Accuracy of Interpersonal Stress Appraisals: Relationships between Mother and Adolescent Daughter Depression

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Abstract

Associations between maternal and offspring depression have been thoroughly established, but many questions remain as to how maternal depression increases risk for depression in youth. Evidence suggests that children of depressed mothers are exposed to elevated levels of interpersonal stress and may be at a higher risk for developing cognitive vulnerabilities to depression. Therefore, this study examined how adolescent girls appraise naturally occurring life stressors and how these stress appraisals are associated with both maternal and offspring depressive symptoms. Depressive symptoms in female participants between the ages of 12 and 16 and their mothers \((n = 57)\) were evaluated at two time points separated by a 9 month interval. Adolescents also participated in a semi-structured interview at the second time point in order to assess episodes of life stress. The accuracy of stress appraisals was assessed by accounting for both subjective appraisals and objective ratings of negative impact stress. In accordance with our hypothesis, elevated appraisals of stress restricted to the interpersonal domain were associated with increases in depressive symptoms in the youth. Additionally, elevated appraisals of interpersonal stress moderated the relationship between maternal and youth depressive symptoms. Contrary to our hypothesis, maternal depression was not related to the way in which youth appraised interpersonal or non-interpersonal stress. Findings from this study contribute to interpersonal models of depression, suggesting that increases in depression are associated with stress appraisals restricted to the interpersonal domain.
Accuracy of Interpersonal Stress Appraisals: Relationships between Mother and Adolescent Daughter Depression

Maternal depression is a topic that has been extensively examined due to the many negative outcomes it has been found to predict in children. Children have been found to be at an increased risk for a variety of psychiatric disorders when exposed to maternal depression (Goodman et al., 2011; Hammen, 2009). Two studies which followed the offspring of depressed mothers for 10 and 20 years indicated that when compared to children of non-depressed mothers, children of depressed mothers were at higher risk of developing depression, anxiety, substance abuse, psychosocial impairment, and medical problems that continued from adolescence into adulthood (Weissman, Warner, Wickramaratne, Moreau, & Olfson, 1997; 2006). Not only has maternal depression been found to be an important predictor of adolescent depressive episodes, it also increases the risk of recurrent depression in youth and adulthood for children of depressed mothers who themselves have an early-onset of depression (Hammen, Brennan, & Keenan-Miller, 2008; Rohde, Lewinsohn, Klein, & Seeley, 2005). Although maternal depression has proven to be an important predictor in the development of various negative outcomes in offspring, including adolescent depression, not all offspring of depressed mothers go on to develop these problems (Pargas, Brennan, Hammen, & Le Brocque, 2010). As seen, several studies have shown the connection between maternal and offspring depression. However, the question remains whether maternal depression in itself leads to the development of depression in adolescence, or if there are moderating effects that combine with maternal depression that lead to the onset of these symptoms in offspring.

Cognitive Vulnerability Stress Model
Cognitive vulnerabilities are important mechanisms which have been associated with the development of depressive symptoms. In the past few decades, a few cognitive vulnerability models have emerged. Beck’s (1987) cognitive theory of development states that individuals who possess maladaptive schemas and dysfunctional attitudes that negatively filter and bias information are more likely to develop depression. Additionally, the hopelessness theory of depression indicates that individuals who make negative inferences about the causes, self-implications, and consequences of events are at risk for developing depression (Abramson, Metalsky, & Alloy, 1989). Based on previously established cognitive theories of depression, a cognitive vulnerability stress model of depression has emerged. The cognitive vulnerability stress model of depression suggests that together, negative cognitive appraisals and exposure to stress contribute to the risk of development of depression (Hankin & Abramson, 2001).

**Maternal Depression and Offspring Cognitive Vulnerabilities**

As indicated, cognitive vulnerabilities have been shown to predict the development of depressive symptoms in individuals. Furthermore, maternal depression has been associated with the development of cognitive vulnerabilities in children, which contributes to the onset of their depression (see Abela & Hankin, 2009 for review). For example, research has shown associations between maternal depression and levels of low self-worth, depressive attributional style, and hopelessness in adolescent offspring (Garber & Flynn, 2001). Still, it is important to understand the specific mechanisms through which maternal depression contributes to the development of cognitive vulnerabilities in children and adolescents.

Research has suggested that one way depressed mothers may contribute to the development of cognitive vulnerabilities in their children is through negative feedback (Hankin
et al, 2009). It has been suggested that explicit suggestions of mothers in response to their children’s behaviors may contribute to this acquisition of cognitive vulnerabilities (Alloy et al, 2001; Crossfield, Alloy, Gibb, & Abramson, 2002). In a study by Mezulis, Funasaki, & Hyde (2011) it was shown that having a mother who made negative attributions for their child’s failures was predictive of increased negative cognitions in the child. This is consistent with the hypothesis that indicates that children internalize negative feedback from their parents about their behavior (Fincham & Cain, 1986).

