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Mediators of Aggression Among Young Adult Offspring of Depressed Mothers

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Abstract

The current paper explores the connection between maternal depression and offspring aggression during the transition to adulthood, expanding the scope of prior research on this topic. Both family-level factors (including parent-child relationship quality and maternal relationship quality) and youth factors (including depression history and social functioning in mid-adolescence) were tested as potential mediators in a longitudinal community sample of 710 youth at ages 15 and 20. The results suggest that maternal depression confers a risk for higher levels of aggressive behavior by offspring at age 20. Structural Equation Models suggested that the association between maternal depression and youth aggression is fully mediated by youth history of depression by mid-adolescence, even when accounting for the stability of aggression between ages 15 and 20. Parent-child relationship quality, youth social functioning, and maternal relationship quality were not unique mediators of this association. Limitations and implications are discussed.

Offspring of depressed mothers are at risk for a wide range of negative social, cognitive, and psychopathological outcomes (for recent reviews, see Goodman, 2007; Hammen, 2009). Several models accounting for this transmission of risk have been proposed (e.g. Goodman & Gotlib, 1999), but few complex models incorporating multiple potential mediators have been tested (Hammen, 2009). Our understanding of these mediating mechanisms has been further limited by a focus on overly general categories of youth outcome, such as internalizing and externalizing disorders. The various constellations of symptoms and multiple forms of impairment encompassed in these outcome measures may be differentially related to specific mechanisms of risk transmission, resulting in weak or inconsistent findings.

The goal of the current study is to test several potential mediators of the risk between maternal depression and one specific outcome associated with maternal depression: aggression. Evidence from both cross-sectional and longitudinal studies suggests that children of depressed mothers are more physically aggressive than children of non-depressed mothers (Brennan, Hall, Bor, Najman, & Williams, 2003; Elgar, Curtis, McGrath, Waschbusch, & Stewart, 2003; Hay, Pawlby, Angold, Harold, & Sharp, 2003; Kim-Cohen,

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Moffitt, Taylor, Pawlby, & Caspi, 2005; Langrock, Compas, Keller, Merchant, & Copeland, 2002; Malik et al., 2007; Zahn-Waxler, Iannotti, Cummings, & Denham, 1990). This risk for aggressive behavior seems to hold even after accounting for other established risk factors for aggression, such as parental history of arrest, parental antisocial personality disorder, social class, family financial stress, and single-parent household structure (Hay et al.; Kim-Cohen et al.). Furthermore, several studies have suggested that maternal depression may be a proximal mediating mechanism for other well-known risk factors for aggression, including economic stress, maternal history of child abuse, and paternal alcoholism (Conger et al., 1993; El-Sheikh & Flanagan, 2001; Koverola et al., 2005).

Despite the evidence suggesting that offspring of depressed mothers show elevated rates of aggressive behavior, and the widely recognized clinical and public health risks associated with aggression, several important questions regarding the nature and mechanisms of risk in this population remain unanswered. First, it is not known whether this risk is limited to specific developmental periods or whether it can be observed throughout the life course. At present, longitudinal research on aggressive outcomes among offspring of children of depressed mothers has only extended up to age 15 (Brennan et al., 2003; Black et al., 2003; Hay et al., 2003; Kim-Cohen et al., 2005, Zahn-Waxler et al., 1990). It is not known whether this risk continues into late adolescence and early adulthood, when most violent offenders perpetrate their first serious act of aggression (Elliot, 2000; Maguire & Pastore, 1999).

This transition through adolescence into young adulthood is also a particularly important period in which to examine interpersonal aggression, as the developmental pressures for both increased autonomy and increased intimacy may create the opportunity for new conflict in relationships. Given previous findings demonstrating that the importance of genetic, familial, and peer risk factors fluctuate over development (Connell & Goodman, 2002; Farrington, 1997; Gjone & Stevenson, 1997b; Hale, VanderValk, Akse, & Meeus, 2008), it cannot be assumed that the impact of maternal depression will be invariant across time. Therefore, the first goal of the current study is to assess whether maternal depression history affects offspring risk for aggression during the transition to adulthood.

Another unanswered question with important implications for intervention is what mechanisms might account for an increased risk of aggression among these youth. Only one study (Hay et al., 2003) has examined mechanisms of risk for antisocial behavior among offspring of depressed mothers, finding that children's ADHD symptoms and difficulties managing anger were partial mediators of this association. The current project aims to expand on these findings by examining other person-level and family-level variables that may explain how maternal depression contributes to offspring aggression. There are several strong candidate mechanisms, each of which has been independently shown to be both a consequence of maternal depression and a risk factor for the development of aggressive or antisocial behavior in the general population.

One potential mediator shown to be closely associated with both maternal depression and child aggression is the quality of the parent-child relationship. Considerable evidence suggests that depressed mothers display negative, unsupportive, and withdrawn parenting behaviors (Dawson et al., 2003; Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Lundy, 2002; McCarty & McMahon, 2003; Murray, 1993) and that their offspring are less likely to show secure attachment (Cicchetti, Rogosch, & Toth, 1998; Teti, Gelfand, Messinger, & Isabella, 1995). Low perceived parental warmth and acceptance, in turn, have been shown to predict reported use of aggressive behavioral responses in hypothetical peer situations (Du Rocher Schudlich, Shamir, & Cummings, 2004; Hale, Van Der Valk, Engels, & Meeus, 2005) and on measures of conflict with peers and romantic partners (Hale, Van der Valk, Akse, & Meeus, 2008; Ooi, Ang, Fung, Wong, & Cai, 2006; Ruh Linder, Crick, & Collins, 2002).

