



Life stress and first onset of psychiatric disorders in daughters of depressed mothers

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ABSTRACT

This study used a comprehensive, interview-based measure of life stress to assess the role of different types of stress in predicting first onset of psychiatric disorders among daughters of depressed ($n = 22$) mothers and healthy ($n = 22$) mothers. Several types of stress were assessed: Chronic interpersonal stress, chronic non-interpersonal stress, episodic dependent (i.e., self-generated) interpersonal stress, episodic dependent non-interpersonal stress, episodic independent interpersonal stress, and episodic independent non-interpersonal stress. Daughters (ages 9–14) were recruited to have no clinically significant symptoms upon entry (T1). By a 30-month follow-up assessment (T2), 45% of the daughters of depressed mothers, but none of the daughters of healthy mothers, had developed a psychiatric disorder. Overall, daughters of depressed mothers were exposed to more severe chronic interpersonal and non-interpersonal stress than were daughters of healthy mothers. Further, daughters of depressed mothers who developed a psychiatric disorder by T2 were exposed to more severe chronic non-interpersonal stress and episodic dependent stress than were daughters of depressed mothers who remained healthy. We discuss the implications of these findings in the context of a stress-generation model for the intergenerational transmission of psychiatric risk among children of depressed mothers.

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Research has shown consistently that children of depressed mothers are at elevated risk for developing a range of psychiatric disorders (for reviews see [Hammen, 2009](#); [Joormann et al., 2008](#)). This risk persists beyond the duration of a given maternal depressive episode and can continue into adulthood (e.g., [Weissman et al., 1997](#)). Daughters may be especially vulnerable; investigators have found that daughters of depressed mothers are more likely to develop psychopathology than are sons, especially if the exposure to maternal depression occurs during adolescence ([Davies and Windle, 1997](#); [Hops, 1996](#)). The mechanisms by which risk for psychopathology is transmitted from mother to child, however, are not clearly understood.

Life stress has long been conceptualized as a central mechanism in the etiology and course of several psychiatric disorders,

particularly major depression (for reviews, see [Brown and Harris, 1989](#); [Hammen, 2005](#); [Monroe et al., 2009](#)). Maternal depression often is accompanied by stressful conditions, including occupational and financial difficulties, marital discord, impaired social relationships, and family conflict (for a review see [Gotlib and Goodman, 1999](#)). Children who grow up with a depressed mother are therefore exposed not only to a psychiatrically ill parent, but also to the stressful environmental context within which the mother's illness occurs ([Hammen and Brennan, 2001](#)). Children of depressed mothers have been shown to experience elevated levels of both chronic and episodic stress than children of either chronically medically ill mothers or of mothers with no medical or psychiatric disorder ([Adrian and Hammen, 1993](#)). Exposure to the stressful context of maternal depression, in turn, has been associated with children's depression symptoms. Using a large cohort sample of 15-year-old offspring of depressed and comparison mothers, [Hammen et al. \(2004\)](#) tested the relative impact of multiple risk factors in predicting the severity of children's depression symptoms. Findings indicated that the severity of depressive symptoms in offspring was largely mediated by youth's

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exposure to chronic maternal stress, which included poor parenting quality and marital discord. Thus, studies to date show that children of depressed mothers are exposed to elevated levels of stress compared to children of healthy mothers (Adrian and Hammen, 1993), and that exposure to chronic family stress is associated with more severe depressive symptoms among children of depressed mothers (Hammen et al., 2004). However, the extent to which stress contributes to the *initial* onset of psychiatric disorder among children of depressed mothers is not yet known.

In addition to chronic stress within the family environment, children of depressed mothers may be exposed to stress in contexts outside the home (e.g., Hammen et al., 2004). Growing up with a depressed mother may, for example, interfere with the development of adaptive strategies for social interactions, leading to problematic relationships with peers. Indeed, compared with children of non-depressed mothers, children of depressed mothers have been found to exhibit less adequate social skills and poorer peer relationships (Adrian and Hammen, 1993; Goodman et al., 1993; Lee and Gotlib, 1989, 1991). Peer stress may influence the risk for psychopathology onset, as it has been associated with adverse outcomes in non-depressed children (e.g., Coie et al., 1995; Ladd and Troop-Gordon, 2003) and with internalizing symptoms in adolescent girls (Rudolph, 2002). The adverse consequences of peer stress appear to be particularly salient for adolescent girls, who have stronger connection-oriented goals and report greater concern about peer evaluation than do boys (for a review see Rose and Rudolph, 2006).

