ABSTRACT

Title of Dissertation:	PARENTAL DEPRESSIVE SYMPTOMS, CHILD DEPRESSIVE SYMPTOMS, AND PARENTING: RECIPROCAL RELATIONS FROM EARLY CHILDHOOD THROUGH ADOLESCENCE
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Theories on the interactional nature of families suggest that parents and children each impact one another's moods and behaviors. However, little work has examined reciprocal relations among parental depression, parenting, and child depression across development. We conducted cross-lagged panel models to examine reciprocal relations between parental depression, negative parenting, and child depression from early childhood through adolescence in a community sample of 609 youth. At ages 3, 6, 9, 12, and 15 years old, mothers and fathers completed self-report measures about their own depression and parenting. Child depression was assessed with a developmentally appropriate semi-structured clinical interview at all timepoints. Results demonstrated reciprocal, indirect pathways between maternal and child depression: maternal depression at age 3 led to child depression at age 15 and child depression at age 3 led

to greater maternal depression at age 15 via a number of indirect pathways. Moreover, while child depression at age 3 led to greater maternal and paternal negative parenting from ages 3 to 15, this effect was not reciprocal. Pathways between paternal and child depression were not observed. Our findings highlight the importance of examining reciprocal pathways to identify mechanisms in the development of parent and youth depression across childhood.

PARENTAL DEPRESSIVE SYMPTOMS, CHILD DEPRESSIVE SYMPTOMS, AND PARENTING: RECIPROCAL RELATIONS FROM EARLY CHILDHOOD THROUGH ADOLESCENCE

by

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Chapter 1: Background

In the U.S., more than 15 million children live with a parent who has experienced major depression (Englad & Sim, 2009); this is concerning as the children of depressed parents have a three-fold risk for developing depression themselves compared to offspring of nondepressed parents (Weissman et al., 2006, 2016). Furthermore, by the time these children are 18 years old, about a fourth of them will have experienced clinically significant depression, making depression among the most prevalent psychiatric problems among youth (McLeod et al., 2007). Most work has examined effects of parental depression on child depression and the mediating role of parenting behaviors (Weijers et al., 2018; Yap et al., 2014). However, much less work has examined the effects of child depression on later parental depression and parenting behavior. Theories on the interactional nature of families suggest that while parent's psychopathology influences their parenting and their abilities to respond to their children's strong emotions, children's behaviors also elicit responses from their parents, including negative parenting behaviors, which may further impact parent's and children's moods (Coyne, 1976; Eberhart & Hammen, 2006; Sameroff, 2010). Thus, research is needed to test reciprocal relations between parents' depression, parenting, and children's depression across development to better understand pathways of risk for depression within families and to inform family-based interventions.

In this paper, we define reciprocal effects as indirect, bidirectional relations that unfold over time. For example, longitudinal reciprocal relations between

maternal and child depression would include, for example, the simultaneous indirect effects of 1) maternal depression early in the child's development on child depression in adolescence via parenting and 2) child depression in early childhood on later maternal depression via parenting from early childhood through adolescence.

The transmission of depression from parents to children and parenting as a mediator

Research has consistently documented short- and long-term effects of parental depression on child symptomatology across development (Hammen et al., 2008; Keijser et al., 2020; Sweeney & MacBeth, 2016; Weissman et al., 2016). Considerable research has focused on parenting behaviors as an important, modifiable mechanism in the transmission of depression from parents to children (McLeod et al., 2007; Yap et al., 2014). This work is grounded in attachment theory, which emphasizes the critical role of early parenting in shaping the quality of the parent-child relationship and the foundation upon which children learn to interact with others and develop emotion regulatory skills (Bowlby, 1979). Parental depression can interfere with parents' use of effective parenting skills, increasing children's risk for emotional problems across development (Elgar et al., 2004; Goodman et al., 2011). Parents with depression tend to use less warm and more hostile and ineffective parenting strategies compared to nondepressed parents (Goodman, 2007; Kopala-Sibley et al., 2017; Lovejoy et al., 2000; Wilson & Durbin, 2010). These negative parenting behaviors have in turn, been shown to increase children's risk for depression, with parenting explaining about 8% of the variance in child depression (del Barrio et al., 2016; King et al., 2016; Kuckertz et al., 2018; McLeod et al., 2007;

Yap et al., 2014). Although more limited, paternal depression and parenting behaviors have shown similar patterns of effects on child depression as maternal depression and parenting (Connell & Goodman, 2002; Reeb et al., 2010, 2015; Sweeney & MacBeth, 2016).