There is also evidence to suggest that parent-child relationship quality is a mediator between maternal depression and other externalizing behaviors among offspring. Withdrawn parenting behaviors and negative perceptions of the parent-child relationship have been found to mediate the relationship between maternal depression and general measures of problem behaviors among children (Dawson et al., 2003) and externalizing behaviors among adolescents (Nelson, Hammen, Brennan, & Ullman, 2003). Parent-child relationships characterized by negative or conflictual interactions may deprive offspring of an important relationship context in which interpersonal problem solving is learned. At present there are no studies that evaluate whether parent-child relationship quality or any other dimension of parenting mediates the relationship between maternal depression and young adult aggression.

Another candidate mechanism examined in the current study is exposure to marital conflict. There is a strong association between depression and marital dysfunction, including higher levels of partner conflict, lower levels of relationship satisfaction, and high rates of marital instability (Hammen, 2003; Joiner, 2002), even after the remission of depressive episodes (Zlotnick, Kohn, Keitner, & Della Grotta, 2000). Exposure to home environments characterized by conflict and anger has been shown to increase displays of aggression and anger among children (Cummings, Iannotti, & Zahn-Waxler, 1985) and to promote the development of externalizing symptoms and conduct disorder (Cummings, Keller, & Davies, 2005; Krishnakumar, Buehler, & Barber, 2003; Schoppe-Sullivan, Schermerhorn, & Cummings, 2007).

Previous research has found support for the hypothesis that marital distress is a mechanism through which maternal depression negatively impacts children's socioemotional development. The family process model developed by Cummings and Davies (1994; 1999) posits that marital distress and subsequent emotional insecurity is a primary mechanism through which parental symptomatology influences youth outcomes. This model has received some support in the prediction of externalizing outcomes among adolescents (Davies, Dumenci, & Windle, 1999), although the applicability of this model to aggressive behavior specifically was not tested. The effects of exposure to dysfunctional romantic relationships may be particularly important to study during the period of emerging adulthood as romantic relationships become an increasingly important social context in the lives of young adults.

In addition to the family environment variables, characteristics of the offspring themselves may account for the relationship between maternal depression and youth aggression. Interpersonal skill deficits among high-risk youth may be particularly relevant to the development of aggressive behavior. Hammen and Brennan (2001) have hypothesized that offspring of depressed mothers acquire dysfunctional interpersonal behaviors through observation of and interaction with depressed mothers, who themselves are likely to show maladaptive interpersonal patterns and chronic relationship difficulties. In turn, these interpersonal skill deficits are likely to lead to dysfunctional relationships and chronic interpersonal stress among offspring. Indeed, this transmission of stressful interpersonal patterns has been found to be a crucial mechanism in the intergenerational transmission of risk for depression (Hammen, Shih, & Brennan, 2004). Poor conflict resolution skills and high levels of conflict place individuals at higher risk of perpetrating aggression in both romantic (Riggs, O'Leary, & Breslin, 1990) and peer (Storch, Bagner, Geffken, & Baumeister, 2004) relationships. Previous research (Keenan-Miller, Hammen, & Brennan, 2007) has suggested that social functioning is a mediator of intimate partner violence among children of depressed mothers, but this hypothesis has not been tested in relation to aggression outside of romantic relationships.

A final pathway of risk tested in the current analyses is offspring depression. Numerous studies have established disproportionately high rates of depression among children of depressed parents (for a review see Beardslee, Versage, & Gladstone, 1998; Downey & Coyne, 1990; Hammen, 2009). There is a strong association between depression and aggressive behavior in child and adolescent samples (Gjone & Stevenson, 1997a; Hale et al., 2005), particularly among boys (Akse, Hale, Engels, Raaijmakers, & Meeus, 2004; Hale, Van der Valk, Akse, & Meeus, 2008; Ingoldsby, Kohl, McMahon, Lengua, & Group, 2006). Depression also shows high rates of heterotypic comorbidity with behavioral problems characterized in part by aggression, such as conduct disorder, delinquency and antisocial personality disorder (Angold & Costello, 1993; Angold, Costello, & Erkanli, 1999; Capaldi, 1991; Essau, 2003; Garber, Quiggle, Panak, & Dodge, 1991). Recent research suggests that depression and impulsive aggression may have shared biological risk factors (Carver, Johnson, & Joorman, 2008). Furthermore, depressive symptoms in adolescents have been shown to predict aggression measured as much as one year later (Hale et al., 2008).

The current study aims to address both theoretical and empirical gaps in our knowledge of whether maternal depression predicts aggression among young adult offspring and, if so, what mechanisms may account for this increased risk. The hypothesized model incorporates both child-focused and family-focused mediator variables, including parent-child relationship quality, exposure to maternal relationship conflict, youth social functioning, and youth depression. The proposed mediators, while theoretically and statistically distinct constructs, are interrelated and by incorporating them into a single structural equation model it will be possible to evaluate both the unique effects of these factors as well as their cumulative and comparative effects. Given previous research showing that mediators of the impact of maternal depression may vary by gender (Hammen, Brennan, Keenan-Miller, & Herr, 2008), the current study tests potential gender differences in the proposed pathways.

