

## **ADAPTIVE COPING MEDIATES THE RELATION BETWEEN MOTHERS' AND DAUGHTERS' DEPRESSIVE SYMPTOMS: A MODERATED MEDIATION STUDY**

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Maternal depression is associated with an increased risk for depression in offspring; the factors explaining this association, however, are unclear. We examined coping in a group of 9- to 14-year-old daughters of mothers with and without a history of major depressive disorders. We tested whether daughters' adaptive coping mediated the association between mothers' and daughters' depressive symptoms, and whether these relations were moderated by daughters' pubertal status. Using moderated mediation analyses, higher levels of maternal depressive symptoms were related to less adaptive coping in daughters, which was related to higher levels of daughters' depressive symptoms. The mediating effect of coping was evident only for daughters in late stages of pubertal maturation. Early inter-

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ventions aimed at strengthening coping in girls may have a protective effect on daughters' risk for depression at later pubertal stages.

*Keywords:* depression, coping, maternal depression, risk for depression, pubertal status

Maternal depression is associated with a range of negative outcomes in children, including increased risk for psychiatric difficulties such as major depressive disorder (MDD; for reviews see Hammen, 2009; Joormann, Eugène, & Gotlib, 2008). In fact, having a parent with a depressive disorder is associated with a 40% increase in the probability that the offspring will experience a major depressive episode by age 20 (Beardslee, Versage, & Gladstone, 1998). Maternal depression has been related to deficits in a wide range of areas of children's functioning, including behavior, cognition, academic performance, interpersonal relationships, and neuroendocrine regulation (Goodman & Tully, 2008; Hammen, 2009; Joormann et al., 2008). Children growing up with a depressed mother are exposed to higher levels of maternal stress than are children of well mothers, including occupational and financial difficulties, increased marital discord, and high levels of family conflict (Hammen & Brennan, 2002; Hammen, Shih, & Brennan, 2004). Because MDD is both prevalent among mothers (e.g., Kessler & Wang, 2009) and associated with significant adverse effects in offspring, it is critical to identify and understand which factors underlie the relation between maternal depression and negative outcomes in children.

Investigators have documented links between maternal depression and children's deficits in emotion regulation and coping skills. Compared with offspring of nondepressed mothers, children of depressed mothers have been found to react more negatively to stressful events and to exhibit more difficulties in the development and use of effective emotion regulation strategies (Goodman & Gotlib, 1999). For example, in a laboratory delay task that required children to wait for a cookie or toy, 4- to 7-year-old children of depressed mothers, and particularly girls, exhibited less ability to distract than did children of nondepressed mothers (Silk, Shaw, Skuban, Oland, & Kovacs, 2006). Mothers' depressive symptoms have also been associated with

their school-aged children's difficulties in regulating emotions and generating effective emotion regulation strategies for hypothetical emotional scenarios (Garber, Braafladt, & Zeman, 1991). On a joint puzzle task mothers' depressive symptoms were associated positively with their 5- to 7-year-old children's frustration and negatively with children's persistence (Nolen-Hoeksema, Mumme, Wolfson, & Guskin, 1995). Finally, compared to daughters of nondepressed mothers, 9- to 14-year-old daughters of depressed mothers experienced greater neural activation during a negative mood induction and reduced activation during subsequent mood repair in brain regions implicated in experiencing emotion (Joormann, Cooney, Henry, & Gotlib, 2012).

The factors through which mothers' depression is associated with poorer emotion regulation and coping in their children have not yet been elucidated. One such possible factor is maternal modeling of problematic coping emotion regulation (e.g., Gross & Muñoz, 1995; Sheeber, Allen, Davis, & Sorensen, 2000; Yap, Allen, & Sheeber, 2007). Depressed adults have been found to exhibit poorer emotion regulation and coping skills than do nondepressed adults (e.g., Cronkite, Moos, Twohey, Cohen, & Swindle, 1998). These difficulties appear to extend to parenting behaviors and family interactions. For example, compared with nondepressed mothers, depressed mothers are under-engaged (Gelfand & Teti, 1990) and display less positive behaviors, including warmth, support, and task-focused behavior, and more negative behaviors, such as criticism, in interactions with their children (Gordon et al., 1989). Maternal negativity has been shown to be associated with more deficits in adolescents' emotion regulation skills; interestingly, girls appear to be particularly vulnerable to this effect (e.g., Yap, Schwartz, Byrne, Simmons, & Allen, 2010). It seems reasonable, then, that daughters of depressed mothers are learning ineffective emotion regulation and coping strategies through observing and interacting with their depressed mothers.