Adolescent daughters of depressed mothers may be particularly susceptible to dependent or self-generated forms of stress (i.e., stress to which they contribute through their own characteristics and/or behaviors). According to the stress-generation theory (Hammen, 1991), depressed and depression-prone individuals generate stressful events and circumstances that perpetuate or exacerbate their symptoms. Consistent with this theory, adults with recurrent depression (compared to adults with a single previous depressive episode; Harkness et al., 1999) and depressed offspring of depressed mothers (compared to depressed offspring of non-depressed mothers; Hammen and Brennan, 2001) generate more dependent stress. Support for the stress-generation theory also has emerged among depressed youth with comorbid externalizing psychopathology (Rudolph et al., 2000) and among depressed adolescent girls but not boys (Rudolph et al., 2009). Moreover, self-generated interpersonal stress (e.g., ending a friendship), but not non-interpersonal stress (e.g., failing an exam because the adolescent did not study), mediated the continuity of depression over time in adolescent girls (Rudolph et al., 2009). Beyond depressive symptoms, characteristics and behaviors of depression-prone individuals, such as negative conceptions of relationships (Caldwell et al., 2004) and problematic interpersonal problem-solving styles (Davila et al., 1995), predict subsequent generation of interpersonal stress. In light of the interpersonal deficits characterizing the children of depressed mothers (Anderson and Hammen, 1993), these children are likely to generate more stress, particularly in their relationships. However, research has not yet fully examined multiple types of stress experienced by the adolescent daughters of depressed mothers, or the extent to which these types of stress contribute to the initial onset of disorder among these girls.

This study aimed to address these notable gaps by providing a comprehensive evaluation of the role of different types of stress in the risk for first onset of psychiatric illness among adolescent daughters of depressed mothers. Specifically, we examined daughters' exposure to chronic (ongoing) and episodic (acute) stress using life stress interviews. We rated the severity of stressors using the contextual threat method. Chronic and episodic stressors were

assessed within interpersonal (e.g., mother–child relationship) and non-interpersonal (e.g., academic performance) domains. Episodic stressors also were rated for dependence, evaluating the extent to which the daughter contributed to the event's occurrence. To the best of our knowledge, this is the first study to use a rigorous semi-structured interview methodology to elucidate the role of different types of stress in first onset of disorder in this high-risk group.

Based on previous findings indicating higher rates of psychopathology among children of depressed parents compared to children of healthy parents (e.g., Hammen, 2009), we predicted that daughters of depressed mothers would develop psychiatric disorders, particularly depression, at higher rates during the 30-month study interval than would daughters of healthy mothers. With regard to daughters' stress exposure we had two predictions. First, based on findings indicating higher levels of chronic and episodic interpersonal stress among children of depressed mothers relative to children of healthy mothers (Adrian and Hammen, 1993), we predicted that daughters of depressed mothers would be exposed to more severe chronic and episodic stress, particularly in the interpersonal domain, during the study interval than would daughters of healthy mothers. Second, based on findings highlighting the importance of chronic interpersonal stress (Hammen et al., 2004) and dependent forms of episodic interpersonal stress in youth depression (Hammen and Brennan, 2001; Rudolph et al., 2009), we predicted that exposure to more severe chronic and episodic dependent stress, particularly in the interpersonal domain, during the study interval would be associated with the first onset of psychiatric disorder by the end of the study.

1. Method

1.1. Participants

As part of a larger study, a total of 86 pairs of mothers and their biological daughters were recruited from the community through newspaper, flyer, and online advertisements, as well as by direct referrals from psychiatric research and treatment clinics. Two groups of mothers were recruited: depressed and healthy. Mothers were assigned to the depressed group if they met diagnostic criteria for Major Depressive Disorder (MDD) within the last five years and to the healthy group if they did not meet lifetime criteria for any Axis I psychiatric disorder based on DSM-IV criteria. Mothers were excluded from the depressed group if they: (1) met diagnostic criteria for bipolar disorder; or (2) met diagnostic criteria for alcohol or substance dependence or abuse over the previous six months. Mothers were excluded from either group if they exhibited any significant psychotic symptoms. Dyads were composed of eligible mothers, as outlined above, and their biological daughters, who were between the ages of 9 and 14.

Daughters were included in the study if they did not meet lifetime criteria for any Axis I psychiatric diagnosis and did not exhibit significant depressive symptomatology, defined as scoring higher than a 10 on the Children's Depression Inventory (CDI; Kovacs, 1985). These exclusionary criteria ensured that significant symptoms during the follow-up period reflected first onset of disorder. Of the 86 mother–daughter dyads recruited, 34 were excluded after the first session because they did not meet the eligibility criteria. A total of fifty-two dyads met eligibility criteria and were included in the study: 27 mothers diagnosed with MDD and their biological daughters and 25 mothers with no history of psychopathology and their biological daughters.

Participants were invited to return to the laboratory for a follow-up assessment (Time 2; T2) 30 months after their initial session. Of the 52 dyads who were enrolled at Time 1 (T1), eight mother–daughter dyads did not participate in the T2 assessment (five

depressed mothers and their daughters and three healthy mothers and their daughters). Reasons for non-participation included refusal to participate ($n = 4$) and relocation ($n = 3$). One depressed mother and her daughter did not complete the T2 assessment due to the onset of a terminal illness shortly before their scheduled participation. Thus, 44 of the original 52 dyads completed both assessments (85%); 22 depressed mothers and their daughters and 22 healthy mothers and their daughters. This final sample was used in all the analyses. Mother–daughter dyads that completed both assessments did not differ from dyads that did not participate at T2 in age, number of children in household, ethnicity, annual household income, or mother's education level (all $ps > .05$). Non-participating mothers, however, were more likely to be divorced or separated than were participating mothers, $\chi^2(1) = 5.10, p = .03$.