Method

Participants

A sample of 815 families was selected at youth age 15 from over 5,000 continuing participants in a large birth cohort study of children born between 1981 and 1984 at Mater Misericordiae Mother's Hospital in Brisbane, Queensland, Australia originally designed to study children's health and development (Keeping et al., 1989). The sample was selected to represent a wide array of maternal experiences with depression, with the intention of oversampling women who had reported at least some depressive symptoms on questionnaires administered during earlier phases of the birth cohort study. The current sample was representative of the original birth cohort sample on demographic factors such as maternal education and family income. Complete details of the sampling procedures have been published elsewhere (Hammen & Brennan, 2001).

Of the 815 families that participated at age 15, 710 families participated in some part of the follow-up at youth age 20 and are included here (2 were deceased, 51 refused, and 52 could not be located or scheduled). Of these 710 families, 596 had both mother and youth participation at age 20, 37 had only youth participation, and 77 had only mother participation. There was a fairly even gender distribution among the target youth (343 males, 367 females). The families included in the current analyses did not differ from those not included in terms of maternal depression history ($\chi^2(1, 815) = 1.10, p = .29$), youth depression history ($\chi^2(1, 815) = 2.51, p = .11$), youth history of conduct disorder ($\chi^2(1, 815) = 0.73, p = .39$), or youth history of Oppositional Defiant Disorder ($\chi^2(1, 815) = 1.95, p = .16$) by age 15. The youths who did not participate at age 20 were more likely to be male ($\chi^2(1, 815) = 11.08, p = .001$), and there was a trend towards greater attrition among families earning less money at youth age 15 ($t(782) = -1.87, p = .06$).

Procedures

Interviews and questionnaires were administered separately to youth and mothers in their homes at youth ages 15 and 20. Interviewers were advanced graduate students in psychology, and were blind to maternal depression status and youth prior psychiatric history. All participants gave their written informed consent (or assent), and were compensated for their time. All procedures were approved by the UCLA Institutional Review Board, Emory University Investigations Committee, and the University of Queensland Ethics Review Committee.

Measures

Maternal depression—Given that both clinical episodes of major depression and chronic subsyndromal depressive symptomatology have been shown to affect youth outcomes (Hammen, 2009; Seifer, Dickstein, Sameroff, Magee, & Hayden, 2001), a latent variable representing maternal depression was created using both diagnostic and symptom-based measures. Mothers were assessed for lifetime history of major depressive episodes using the Structured Clinical Interview for the DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995) when their children were 15 years old. Forty-five percent of mothers met criteria for at least one current or past episode of major depression. Inter-rater reliability for SCID depression diagnoses based on a random sample of ten percent of the sample was .84. The number of lifetime episodes of major depression (including current episodes) was summed.¹

Maternal depressive symptomatology was assessed prospectively across the child's lifespan using the seven item Depression Scale of the Delusions-Symptoms-States Inventory (DSSI; Bedford & Foulds, 1977). As part of the larger birth cohort study from which the current sample was drawn, mothers completed the DSSI at five points: during pregnancy, within 3–4 days following the child's birth, at child age 6 months, at child age 5, and at child age 14. The scores across administrations were summed and z-scored. Negative scores represent higher levels of depression. Coefficient alpha was .8 or higher at each time point. Current (in the past two weeks) maternal depressive symptomatology at youth age 15 was assessed using the Beck Depression Inventory (BDI; Beck, Steer, & Brown, 1996), a 21-item self-report measure with well-established psychometric properties. Coefficient alpha was .90 in the current sample.

Youth aggression at ages 15 and 20—Youth aggression at age 15 was measured using the corresponding scales of the Child Behavior Checklist (CBCL), Youth Self-Report, and Teacher Report Form (Achenbach, 1991). Coefficient alpha was .91 for the maternal-report CBCL, .86 for the Youth Self-Report, and .91 for the Teacher Report Form. According to maternal report at age 15, 40 youth (5.6%) displayed clinically significant levels of aggression, with another 76 (10.7 %) in the borderline range.

Three questionnaires measured aggression at age 20. Youth completed the Young Adult Self-Report (YASR) and the mothers completed a comparable questionnaire, the Young Adult Behavior Checklist (YABC; Achenbach, 1997). Respondents indicate how true

¹The potential impact of the timing of maternal depression was explored in a separate set of analyses. Offspring of depressed mothers were placed into groups based on youth age at first exposure to maternal depressive episode (0–2, 3–5, 6–10, 11–15) and compared on aggression measures at age 20. There were no effects of age group membership on either the maternal report (YABC) or self-report (YASR, Buss Aggression Questionnaire) measures of aggression (all *p* values >.80). A second set of analyses was conducted to examine the potential impact of the timing of maternal dysthymia on youth aggression. Offspring of dysthymic mothers were placed into one of two groups representing timing of maternal depression in relation to youth exposure to maternal depression (0–10 or 10–15). T-tests found that there were no group differences in scores on any of the measures of youth aggression at age 20 (all *p* values > .40).