Until recently, very few studies have examined genetic contributions to cognitive vulnerabilities. However, Hankin and Abramson first suggested that genes may serve as risk factors for cognitive vulnerabilities. Following this, a few studies have indicated that some genes may actually contribute to the risk of the development of cognitive vulnerabilities (see Hankin & Abramson, 2001; Hankin et al, 2009 for reviews). Recent studies have indicated that a specific polymorphism of the serotonin transporter promoter gene, 5-HTTLPR, is associated with cognitive vulnerabilities such as negative information processing, dysfunctional attitudes, and depressogenic attributions in individuals (Whisman, Johnson, & Smolen, 2011; Antypa & Van der Does, 2010; Conway et al, 2012). These findings, when combined with findings that the 5-HTTLPR gene moderates the relationship between maternal and adolescent depressive symptoms, indicates that mothers who are depressed might pass on their genetic risks of cognitive vulnerabilities to their children (Gibb, Uhrlass, Grassia, Benas, & McGearry 2009).

Research has shown that children of depressed mothers are exposed to more severe chronic and episodic stress than children of healthy mothers (Gershon et al, 2011; Goodman, 2007; Cummings, Keller, & Davies, 2005). A model proposed by Rose and Abramson has suggested that exposure to negative life events contributes to the development of cognitive
vulnerabilities (Rose et al, 1994). This model has been supported by studies that have shown how exposure to negative life events is associated with negative inferential styles (Gibb, Alloy, Abramson, & Marx, 2003), depressogenic attributional styles (Garber & Flynn, 2001), and helpless cognitions (Cole et al, 2007) in children and adolescents. Therefore, maternal depression further contributes to the development of cognitive vulnerabilities in children through the increased exposures to stress.

Although the literature suggests that maternal depression may be associated with the development of traditional cognitive vulnerabilities in their offspring such as dysfunctional attitudes and negative inferences about the causes, self-implications, and consequences of events, questions remain about other less explored cognitive biases. For example, research has begun to examine the way in which adolescents appraise stressors in their lives, and how these appraisals contribute to the development of depressive symptoms. However, no study has yet examined if maternal depression is associated with these appraisals in the same way that it is associated with cognitive vulnerabilities.

**Accuracy of Appraisals of Life Events**

Research on cognitive vulnerabilities to stress has indicated that individuals with these vulnerabilities have consistently negative biased ways of processing information and viewing the world (Hankin & Abramson, 2001). However, until recently, studies did not examine whether these negative biases were distorted perceptions or accurate appraisals. As depressed individuals are exposed to more chronic and episodic stress (Hammen, Kim, Eberhart, & Brennan, 2009; Gershon et al, 2011) and may be able to accurately perceive the extent to which they are socially competent (Rudolph & Clark, 2001) it is possible that their elevated appraisals of stress are, in
accuracy, realistic reflections of the stressors they are exposed to. In fact, a recent study showed that subjective appraisals have been found to be correlated with objective ratings of stress (Espejo et al., 2011). Of the limited studies which have examined cognitive appraisals of life stressors in youth, only a few have compared subjective ratings to objective ratings of stress (Kracow & Rudolph, 2008; Espejo, Hammen, & Brennan, 2011). These studies have indicated that depressed youth may have elevated appraisals of life stressors that illustrate cognitive distortions, and not accurate depictions, of life stressors.

As studies have just begun to examine the accuracy of appraisals of naturally occurring life stressors, little is known about the extent to which negative appraisals of the self and of the world reflect realistic versus distorted perceptions of reality, and how the accuracy of these appraisals contributes to the onset of depression. Due to the evidence that distorted appraisals may contribute to depressive symptoms (Kracow & Rudolph, 2008; Charbonneau, Mezulis, & Hyde, 2009; Espejo, Hammen, & Brennan, 2011) it is important to examine risk factors for the development of these cognitive distortions. Even though many studies have examined the association between maternal depression and the cognitive vulnerabilities of their offspring, there is a need to assess whether these cognitive biases reflect realistic or negatively biased appraisals of life stressors. This study examined how maternal depression contributes to distorted appraisals of stress by examining subjective appraisals of naturally occurring life events in comparison to objective ratings of stress in order to distinguish between distorted and accurate appraisals of stress.