The extant literature provides support for the mediating role of parenting in the transmission from parental depression to child depression (Elgar et al., 2007; England & Sim, 2009; Goodman, 2007; Goodman et al., 2011; Kuckertz et al., 2018; McLeod et al., 2007; Turney, 2012; Wolford et al., 2019). However, this research has been limited by cross-sectional designs, a focus on one developmental period, and longitudinal studies assessing only two timepoints which does not inform the temporal sequence of associations (Maric et al., 2012). Findings from the few studies that used three or more time points have been mixed. For instance, although negative parenting in early childhood partially mediated the effects of maternal depression on subsequent child internalizing symptoms from ages 3 to 9 years old (Kuckertz et al., 2018), several other studies (which focused on children aged 1-6 or 3 to 9 years old) using three time points did not support parenting as a mediator in the longitudinal relation between maternal depression and child depression (Hails et al., 2018; Kopala-Sibley et al., 2017; Villodas et al., 2018). More longitudinal work is needed incorporating more than 3 time points and repeated measures of parental depression, parenting, and child depression to uncover the role of parenting in the transmission of depression across development. Specifically, an examination of reciprocal (bidirectional, indirect) relations between parental and child depression and serial mediation (i.e., more than one mediating variable in a pathway) of parenting, parental

depression and child depression may elucidate pathways in the transmission of depression within families. This is critical given that child depression may contribute to family stress and elicit negative responses from parents, impacting both children's and parents' moods (Coyne, 1976; Eberhart & Hammen, 2006; Sameroff, 2010). Negative parenting may increase parental depression, given that depressed individuals tend to behave in ways (e.g., reassurance seeking) that alienate others and foster stressful environments that may maintain and increase depression (Coyne, 1976). Thus, child depression, which may lead to negative parenting, may in turn predict increased depressive symptoms in parents. Below, we review the literature testing reciprocal relations among parental depression, parenting and child depression.

Tests of reciprocal relations

Parental depression and child depression. In childhood, some work supports reciprocal relations between maternal and child depressive symptoms (Hails et al., 2018; Kuckertz et al., 2018; Wiggins et al., 2014). These studies found that maternal depression led to greater child internalizing symptoms and child internalizing symptoms led to greater maternal depression from ages 2 to 9 years old (Hails et al., 2018; Kuckertz et al., 2018; Wiggins et al., 2014). In contrast, Panquin and colleagues did not observe reciprocal effects across early childhood: although maternal depressive symptoms predicted subsequent child internalizing symptoms from ages 1.5 to 5 years old, child depressive symptoms did not predict later maternal depression (Paquin et al., 2020). To date, studies in adolescence have not supported reciprocal associations. For instance, while maternal depressive symptoms predicted next wave adolescent depressive symptoms, adolescent depression did not predict

next wave maternal depression (Mennen et al., 2018; Tyrell et al., 2019). Yet, another study reported the oppositive effect: adolescent depressive symptoms predicted greater maternal depressive symptoms later in adolescence, which in turn predicted increases in adolescent depression, yet maternal depression did not lead to subsequent adolescent depressive symptoms (Hou et al., 2020). The one study that spanned age 2 to 15 found maternal depression predicted greater child internalizing symptoms from first grade to age 15, but not vice versa (Yan et al., 2021). Across childhood and adolescent samples, studies with fathers did not support reciprocal associations between paternal depression and child depression and direct effects differed depending on the age of the child (Hou et al., 2020; Tichovolsky et al., 2018). Taken together, there is some support for reciprocal relations between maternal, but not paternal, depression and youth depressive symptoms in childhood but not adolescence. Nevertheless, most studies have been limited by the narrow age ranges under investigation. Importantly, no study has examined reciprocal associations between both mother *and* father depression and youth depression from early childhood, starting as young as the preschool years, through adolescence. Studies measuring both parents and multiple developmental periods with repeated measures are critical given that mothers and fathers may influence youth differently at different stages of development (Tyrell et al., 2019).