1.2. Procedure

The University's Institutional Review Board approved all of the procedures for this study. Potential study participants were screened by phone interview for clinical symptoms and those who appeared likely to meet selection criteria for the study were invited for a laboratory session of approximately 2 h. During this session (T1), mothers and daughters gave informed consent (assent) to complete interviews and questionnaires. Diagnostic status and symptom levels were assessed and used to determine eligibility into the study. Two trained doctoral students administered all interviews with mothers and daughters separately.

Approximately 30 months after T1, mother–daughter dyads were invited back for two follow-up assessment sessions, scheduled approximately one week apart. During the first session at T2, mothers and daughters gave informed consent (assent) to complete interviews and questionnaires. Psychiatric history of daughters over the T1–T2 study interval and their current depressive symptom severity were assessed. During the second session at T2, daughters' stress over the T1–T2 study interval was assessed. A trained doctoral student or a post-baccalaureate research assistant administered all interviews. The daughter interviewer had no knowledge of mothers' diagnostic history. In addition to face-to-face interviews with the daughters, mothers' major depression history over the T1–T2 interval was assessed by phone interviews. Interviews were audio taped for inter-rater reliability analyses. Mother–daughter dyads received \$15 per hour for their participation.

1.3. Measures

1.3.1. Daughters' diagnostic history

Daughters' current and lifetime Axis I disorders were assessed at T1 and T2 based on DSM-IV criteria using the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Kaufman et al., 1997). At T1, daughters were included in the study if they did not meet diagnostic criteria for any psychiatric disorder by either daughter or mother report. Consensus meetings with a three-member diagnostic team were used to ensure reliability of T1 diagnoses. By T2, the majority of daughters were middle to late adolescents; consequently, diagnostic decisions were made using daughter reports. For reliability purposes, a second independent rater coded 12 randomly selected audio taped diagnostic interviews. High inter-rater reliability was obtained for both current (Cohen's $\kappa = .95$) and past (Cohen's $\kappa = .89$) diagnoses.

1.3.2. Daughters' depressive symptoms

The CDI was used to assess current depressive symptoms. The CDI consists of 27 items that measure the presence and severity of symptoms during the previous two-week period. Scores range from

0 to 54. The CDI demonstrated adequate internal consistency at both T1 ($\alpha = .66$) and T2 ($\alpha = .79$). The lower reliability at T1 is likely an effect of the reduced range of responses on this measure. As noted above, daughters were excluded if they had significant depressive symptoms at T1 (defined as a score of 10 or above); this reduced the average correlation between items and, consequently, the internal consistency.

1.3.3. Mothers' diagnostic history at T1 and depression history at T2

At T1, mothers' lifetime Axis I disorders were assessed using the Structured Clinical Interview for DSM-IV (SCID; First et al., 1995). Consensus meetings were used to ensure reliability of T1 diagnoses. As part of the SCID, the number of lifetime major depressive episodes (MDEs) was assessed. At T2, mothers' history of depression over the T1–T2 interval also was assessed according to DSM-IV criteria using the SCID, yielding a count of MDEs experienced over the T1–T2 interval. For reliability purposes, a second independent rater coded twelve randomly selected audio taped diagnostic interviews. High inter-rater reliability was achieved for diagnosis of major depression during the study interval (Cohen's $\kappa = 1.00$).

1.3.4. Mothers' depressive symptoms

The Beck Depression Inventory-2nd Edition (BDI-II; Beck et al., 1996) was used to assess current depressive symptoms. The BDI-II consists of 21 items that measure the presence and severity of depression symptoms during the previous two-week period. Scores range from 0 to 63. The BDI demonstrated high internal consistency in the present study at both T1 ($\alpha = .94$) and T2 ($\alpha = .86$).

1.3.5. Daughters' chronic and episodic stress

The Youth Life Stress Interview (YLSI; Rudolph and Flynn, 2007) is a semi-structured interview modeled after the contextual threat interview method of the Bedford College Life Events and Difficulties Schedule (LEDS; Brown and Harris, 1978). The YLSI has been systematically used and validated in previous research (e.g., Krackow and Rudolph, 2008; Rudolph et al., 2000; Rudolph and Flynn, 2007). The interview assessed chronic stress occurring over the T1–T2 period across five domains: mother–child relationship, parents' marital relationship, peer relationships (including romantic relationships), academic performance, and school behavior. Within each domain, specific probes were used to assess ongoing stress. Probes were designed to assess interpersonal aspects of stress in the case of the family and peer domains, and non-interpersonal aspects of stress in the academic and behavior domains. For example, in the mother–child relationship domain, questions assessed problematic aspects of the relationship such as lack of trust, difficulties in communication, and the presence of conflict. In the school behavior domain, questions assessed chronic non-interpersonal problems at school such as receiving detentions or being suspended.