In addition to examining how maternal depression is associated with stress appraisals, it is also important to examine what types of stress appraisals serve as risk factors for depression in adolescent girls. Although elevated appraisals of stress have been found to be associated with
the onset of depression in youth (Espejo, Hammen, & Brennan, 2011), this study failed to
differentiate between the different types of stress being appraised. Furthermore, another study
that examined interpersonal and non-interpersonal stress appraisals separately in adolescents did
not do so longitudinally, and therefore was unable to draw conclusions about where interpersonal
stress appraisals served as a precursor or consequence of depression (Krackow & Rudolph,
2008). This study also examined interpersonal and non-interpersonal stress appraisals
separately in order to determine what types of stress appraisals contribute to the development of
depression symptoms in adolescent girls.

**Intergenerational Interpersonal Stress Model**

In addition to cognitive vulnerabilities, there have been many other risk factors that have
been association with the onset of depression, including dysfunctional interpersonal
relationships. There is a wealth of literature that suggests that there is an interpersonal context of
depression, and that youth depression is more strongly linked to interpersonal stressors (e.g., a
fight with a friend) than non-interpersonal stressors (e.g., a bad grade on a test) (Flynn &
Rudolph, 2011; Katz, Conway, Hammen, Brennan, & Najman, 2011). Furthermore,
interpersonal stress is more associated with depressive symptoms in girls than in boys (Katz et al,
2011; Hankin, Merzelstein, & Roesch, 2007). Not only do interpersonal episodes of stress
predict depressive symptoms in youth, but deficits in social skills also have been illustrated as
risk factors (Hammen, Shih, & Brennan, 2004; Ebert & Hammen, 2006). Based on the evidence,
maladaptive interpersonal functioning is an important risk factor for depression in adolescents
and therefore it is important to understand the processes that contribute to interpersonal
dysfunction.
As interpersonal stressors are predictors of adolescent depression, it is important to look at how maternal depression may increase interpersonal stress in offspring. The Intergenerational Interpersonal Stress model of depression is one model which illustrates how depressed mothers may contribute to their children’s interpersonal difficulties. The model suggests that youth learn maladaptive social skills by observing the mother’s interpersonal relationships and responses to interpersonal stressors, and thereby generate interpersonal stress in their own lives (Hammen, Shih, & Brennan, 2004). This model is supported as research has shown how children of depressed parents have poorer psychosocial functioning (Lewinsohn, Olino, & Klein, 2005). Furthermore, in populations of depressed children, those of depressed mothers have more interpersonal dysfunction than those of healthy mothers (Hammen & Brennan, 2001; Hammen et al, 2008).

Cognitive Vulnerability and Interpersonal Stress

Although cognitive vulnerabilities and interpersonal stressors have been examined separately as risk factors for depression, the ways in which they interact have also been examined. Just as exposure to life stress has been found to predict cognitive vulnerabilities in adolescents, studies have further shown that interpersonal difficulties also contribute to the development of negative cognitions (Mezulis, Hyde, & Abramson, 2006; Gibb, Benas, Crossett, & Uhrlass, 2007), and that depressed adolescents possess both cognitive vulnerabilities and interpersonal stressors (Rudolph & Clark, 2001). Furthermore, interpersonal cognition approaches suggest that cognitive vulnerabilities in the interpersonal domain interact with interpersonal stressors to predict the onset of depressive symptoms in adolescents (Flynn, Kecmanovic, & Alloy, 2010; Carter & Garber, 2011).
Summary

Overall, many studies have indicated that offspring of depressed mothers possess an increased risk for developing cognitive vulnerabilities to depression. Children of depressed mothers may acquire these vulnerabilities through the inheritance of genetics, social learning, or through their increased exposure to stressful events. Furthermore, these at risk children are likely to acquire interpersonal dysfunction as seen through the Intergenerational Interpersonal Stress Model. However, little research has focused on the accuracy of cognitions regarding naturally occurring life events, and no studies have examined whether maternal depression poses a risk for distorted versus accurate appraisals of stressful events. As maternal depression is predictive of an increased risk for both cognitive vulnerabilities and interpersonal stress, and the interaction of these risk factors are predictive of the onset of depressive symptoms in offspring, we hypothesized that adolescent daughters of mothers who possessed depressive symptoms would have higher and less accurate appraisals of the stressfulness of interpersonal life events.