various symptom descriptors are of the target youth, ranging from 0 (not at all true) to 2 (very true or often true). Coefficient alphas for the 12-item youth-report and the 17-item maternal-report Aggression scales were .83. and .91, respectively. Maternal and youth reports on these scales were correlated at .49 ($p < .01$). There were no gender differences in self-reported ($t(604) = .80, p = .42$) or mother-reported aggression ($t(671) = -.90, p = .37$). Based on clinical cutoffs suggested by Achenbach (1997), 75 youth (10.56%) were in the clinical range by either mother or youth report, and an additional 42 youth (5.92%) were in a borderline clinical range. At age 20 the target youth completed the Buss Aggression Questionnaire (Buss & Warren, 2000), which assesses various aggressive behaviors on a 5-point scale ranging from “not at all like me” to “completely like me.” The measure has adequate internal consistency and test-retest reliability (Harris, 1997; Von Collani & Werner, 2005). In the current sample, the coefficient alpha was .93. Men reported higher levels ($M = 65.02, SD = 18.79$) of aggression on the Buss Aggression Questionnaire than women ($M = 60.68, SD = 19.22; t(631) = -2.87, p = .004$).

Socioeconomic status—The potential effects of family socioeconomic status were controlled using a latent variable indicated by level of maternal education, maternal occupation status, and level of reported family income at youth age 15.

Parent-child relationship quality—Four measures administered at youth age 15 were used as indicators of the quality of the mother-child relationship. Two subscales of the revised version of the Children’s Report of Parental Behavior Inventory (Schludermann & Schludermann, 1988), the Perceptions of Maternal Acceptance Subscale, and the Maternal Psychological Control subscale, were used in the current investigation. These 10 item subscales have been found in previous studies to relate to broad categories of child outcome (Hammen, Brennan, & Shih, 2004). Coefficient alpha for the Acceptance and Psychological Control Scales were .90 and .81, respectively.

Additional measures of the quality of the mother-child relationship were obtained through semi-standardized interviews administered to both mother and child. The UCLA Chronic Stress Interview (CSI; Hammen et al., 1987) was used to assess functioning in the previous 6 months (before the age 15 interview) across several life roles, as described below. The quality of functioning in each domain is rated by the interviewer on a 5-point scale, with behaviorally specific anchor points in each domain (with 1 indicating exceptionally good conditions and 5 representing extreme adversity). Of interest to the current study, interviewers assessed the mother’s descriptions of the quality of her relationship with her target child, and an independent interviewer assessed the target child’s perceived quality of family relationships. Previous research using these scales has demonstrated convergent and construct validity (Hammen et al., 1987; Rao, Hammen, & Daley, 1999).

Maternal romantic relationship conflict—As part of the CSI, the quality of mothers’ intimate relationship with spouse or partner over the previous six months was rated by the interviewer on a scale with behaviorally specific anchors of one to five, where five represents highly conflicted, abusive, and unstable relationships. All mothers received a rating in this domain, regardless of their current marital status (with alternative anchor points reflecting quality of single or dating status). In addition, the 606 mothers currently in a relationship (512 married, 41 cohabitating, 39 currently separated, 8 in a relationship but not cohabitating, and 6 “other”) completed two questionnaire measures about their current relationships. Severity and frequency of aggression within the maternal relationship was measured with a seven-item modified version (Pan, Neidig, & O’ Leary, 1994) of the Conflict Tactics Scale (Straus, 1979). Coefficient alpha was .92 in the current sample. Mothers’ overall satisfaction and frequency of conflict in her current relationship were

measured using the nine-item Satisfaction Scale of the Dyadic Adjustment Scale (Spanier, 1976). Coefficient alpha in the current sample was .95.

Youth social functioning at 15—As part of the CSI, interviewers rated the quality of relationships over the previous six months in two social domains: best friendships and general social life. Reliabilities (intraclass correlations) obtained from independent judges were .76 for the Best Friend scale and .63 for the Social Life scale. In addition, probands completed the Self- Perception Profile for Adolescents (Harter, 1988), a 45- item self-report scale that assesses domain- specific areas of perceived competence. Two interpersonal subscales, reverse coded, are included in the present project: Close Friendship and Social Acceptance. Previous research has found high internal consistency and convergent validity for the various domains (Klein, 1995; Trent, Russell, & Cooney, 1994). Coefficient alpha was .78 for the Social Acceptance scale and .79 for the Close Friendship scale.

Youth depression—The presence and history of affective disorders in the child were assessed at age 15 using the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Revised (Epidemiologic version) for the DSM-IV (K-SADS-E; Orvaschel, 1995). It was administered separately to the mother and the child, and diagnostic decisions were made by the clinical rating team based on all available sources of information using best-estimate diagnostic procedures. A total of 101 youth had a lifetime diagnosis of a depressive disorder by age 15. Among a sample of 75 randomly selected interviews, weighted Kappas were .82 for current major depression, subclinical depression, or dysthymia, and .72 for past depression. A binary variable representing presence or absence of a lifetime history of a depression diagnosis was used in the current analyses. Additional measures of youth depressive symptomatology at age 15 were drawn from the BDI (Beck, Steer, & Brown, 1996) and maternal reports on the Anxious-Depressed Scale of the CBCL (Achenbach, 1991). Coefficient alpha for the BDI and CBCL scales were .93 and .85, respectively.