Covering the T1–T2 interval, the YLSI also assessed for specific events occurring within the five chronic stress domains, as well as the occurrence of events in other domains, including health (e.g., illness, hospitalization, injury), legal issues (e.g., problem with the law or other authorities), neighborhood (e.g., problem with neighbors, victim or witness of a crime), material losses (e.g., losing something important or having something stolen), finances (e.g., decrease in family income), activities (e.g., problem with a group or team, start of a new job, problem at work), romantic relationships (e.g., beginning of a new relationship or dating, break-up with boyfriend/girlfriend), disappointments (e.g., failure to achieve something desired), and moves (e.g. moving to a new home or city, change of school). Information was obtained about the nature of each event and its surrounding circumstances.

The interviewer prepared a narrative summary of stress, excluding daughter's subjective response to stressors. Narratives were presented to a panel of three independent raters who were unaware of the daughter's or mother's diagnostic status. The rating team determined which stressors should be retained for analysis based on the contextual details. Stressors involving members of the daughter's family were only retained if the rating team determined that the stressor affected the daughter directly through some objective consequence. For example, a mother's job loss was included if this loss affected the mother's time with the daughter or impacted family finances in a way that directly affected the daughter.

For each chronic stress domain (i.e., mother–child relationship, parents' marital relationship, peer relationships, academic performance, and school behavior), the rating team assigned a consensus-based severity rating using a scale ranging from 1 (*minimal to no stress*) to 5 (*severe stress*). Each rating point was anchored by specific behavioral indicators, developed by the author of the interview (KR), in order to provide an objective rating that was independent of the daughter's subjective reaction to the stressor. High reliability was achieved for ratings of chronic stress severity (average intraclass correlation coefficient: $r = .88$).

For each episodic stressor, the rating team provided a consensus-based severity rating using a scale ranging from 1 (*minimal to no stress*) to 5 (*severe stress*). The rating team also categorized each event as *interpersonal* (stress that involves a significant interaction between the youth and another person, or directly affects the relationship between the youth and another person) or *non-interpersonal* (all other stressors), according to its content. Finally, for each event, the rating team assigned a dependence rating representing the extent to which the daughter contributed to the event's occurrence using a scale ranging from 1 (*independent*) to 5 (*dependent*). Following cutoffs used in previous research (e.g., Rudolph et al., 2000), events with a rating of 3 (*mixed dependence*) or higher were categorized as dependent to reflect the fact that the daughter was at least an equal partner in contributing to the occurrence of the event. High reliability was achieved for ratings of event severity and dependence ($r = .84$ and $r = .90$, respectively) as well as for ratings of event content (Cohen's $\kappa = .92$).

In line with previous research using contextual life stress interviews (e.g., Hammen and Brennan, 2002; Hammen et al., 2004; Rudolph et al., 2000), chronic stressors were not rated for dependence due to the inherent difficulty in assessing and rating the degree to which a person contributed to a condition that has been ongoing for weeks, months, and in some cases, years.

1.4. Creation of composite variables

To reduce the number of variables for analysis and to map onto previous distinctions between chronic versus episodic stress, interpersonal versus non-interpersonal, and independent versus dependent stress (e.g., Krackow and Rudolph, 2008), we computed six mutually exclusive composite variables for stress analyses: two chronic stress variables (interpersonal and non-interpersonal) and four episodic stress variables (dependent interpersonal, dependent non-interpersonal, independent interpersonal, and independent non-interpersonal). Chronic and episodic forms of stress are likely to be inter-related in complex ways (Brown and Harris, 1978). Given that clarification of the association between stress and psychopathology requires careful consideration of both chronic and acute forms of stress (Hammen, 2005), we chose to separate these forms in order to systematically compare the effects of each. *Chronic interpersonal stress* was calculated as the average severity of chronic stressors occurring in the family and peer domains. *Chronic non-interpersonal stress* was calculated as the average severity of chronic stressors occurring in the academic performance and

school behavior domains. *Episodic dependent interpersonal stress* was calculated as the average severity of events rated both dependent and interpersonal in content (e.g., an argument with a friend, assuming daughter was at least an equal contributor to the argument). *Episodic dependent non-interpersonal stress* was calculated as the average severity of events that were rated as both dependent and non-interpersonal (e.g., failing an exam at school because the daughter did not study). *Episodic independent interpersonal stress* was calculated as the average severity of events that were rated as both independent and interpersonal (e.g., the death of a relative). *Episodic independent non-interpersonal stress* was calculated as the average severity of events that were rated as both independent and non-interpersonal (e.g., getting sick).

2. Results

2.1. Participant characteristics

Table 1 presents demographic characteristics as a function of mothers' diagnostic group (depressed, healthy). The two groups did not differ with respect to age, number of children in the family, ethnicity, mother's marital status, or annual household income (all $ps > .05$). Depressed mothers were less likely, however, to have obtained a bachelor's (or higher) degree than were healthy mothers, $\chi^2(1) = 5.82, p = .017$. Consequently, mothers' education level was entered as a covariate in the primary analyses. Finally, despite our criterion of including only daughters of depressed mothers who exhibited sub-clinical levels of depressive symptoms at T1, daughters of depressed mothers reported significantly more severe depressive symptoms at T1 than did daughters of healthy mothers, $t(42) = 2.70, p = .01$. Therefore, T1 CDI scores were entered as a covariate in the primary analyses.