Additionally, although elevated stress appraisals in general have been found to be predictive of an increase in depressive symptoms in youth, research has not examined if interpersonal stress appraisals are more significant predictors of depression than non-interpersonal appraisals. Given the potency of interpersonal stress as a risk factor for depression and research findings that have suggested that cognitive vulnerabilities may interact with interpersonal stress to predict an increase in depressive symptoms in adolescent girls, it is possible that interpersonal stress appraisals are predictive of depression in youth whereas non-interpersonal appraisals are not. Therefore, the second hypothesis of this study was that elevated appraisals of interpersonal stress would be significantly associated with an increase of depressive symptoms in adolescent girls.
Finally, it is evident that not all daughters of depressed mothers develop depressive symptoms (Pargas et al., 2010; Gershon et al., 2011). As it has been found that daughters of depressed mothers are exposed to more interpersonal stress than daughters of non-disordered mothers, it is possible that the way in which daughters interpret this stress that they are exposed to moderates the relationship between maternal and offspring depression. We hypothesized that elevated appraisals of interpersonal stressors would moderate the relationship between maternal depressive symptoms and a subsequent increase in daughters’ depressive symptoms.

Methods

Participants

A total of 57 adolescent girls and their mothers participated in this study. All adolescent participants were females between the ages of 12 and 16 ($M = 14.12, SD = 1.40$) with no history of intellectual disability, Autism, or Asperger’s. Recruited participants had either been previously diagnosed with a psychological disorder (e.g., depression, bipolar disorder, ADHD), experienced depressive symptoms over the course of two weeks, experienced problems related to either drug or alcohol use, or exhibited conduct disorder symptoms. Additionally, individuals were recruited if they had been in treatment with a therapist for more than two sessions for a reason other than grief. This study excluded individuals who had experienced auditory or visual hallucinations, extreme paranoia, or any concerns regarding psychosis. Within the sample of participants, 63.2% were Caucasian, 24.6% African American, and 12.2% other/mixed ethnicity.

Participants were recruited from inpatient and outpatient units as well as from bus advertisements and previous studies.

Procedure
After being recruited and screened, both adolescent participants and their mothers filled out questionnaires to assess their current depressive symptoms. Prior to their assessment, consent from the mothers and assent from the youth was obtained. Depressive symptoms in both the participant and her mother were assessed again 9 months later by phone. Finally, at this 9 month follow up the participant also completed the Youth Life Stress Interview which was conducted by either a graduate student or a post-doctoral fellow. Both adolescent participants and their mothers received gift cards for compensation for their participation.

**Measures**

*Participant Depressive Symptoms*

At the initial assessment and at the 9 month follow ups adolescent’s depressive symptoms were assessed using the Mood and Feelings Questionnaire (MFQ). This measure was developed in order to assess depressive symptoms in children and adolescents between the ages of 8 and 18 (Costello & Angold, 1988). This questionnaire consists of 33 questions that have statements such as “I felt miserable or unhappy” or “I felt lonely”. The participants filled out the questionnaire by rating each statement on a three point Likert scale where the available responses are “mostly true”, “sometimes true”, or “not true”. These responses indicated whether or not they experienced these symptoms in the past two weeks. Higher scores on this measure reflect higher levels of depressive symptoms in children and adolescents. In our study, the MFQ had a high internal consistency at both the initial assessment ($\alpha = 0.94$) and at the second time point ($\alpha = 0.96$).

*Maternal Depressive Symptoms*
Maternal depressive symptoms were measured at the initial assessment and again 9 months afterwards using Beck’s Depressive Inventory-II (Beck, Steer, & Brown, 1996). This measure is appropriate to use in assessing the severity of depressive symptoms of adults, but not for diagnostic purposes. The measure consists of 20 questions, and for each question, there are 4 statements to choose from. For each question, the different statements describe varying levels of the severity of depressive symptoms, and the individual indicates which statement is closest to the symptoms they have been experiencing for the past two weeks. For example, one question in the measure would include the statements “I don’t feel sad”, “I feel sad much of the time”, “I am sad all of the time”, and “I am so sad or unhappy I can’t stand it”. Each question is given a score between 0 and 3, and all of the combined scores constitute the participant’s final BDI-II score. Higher scores indicate a greater severity of depressive symptoms. A score of 0 to 13 indicates minimal depression, 14 to 19 indicates mild depression, 20 to 28 indicates moderate depression, and 29 to 63 indicates severe depression. Our study yielded a high internal consistency at both the initial assessment (α = 0.91) and at the follow up time point (α = 0.86) for the BDI-II.

**Objective Ratings of Stress**

The Youth Life Stress Interview (LSI) was conducted 9 months after the initial assessment via phone to assess the objective negative impact, or stressfulness, of specific life events that occurred during the study interval for each participant. This measure (Rudolph & Flynn, 2007) was modified from the Child Episodic Life Stress Interview (Rudolph & Hammen, 1999; Rudolph et al, 2000). Post-doctoral fellows or graduate students interviewed participants, beginning with a query about any stressful life events that had occurred in the past 9 months. Then, the interviewer probed the adolescent about stressful events that may have occurred within five specific domains: Academic, Behavioral, Peer, Romantic, and Family. If the adolescent
acknowledged any specific events that occurred, the interviewer questioned them further about
the event to get information about the context, timing, and objective implications of the episode.
Following the LSI, the interviewers compiled the information into a narrative devoid of
subjective responses related by the participant, describing the adolescent’s life experiences for
the past 9 months.