Overview of Data Analytic Strategy

To examine the direct and indirect effects of maternal depression on youth aggression, a series of structural equation models were tested using Mplus software (Muthén & Muthén, 2009). Structural equation modeling (SEM) has several significant advantages over standard regression analyses, including the ability to generate multi-informant, multi-method latent variables, and the ability to test complex mediation hypotheses. Due to the substantial univariate and multivariate non-normality of the data, robust maximum likelihood (MLR) estimation methods were used (Byrne, 1994). The MLR estimator in Mplus computes standard errors using a sandwich estimator and yields a chi-square test statistic that is asymptotically equivalent to the Yuan-Bentler Scaled T2 statistic (Yuan & Bentler, 2000). Chi-square tests often produce significant values in large samples, even if only small differences exist between the covariance matrices of the model and the sample data (Bentler & Bonett, 1980). In studies of moderate-to-large samples, the robust RMSEA and the Comparative Fit Index (CFI; Bentler, 1990) may be more appropriate indicators of fit. The suggested values representing excellent fit are .95 or higher for CFI (Hu & Bentler, 1999), with values greater than .9 representing acceptable fit (Bentler, 1992), and .05 or lower for the RMSEA, with values less than .08 representing reasonable fit (Browne & Cudeck, 1993). Missing data were handled using full information maximum likelihood estimation.

In order to examine potential gender differences, multiple group analyses were conducted using gender as the grouping variable. By default, Mplus constrains factor loadings and regression paths to be equal across groups (although variances and covariance paths are set to be free and unequal) and generates a set of parameter estimates for each gender group.

Post-hoc Wald chi-square tests using the MODEL TEST command were conducted to test the assumption of equality in the constrained regression pathways between latent variables. The null hypothesis for these Wald tests is that the constraint is true in the population from which the groups are drawn.

In order to first establish the existence of a relationship between maternal depression history by youth age 15 and youth aggression at age 20, a direct effects model not containing the hypothesized mediators was tested, controlling for the effects of a latent variable representing socioeconomic status. Results suggested that socioeconomic status, although associated with maternal depression, was not predictive of youth aggression and was dropped from future analyses. Subsequently, a model containing the proposed mediators was tested. The latent mediating variables were allowed to covary and the significance of the direct and indirect pathways between latent variables was tested using the MODEL INDIRECT command. Standardized beta values are reported. The significant direct mediating pathways in this model were retained for a final model that also accounts for the relationship between the model variables and age 15 levels of aggression. The correlations among the variables are shown in Table 1.

Results

In order to first establish whether there was a relationship between maternal depressive history by youth age 15 and youth aggression at age 20, a direct-effects model was tested (Figure 1). This model was a good fit to the data: χ^2 (df= 24, N=710) = 58.70, $p < .01$; CFI = .96; RMSEA = .06 (90% CI .04, .09). Results of the Wald test suggested that constraining the structural model parameters to be equal between genders was an appropriate fit to the data (all $p > .05$). The significant pathway between the latent factors representing maternal depression and youth aggression in both gender groups suggests that maternal depression history by youth age 15 does predict youth aggression at age 20.

Having established a direct effect of maternal depression on youth aggression, a model (Figure 2) was tested that measured both the direct effects of maternal depression on youth aggression and the indirect effects through the hypothesized mediators: χ^2 (df= 347, N=710) = 810.67, $p < .01$; CFI = .86; RMSEA = .06 (90% CI .06, .06). Wald tests revealed that the cross-gender constraints were appropriate, although gender differences in the pathway between maternal depression and parent-child relationship quality approached significance ($p = .07$). Inspection of the parameter estimates reveals that the effects of maternal depression on youth aggression were fully mediated, as the regression coefficients between these latent variables dropped to non-significant ($\beta = -.08, -.04$, in males and females, respectively). The only significant direct mediator of this relationship in the final model was youth depression at age 15. Indirect effect tests suggested that the only significant indirect effect through the hypothesized mediators was through youth depression ($p = .03$ for men and women; all other $p > .10$).

In order to account for the stability of aggressive behavior between ages 15 and 20, a final model was tested retaining the significant mediator from the previous model, youth depression, in a model that also includes youth aggression at age 15 (χ^2 (df= 118, N=710) = 461.49, $p < .01$; CFI = .81; RMSEA = .09 (90% CI .08, .10)). Wald tests revealed that the cross-gender constraints were appropriate. As shown in Figure 3, there was a significant covariance between levels of aggression measured at ages 15 and 20. In addition, youth aggression at age 15 was significantly predicted by concurrent levels of youth depression. Youth depression at age 15 was a full mediator of the association between maternal depression and youth aggression at ages 15 and 20. Even accounting for the stability of aggression between ages 15 and 20, youth depression continued to exert a unique effect on

levels of youth aggression at age 20. Among men, the total effect of maternal depression on youth aggression at age 15 was $\beta = .40$, of which $\beta = .37$ was an indirect effect through youth depression. Among women, the total effect of maternal depression on youth aggression at age 15 was $\beta = .44$, of which $\beta = .40$ was an indirect effect through youth depression. Similar results were observed for the effect of maternal depression on youth aggression at age 20, with the majority of the total effect (.18 of .28 among men, .17 of .27 among women) indirect through youth depression.

Discussion

The goal of this study was to examine whether young adult offspring of depressed mothers display elevated levels of aggressive behavior at age 20, and to examine four family-level and individual-level factors that may mediate this association. The potential mediators tested in the current analyses were the quality of the parent-child relationship, exposure to maternal relationship dysfunction, youth social functioning, and youth depression. These questions were addressed using a two-wave longitudinal design in a community-based sample of mothers with varying depression histories and their offspring. The results suggested that a history of maternal depression prior to youth age 15 does predict higher levels of offspring aggression during the transition to adulthood. This association was fully mediated by youth depressive history. Three additional variables reflecting mother-child relationship quality, maternal romantic relationship quality and youth peer functioning were not significant mediators when taking into account the effects of youth depression.