Studies consistently show that the use of less effective emotion regulation and coping strategies, such as disengagement (e.g., denial) or involuntary responses (e.g., rumination), are associated with more behavioral and emotional problems, in-

cluding depressive symptoms in adolescents (e.g., Silk, Steinberg, & Morris, 2003). In contrast, forms of emotional regulation and coping that involve intentional, goal-directed engagement with the stressor (e.g., problem solving) and/or dealing with the negative emotions that have resulted from stressors (e.g., acceptance) are generally regarded as adaptive (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000; Thompson et al., 2010). These adaptive forms of coping are associated with fewer adjustment problems (Connor-Smith et al., 2000; Hampel & Petermann, 2006; Langrock, Compas, Keller, Merchant, & Copeland, 2002), fewer internalizing disorders (e.g., Steinhausen & Metzke, 2001; Wadsworth & Compas, 2002), and better physical health outcomes (e.g., Connor-Smith & Compas, 2004; Jaser et al., 2005) in children and adolescents. This suggests that the use of adaptive emotion regulation and coping strategies protects against the development of behavioral and emotional problems in children and adolescents. This may be particularly important for children of depressed mothers, who are at high risk for developing depression themselves (Beardslee et al., 1998).

In this study we examined whether the use of adaptive emotion regulation and coping strategies by daughters protects against their experience of depressive symptoms. Currently well mothers were selected to have either no current or past history of any mental health disorders or a history of Major Depressive Disorder. We recruited currently well mothers with a history of recurrent depressive episodes to rule out the possibility that daughters' depressive symptoms and coping strategies are due to living with a currently depressed mother. Importantly, including mothers who have experienced past major depressive episodes increased the range of maternal depressive symptoms in the study.

We focused on girls because the effects of maternal depression have been shown to be particularly harmful for girls compared to boys, especially if the exposure to maternal depression occurs

during adolescence (Davies & Windle, 1997; Hops, 1996). We focused on 9- to 14-year-olds because this age range captures the developmental period during which most girls mature through puberty, a stage of important emotional, social, physical, and biological changes (see Steinberg & Morris, 2001, for a review). Indeed, few studies have focused on a sample young enough to capture the true start of puberty at around age nine (Angold & Costello, 2006). Early adolescence is also a time of increasing depressive symptoms, particularly for girls, and thus offers a unique window into the emergence of this often lifelong disorder (Galambos, Leadbeater, & Barker, 2004; Nolen-Hoeksema & Girgus, 1994; Twenge & Nolen-Hoeksema, 2002). In girls, the emergence of depression during adolescence has been directly linked to pubertal maturation. That is, girls at later stages of puberty show a significantly higher risk for depression than do girls earlier in pubertal development (for a review, see Angold & Costello, 2006), an effect that is independent of age (Angold, Costello, & Worthman, 1998).

We tested two hypotheses in this study. First, based on prior literature indicating (1) that maternal depression is associated with increased risk of depression in children; (2) that maternal depression is associated with deficits in children's coping; and (3) that deficits in coping are associated with adolescents' symptoms of depression, we tested a mediational model in which daughters' coping is one factor underlying the relation between mothers' depressive symptoms and daughters' depressive symptoms.

Second, based on the literature highlighting the importance of pubertal development in the rising rates of depression in adolescent girls, we tested the hypothesis that the relation between daughters' coping and daughters' depression is moderated by daughters' pubertal stage. We tested each of these models using daughters' self reports of their coping and mothers' reports of their daughters' coping. Importantly, including both daughters' and mothers' reports of daughters' coping allows us to assess two perspectives on the daughters' coping behavior.

## METHOD

### PARTICIPANTS

Participants were 122 biological mother-daughter pairs who had complete data on all measures.<sup>1</sup> The daughters were 9 to 14 years old ( $M = 12.2$ ,  $SD = 1.6$ ). The ethnic/racial composition of the sample of daughters was 72.3% Caucasian, 10.9% biracial, 8.4% Asian American, 5.0% Latina, and 3.4% African American. Of the daughters who reported on their menarcheal status ( $n = 98$ ), 48.0% were post-menarcheal. Mothers were 27 to 59 years of age ( $M = 44.1$ ,  $SD = 5.6$ ). The ethnic/racial composition of the sample of mothers was 78.3% Caucasian, 8.3% Asian American, 5.0% Latina, 3.3% African American, 1.7% Native American, with 3.3% indicating the option Other. The majority of mothers were married/partnered (73.0%) and highly educated (75.4% held a bachelors degree or higher).