2.2. Do daughters of depressed mothers develop psychiatric disorders, particularly depression, at higher rates than do daughters of healthy mothers?

We found that by T2, 10 of the 22 daughters of depressed mothers (45%) met diagnostic criteria for at least one psychiatric disorder, whereas none of the daughters of healthy mothers had developed a diagnosable disorder, $\chi^2(1) = 12.94, p = .000$. Of the 10

Table 1
Sample's Demographic Characteristics by Mother's Diagnostic Group.

	Healthy Mothers (n = 22) Mean (SD)	Depressed Mothers (n = 22) Mean (SD)	t (df)
Mother's age (years)	43.55 (4.62)	41.86 (5.30)	1.12 (42)
Daughter's age (years)	11.32 (1.67)	11.73 (1.61)	.83 (42)
Number of children	2.27 (.77)	2.50 (1.23)	.74 (42)
	% (N)	% (N)	χ^2 (df)
Daughter's Ethnicity			
African-American	9 (2)	14 (3)	
Asian-American	14 (3)	9 (2)	
Caucasian	77 (17)	64 (14)	3.69 (4)
Latina	0 (0)	9 (2)	
Other/biracial	0 (0)	4 (1)	
Mother's Marital Status			
Separated/Divorced	23 (5)	45 (10)	
Married	77 (17)	55 (12)	2.53 (1)
Annual Household Income			
Less than \$75,000	32 (7)	50 (11)	
\$75,000 or more	68 (15)	50 (11)	
Mother's Education Level			
Less than college	32 (7)	68 (15)	
College graduate or above	68 (15)	32 (7)	5.82 (1) ^a

^a $p < .05$.

daughters who met diagnostic criteria for at least one psychiatric disorder, seven met diagnostic criteria for current ($n = 1$) or past ($n = 6$) major depression. Among these seven daughters diagnosed with major depression, two also met diagnostic criteria for current or past substance abuse, with the former also meeting diagnostic criteria for current bulimia. The remaining three daughters were diagnosed with current oppositional defiant disorder ($n = 1$), past attention deficit disorder ($n = 1$), and current separation anxiety disorder and past oppositional defiant disorder ($n = 1$).

Comparison of the depressed mothers whose daughters developed psychiatric disorders with the depressed mothers whose daughters remained healthy revealed no significant differences in length of mother's illness (age of onset in depressed mothers of disordered daughters: $M = 21.50$, $SD = 15.17$; age of onset in depressed mothers of non-disordered daughters: $M = 18.64$, $SD = 11.43$; $t(20) = .47$, $p = .64$). We also found no significant differences in mother's rate of lifetime MDE recurrence (depressed mothers of disordered daughters: $M = 13.50$, $SD = 10.93$; depressed mothers of non-disordered daughters: $M = 12.00$, $SD = 11.30$; $t(20) = .28$, $p = .78$), or mothers' MDE recurrence during the T1–T2 time period (depressed mothers of disordered daughters: $M = .86$, $SD = 1.21$; depressed mothers of non-disordered daughters: $M = .55$, $SD = .69$; $t(20) = .70$, $p = .49$). Finally, there were no significant differences between groups on mothers' BDI scores at either T1 (depressed mothers of disordered daughters: $M = 16.44$, $SD = 10.96$; depressed mothers of non-disordered daughters: $M = 16.17$, $SD = 11.61$; $t(20) = .56$, $p = .96$) or T2 (depressed mothers of disordered daughters: $M = 10.78$, $SD = 8.33$; depressed mothers of non-disordered daughters: $M = 6.91$, $SD = 5.13$; $t(20) = 1.28$, $p = .22$).

2.3. Are daughters of depressed mothers exposed to more severe chronic and episodic interpersonal stress than are daughters of healthy mothers?

A multivariate analysis of covariance (MANCOVA) conducted on the six composite stress variables with mothers' diagnostic group (depressed, healthy) as the between-subjects factor and mothers' education level and daughters' T1 CDI scores entered as covariates yielded a significant effect for group, $F(6,35) = 2.85$, $p = .023$, partial eta-squared = .33. Subsequent univariate analyses yielded significant group effects for severity of chronic interpersonal stress ($p = .000$; partial eta-squared = .28) and severity of chronic non-interpersonal stress ($p = .031$; partial eta-squared = .11), but not for severity of any episodic stress variables (episodic dependent interpersonal stress: $p = .13$; episodic dependent non-interpersonal stress: $p = .92$; episodic independent interpersonal stress: $p = .17$; episodic independent non-interpersonal stress: $p = .49$). Table 2 presents comparisons between daughters of depressed and healthy mothers. As can be seen in Table 2, daughters of depressed mothers experienced significantly more severe chronic interpersonal and non-interpersonal stress than did daughters of healthy mothers.