Parenting behavior and child depression. The prior work on reciprocal relations between parenting behavior and child depressive symptoms is more limited than tests of reciprocal relations between parent and child depression. The majority of these studies did not support reciprocal relations between parenting and child

internalizing symptoms over time (Hails et al., 2018; Kuckertz et al., 2018; Reitz et al., 2006; Wang & Kenny, 2014; Wiggins et al., 2015). These studies either found parenting effects on youth internalizing symptoms (Hails et al., 2018; Kuckertz et al., 2018; Wang & Kenny, 2014) or youth internalizing symptoms on later parenting (Reitz et al., 2006; Wiggins et al., 2015), but not bidirectional effects in the same sample over time. However, one study did observe reciprocal effects between negative parenting and youth depressive symptoms across a one year follow-up in females ages 7-12 years old (Hipwell et al., 2008). Across these studies, the assessment of parenting varied greatly (i.e., by construct and method) and narrow age ranges were assessed, which likely contributed to the inconsistent findings. Moreover, these studies did not examine parental depression, alongside parenting behavior and child depression, which is critical as parenting and parental depression are related (Lovejoy et al., 2000). A more comprehensive model incorporating parental depression, parenting, and child depression from early childhood through adolescence could reveal distinct pathways that show change across different developmental periods.

Gaps in prior literature

Although reciprocal relations among parental depression, parenting, and child depression have been theorized frequently, empirical investigation is surprisingly lacking. The current study extends the field by addressing a number of gaps in the prior literature. First, no study to our knowledge has examined reciprocal models of child depressive symptoms and *each* parent's depression and parenting measured repeatedly from early childhood through adolescence. Considering the relations

between child depression and their mother's and father's depression would allow for an examination of how childhood depression may be transmitted differently through mothers and fathers at different points in development; these pathways would be critical for informing family-focused interventions approaches. Second, prior longitudinal work has largely used three timepoints and thus tested one mediating variable. Study designs with 4 or more repeated assessments allows for an examination of serial mediation and the temporal unfolding of parental depression, parenting, and child depression throughout development. Last, most prior work focused on one developmental period (early childhood, middle childhood, or adolescence), despite evidence that parenting may impact youth differently throughout development (Kobak et al., 2017; Maccoby, 2000) and depressive symptoms tend to increase from childhood through adolescence (Gaffrey et al., 2018; Luby et al., 2014).

The current study

The current study examines reciprocal relations among parental depression, negative parenting and child depression in a community sample of 609 children from the Stonybrook Temperament Study (SBTS), a longitudinal study following a large cohort from age 3 to 15 years old with assessments every 3 years (Klein & Finsaas, 2017). These repeated assessments afford us a unique opportunity to examine reciprocal associations across multiple developmental periods. Using the SBTS, we previously reported that maternal, but not paternal, parenting mediated the longitudinal association between age 3 depressive symptoms and age 9 depressive symptoms (Allman et al, in press) and between parental depression history and age 9

externalizing symptoms, but not age 9 internalizing symptoms (Kopala-Sibley et al., 2017).

We are extending this work by conducting two models to examine reciprocal relations among: 1) child depression, maternal depression, and maternal negative parenting and 2) child depression, paternal depression, and paternal negative parenting from ages 3 to 15 years old. We focused on negative parenting, given evidence in the literature that hostile, negative parenting is a particularly salient dimension that impacts child depression (Griffith et al., 2019; Kuckertz et al., 2018; Yap et al., 2014). We hypothesized that child depression and parental depression would reciprocally influence one another over time from ages 3 to 15 and parental negative parenting would mediate these associations. We did not make hypotheses about whether child depression and parental negative parenting would reciprocally influence one another from ages 3 to 15, given limited and mixed evidence in the prior literature.

As an exploratory aim, we explored child sex as a moderator, but did not have specific hypotheses about the nature of associations with child sex. Sex differences have been identified in child depression, parental socialization, and children's responses to negative parenting (Endendijk et al., 2017; Goodman et al., 2011; Lewis et al., 2015; McIntyre & Edwards, 2009), yet prior work examining sex differences in reciprocal models have been mixed (Allman et al., in press; Mennen et al., 2018; Tyrell et al., 2019). Thus, we will examine whether our models differ for males and females. See Appendix 1 for an expanded literature review.

