	--	-.32***	.30***	.20**	.37***	.43***	.33***	.30***	.03
3. W ₁ Academic Performance	3.18	.97	3.16	.96	-.11	-.38***	--	-.10	-.05	-.42***	-.46***	-.21**	-.34***	-.01
4. W ₄ Negative Emotionality	2.49	.74	2.49	.92	.17*	.12	.02	--	.41***	.22***	.20**	.30***	.30***	.29***
5. W ₁ – W ₄ Peer Stress	57.21	24.89	60.04	--	.23**	.15*	-.12	.29***	--	.17**	.15*	.30***	.17**	.30***
6. W ₅ Memory	1.45	.54	1.45	.95	.16*	.32***	-.41***	.18**	.24***	--	.92***	.61***	.67***	.13*
7. W ₅ Plan/Organize	1.48	.57	1.48	.96	.15*	.35***	-.44***	.17*	.23***	.91***	--	.52***	.65***	.18**
8. W ₅ Inhibit	1.32	.52	1.33	.96	.07	.26***	-.28***	.15*	.29***	.70***	.64***	--	.67***	.16**
9. W ₅ Shift	1.24	.38	1.24	.90	.13	.30***	-.34***	.22**	.21**	.63***	.64***	.64***	--	.23***
10. W ₅ Depressive Symptoms	2.18	4.85	2.18	.94	.13	-.03	-.10	.05	.17*	.17*	.15*	.07	.03	--

Note. * $p < .05$ ** $p < .01$ *** $p < .001$. Correlations above the diagonal are for girls; correlations below the diagonal are for boys.

A. Calculated from original data.

B. Calculated from imputed data.

Table 2

3-Way Hierarchical Linear Regressions Predicting Depression: Objective Stress

	Working Memory		Plan/Organize		Inhibit		Shift	
	B	<i>t</i>	B	<i>t</i>	B	<i>t</i>	B	<i>t</i>
Step 1								
W ₁ Depression	.99	2.75**	.99	2.75**	.99	2.75**	.99	2.75**
W ₁ Lunch Status	-.52	-1.08	-.52	-1.08	-.52	-1.08	-.52	-1.08
W ₁ Academic Performance	-.12	-.51	-.12	-.51	-.12	-.51	-.12	-.51
W ₄ Negative Emotionality	1.45	4.74***	1.45	4.74***	1.45	4.74***	1.45	4.74***
Step 2								
W ₁ - W ₄ Peer Stress	.03	3.51***	.03	3.50***	.03	3.50**	.04	3.58***
W ₅ EF Deficit	.83	1.84	1.17	2.73**	.36	.79	1.28	2.05*
Sex	1.32	3.00**	1.37	3.15**	1.24	2.76**	1.28	2.94**
Step 3								
Peer Stress x EF Deficit	-.01	-.88	-.00	-.10	.00	-.03	.01	.70
EF Deficit x Sex	.21	.27	.90	1.19	.73	.81	2.77	2.54*
Peer Stress x Sex	.04	2.40*	.04	2.40*	.04	2.19*	.04	2.17*
Step 4								
Peer Stress x EF Deficit x Sex	.05	1.50	.04	1.54	.07	1.96*	.01	2.28*

Note. * $p < .05$ ** $p < .01$ *** $p < .001$. Sex is coded in the positive direction, with girls 1 and boys 0.

Table 3

3-Way Hierarchical Linear Regressions Predicting Depression: Subjective Stress

	Working Memory		Plan/Organize		Inhibit		Shift	
	B	<i>t</i>	B	<i>t</i>	B	<i>t</i>	B	<i>t</i>
Step 1								
W ₁ Depression	.99	2.75**	.99	2.75**	.99	2.75**	.99	2.75**
W ₁ Lunch Status	-.52	-1.08	-.52	-1.08	-.52	-1.08	-.52	-1.08
W ₁ Academic Performance	-.12	-.51	-.12	-.51	-.12	-.51	-.12	-.51
W ₄ Negative Emotionality	1.45	4.74***	1.45	4.74***	1.45	4.74***	1.45	4.74***
Step 2								
W ₁ - W ₄ Peer Stress	.03	2.94**	.03	2.94**	.03	2.95**	.03	2.99**
W ₅ EF Deficit	.82	1.80	1.18	2.73**	.40	.87	1.23	1.97*
Sex	1.22	2.78**	1.28	2.93***	1.15	2.57*	1.17	2.70**
Step 3								
Peer Stress x EF Deficit	-.01	-.65	.00	.38	.01	.88	.02	1.43
EF Deficit x Sex	-.02	-.02	.67	.88	.28	.30	2.24	2.03*
Peer Stress x Sex	.05	3.06**	.05	3.09**	.05	3.03**	.04	2.84**
Step 4								
Peer Stress x EF Deficit x Sex	.04	1.46	.05	2.17*	.07	2.49*	.09	2.85**