### PROCEDURES AND MATERIALS

Procedures for this study were approved by the university's Institutional Review Board. Mother-daughter dyads were recruited through advertisements posted throughout the local community to participate in a larger project on how people process information. Mothers completed a telephone interview to establish that both mothers and daughters were fluent in English and whether the dyad might be eligible for participation. Before participating, mothers provided written informed consent and daughters gave

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1. We recruited 162 mother-daughter pairs, but 40 girls and their mothers who did not have complete data on all of the measures were not included in any of the reported analyses, leaving a final sample of 122 pairs of participants. Six daughters were missing the measure of depressive symptoms; 20 daughters were missing the pubertal assessment; twelve daughters were missing the self-report measure of coping; 8 mothers were missing the measure of coping; and 22 mothers were missing the measure of depressive symptoms. These numbers do not add up to 40 because participants who had missing data on one measure often also had missing data on other measures. Mothers who had incomplete data did not differ systematically from the mothers who had complete data in their depressive symptoms or reports of their daughters' coping,  $ts < 1.00$ , *ns*. Daughters who had incomplete data also did not differ systematically from those who had complete data in their depressive symptoms, coping, or pubertal status,  $ts < 1.29$ , *ns*.

written assent; dyads were compensated \$25 per hour for their participation.

Daughters and their mothers were each administered a structured clinical interview about the daughters, the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-P; Kaufman, Birmaher, Brent, Ryan, & Rao, 2000), by trained post-baccalaureate research assistants. In order for daughters to be eligible to participate, both informants needed to report an absence of any current or past Axis I disorders for the daughters. Mothers were administered the Structured Clinical Interview for DSM-IV (SCID-I; First, Spitzer, Gibbon, & Williams, 2001). To be eligible to participate mothers were required either to have no current or past history of Axis I disorders (low-risk;  $n = 78$ ), or to have experienced at least two major depressive episodes during their daughter's lifetime but be currently well (i.e., not in a current major depressive episode; high-risk;  $n = 44$ ).

Daughters completed self-report measures of depressive symptoms and coping; mothers completed self-report measures of depressive symptoms and reported on their daughters' coping.

*Mothers' Depressive Symptoms.* Current level of maternal depressive symptoms was assessed with the 21-item Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). Using 4-point scales, mothers indicated the extent to which they experienced various symptoms of depression over the past two weeks. The BDI-II has been demonstrated to have high validity and reliability (e.g., Beck et al., 1996; Dozois, Dobson, & Ahnberg, 1998; Steer, Ball, Ranieri, & Beck, 1999). Cronbach's alpha for the BDI-II was .94 for this study.

*Daughters' Depressive Symptoms.* Daughters' depressive symptoms were assessed with the 10-item form of the Children's Depression Inventory (CDI-S; Kovacs, 1985). This widely-used self-report instrument was designed to assess depressive symptoms in children between the ages of 8 and 17. Daughters indicated which of a series of statements best described how they have been feeling over the past two weeks. Internal consistency for the CDI-S in this sample was  $\alpha = .75$ .

*Adaptive Coping.* Both mothers and daughters provided reports on daughters' adaptive coping, as measured by the Responses to Stress Questionnaire (RSQ; Connor-Smith et al., 2000). The RSQ is a five-factor scale that has been validated in several samples of adolescents and young adults. Using a 4-point scale from 1 (not at all) to 4 (a lot), respondents indicate the extent to which they (in the case of the daughters) or their daughters (in the case of the mothers) have engaged in specific behaviors or feelings in response to experiencing problems with their mothers. In the present study we focused on two of the five RSQ factors: (1) primary control, composed of problem solving, emotional regulation, and emotional expression; and (2) secondary control, composed of positive thinking, cognitive restructuring, and acceptance. We focus on these two RSQ factors because these have been found to be associated with lower psychological distress and better physical health outcomes (e.g., Connor-Smith & Compas, 2004; Jaser et al., 2005). As recommended by Connor-Smith et al. (2000), the total score for each coping scale was computed and then divided by the total RSQ score to control for response bias and individual differences in base-rates of item endorsement. The internal consistency for this combined scale for daughters' self-reports was  $\alpha = .84$  and for mothers' reports of their daughters' coping was  $\alpha = .84$ .