Chapter 2: Methods

Participants

Participants were selected from the Stony Brook Temperament Study (SBTS), a longitudinal study examining the role of early temperament on the development of internalizing disorders (for detailed description of the study sample and recuitment see Klein & Finsaas, 2017). Families with a 3-year-old child were recruited within 20 contiguous miles of Stony Brook University and identified via commercial mailing lists. Eligible families had a child between 3- and 4-years old with no developmental disabilities or serious medical conditions and at least one English-speaking biological parent. The study was approved by the human subjects review committee. Parents provided informed consent and children ages 9 and older provided assent. Families were financially compensated for participating in the study.

Participants were assessed at ages 3 (*M*= 3.55 years, *SD*=.26), 6 (*M*=6.11 years, *SD*=.44), 9 (*M*=9.23 years, *SD*=.42), 12 (*M*=12.66 years, *SD*=.46), and 15 (*M*=15.25 years, *SD*=.41) years-old. At baseline, 559 families entered the study. At the age 6 assessment, an additional 50 minority/non-White families were recruited to increase the diversity of the sample. At all timepoints, mothers and fathers completed a measure about their depressive symptoms and parenting. At ages 3 and 6 assessments, parents completed an interview about their child's depressive symptoms and at the ages 9 through 15 assessments, both a parent and their child completed an interview about their child's depressive symptoms. We had data on all children's depressive symptoms at one or more timepoints (*n*=609, 45.2% female). See Table 1 for demographic information and sample characteristics.

There were 385 children for whom there was complete data at age 3 for all variables, including both mother and father depression and parenting. Those with at least some missing data did not differ significantly from the remainder of the sample with complete data on any variables of interest (all *p*s > .05). Little's MCAR test (Little & Rubin, 1989) confirmed that missingness was unrelated to any variable in our study: χ^2 (7968) = 7975.88, p = .473. Maximum likelihood (ML) procedures were therefore considered appropriate for modeling the missing data (Schafer & Graham, 2002).

Measures

Parental depressive symptoms. Across all waves, mothers and fathers (mothers: 3: *n*=473, 6: *n*=470; 9: *n*=482, 12: *n*=469, 15: *n*=449; fathers: age 3 n=398, age 6 *n*=365 9: *n*=410, 12: *n*=370, 15: *n*=365) completed the 19-item Diagnostic Inventory for Depression (DID; Zimmerman et al., 2004). The DID is a self-report scale used to assess symptoms of DSM-IV depressive symptoms in adults. The DID has achieved high levels of internal consistency, test-retest reliability, and construct validity and is a valid measure of symptom change over time (Zimmerman et al., 2004). In the current sample, internal consistency was excellent at all timepoints (α's collapsed across parents; *Median*= α=.88, *range*=α=.85-.90).

Parenting behaviors. At ages 3 (mothers: *n*=496; fathers: *n*=398) and 6 (mothers: *n*=470; fathers: *n*=367) mothers and fathers completed the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson et al., 2001) to assess their parenting styles. The PSDQ is a 37-item self-report measure that assesses three styles of parenting for young children: authoritative, authoritarian, and permissive parenting

(PSDQ; Robinson et al., 2001). In the current study, we used the 12-item Authoritarian Parenting subscale, which captures high levels of parental control and low levels of responsiveness, is considered a negative parenting style in European-American/ White families (Baumrind, 1971). Reliability in the current sample was good across parents and timepoints (α's range=.74-.77, *Median* α= .76).

At ages 9 (mother: *n*=482; fathers: *n*=410), 12 (mother *n*=469, fathers: *n*=376), and 15 (mothers *n*=449; fathers: *n*=369), mothers and fathers each reported on their own parenting style using a modified version of the Children's Report of Parent Behavior Inventory (CRPBI; Schaefer, 1965; Schludermann & Schludermann, 1970). The CRPBI is a 30-item questionnaire assessing parenting practices and behaviors with children and adolescents. Although it was originally designed for youth to complete, we used a parent version that was administered to mothers and fathers. The CRPBI assesses three parenting dimensions that map onto Baumrind's model: acceptance (authoritative parenting), psychological control (authoritarian parenting), and lax discipline (permissive parenting) (Baumrind, 1967; Baumrind, 1971). For this study, we used the psychological control (authoritarian parenting) subscale to measure high levels of parental control and low responsiveness (negative parenting). The CRPBI has been demonstrated to have good internal consistency and test-retest reliability and validity in prior work with the child- and parent-report versions (Alderfer et al., 2008; Schaefer, 1965; Schwarz et al., 1985). The psychological control parenting dimension showed acceptable to good reliability in the current sample across parents and timepoints (α's range =.70-.75, *Median* α=.74).