We conducted an exploratory follow-up analysis to compare the two groups (daughters of depressed vs. healthy mothers) by chronic stress subtypes using independent samples t -tests. We found that daughters of depressed mothers experienced significantly more severe stress than did daughters of healthy mothers in all of the chronic interpersonal stress subtypes measured: mother–child relationship (daughters of depressed mothers: $M = 2.68$, $SD = .85$; daughters of healthy mothers: $M = 2.00$, $SD = .83$; $t(42) = 2.69$, $p = .01$), parents' marital relationship (daughters of depressed mothers: $M = 2.55$, $SD = .91$; daughters of healthy mothers: $M = 1.75$, $SD = .70$; $t(42) = 3.24$, $p = .002$); and peer relationships (daughters of depressed mothers: $M = 2.32$, $SD = .65$;

daughters of healthy mothers: $M = 1.70$, $SD = .65$; $t(42) = 3.14$, $p = .003$). Daughters of depressed mothers also experienced significantly more severe stress in the chronic non-interpersonal domain of school behavior (daughters of depressed mothers: $M = 2.30$, $SD = .63$; daughters of healthy mothers: $M = 1.57$, $SD = .64$; $t(42) = 3.79$, $p = .000$). No difference was found between groups in severity of academic performance stress (daughters of depressed mothers: $M = 2.45$, $SD = .87$; daughters of healthy mothers: $M = 2.05$, $SD = .96$; $t(42) = 1.48$, $p = .15$).

2.4. Is exposure to more severe chronic and episodic dependent interpersonal stress associated with the first onset of psychiatric disorder among daughters of depressed mothers?

A MANCOVA conducted on the six composite stress variables with daughters' outcome group (disordered daughters of depressed mothers, non-disordered daughters of depressed mothers) as the between-subjects factor and mothers' education level and daughters' T1 CDI scores as covariates yielded a significant effect for group, $F(6,13) = 5.51$, $p = .005$, partial eta-squared = .72. Subsequent univariate tests yielded significant group effects for severity of chronic non-interpersonal stress ($p = .000$; partial eta-squared = .62), severity of episodic dependent interpersonal stress ($p = .008$; partial eta-squared = .33), and severity of episodic dependent non-interpersonal stress ($p = .001$; partial eta-squared = .50). No significant effects were found for severity of chronic interpersonal stress ($p = .078$; partial eta-squared = .16) nor for the episodic independent stress variables ($p = .49$ and $p = .65$). Table 3 presents comparisons between disordered daughters of depressed mothers and non-disordered daughters of depressed mothers. As can be seen in Table 3 disordered daughters of depressed mothers experienced significantly more severe chronic non-interpersonal stress than did non-disordered daughters of depressed mothers. Disordered daughters of depressed mothers also experienced significantly more severe episodic dependent interpersonal stress and episodic dependent non-interpersonal stress, than did daughters of depressed mothers who remained healthy.

We conducted an exploratory post-hoc analysis to compare the two groups (disordered vs. non-disordered daughters of depressed mothers) on chronic non-interpersonal stress subtype using independent samples t -tests. Disordered daughters of depressed

Table 2

Severity of chronic and episodic stress among daughters of depressed mothers and daughters of healthy mothers.

	Daughters of Depressed Mothers ($n = 22$) Mean (SD)	Daughters of Healthy Mothers ($n = 22$) Mean (SD)	t (df)	Cohen's d
Mean Severity of Chronic Stress				
Interpersonal	2.52 (.49)	1.82 (.47)	4.82 (42) ^b	1.45
Non-interpersonal	2.38 (.66)	1.81 (.72)	2.73 (42) ^a	.82
Mean Severity of Episodic Stress				
Dependent Events				
Interpersonal	2.16 (.45)	1.48 (.97)	Univariate test ns	.90
Non-interpersonal	1.65 (.98)	1.64 (.87)	Univariate test ns	.01
Independent Events				
Interpersonal	2.53 (.48)	2.07 (.82)	Univariate test ns	.69
Non-interpersonal	1.68 (1.14)	1.76 (.99)	Univariate test ns	.08

^a $p < .05$.

^b $p < .001$.

Table 3
Severity of chronic and episodic stress among disordered daughters of depressed mothers and non-disordered daughters of depressed mothers.

	Disordered Daughters of Depressed Mothers (n = 10)	Non-disordered Daughters of Depressed Mothers (n = 12)	t (df)	Cohen's d
Mean Severity of Chronic Stress				
Interpersonal	2.72 (.38)	2.35 (.52)	1.86 (20)	.81
Non-interpersonal	2.93 (.44)	1.92 (.40)	5.59 (20) ^b	2.38
Mean Severity of Episodic Stress				
Dependent Events				
Interpersonal	2.38 (.48)	1.97 (.34)	2.29 (20) ^a	.97
Non-interpersonal	2.32 (.33)	1.09 (1.00)	3.73 (20) ^a	1.66
Independent Events				
Interpersonal	2.59 (.40)	2.48 (.54)	Univariate test ns	.23
Non-interpersonal	1.89 (1.28)	1.50 (1.02)	Univariate test ns	.34

^a $p < .01$.