*Pubertal Status.* Daughters' pubertal status was assessed using the five Tanner stages of maturity (Morris & Udry, 1980). The female version of the measure consists of drawings illustrating the five stages of breast development and pubic hair development ranging from 1 (Stage 1: least mature) to 5 (Stage 5: most mature). Daughters indicated which of five drawings was closest to their current breast development and pubic hair development. Adolescents' self-reports of pubertal development have been shown to be highly correlated with those made by observing physicians (e.g., Morris & Udry, 1980) and by caregivers (e.g., Rudolph, 2008; but also see Hergenroeder, Hill, Wong, Sangi-Haghpeykar, & Taylor, 1999). As has been done in previous research (e.g., Dorn, Susman, Nottelmann, Inoffgermain, & Chrousos, 1990; Hayward et al., 1997), the two stages were averaged both to represent the girls' current pubertal stage of development and to preserve the original metric (1–5).



TABLE 1. Descriptive Statistics

	Range	Mean	Standard Deviation
Daughters' Age	9–14	12.2	1.6
Mothers' Age	27–59	44.1	5.6
Puberty Stage	1–5	3.2	1.0
Daughters' Depressive Symptoms	0–13	1.8	2.2
Mothers' Depressive Symptoms	0–38	6.3	8.3
Daughters' Adaptive Coping			
Self-report <sup>a</sup>	.25–.66	.44	.07
Mothers' report <sup>a</sup>	.23–.61	.44	.08

Note. <sup>a</sup>This number represents the proportion of time in which daughters are adaptively coping.

## RESULTS

### PARTICIPANT CHARACTERISTICS

Means, ranges, and standard deviations for all variables are presented in Table 1 separately for the daughters and mothers. Correlations among the variables are presented in Table 2. Consistent with the literature, pubertal stage of development was positively associated with daughters' depressive symptoms, and mothers' and daughters' depressive symptoms were positively correlated with each other. Both daughters' and mothers' depressive symptoms were negatively correlated with daughters' coping (regardless of whether daughter or mother reported about the daughters' coping). Finally, mothers' and daughters' reports of daughters' coping were positively correlated with each other.

### TESTS OF MEDIATION

We conducted two mediation analyses to test whether coping mediates the relation between mothers' and daughters' depressive symptoms. Analyses followed the recommendations of Preacher and Hayes (2008), as well as Hayes (2009), and used the SPSS macro developed by Hayes (2009; see Model A in Figure 1 for a graphic representation of the mediation model). In the first mediation analysis, we used daughters' self-reported coping as a mediator to examine the relation between mothers' and daughters' depressive symptoms. In the second analysis, we

TABLE 2. Correlations Among Variables

	Daughters' Age	Pubertal Stage	Daughters' Depressive Symptoms	Mothers' Depressive Symptoms	Daughters' Self-Reported Coping
Daughters' Pubertal Stage	.71**	—			
Daughters' Depressive Symptoms	.24**	.32**	—		
Mothers' Depressive Symptoms	-.15	.03	.21*	—	
Daughters' Adaptive Coping					
Self-report	-.04	-.09	-.44**	-.34**	—
Mothers' report	.01	.04	-.26**	-.47**	.24**

Notes. \* $p < .05$ ; \*\* $p < .01$

used the same independent and dependent variables, but examined mothers' reports of their daughters' coping as the mediator. For both analyses, we tested the effect of mothers' depressive symptoms on daughters' depressive symptoms (total effect, path  $c$ ) and the effect of mothers' depressive symptoms on daughters' depressive symptoms controlling for the mediating effect of daughters' coping (direct effect, path  $c'$ ). We also used a bootstrapping method to formally test whether the strength of the difference between the total effect (path  $c$ ) and the direct effect (path  $c'$ ), also called the indirect effect or the "mediated effect," was significantly different from zero (see Preacher & Hayes, 2008). Bootstrapping estimates presented below are based on 5,000 bootstrap samples. When the confidence intervals (CIs) of bootstrapping point estimates do not contain zero, the indirect effect is considered statistically significant (Preacher & Hayes, 2008). We also computed the ratio of indirect effect to the total effect as instructed by Preacher and Kelley (2011). All included variables were standardized.