This narrative was then presented to a team of trained coders. All coders underwent
several months of training until they reached reliability. As the interviewer read the LSI
narrative, coders assigned an objective negative impact stress score to each reported life episode.
These objective stress ratings indicated how stressful a life event would be for a typical teenage
girl. These scores ranged from 1 to 5, where a score of 1 indicated that the episode contained no
negative impact stress for the participant, and a score of 5 indicated that the episode was
objectively severely stressful for the participant. Additionally, the team of coders assigned
content codes to each of the reported episodes, indicating whether the episode was interpersonal
or non-interpersonal in nature. In order to assess reliability, two independent teams of coders
rated 171 reported episodes across 15 interviews. The team of coders had a high interrater
reliability for both objective stress ratings (interclass correlation coefficient = 0.90) and content
codes (Cohen’s $k = 0.80$).

Subjective Appraisals of Stress

The Youth Life Stress Interview (Rudolph & Flynn, 2007) was additionally used to
assess the participants’ subjective appraisals of naturally occurring life events at the 9 month
follow up. During the LSI, the participants reported specific life events that had occurred in the
9 months prior to the interview in response to probes from the interviewer. Each time the
participants reported a specific life event, the interviewer asked them how stressful the experience was. The participants indicated their subjective appraisals of negative impact stress for each event on a 5 point Likert scale on which a score of 1 indicated no stress, and a score of 5 indicated severe stress.

Accuracy of Stress Appraisals and Creation of Composite Variables

In order to assess the accuracy of participants’ subjective appraisals of stress, the participants’ subjective ratings of stress were subtracted from the coding team’s objective ratings of stress. This produced a stress appraisal score that indicated how accurate the participant’s appraisals were, where more positive scores indicated an underestimation of stress and more negative scores indicated an overestimation of stress. Average appraisal scores were calculated for both interpersonal and non-interpersonal episodes by taking the mean of the episodes from each domain as indicated by their content codes.

Analysis Plan

As previously stated, the first hypothesis of this study was that adolescent daughters of mothers possessing elevated depressive symptoms would have higher, less accurate appraisals of interpersonal stressors than daughters of mothers with lesser depressive symptoms. This hypothesis was tested using bivariate correlations. The second hypothesis of this study that interpersonal stress appraisals would be associated with increases in depressive symptoms in adolescent girls was examined using a hierarchical multiple regression. Finally, the third hypothesis was that interpersonal stress appraisals would moderate the relationship between maternal depressive symptoms and youth depressive symptoms. This hypothesis was also tested through the use of a hierarchical multiple regression.
Results

Preliminary Analyses

Means and standard deviations were calculated for all primary variables. Additionally, correlations were examined for hypothesized associations between maternal depressive symptoms, adolescent depressive symptoms, and naturally occurring life stressors (see Table 1). As expected, youth depressive symptoms and maternal depressive symptoms at Time 1 were significantly associated with youth depressive symptoms at Time 2. Additionally, the number of interpersonal stressors reported and intensity of interpersonal stress experienced were both related to youth depressive symptoms at Time 2. Youth appraisals of interpersonal stress, but not non-interpersonal stress, were strongly associated with youth depressive symptoms at Time 2.

Maternal Depression and Appraisals of Stress

Correlations were conducted to examine the hypothesis that maternal depression would be related to the way youth appraise naturally occurring life stress (see Table 1). Analyses revealed that maternal depressive symptoms at both time points were associated with neither interpersonal nor non-interpersonal stress appraisals. However, maternal depressive symptoms at Time 1 were correlated with the severity of interpersonal stress experienced by the youth over the T1-T2 interval.

Comparison of Interpersonal and Non-Interpersonal Appraisals: Associations with Youth Depressive Symptoms

To examine the hypothesis that stress appraisals, restricted to the interpersonal domain, would be associated with an increase in depressive symptoms in youth, a hierarchical regression
was conducted. Youth depressive symptoms at Time 2 were entered as the dependent variable. Youth depressive symptoms at Time 1 were entered as a control variable at the first step, followed by both interpersonal and non-interpersonal stress appraisals at the second step. After controlling for depressive symptoms at Time 1, elevated appraisals of interpersonal stressors ($b = -6.56$, $SE = 2.89$, $\beta = -0.33$, $p < 0.05$) were found to be a significantly associated with youth depressive symptoms at Time 2. However, main effects for non-interpersonal stress appraisals ($b = 0.58$, $SE = 1.90$, $\beta = 0.04$, $p = 0.76$) were not found to be significant.