^b $p < .001$.

mothers experienced significantly more severe stress than did non-disordered daughters of depressed mothers in school behavior, $t(20) = 3.36$, $p = .003$, but not in academic performance, $t(20) = 1.28$, $p = .06$, respectively.

3. Discussion

Using rigorous interview methodologies to assess psychiatric disorder and life stress, this study provided one of the few comprehensive comparisons of multiple types of life stress among adolescent daughters of depressed and healthy mothers; moreover, this research provided the first examination of the extent to which multiple types of stress predict the first onset of psychiatric disorder among adolescent daughters of depressed mothers. Results have implications for theories regarding the role of life stress in the intergenerational transmission of depression as well as for interventions with the daughters of depressed mothers.

Our findings indicate that nearly half of the daughters of depressed mothers developed a psychiatric disorder by T2. In contrast, none of the daughters of healthy mothers developed a psychiatric disorder by T2. The majority of the daughters who developed a psychiatric disorder had at least one comorbid diagnosis. These findings are consistent with prior studies indicating higher rates of psychiatric disorders (for a review see [Gotlib and Goodman, 1999](#)) and diagnostic comorbidity (e.g., [Rhode et al., 1991](#)) in children of depressed mothers relative to children of healthy mothers. Interestingly, depressed mothers whose daughters developed a disorder did not differ from depressed mothers whose daughters remained healthy in illness duration, rate of episode recurrence, or depressive symptom severity.

With respect to stress severity, we found that daughters of depressed mothers were exposed to more severe chronic interpersonal and non-interpersonal stress during the study interval than were daughters of healthy mothers. Exploratory follow-up analyses revealed that daughters of depressed mothers were exposed to more severe levels of each subtype of chronic interpersonal stress (i.e., mother–child relationship, parents' marital relationship, and peer relationships) than were daughters of healthy mothers. Heightened levels of stress in interpersonal domains have been previously found in children of depressed mothers ([Adrian and Hammen, 1993](#)). Chronic interpersonal stress may be especially salient during adolescence, given that this is

a time of learning to navigate social situations, negotiate interpersonal boundaries, and develop skills for regulating emotions and behaviors ([Dahl, 2004](#)). Indeed, investigators have underscored the importance of family stress (and specifically the mother–child relationship) in children's emotional development, especially in adolescent girls (e.g., [Davies and Windle, 1997](#); [Fergusson et al., 1995](#)).

Contrary to our prediction of interpersonal specificity, we found that daughters of depressed mothers were exposed to more severe chronic stress in both the interpersonal and non-interpersonal domains than were daughters of healthy mothers. It is important to note that our assessment of chronic non-interpersonal stress was limited to the academic performance and school behavior domains. An important next step is to examine if there are other forms of chronic non-interpersonal stress to which daughters of depressed mothers are exposed (e.g., financial difficulties). An exploratory follow-up analysis by non-interpersonal stress subtype indicated that daughters of depressed mothers experienced significantly more severe chronic stress in the domain of school behavior, but not in academic performance. This distinction is consistent with previous evidence that exposure to a difficult mother–child relationship is associated with disruptive behaviors among adolescent offspring of depressed mothers ([McCarty and McMahon, 2003](#)). More severe stress in the domain of school behavior (e.g., detention, suspension) may reflect emerging deficiencies in daughters' behavioral and emotional functioning. For example, it may be that adolescent daughters of depressed mothers, through their exposure to depressed parenting and problematic relationships with mothers, are learning maladaptive behaviors and emotion regulation strategies that are generalized to contexts outside the home. Children of depressed mothers exhibit a limited repertoire of emotion regulation strategies and use less effective coping methods than do children of never depressed mothers ([Garber et al., 1991](#); [Silk et al., 2006](#)). Further research is needed to investigate the precise mechanisms by which maternal depression increases adolescents' stress in the domain of school behavior.

Severity of chronic non-interpersonal stress also was associated with the first onset of disorder among daughters of depressed mothers. Exploratory follow-up analyses revealed that daughters of depressed mothers who developed a psychiatric disorder experienced significantly more severe stress in the school behavior domain, than did daughters of depressed mothers who remained healthy. The mechanism by which this form of stress increases risk for first onset of psychiatric disorder among high-risk girls warrants further investigation. It may be that in the context of having a depressed mother, increased stress at school overwhelms or exceeds daughters' resources for coping, thereby increasing their vulnerability to psychiatric onset.

Our results also show that among daughters of depressed mothers, exposure to more severe episodic dependent stress during the study interval was significantly associated with the onset of disorder by T2. This pattern is consistent with findings indicating that depressed youth are exposed to more dependent stress than are non-depressed youth ([Rudolph et al., 2000](#)) and that exposure to episodic dependent interpersonal stress contributes to the continuity of depressive symptoms over time among adolescent girls but not boys ([Rudolph et al., 2009](#)). However, given that our study assessed both stress and disorder onset retrospectively at T2, we cannot determine the precise direction of effect.