For the first mediation analysis, the independent variable (mothers' depressive symptoms) was significantly associated with the outcome variable (daughters' depressive symptoms) and with the mediator (daughters' coping), and the mediator was significantly associated with the outcome variable. All statistical results of the mediation are reported in Table 3. When daughters' self-reported coping was added to the model as a mediator, the relation between mothers' depressive symptoms and daughters'

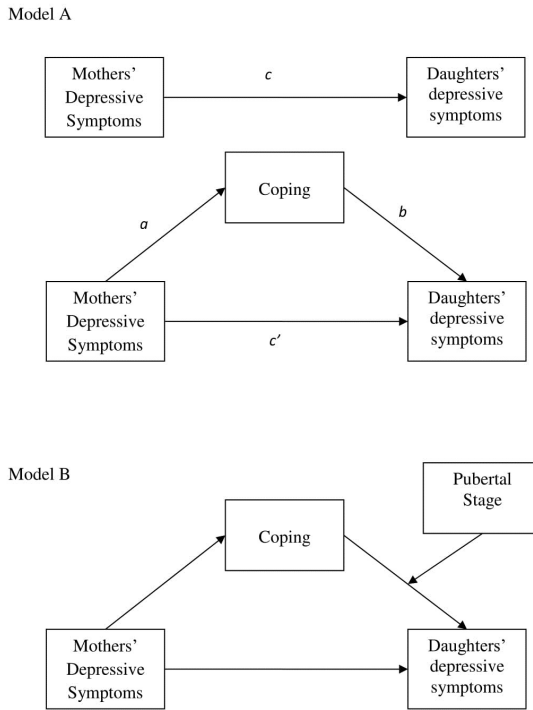


FIGURE 1. Models of mediation (Model A) and moderated mediation (Model B)

depressive symptoms was no longer significant. The total indirect or mediating effect was significant, with a point estimate of 0.14 and a 95% CI of .05 to .28, indicating that daughters' self-reported coping significantly mediated the relation between mothers' and daughters' depressive symptoms. Approximately 68% of the total effect was accounted for by the indirect effect.

In a second mediation analysis, we replaced the mediator, daughters' self-reported coping, with mothers' reports of their daughters' coping. All statistical results of the mediation are reported in Table 3. Mothers' depressive symptoms were significantly associated with daughters' depressive symptoms, and this relation was no longer significant after including mothers' reports of their daughters' coping as a mediator. The indirect effect was significant, with a point estimate of 0.10 and a 95% CI of

TABLE 3. Summary of Mediation Results (Beta Values, Standard Errors in Parentheses, 5000 Bootstrap Samples)

Independent variable (IV)	Mediating variable (M)	Dependent variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Total effects (c)	Direct effects (c')	Indirect effect (a * b)
Mothers' Depressive Symptoms	Daughters' Self-Reported Coping	Daughters' Depressive Symptoms	-.35 (.09)**	-.41 (.09)**	.21 (.09)*	.07 (.09)	.14 (.06)*
Mothers' Depressive Symptoms	Mothers' Reports of Daughters' Coping	Daughters' Depressive Symptoms	-.47 (.08)**	-.21 (.10)*	.21 (.09)*	.11 (.10)	.10 (.05)*

Notes. \* $p < .05$ ; \*\* $p < .01$

**TABLE 4. Results of the Moderated Mediation Analysis with Daughters' Self-Reported Coping as the Mediator**

Mediator variable model: DV = Daughters' self-reported coping				
Predictor	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	.03	.09	.31	.756
Mothers' Depressive Symptoms	-.35	.09	-4.01	<.001
Dependent variable model: DV = Daughters' depressive symptoms				
Predictor	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	-.04	.08	-.57	.573
Daughters' Coping	-.36	.08	-4.56	<.001
Pubertal Status	.34	.08	4.21	<.001
Daughters' Coping × Pubertal Stage	-.26	.07	-3.60	.001
Conditional effects at specific values of pubertal status: DV = Daughters' depressive symptoms				
Pubertal Stage	Boot indirect effect	Boot <i>SE</i>	Boot <i>z</i>	Boot <i>p</i>
-1 <i>SD</i> (-.93)	.04	.03	1.30	.193
<i>M</i> (.04)	.13	.05	2.57	.010
+1 <i>SD</i> (1.01)	.22	.09	2.54	.011

Notes. Standardized regression coefficients are reported. Bootstrap sample size = 5,000. DV = Dependent variable; *M* = mean; *SE* = standard error.