**Stress Appraisals as Moderators in Relationship between Maternal and Daughter Depressive Symptoms**

**Depressive Symptoms**

In order to examine if stress appraisals moderated the relationship between maternal and offspring depressive symptoms, two hierarchical multiple regressions were conducted. The first regression examined the role of non-interpersonal stress appraisals as a potential moderator. In this model, youth depressive symptoms at Time 2 served as the dependent variable and youth depressive symptoms at Time 1 were entered at the first step. Maternal depressive symptoms and non-interpersonal stress appraisals were entered at the second step, followed by a Maternal Depression X Non-Interpersonal Appraisals interaction at the third step. Main effects for maternal depressive symptoms and non-interpersonal stress appraisals were not found to be significant. Additionally, the interaction effect between maternal depressive symptoms and non-interpersonal stress appraisals was not found to be significant as well. Results from this regression can be found in Table 2.

The second regression model was conducted in order to determine if elevated interpersonal stress appraisals served as a moderator in the relationship between maternal
depressive symptoms and subsequent youth depressive symptoms. The effects of stress appraisals and maternal depression were examined using a hierarchical multiple regression. For this model, youth depressive symptoms at Time 2 were entered as the dependent variable. Youth depressive symptoms at Time 1 were entered at the initial step as a control variable, followed by maternal depression at Time 1 and interpersonal stress appraisals at the second step. Finally, at the third step of the regression a Maternal Depression X Interpersonal Stress Appraisals interaction was entered.

Significant main effects suggested that higher levels of maternal depressive symptoms at Time 1 and elevated interpersonal stress appraisals were associated with higher levels of youth depressive symptoms at Time 2. Furthermore, interaction effects between maternal depressive symptoms and interpersonal stress appraisals approached significance \( p = 0.06 \). Results from this regression are presented in Table 3. In accordance with Holmbeck’s (2002) guidelines for post-hoc probing of moderational effects, this interaction effect was further explored. For Maternal Depression X Interpersonal Stress Appraisals, slopes suggested that maternal depressive symptoms were significantly associated with increases in youth depressive symptoms under conditions of highly elevated interpersonal stress appraisals \(+1 \, SD, b = 0.61, \beta = 0.46, p < 0.01\) but not under conditions of un-elevated interpersonal stress appraisals \(-1 \, SD, b = -0.02, \beta = 0.24, p = 0.92\).

Discussion

Although it has been well documented that maternal depression serves as an important risk factor for depression in children and adolescents, many questions remain in regards to the mechanisms through which depression is transmitted from mother to child. The
Intergenerational Interpersonal Stress model of depression suggests that children adopt maladaptive responses to interpersonal stress from their depressed mothers and consequentially generate interpersonal stress in their own lives (Hammen, Shih, & Brennan, 2004). Additionally, emerging research on the accuracy of stress appraisals in adolescents has suggested that elevated stress appraisals may contribute to the onset of depression (Espejo, Hammen, & Brennan, 2011). This study sought to combine these two approaches in order to examine how maternal depression is related to stress appraisals, how stress appraisals are associated with increases in adolescent depression, and if the interaction between stress appraisals and maternal depression contributes to the development of depressive symptoms in daughters.

**Interpersonal Stress Appraisals as Moderators**

One goal of this study was to examine if interpersonal stress appraisals moderate the relationship between maternal depressive symptoms and subsequent youth depressive symptoms. In line with our hypothesis, results indicated that the ways in which adolescents appraise interpersonal stress influence the relationship between mothers’ depression and daughters’ increase in depressive symptoms. Additionally, non-interpersonal stress appraisals were not found to be a significant moderator. This means that daughters who are exposed to maternal depression who also overestimate the stressfulness of interpersonal stressors in their lives are at a higher risk for depressive symptoms than daughters who do not overestimate the stressfulness of interpersonal stressors (see Figure 1). Therefore, elevated appraisals of interpersonal stressors are noteworthy risk factors that should be addressed in this population, whereas elevated appraisals of non-interpersonal stress do not contribute any additional risk. Although stress appraisals have not previously been examined as a variable that changes the relationship between mother and daughter depression, the results are consistent with previous findings that elevated
stress appraisals are associated with increases in depression in youth (Espejo, Hammen, & Brennan, 2011). It must be noted that the moderation effect did not quite reach statistical significance. However, this could be due to the small sample size in the study.