The current study has several limitations that must be considered when interpreting our findings. First, daughters' psychiatric status at follow-up and their exposure to life stress were both measured retrospectively; thus, the temporal or causal associations between these variables could not be examined. Although our findings indicate that, relative to daughters of depressed mothers

who remained healthy, daughters of depressed mothers who developed a psychiatric disorder by T2 were exposed to more severe chronic non-interpersonal stress and episodic dependent stress over the study interval, it is not possible to delineate the temporal sequence between stress and disorder onset. This constraint limited the extent to which we can ascertain whether stress mediates the association between maternal depression and daughter's psychiatric outcome. Prospective longitudinal designs, with frequent assessments of stress and symptoms, in samples of children of depressed mothers recruited prior to the first onset of disorder are the next step to delineating the pathway linking these variables over time. Specifically, future studies should explicitly examine whether stress accounts for the association between maternal depression and daughters' first psychiatric onset.

Second, our relatively small sample size limited statistical power for subgroup analyses. For example, in two of our analyses—comparing daughters of depressed and healthy mothers on episodic dependent interpersonal stress, and comparing disordered daughters and non-disordered daughters of depressed mothers on chronic interpersonal stress—large effect sizes were found (Cohen's $d = .90$ and $.81$, respectively). However, neither comparison achieved conventional statistical significance ($ps = .13$ and $.08$, respectively). These effect sizes are consistent with our hypotheses but only replication with larger samples would provide more definitive support. The small sample size also precluded analysis of comorbidity and analyses of daughters by diagnostic profiles.

Third, our reliance on adolescent reports of their own symptoms and stressors may have resulted in informant bias. It is important to note, however, that use of structured interviews and consensus-based rating for measuring stress have been shown to be more effective in enhancing recall and minimizing potential reporting biases than are questionnaires (McQuaid et al., 1992, 2000). Nevertheless, it is possible that information gathered during the interview might have been influenced by the characteristics of the informants, including the presence of psychiatric symptoms. Gathering data from multiple informants in studies of adolescent psychopathology has been highlighted in the literature (e.g., De Los Reyes and Kazdin, 2005).

Finally, our use of a multivariate analysis of variance to examine group differences in forms of stress does not capture potentially important inter-relationships among the different forms of stress. As noted by Brown and Harris (1978), there is likely to be complex interplay between chronic and episodic stress such that one form of stress can lead to the other (e.g., chronic relationship problems lead to the break-up of a romantic relationship). As a first step toward considering the role of both forms of stress (Hammen, 2005), the present study systematically compared the effects of each; future research is needed to determine more complex interactions among chronic and episodic stress, and the mechanisms by which the combination of these forms of stress may heighten vulnerability to psychiatric onset in daughters of depressed mothers.

Replication of this study is warranted using a larger sample of children of depressed mothers recruited prior to the first onset of disorder, as well as a prospective longitudinal design with frequent assessments of stress and symptoms (allowing for tests of the temporal or causal associations between stress and symptoms) by multiple informants. In addition, future studies should assess a wider range of non-interpersonal stressors, and analytically consider the potential interplay between the various forms of stress.

In conclusion, the current study is unique in using a rigorous interview-based methodology to examine severity of chronic and episodic stress among daughters of depressed mothers who were selected prior to the onset of clinically significant symptoms, and in specifying the types of stress associated with the first onset of

psychiatric illness within this group. The importance of a more fine-grained understanding of the types of stress that heighten risk for developing psychopathology lies in its potential to inform preventative interventions. Adolescence is a critical time for the emergence of gender differences in depression and related psychopathology (Hayward, 2003) and, therefore, represents a potent period of vulnerability for daughters of depressed mothers. Our findings highlight the importance of chronic non-interpersonal stress (and specifically stress in the school behavior domain) and episodic dependent stress with regard to daughters' risk for disorder onset.

Given the prominence of non-interpersonal, and specifically school behavior chronic stress, among disordered daughters, our findings suggest that schools may be a logical place to implement interventions aimed at reducing behavioral stress among children of depressed parents. Our findings also suggest that there may be modifiable risk factors, such as the adolescent's coping skills, which can be targeted through early interventions to help identify and change the ways in which stress is self-generated.

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Contributors

Dr. Gershon formulated the study question for this manuscript, collected the T2 data, completed the statistical analyses, and took the lead in writing the manuscript. Dr. Hayward supervised data analysis, interpretation of findings, and provided feedback and assistance on manuscript drafts. Dr. Schraedley-Desmond designed the T1 assessment, collected the T1 data, and assisted with analyses. Dr. Rudolph guided data analysis and interpretation of findings, and helped write the manuscript. Dr. Rudolph also authored the life stress interview used in this study, and provided extensive training in its use. Dr. Booster assisted with data collection at both T1 and T2 time-points, and with preparation of manuscript. Dr. Gotlib directed and supervised study design, data collection and analysis, interpretation and manuscript preparation. All authors contributed to and have approved the final manuscript.

Conflict of interest

The authors have no conflicts of interest directly relevant to the content of this study.

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