.001 to .20. Approximately 47% of the total effect was accounted for by the indirect effect. The findings from these two mediation analyses indicated that regardless of whether the informant was daughter or mother, daughters' coping mediated the relation between mothers' depressive symptoms and daughters' depressive symptoms.

## TESTS OF MODERATED MEDIATION

Next, we examined whether the strength of the mediated relations found above were contingent on daughters' pubertal status. More specifically, we tested whether pubertal status moderated the effect of daughters' coping on their depressive symptoms within the mediation models presented above (see Model B in Figure 1 for a graphical representation of the moderated mediation model). Moderated mediation analyses test the circumstances under which a given effect occurs. Our moderated mediation analyses followed the guidelines of Preacher, Rucker,

and Hayes (2007), using the SPSS macro developed by Preacher et al. (2007). Again, all variables included were standardized.

We tested two moderated mediation models. In the first analysis, we examined the relation between mothers' depressive symptoms and daughters' depressive symptoms using daughters' self-reported coping as a mediator, and pubertal stage as a moderator. The results for this analysis are presented in Table 4. All statistical requirements for a moderated mediation were fulfilled. Specifically, the interaction between pubertal status and daughters' self-reported coping regressed on daughters' depressive symptoms was significant. To interpret this interaction, we examined how different stages of puberty influenced the conditional indirect effects of mothers' depressive symptoms on daughters' depressive symptoms through daughters' self-reported coping at different values representing the daughters' pubertal stage: the mean value, and one standard deviation (SD) above the mean, and one SD below the mean. Two of these three conditional indirect values were significantly different from zero as tested by the normal-theory test. Bootstrapping technique (5,000 bootstrap samples) for these two conditional indirect effects corroborated the results: there was a significant effect of pubertal stage at the mean stage of puberty (95% CI: .05 to .24) and at the pubertal stage one SD above the mean (95% CI: .08 to .41). Also, corroborating the results of the normal theory test, pubertal stage at one SD below the mean did not significantly moderate the conditional indirect effect (95% CI:  $-.02$  to  $.12$ ). The Johnson-Neyman technique revealed that at a pubertal stage equal to or greater than  $-.57$  (standardized), pubertal stage significantly interacted with daughters' coping to predict daughters' depressive symptoms. Thus, for daughters whose pubertal stage is at or greater than  $.57$  SD below the mean, pubertal status significantly interacted with daughters' coping to predict daughters' depressive symptoms. That is, the mediating effect of adaptive coping on the relation between mothers' depressive symptoms and daughters' depressive symptoms was only present for daughters who were at a later stage of pubertal maturation. For daughters whose pubertal stage is less than  $.57$  below the mean, or those who are at earlier stages of pubertal maturation, the interaction of pubertal status and coping was not significant.

**TABLE 5. Results of the Moderated Mediation Analysis with Mothers' Reports of Their Daughters' Coping as the Mediator**

Mediator variable model: DV = Daughters' self-reported coping				
Predictor	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	.05	.08	.56	.576
Mothers' Depressive Symptoms	-.47	.08	-5.75	<.001
Dependent variable model: DV = Daughters' depressive symptoms				
Predictor	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	-.02	.08	-.19	.850
Daughters' Coping	-.23	.09	-2.46	.015
Pubertal Status	.36	.09	4.15	< .001
Daughters' Coping × Pubertal Stage	-.15	.08	-1.89	.061
Conditional effects at specific values of pubertal status: DV = Daughters' depressive symptoms				
Pubertal Stage	Boot indirect effect	Boot <i>SE</i>	Boot <i>z</i>	Boot <i>p</i>
-1 <i>SD</i> (-.93)	.04	.05	.73	.463
<i>M</i> (0.04)	.11	.05	2.38	.017
+1 <i>SD</i> (1.01)	.18	.07	2.36	.018

Notes. Standardized regression coefficients are reported. Bootstrap sample size = 5,000. DV = Dependent variable; *M* = mean; *SE* = standard error.