Note. * $p < .05$ ** $p < .01$ *** $p < .001$. Sex is coded in the positive direction, with girls 1 and boys 0.

Table 4

Summary of Main Effects and Interactions with Peer Stress in Regressions Predicting Depression

	Main Effects		Two-Way w/ Stress		Three-Way w/ Stress	
	Obj. Stress	Sub. Stress	Obj. Stress	Sub. Stress	Obj. Stress	Sub. Stress
<i>Covariates</i>						
W ₁ Depression	X	X				
W ₁ Lunch Status						
W ₁ Academic Performance						
W ₄ Negative Emotionality	X	X				
<i>Independent Variables</i>						
Peer Stress	X	X				
Sex	X	X	X	X		
<i>Moderators</i>						
Working Memory						
Plan/Organize	X	X				X
Inhibit					X	X
Shift	X	X			X	X

FIGURES

Figure 1. The interactive contribution of peer stress and sex to W_5 depressive symptoms, adjusting for W_1 depressive symptoms, W_1 lunch status, W_1 academic performance, and W_4 negative emotionality.

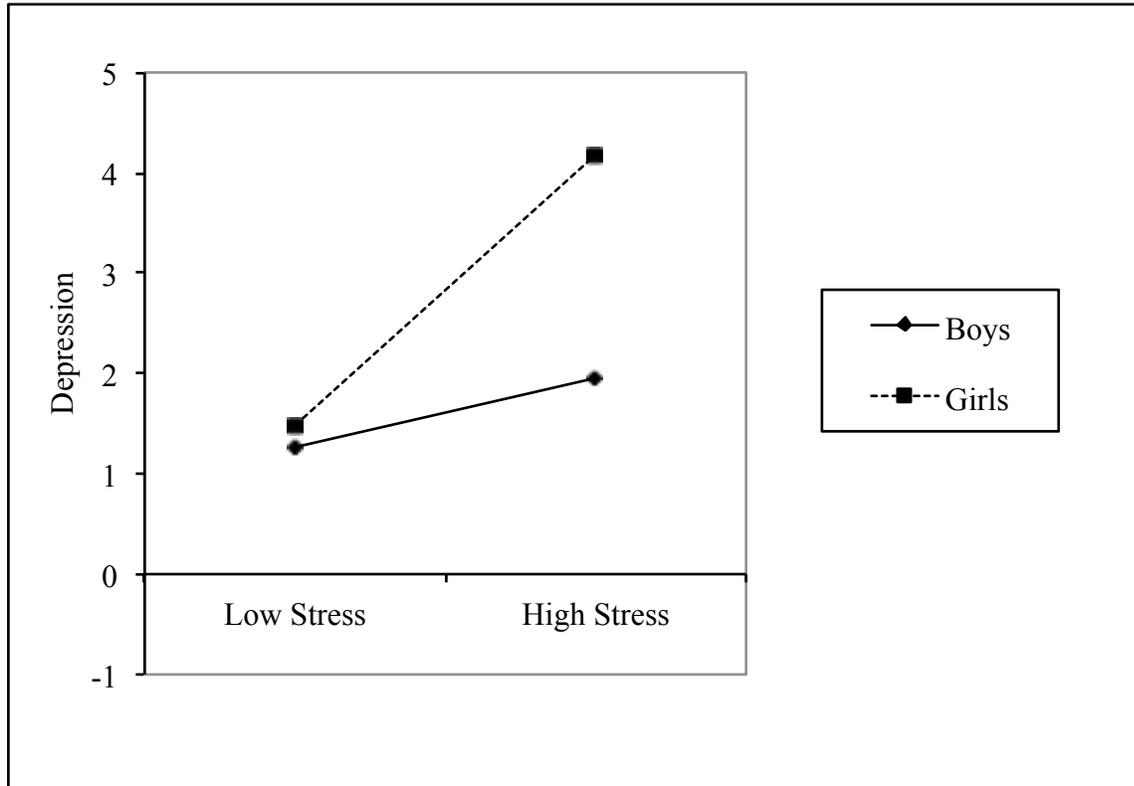


Figure 2. The interactive contribution of peer stress and inhibitory deficits to W_5 depressive symptoms in girls and boys, adjusting for W_1 depressive symptoms, W_1 lunch status, W_1 academic performance, and W_4 negative emotionality.

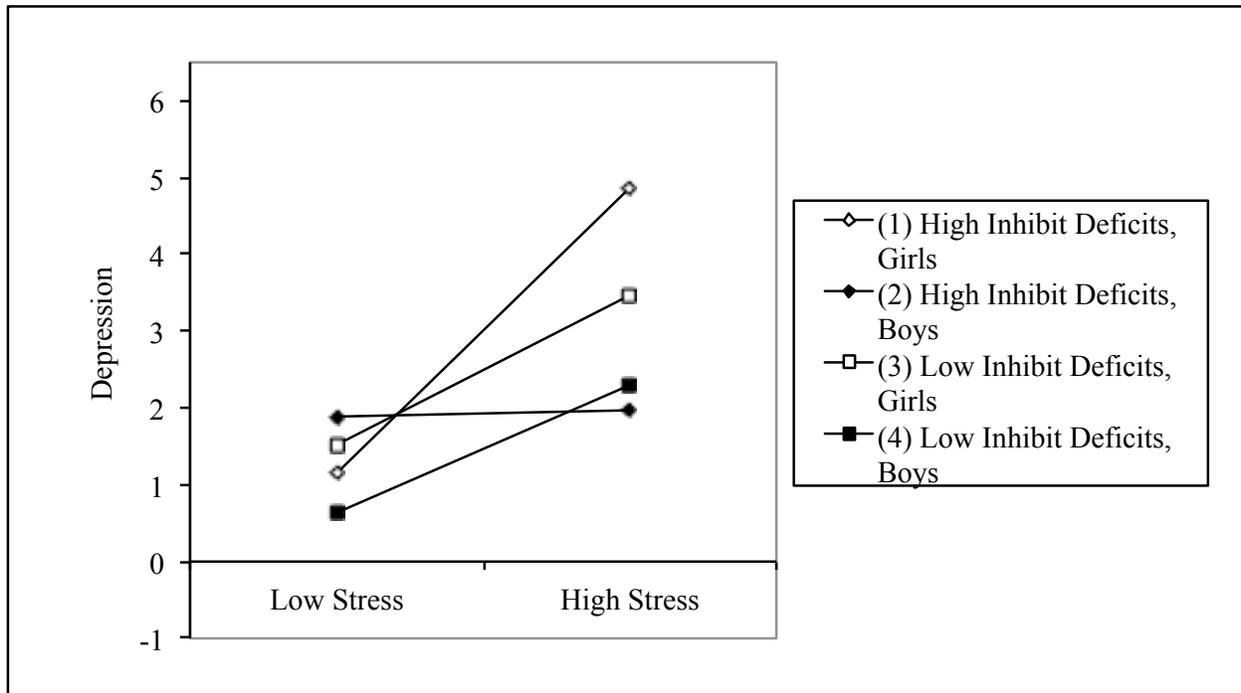
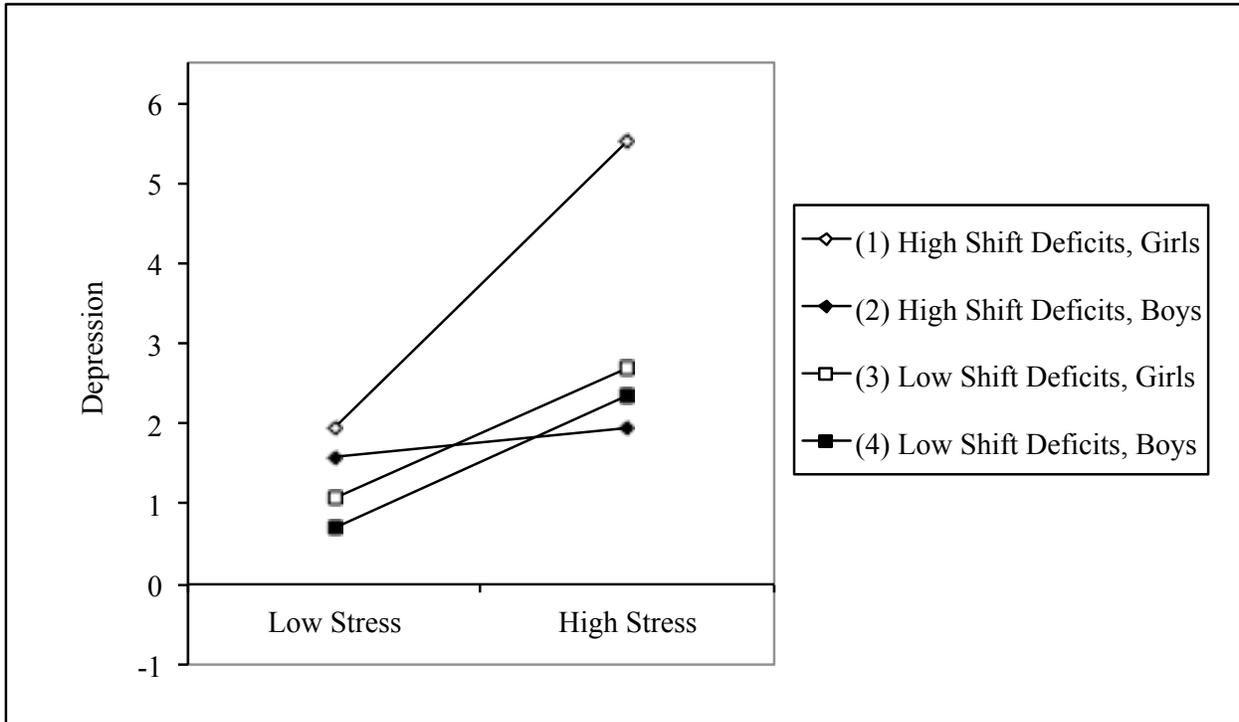