The current finding that maternal depressive history predicts aggressive behavior among offspring is consistent with previous research demonstrating aggressive (Brennan et al., 2003; Elgar et al., 2003; Hay et al., 2003; Kim-Cohen et al., 2005; Langrock et al., 2002; Malik et al., 2007) and other externalizing (Anderson & Hammen, 1993; Dawson et al., 2003; Trapolini, McMahon, & Ungerer, 2007) outcomes among children of depressed mothers. The current study is unique in suggesting that these effects may extend into later periods of development, even when accounting for the stability of prior aggression. It is essential to understand the predictors of aggression during this period of emerging adulthood, as individuals who do not desist from aggressive behavior before late adolescence are likely to engage in increasingly violent and dangerous behaviors (Elliot, 2000; Loeber & Farrington, 1998; Loeber & Hay, 1997).

Aggression in young adulthood may also present unique risks to long-term psychosocial functioning, as the importance and nature of relationships with peers and romantic partners changes during this time, and new behavioral patterns of interaction may be established. Adolescents who are prone to negative affect may have difficulty navigating the increasingly complex relationships that are established during young adulthood, and may be more likely to experience conflict and react to that conflict in a maladaptive way. Furthermore, young adults with an aggressive interpersonal style may by choice or necessity select into relationships with peers who themselves have maladaptive interpersonal patterns, creating relationships that are likely to be characterized by conflict and perpetuate risk for negative psychosocial outcomes.

It is important to keep in mind that the current findings do not test change in aggressive behavior over late adolescence and are not specific to any specific trajectory of aggressive behavior, but apply to youth aggression during young adulthood in general. Previous research using a subsample of 370 adolescents from the current dataset found that maternal depression was predictive of both early-onset and adolescent-onset patterns of aggression and did not distinguish between these two trajectories (Brennan et al., 2003). In fact, the current findings indicate significant stability of aggression between ages 15 and 20. Similar

to prior longitudinal research describing a general trend towards desistance from aggression during adolescence (Cairns, Cairns, Neckerman, Ferguson, & Gariepy, 1989; Stanger, Achenbach, & Verhulst, 1997), the rates of clinically significant aggression in this study dropped between ages 15 and 20. However, there was notable continuity of relative levels of aggression within individuals. Spearman rank correlation tests show significant associations of rank ordered aggression scores at ages 15 and 20 by both mother ($P = .70, p < .001$) and youth ($P = .43, p < .001$) report. These findings suggest that the youth who were most aggressive at age 15 were also the most aggressive youth at age 20. The current study showed that youth depression is a strong predictor of aggression at age 20 even accounting for this intraindividual stability in relative levels of aggression.

Several potential mediators of the association between maternal depression and youth aggression were not significant. Three of these four met initial criteria as a candidate mediator when modeled individually.² Maternal relationship conflict was the only proposed mechanism that did not predict youth aggression at age 20. Although some studies suggest that interparental conflict is an important mediator of youth adjustment among families with depressed parents (Cummings, Keller, & Davies, 2005; Davies & Cummings, 1998; Davies, Dumenci, & Windle, 1999) other studies have not supported this hypothesis (Papp, Cummings, & Schermerhorn, 2004; Trapolini, McMahon, & Ungerer, 2007). It is possible that various youth outcomes are differentially related to marital conflict. Alternatively, it is possible that our ability to detect such a relationship may be limited by our measures of maternal relationship functioning. Although selected to reflect both physical and non-physical forms of conflict, at least two of the indicator variables may also capture other aspects of relationship quality, thereby obscuring a more precise influence of marital conflict. Finally, models examining the additive (Essex, Klein, Cho, & Kraemer, 2003) or moderating (Papp, Goeke-Morey, & Cummings, 2004) effects of interparental conflict may be more appropriate.

Of the four potential mediators examined, only youth depression by age 15 was a unique mediator of youth aggression at age 20. It is important to note that these effects of depression were found even when the effects of related impairments in youth social functioning and parent-child relationship quality were controlled. At least one previous study has found that adolescent depressive symptoms predict aggression one year later (Hale et al., 2008). Additional research suggests that depression predicts a range of delinquent behaviors including aggression across adolescence, even when controlling for shared environmental risk factors (Beyers & Loeber, 2003). The current findings suggest that this effect of depression on aggression extends into young adulthood, even accounting for levels of aggressive behavior in mid-adolescence.

In addition to the predictive relationship observed between depression at age 15 and aggression at age 20, there was also a strong cross-sectional relationship between depression and aggression at age 15. These findings are in line with previous studies demonstrating a moderate to strong correlation between depressive and aggressive symptoms in youth samples (Gjone & Stevenson, 1997a; Hale, Vander Valk, Engels & Meeus, 2005; Messer & Gross, 1994). The current study extends these findings by suggesting that even when this earlier association between aggression and depression and the stability of aggression is taken into account, youth depression remains a significant predictor of aggression in young adulthood. The association of depression with aggression both cross-sectionally and across developmental periods suggests that mood disorder history in adolescence may promote a

²Preliminary models tested each of the individual mediators separately. Each of the models was a good fit to the data. Each mediator was significantly predicted by maternal depression at age 15. Each hypothesized mediator was also predictive of youth aggression at age 20, with the exception of maternal relationship functioning.

stable and vicious cycle of aggressive behaviors and their concomitant negative outcomes among some youth.