In the second analysis, we used the same independent, dependent, and moderator variables, but examined mothers' reports of their daughters' coping as the mediator. Table 5 presents the results of this analysis. The interaction between pubertal status and daughters' self-reported coping predicting daughters' depressive symptoms was marginally significant. When examining the conditional indirect effects, however, at the mean, at one SD above the mean, and at one SD below the mean for levels of pubertal stage, a pattern of findings emerged similar to the moderating mediator model that included the daughters' self-reported coping. Again, bootstrap analyses showed that the interaction between pubertal status and daughters' coping as reported by their mothers was significant at the mean stage of puberty (95% CI: .02 to .20) and at one SD above the mean (95% CI: .03 to .32), but not at one SD below the mean (95% CI: -.07 to .14). The Johnson-Neyman technique revealed that at a pubertal stage at a value equal to or greater than -.20 (standardized), pubertal

status interacted significantly with daughters' coping to predict daughters' depressive symptoms.

## DISCUSSION

A large body of literature has documented the relation between mothers' and their children's depressive symptoms; investigators have begun to elucidate possible mediators of this relation, such as the quality of parenting (e.g., Goodman, 2007) and exposure to maternal stress (e.g., Hammen et al., 1987). Our findings suggest that another variable could underlie the link between mothers' and daughters' depression: the relation between mothers' and daughters' depressive symptoms may be mediated by daughters' use of adaptive coping. More specifically, we found that mothers' depressive symptoms were related to lower levels of daughters' adaptive coping, which were related to higher levels of depressive symptoms in the daughters.

Importantly, regardless of whether assessed by self-report or by mothers' reports, daughters' adaptive coping mediated the relation between mothers' and daughters' depressive symptoms. Using two informants to assess daughters' adaptive coping is a notable strength of the present study. Information obtained from a single source is inherently biased. For example, had we only assessed coping from the daughters' perspective, any reporting biases on the part of the daughters would have been present in their reports of both depressive symptoms and coping. Thus, obtaining information from multiple informants improves the reliability and validity of the measurement of coping and, in turn, the strength of the findings. Although our use of two informants, mothers and daughters, to assess daughters' adaptive coping was a significant strength of this study, obtaining reports of daughters' coping from additional sources (e.g., peer or teacher reports) may be beneficial.

Another important finding of this study involves the role of pubertal status. The mediation findings described above (including both daughters' and mothers' reports of adaptive coping) differed as a function of the daughters' pubertal status. That is, coping mediated the relation between mothers' and daughters' depressive symptoms but only for daughters who were in



middle to late stages of puberty. Although we did not test this formulation explicitly in this study, using adaptive coping strategies later in puberty may have particular benefits in protecting girls against the physical, psychological, and social challenges associated with the advancement of puberty. As pubertal maturation occurs, girls may experience increasing concerns about their weight and appearance. For example, girls who were at later stages of puberty reported less satisfaction with their weight than did girls at earlier pubertal stages (Dorn, Crockett, & Petersen, 1988). The advancement of puberty is also associated with greater peer stress, particularly for girls (Ge, Conger, & Elder, 2001), as adolescents shift from family-orientation to placing increasing value on relationships outside of the family. The advancement of puberty is also related to the initiation of romantic relationships, which may present new sources of conflict for developing girls. The ability to cope adaptively with the new challenges and stressors of this developmental period is likely to have protective value for adolescents.

The importance of puberty in this context is underscored by the results of several studies examining the relation between puberty and depression (e.g., Angold, Costello, Erkanli, & Worthman, 1999; Mendle, Harden, Brooks-Gunn, & Graber, 2012; Patton et al., 2008). For example, higher rates of depression among young daughters than boys have been found to be associated with both perceived and actual pubertal timing (e.g., Conley & Rudolph, 2009; Ge et al., 2001; Rudolph, 2008) and with hormone levels (e.g., oestradiol and testosterone; Angold, Costello, Erkanli, & Worthman, 1999). The present findings should be replicated using a more systematic assessment of pubertal status (see recommendations by Dorn, Dahl, Woodward, & Biro, 2006). Future research could also profitably examine the role of pubertal hormones in affecting daughters' coping. Finally, investigators should examine whether the present findings replicate in a sample of boys or, if they do not, whether they reflect a reliable gender difference in depression.