Figure 3. The interactive contribution of peer stress and shifting deficits to W_5 depressive symptoms in girls and boys, adjusting for W_1 depressive symptoms, W_1 lunch status, W_1 academic performance, and W_4 negative emotionality.



APPENDIX A

Behavior Rating Inventory of Executive Function (BRIEF)

Item	Subscale
Acts wilder or sillier than others in groups (birthday parties, recess).	Inhibit
Interrupts others.	Inhibit
Gets out of seat at the wrong times.	Inhibit
Gets out of control more than friends.	Inhibit
Blurts things out.	Inhibit
Acts “too wild” or out of control.	Inhibit
Has trouble putting the brakes on his/her actions.	Inhibit
Gets in trouble if not supervised by an adult.	Inhibit
Becomes too silly.	Inhibit
Talks at the wrong time.	Inhibit
Resists or has trouble accepting a different way to solve a problem with schoolwork, friends, chores, etc.	Shift
Becomes upset with new situations.	Shift
Tries the same approach to a problem over and over, even when it doesn’t work.	Shift
Acts upset by a change in plans.	Shift
Is disturbed by change of teacher or class.	Shift
Resists change of routine, foods, places, etc.	Shift
Has trouble getting used to new situations (classes, groups, friends).	Shift
Thinks too much about the same topic.	Shift
When given three things to do, remembers only the first or the last.	Working Memory
Has a short attention span.	Working Memory
Has trouble concentrating on chores, schoolwork, etc.	Working Memory
Is easily distracted by noises, activity, sights, etc.	Working Memory
Has trouble with chores or tasks that have more than one step.	Working Memory
Needs help from an adult to stay on task.	Working Memory
Forgets what s/he was doing.	Working Memory
When sent to get something, forgets what s/he is supposed to get.	Working Memory
Has trouble finishing tasks (chores, homework).	Working Memory
Has trouble remembering things, even for a few minutes.	Working Memory
Does not bring home homework, assignment sheets, materials, etc.	Plan/Organize
Has good ideas, but cannot get them on paper.	Plan/Organize
Does not connect doing tonight’s homework with grades.	Plan/Organize
Forgets to hand in homework, even when completed.	Plan/Organize
Gets caught up in details and misses the big picture.	Plan/Organize
Has good ideas but does not get the job done (lacks follow through).	Plan/Organize
Becomes overwhelmed by large assignments.	Plan/Organize
Underestimates time needed to finish tasks.	Plan/Organize
Starts assignments or chores at the last minute.	Plan/Organize
Does not plan ahead for school assignments.	Plan/Organize
Written work is poorly organized.	Plan/Organize
Has trouble carrying out the actions needed to reach goals (saving money for special item, studying to get a good grade).	Plan/Organize