Child depressive symptoms. Children's depressive symptoms were assessed with age-appropriate semi-structured interviews. At ages 3 (*n*=541) and 6 (*n*=462), parents (age 3: 98.0% mothers, age 6: 92.8% mothers) were interviewed using the Preschool Age Psychiatric Assessment (PAPA; Egger et al., 2006; Egger & Angold, 2004), a parent-reported clinical interview that assesses emotional and behavioral problems in preschool age children during the past 3 months. Each item was coded as present (a rating of 2 or 3 on a 3-point scale) if the behavior was intrusive, interfering, and generalizable across activities at a threshold level. Current symptoms of depression coded as present were summed to create a current depressive symptoms scale at each time point (age 3: *M*=1.95, *SD*=2.29, *range*=0-20; age 6: *M*=4.17, *SD*=3.37, *range*=0-21). Doctoral students in clinical psychology and a master's-level clinician administered interviews. Internal consistency and inter-rater reliability, based on independent raters of audiotapes, was excellent (age 3: α =.72, intra class correlation [ICC]=.98, *n*=21; age 6: α= .74, ICC=.95, *n=35*).

At ages 9 (*n*=488), 12 (*n*=476), and 15 (*n*=458), one parent (age 9: 92.2% mothers, age 12: 89.5% mothers, age 15: 91.3% mothers) and the youth were interviewed about the youth's depressive symptoms using the Kiddie-Schedule of Affective Disorders and Schizophrenia-Present and Lifetime (K-SADS-PL; Axelson et al., 2009). Doctoral students in clinical psychology and a master's-level clinician administered the K-SADS first to the parent and then to the child. Further information was obtained to reconcile discrepancies. Summary ratings for each symptom were derived based on the combination of parent and child reports. Administration of the K-SADS was supervised in a group format by an experienced child psychiatrist and

licensed clinical psychologist. Current symptoms of any depression were rated on a 3-point scale (0=not present; 1=subthreshold; 2=threshold) and were summed to create a current depressive symptoms scale at each time point (α range=.84-.98). To assess interrater reliability, a second rater independently rated videotapes (*n*=74 videotapes at age 9 and *n*=25 videotapes at ages 12 and 15). ICCs for the depressive scale ranged from .76 to .97.

Data analysis plan

Analyses were conducted using Mplus Version 8. Two separate cross lagged panel models (CLPM) were used to examine relations among 1) maternal depressive symptoms, maternal negative parenting, and child depressive symptoms and 2) paternal depressive symptoms, paternal negative parenting, and child depressive symptoms[1]. In each model, all waves of data were included and all variables were entered simultaneously to examine unique relations among parental depressive symptoms, parenting, and child depressive symptoms, while controlling for the other variables. Models were examined separately for mothers and fathers.

In each model, stability paths were included for each construct across timepoints (e.g., from age 3 child depression to age 6 child depression) and all variables within each time point were covaried. For parental depression, it is reasonable to assume stationarity; that is, the degree to which parental depression produces change in parental depression should remain the same over time (Cole & Maxwell, 2003). Thus, we applied equality constraints on paths estimating the

[1] As a supplementary analysis, we also examined relations among parental depression and parenting. See Appendix 2 for a detailed description and results of this model.

stability in mother's and father's depressive symptoms across adjacent waves, given relative stability of depressive symptoms in adults (Moffitt et al., 2010). These equality constraints are useful because multiple lags are aggregated into a single lagged effect, providing smaller standard errors, more precise estimates, and greater statistical power. We did not apply equality constraints for child depression, as child depressive symptoms tend to increase from childhood to early adolescence (Charles & Fazeli, 2017; Costello et al., 2005) and thus temporal stability in child depression may vary across waves. Serial indirect effects were estimated via bootstrapping procedures (Hayes & Rockwood, 2017).