Mediation analyses are limited in their ability to test causal mechanisms (e.g., Kazdin & Nock, 2003). Although there has been some support for the idea that coping is one of the key processes through which parental depression affects children's risk

for psychopathology (e.g., Langrock et al., 2002), additional research is needed to confirm whether daughters' coping is one of the mechanisms through which mothers' MDD is transmitted to (or prevented in) their daughters. If supported, teaching children adaptive coping strategies could provide an important therapeutic target for the prevention of depression in adolescent daughters of depressed mothers, especially as they advance through puberty. In fact, teaching coping strategies as a prevention technique is consistent with numerous cognitive behavioral interventions for MDD (e.g., cognitive restructuring, problem-solving coping; D'Zurilla & Nezu, 2006; Muñoz, 1984/1998). In this context, cognitive behavioral therapy for depression in youth, which focuses on teaching primary and secondary control coping, has been found to be as effective as, but briefer and less costly than, comparison treatments (Weisz et al., 2009). Preventative or educational efforts to teach coping strategies to adolescent girls may be an effective means to counteract the effects of depression.

Teaching adaptive coping strategies is also a component of family-focused interventions designed to improve communication patterns within families, increase positive family experiences and cohesion, and strengthen children's coping skills (e.g., Riley et al., 2008). Our findings support the focus of such interventions and indicate that these may be particularly helpful in offering protection against the harmful effects of maternal depression on daughter's risk for this disorder. Indeed, increasing positive mother-child interactions, encouraging effective communication skills, and teaching solution-focused strategies for dealing with stressful family conditions have already shown promise in decreasing depression symptoms in 9- to 16-year-old children of depressed mothers (Valdez, Mills, Barrueco, Leis, & Riley, 2011).

Despite the importance of the present findings, it is important to note the following limitations. First, we did not account for the role of daughters' personality traits in the association between mother's depression and daughter's depression. Traits such as neuroticism have been identified as risk factors for MDD (e.g., Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014) and may be an additional pathway through which parental MDD is transmitted to offspring. It will be important for future research to examine

the extent to which intergenerational transmission of depression is accounted for by personality traits.

Second, we excluded mothers who were currently experiencing a major depressive episode. We selected mothers with a history of major depression but who were currently well to examine the potential effect of maternal depression on daughter's coping and symptoms outside of the effect of mothers' current depressive episode. Doing so allowed us to rule out the possibility that the findings were due to state effects of mothers' depression. It is important to note, however, all the mothers with a history of MDD have experienced at least two major depressive episodes during their daughters' lifetime; consequently, over one-third of the daughters have witnessed at least two of their mothers' major depressive episodes. Individuals with MDD have been found to engage in maladaptive coping and emotion regulation strategies (e.g., rumination) even when they are not in a major depressive episode (e.g., McMurrich & Johnson, 2008); moreover, girls at familial risk for depression themselves have been found to report high levels of maladaptive coping (Thompson et al., 2010). And even though the mothers with no history of MDD have not had major depressive episodes during their daughters' lifetime, they may nevertheless have had periods in which they exhibited more state-like high levels of depressive symptoms, which could have been accompanied by maladaptive coping.

Third, coping was measured with regard to daughters experiencing problems with their mothers. In this study, the stressor of problems experienced between daughters and their mothers was chosen as a stressor domain on which both informants could reliably and validly report. The Responses to Stress Questionnaire was chosen because its strong psychometrics (e.g., Jaser et al., 2005; Langrock et al., 2002). The questionnaire has also been validated for use in samples of children of depressed parents to assess for stressors specific to the parental depression, including problems between parent and child. We think that our findings would generalize to other stressors, but future research is needed to test this formulation.

Finally, because the present study is cross-sectional, we cannot make causal interpretations of the data (Maxwell, Cole, & Mitchell, 2011). Indeed, there may be a reciprocal relation be-

tween coping and depressive symptoms. Longitudinal studies of children of depressed mothers, with frequent assessments of the children's coping and symptoms, would be ideal for informing the temporal relation between coping and depression, such as whether difficulties in coping precede the onset of depressive symptoms in daughters of depressed mothers. Daughters' depressive symptoms may hinder their own adaptive coping efforts, as suggested by Yap et al.'s (2010) findings that higher levels of depressive symptoms among adolescents are associated with poor emotional regulation skills. There may also be a reciprocal relation between mother and daughter symptoms, such that daughters' depressive symptoms and/or less effective coping may contribute to increased stress levels in their mothers, which may exacerbate the mothers' depressive symptoms (Hughes & Gullone, 2010). Our results suggest that future research could profitably examine preventive interventions implemented within a family framework, focusing on the relationship between mothers and daughters and at early stages of daughters' pubertal development. Such interventions may include effective stress management training aimed to improve adaptive coping strategies among developing adolescent girls.

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