APPENDIX B

Life Events Scale

Has this happened since the school year began? If this happened, how bad was it for you?

One of your friends moved out of town.

One of your friends started having serious health problems, was in an accident, or was in the hospital.

One of your friends is not in your class because they are in another class or school.

You had a physical fight with another kid.

A friend of yours got picked on or teased.

Other kids tried to get you to do something you didn't want to do.

A friend died.

You were not invited to a party that you wanted to go to.

A friendship ended.

A friend got into trouble.

You had a big argument with a friend.

You had a problem other than an argument with a friend.

You had a problem with another kid who is not your friend.

APPENDIX C

Example Items from the Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID), Modified

At any time in the past year, including in the past two weeks:

Depressive Symptoms:

Did you feel sad or depressed? Felt down or empty? Felt grouchy or annoyed?

Were you less hungry or more hungry most days? Did you lose or gain weight without trying?

Did you talk or move more slowly than usual?

Were you fidgety, restless, or couldn't sit still almost every day?

Did you feel bad about yourself most of the time?

Did you have trouble paying attention? Did you have trouble making up your mind?

Did you feel that things would never get better?

APPENDIX D

Short Mood and Feelings Questionnaire Items

In the past two weeks:

I felt unhappy or miserable.

I didn't enjoy anything at all.

I felt so tired I just sat around and did nothing.

I was very restless.

I felt I was no good anymore.

I cried a lot.

I found it hard to think properly or concentrate.

I hated myself.

I felt I was a bad person.

I felt lonely.

I thought nobody really loved me.

I thought I could never be as good as other kids.

I felt I did everything wrong.

APPENDIX E

Temperament in Middle Childhood Questionnaire – Negative Emotionality Subscale

Item	Subscale
I tend to get sad if plans don't work out.	Sadness
I sometimes feel sad for no reason.	Sadness
I get sad when someone tells me to do something I do not want to do.	Sadness
I cry sadly when a favorite thing of mine gets lost or broken.	Sadness
I become tearful when I'm tired.	Sadness
I am told by others to "cheer up" and be happier.	Sadness
My feelings are easily hurt.	Sadness
I feel sad or down when I am unable to finish a task.	Sadness
I feel sad often.	Sadness
I tend to feel sad even when others are happy.	Sadness
I get very angry when another child takes something of mine away.	Anger
I get angry when called in from play before I am ready to quit.	Anger
I get angry when I can't find something I am looking for.	Anger
I get angry when I have trouble with a task.	Anger
I get angry when I make a mistake.	Anger
I have temper tantrums when I don't get what I want.	Anger
I get mad when other children provoke (bother or annoy) me.	Anger
I have a hard time calming down after an exciting activity.	Soothability
I have a hard time calming down when I am upset.	Soothability
I cheer up quickly.	Soothability
When I cry, I tend to cry for more than a couple of minutes at a time.	Soothability
I stay upset for hours when someone hurts my feelings.	Soothability
When angry about something, I tend to stay upset for five minutes or longer.	Soothability
I have a hard time going back to sleep after waking in the night.	Soothability
I feel nervous for a long time after being scared.	Soothability