Although clarification of the processes that account for the link between youth depression and aggression is beyond the scope of this project, several possibilities should be considered in future research. For example, shared genetic risk factors for depression and aggression may account for part of this association, as suggested by twin studies examining the overlap between depression and aggression that have implicated both genetic and environmental influences (Gjone & Stevenson, 1997a; O'Connor, McGuire, Reiss, Hetherington, & Plomin, 1998; Rowe, Rijdsdijk, Maughan, Hosang, & Eley, 2008; Subbarao et al., 2008). The two conditions may also share biological risk factors, including decreased serotonergic activity and dopamine hyperfunction (Carver, Johnson, & Joorman, 2008; Lahey, Hart, Pliszka, & Applegate, 1993; Seo, Patrick, & Kennealy, 2008).

A second potential explanation is underlying biologically and psychologically mediated deficits in emotion regulation that account for both early onset depression and aggressive behaviors. Previous research among child samples has found that difficulties with anger control are predictive of aggression (Chang, Schwartz, Dodge, & McBride-Chang, 2003; Musher-Eizenman et al., 2004). Symptoms such as irritability and hostility, which are common to both aggression and depression, may reflect this core deficit in regulation of negative affect. Further research with more direct physiological or self-report measurements of emotion regulation is needed to evaluate the hypothesis that emotional regulation difficulties may underlie both adolescent vulnerability to depression and risk for aggression in young adulthood. It is possible that poor emotion regulation skills may be a particularly important mechanism for aggression risk in this population given research suggesting a connection between the emotion regulatory abilities of parents and offspring (Carson & Parke, 1996; Eisenberg & Fabes, 1994).

Furthermore, the social experiences of depressed adolescents may contribute to the development or maintenance of an aggressive interpersonal style. Depressed youth are more likely than healthy peers to experience social rejection (Vernberg, 1990), which may contribute to the development of the elevated rates of hostile attributional biases observed among depressed youth (Quiggle, Garber, Panak, & Dodge, 1992). These biases in turn may increase the likelihood of aggressive behavior (Dodge & Coie, 1987), which is likely to contribute to further rejection by peers (Juvonen & Gross, 2005), thereby creating an escalating cycle of rejection and aggression. This pathway may account for both the cross-sectional and prospective relationships between depression and aggression. These risk processes may be particularly pronounced among depressed offspring of depressed mothers who are more likely than depressed offspring of nondepressed mothers to have negative cognitions about their own social abilities and higher levels of chronic interpersonal stress (Hammen & Brennan, 2001; Hammen, Shih, Altman & Brennnan, 2003). Further research is needed to explore these and other potential processes linking depression and aggression in youth.

In sum, these findings indicate that maternal depression by youth age 15 predicts overall levels of aggressive behavior at age 20. The relationship between maternal depression and youth aggression at age 20 was fully mediated through youth depressive symptoms by age 15, and this pathway remained significant even when accounting for the stability of aggressive behavior between ages 15 and 20. Theories regarding the well-established association between parental and offspring depression may need to be elaborated to account for an especially pernicious form of combined youth aggression and depression among some offspring. The functional outcomes of such youth need to be studied further in order to better understand the implications of depression-aggression comorbidity in adulthood.

An important limitation to the present analyses is that only one direction of causality between our predictor, mediator, and outcome variables was tested. It is likely that the true relationship between these variables is bidirectional and evolves over time. Unfortunately, the nature of the data collected in this project does not allow for a direct examination of how these relationships may unfold temporally. A longitudinal study beginning in early childhood with multiple waves of data collection is needed to address these issues more clearly. It is worth noting, however, that a recent study examining the relationship between adolescent aggression, depression, and parental rejection found that a uni-directional model predicting aggression from youth depression and parental rejection was a better fit than a bi-directional model (Hale et al., 2008). Furthermore, longitudinal studies have shown that the pathway from depression to antisocial behavior is more robust than the pathway from antisocial behavior to depression (Beyers & Loeber, 2003). Therefore, there is reason to suspect that the direction of causality tested in the current project is representative of a true effect of depression and family environment on aggression, even if other temporal relationships between these variables also exist.

An additional limitation was that not all potential mediators were tested. While an effort was made to consider both family-level and individual-level variables from a variety of domains considered to be important in the prediction of aggression, contextual variables and cognitive styles promoting aggression were not measured, nor were biological and genetic factors. In addition, the two-wave study design did not allow for the three waves of measurement that are the gold standard for tests of mediation (Cole & Maxwell, 2003). The relatively modest CFI values for the mediational models must also be taken into consideration when evaluating these findings, although such values are not atypical among models with a large number of degrees of freedom.

Use of a community population that oversampled women with histories of depression may limit the generalizability of these results. It is possible that somewhat different patterns would emerge in unselected samples. Furthermore, the majority of the aggression observed in the current study was within a developmentally normative range. These results may not apply to predictors of more serious violent behavior.