**Associations between Stress Appraisals and Youth Depression**

This study also sought to differentiate between interpersonal and non-interpersonal appraisals to determine if increases in depressive symptoms were limited to overestimations of stress only in the interpersonal domain. The results of this study illustrated that elevated appraisals of interpersonal stress were significantly associated with an increase in depressive symptoms in young girls. However, elevated appraisals of non-interpersonal stress were not associated with an increase in depressive symptoms. Although a previous study illustrated how elevated appraisals predict increases in these symptoms, it did not differentiate between different domains of stress (Espejo et al, 2012). One study that did differentiate between interpersonal and non-interpersonal stress appraisals was not longitudinal, and therefore could not assert whether elevated interpersonal appraisals were a precursor or consequence of adolescent depression (Krackow & Rudolph, 2008). The findings of this study confirm and connect the findings from both of these studies. Additionally, these findings contribute to interpersonal models of depression, indicating that youth depression is more strongly linked to interpersonal stressors than non-interpersonal stressors (Flynn & Rudolph, 2011).

**Maternal Depression and Interpersonal Stress Appraisals**

In the present study, we predicted that maternal depressive symptoms would be related to elevated appraisals of the stressfulness of interpersonal life events in adolescent girls. In contrast to our expectations, maternal depressive symptoms were not found to be related to youths’ stress
appraisals in either the interpersonal or non-interpersonal domains. These results contrast with past findings that maternal depression is associated with the development of cognitive vulnerabilities in children (Garber & Flynn, 2001). However, in line with previous research that suggests that daughters of depressed mothers are exposed to more interpersonal stress than daughters of non-depressed mothers (Hammen et al, 2008), maternal depression was found to be associated with elevated levels of interpersonal stress. These results indicate that although being exposed to a depressed mother is related to experiencing more severe interpersonal stress, it is not associated with the way in which one appraises these stressors. Therefore, stress appraisals may behave differently than the cognitive vulnerabilities that have been previously explored. In the future, it would be beneficial for studies to compare previously explored cognitive vulnerabilities to stress appraisals to examine how they relate to each other. Additionally, it would be advantageous to examine other potential risk factors for elevated stress appraisals, as the acquisition of these systematic biases increases vulnerability to depression.

**Limitations and Future Directions**

There were some limitations in this study that should be acknowledged and addressed in future research. One such limitation is that stress appraisals were only examined at one time point. As this study was examining how maternal depression was related to stress appraisals in youth, it would have been beneficial to have assessments of stress appraisals at both time points. With stress appraisals assessed at two times, it would have been possible to examine if maternal depression predicted a change in stress appraisals over the course of the study. Additionally, it has been suggested that depressive symptoms themselves may lead to the development of negative views of the self and world (Pomerantz & Rudolph, 2003). Future studies should assess
stress appraisals at two time points in order to examine if youth depressive symptoms and stress appraisals had a reciprocal effect on each other.

Sample size is another limitation in this study. Due to the low number of participants, statistical power was reduced. This lack of statistical power could account for why the moderation effect of interpersonal stress appraisals did not quite reach the level of significance. Additionally, due to the low number of participants it was not possible to differentiate between the different domains of interpersonal stress that the participants experienced. Distinguishing between different types of interpersonal stress would be an interesting follow-up to this study. Although elevated appraisals of interpersonal stress were found to be associated with increased depressive symptoms in adolescent girls, it is unclear if all interpersonal stress appraisals are systematically elevated in the same way. Additionally, it is possible that elevated appraisals in one specific domain (i.e., peer, romantic, family) may be more strongly associated with depressive symptoms than appraisals from a different domain.

A third limitation in this study is that stress appraisals were examined retrospectively by the participant at Time 2 using self-report. It is possible that adolescents’ depressive symptoms at this follow-up may have influenced the way in which they remembered and interpreted past stressors. Additionally, objective evidence gathered about the context surrounding a stressor may have been skewed by informant bias. Biased information about a stressful life event could have resulted in skewed objective ratings of stress, thereby distorting measures of the accuracy of their appraisals.

A final limitation in this study stems from the number of stressors that were endorsed by the participant. As most participants reported more interpersonal stressors ($M = 7.53, SD = 3.58$)
than non-interpersonal stressors ($M = 3.21, SD = 1.80$), appraisal scores of interpersonal stress may have been an accurate depiction of the way the adolescent girls appraise a variety of interpersonal stressors. In contrast, non-interpersonal stressors may have been influenced by a small sample of stressors, and may not accurately reflect the way in which participants’ systematically appraise stressors in this domain.