The present study expands upon the existing literature by demonstrating that maternal depression is an important predictor of aggression perpetrated by young adults. Although research on offspring of depressed mothers often focuses on the intergenerational transmission of depression, the current study suggests that aggression may be another important domain of adverse outcome that may have serious consequences for psychosocial functioning, including romantic relationship functioning (Keenan-Miller, Hammen, & Brennan, 2007). The current findings may facilitate identification of individuals at high risk for aggression. Furthermore, the knowledge that this connection is mediated by youth depression suggests that interventions aimed at depression prevention and improvement of emotion regulation may be useful in decreasing aggression among at-risk populations. Given the high societal cost of aggression perpetrated by young adults, further research into the etiology and prevention is warranted.

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Figure 1.

Results of Structural Equation Model testing the relationship between maternal depression and youth aggression. Path coefficients among men are shown in bold; coefficients among women are shown in italics. Significant pathways are shown as solid lines; nonsignificant pathways are shown as dotted lines.

Figure 2. Results of Structural Equation Model testing the direct effects of maternal depression on youth aggression at age 20 as well as indirect effects through hypothesized mediators. Path coefficients among men are shown in bold; coefficients among women are shown in italics. Significant pathways are shown as solid lines; nonsignificant pathways are shown as dotted lines.

Figure 3.

Results of Structural Equation Model testing the direct effects of maternal depression on youth aggression at ages 15 and 20 as well as indirect effects through youth depression. Path coefficients among men are shown in bold; coefficients among women are shown in italics. Significant pathways are shown as solid lines; nonsignificant pathways are shown as dotted lines.

Correlation matrix

Table 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. YASR aggression	---																								
2. Buss Aggression	.77	---																							
3. YABC Aggression	.50	.42	---																						
4. Maternal BDI	.19	.14	.25	---																					
5. Maternal episodes	.11	.12	.15	.26	---																				
6. DSSI score	-.17	-.10	-.17	-.48	-.28	---																			
7. CSI- Maternal Relationship	.10	.05	.12	.38	.18	-.32	---																		
8. Marital Coercion	.15	.12	.19	.33	.16	-.27	.54	---																	
9. Marital Satisfaction	.14	.09	.14	.47	.22	-.35	.70	.63	---																
10. Youth LSI- family	.27	.22	.24	.21	.18	-.15	.27	.23	.25	---															
11. Mother LSI- child	.27	.20	.39	.25	.20	-.18	.27	.18	.18	.40	---														
12. CRPBI- Accept	.14	.13	.09	.06	.07	-.07	.00	.01	.04	.44	.32	---													
13. CRPBI- Control	.27	.25	.31	.16	.12	-.11	.04	.07	.07	.29	.29	.36	---												
14. Youth LSI - close friendships	.09	.10	.16	.08	.09	-.09	-.02	-.01	-.01	.17	.12	.05	.05	---											
15. Youth LSI- general social life	.17	.13	.21	.11	.12	-.09	.03	.08	.06	.20	.13	.08	.10	.51	---										
16. Harter- close friendships	.15	.16	.15	.12	.12	-.06	-.03	.01	-.01	.12	.10	.18	.20	.38	.33	---									
17. Harter- social acceptance	.17	.25	.13	.07	.06	-.05	.05	.04	-.04	.09	.05	.12	.11	.20	.44	.47	---								
18. Youth BDI at 15	.29	.25	.16	.07	.09	-.04	.07	.05	.05	.29	.17	.24	.22	.06	.18	.21	.25	--							
19. Youth MDE	.13	.09	.13	.08	.09	-.07	.16	.21	.10	.23	.09	.10	.09	.11	.17	.06	.10	.26	--						
20. Maternal CBCL 15- anxiety and depression	.33	.21	.42	.33	.17	-.25	.16	.21	.22	.27	.39	.09	.21	.17	.28	.14	.22	.29	.22	---					
21. Family income	-.12	-.10	-.14	-.13	-.13	.18	-.17	-.16	-.19	-.14	-.08	.03	-.03	-.11	-.17	-.05	-.09	-.08	-.08	-.08	---				
22. Maternal education	.00	-.03	-.02	-.04	-.02	.08	-.05	-.05	.04	-.05	-.06	-.06	.00	-.09	-.02	.01	-.02	.01	-.05	.01	.14	---			
23. Maternal occupation status	-.04	-.03	-.08	-.18	-.11	.19	-.12	-.10	-.12	-.12	-.06	-.02	-.07	-.09	-.18	-.06	-.10	-.05	-.04	-.08	.45	.21	---		
24. YSR aggression at age 15	.48	.43	.37	.11	.09	-.09	.12	.13	.12	.35	.26	.26	.38	.04	.15	.10	.16	.39	.14	.28	-.09	.00	-.08	---	
25. CBCL aggression at age 15	.39	.35	.58	.28	.20	-.21	.13	.25	.19	.30	.51	.18	.35	.12	.19	.15	.13	.18	.08	.64	-.12	-.04	-.10	.41	---
26. TRF aggression at age 15	.25	.21	.25	.07	.13	-.11	.08	.10	-.01	.16	.36	.09	.18	-.01	.05	.03	.04	.07	.07	.21	-.06	-.06	-.04	.23	.38

Note: YASR= Young Adult Self-Report. YABC= Young Adult Behavior Checklist. BDI= Beck Depression Inventory. DSSI= Delusions-Symptoms-States Inventory. LSI= UCLA Life Stress Interview. CRPBI= Child Report of Parent Behavior Inventory. CBCL= Child Behavior Checklist. MDE= Major Depressive Episode.