As this study was focusing on the accuracy of stress appraisals and how these appraisals relate to maternal depression, it would have been beneficial to have used a between-subjects design to compare daughters of mothers experiencing severe diagnosed depression with daughters of mothers without depressive symptoms. As previous studies have used this approach to compare the types of stress that daughters of depressed and non-depressed mothers were exposed to (Gershon et al, 2011), it could also be beneficial to use this approach to further explore if daughters exposed to severe maternal depression have a significantly different way of appraising naturally occurring life stressors than daughters of non-disordered mothers.

Additionally, future studies should explore how stress appraisals interact with exposure to stressful life events to predict depressive symptoms in youth. Although it has been firmly established that cognitive vulnerabilities interact with stressful life events to predict depression (Hankin & Abramson, 2001), it is unclear if stress appraisals interact with stress exposure in the same way. As questions remain as to how similar stress appraisals are to previously explored cognitive vulnerabilities, it is also important to examine relationships between these two risk factors.

**Summary**
In conclusion, the current study suggests that the way in which adolescent girls appraise interpersonal stressors is a significant risk factor that may contribute to increases of depressive symptoms. Although maternal depression itself is not associated with stress appraisals, when combined with elevated stress appraisals in the interpersonal domain it is associated with an increase in depressive symptoms in adolescent daughters. As it is evident that daughters exposed to maternal depression are less vulnerable to depression when they do not overestimate the negative impact of interpersonal stressors, it is important that interventions for children of depressed mothers target the way in which interpersonal stressors are appraised.
|       | 1.1 Youth Depression | 2.1 T2 Youth Depression | 3.1 T1 Maternal Depression | 4.1 T2 Maternal Depression | 5.1 Stress Appraisal Interpersonal | 6.1 Stress Appraisal Non-Interpersonal | 7.1 Stress Exposure Interpersonal | 8.1 Stress Exposure Non-Interpersonal | 9.1 Even Total | 10.1 Even Interpersonal | 11.1 Even Non-Interpersonal | 1.2 Mean | 2.2 Mean | 3.2 Mean | 4.2 Mean | 5.2 Mean | 6.2 Mean | 7.2 Mean | 8.2 Mean | 9.2 Mean | 10.2 Mean | 11.2 Mean | 1.3 SD | 2.3 SD | 3.3 SD | 4.3 SD | 5.3 SD | 6.3 SD | 7.3 SD | 8.3 SD | 9.3 SD | 10.3 SD | 11.3 SD |
|-------|---------------------|-------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------------|---------------------------------|---------------------------------|----------------|----------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |                     |                         |                             |                             |                             |                                 |                                 |                                 |                |                |                |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
### Table 2. Longitudinal Prediction of Depressive Symptoms in Adolescent Daughters by Non-Interpersonal Stress Appraisals and Maternal Depressive Symptoms

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Step statistics</th>
<th>Final statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR²</td>
<td>b (SE b)</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Depression</td>
<td>.19**</td>
<td>.48 (.14)</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal Depression</td>
<td>.24**</td>
<td>.27 (.18)</td>
</tr>
<tr>
<td>Non-Interpersonal Appraisals</td>
<td></td>
<td>-2.10 (1.71)</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal Depression X Interpersonal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appraisals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05 level.

**p < 0.01 level.
Table 3. Longitudinal Prediction of Depressive Symptoms in Adolescent Daughters by Interpersonal Stress Appraisals and Maternal Depressive Symptoms

<table>
<thead>
<tr>
<th>Predictors</th>
<th>T2 Depression</th>
<th></th>
<th>Final statistics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR²</td>
<td>b (SE b)</td>
<td>B</td>
<td>b (SE b)</td>
<td>B</td>
</tr>
<tr>
<td>Step 1</td>
<td>.19**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Depression</td>
<td></td>
<td>.48 (.13)</td>
<td>.44**</td>
<td>.34 (.13)</td>
<td>.31*</td>
</tr>
<tr>
<td>Step 2</td>
<td>.34**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal Depression</td>
<td>.33 (.16)</td>
<td>.25*</td>
<td></td>
<td>.29 (.16)</td>
<td>.22†</td>
</tr>
<tr>
<td>Interpersonal Appraisals</td>
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<td></td>
<td>8.56 (8.45)</td>
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<tr>
<td>Step 3</td>
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<tr>
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<td></td>
<td>-.55 (.29)</td>
<td>-.80†</td>
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<td></td>
</tr>
</tbody>
</table>

†p < 0.10 level
*p < 0.05 level.
**p < 0.01 level.
Figure 1. Regression lines for relations between maternal depressive symptoms and youth depressive symptoms as moderated by overestimations of interpersonal stress. \( b = \) unstandardized regression coefficient; SD = standard deviation.
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