As measures of goodness of fit, chi-square, the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR) will be used. Generally, CFI values greater than .90 (Hoyle & Panter, 1995), and a RMSEA and SRMR of less than .08 (Kline, 1988) indicate acceptable fit.

As an exploratory analysis, we also examined child sex as a moderator. Differences in effects across child sex were examined via multigroup models. All paths were initially constrained to be equal across groups. The fit of this model was then compared to the fit of a model in which these paths were free to vary across groups. A significant improvement in model fit would indicate that at least some paths are significantly moderated by group (i.e., child sex). See Appendix 1 for an expanded method.

Chapter 3: Results

There was no evidence of multicollinearity among variables of interest (Tolerance > .50, VIF <2.5).

Model Fit

Model 1: Mother and Child model: Relations among maternal depression, parenting, and child depression (Figure 1). The mother and child model yielded the following fit statistics: $\chi 2$ (57, N = 599) = 137.27, p<.001, CFI = .962, RMSEA = .048, 95% confidence interval
(95% CI) [.038, .059], SRMR = .044. This model demonstrated excellent fit to the data.

Model 2: Father and Child model: Relations among paternal depression, parenting, child depression (Figure 2). The father and child model yielded the following fit statistics: $\chi 2$ (48, N = 592) = 130.14, p<.001, CFI = .921, RMSEA = .054, 95% confidence interval
(95% CI) [.043, .065], SRMR = .060, demonstrating acceptable fit to the data.

Child sex analyses

We next used a multi-group design to examine whether each model differed for males and females. Chi-square difference tests revealed that none of the models varied significantly as a function of child sex. See Appendix 3 for a detailed description of the multi-group analyses.

Direct effects

Model 1: Mother and child direct effects. See Figure 1 for significant direct effects among child depression, maternal depression, and maternal parenting. Child depression at 6 predicted greater maternal depression and greater maternal negative parenting at age 9. Maternal depression at age 3 predicted greater child depression and greater maternal negative parenting at age 6. Maternal negative parenting at age 12 predicted greater maternal depression at age 15.

Model 2: Father and child direct effect. As shown in Figure 2, greater child depression at age 3 predicted greater paternal negative parenting at age 6. There were no other direct effects among paternal depression, parenting, and child depression.

Indirect effects: Examination of reciprocal relations from early childhood to adolescence

Model 1: Mother and child indirect effects **(Figure 1)**. Maternal depression at age 3 predicted greater child depression 15 via a serial indirect effect involving child depression at ages 6, 9, and then 12 ($\beta = .015$, $p < .05$, 95% CI [.001, .055]). The reciprocal relation was also significant: child depression at age 3 predicted greater maternal depression at age 15 via a number of pathways: 1) via greater child depression at age 6, which led to greater maternal negative parenting at ages 9 and 12 ($\beta = .005$, $p < .05$, 95% CI [.001, .014]) and 2) via greater child depression at ages 6, which led to greater maternal depression at ages 9 and 12 ($\beta = .061$, $p < .05$, 95% CI [.036, .099]).

Maternal depression at age 3 predicted greater maternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at ages 6, 9, and 12 ($\beta = .048$, $p < .05$, 95% CI [.005, .091]) and 2) via greater child depression at

age 6, which led to greater maternal negative parenting at ages 9 and 12 (β = .036, p < .05, 95% CI [.018, .064]). The reciprocal effect was also significant: negative maternal parenting at age 3 predicted greater maternal depression at age 15 via greater negative maternal parenting at ages 6 through 12 (β = .030, p < .05, 95% CI [.001, .069]).

We also found a significant pathway for maternal depression over time: maternal depression at age 3 predicted greater maternal depression at age 15 via multiple pathways: 1) via greater child depression at age 6, which in turn led to greater negative maternal parenting at ages 9 and 12 (β = .003, p < .05, 95% CI [.001, .010]) and 2) via greater child depression at age 6, which led to greater maternal depression at ages 9 and 12 (β = .038, p < .05, 95% CI [.020, .071]).

Child depression at age 3 predicted greater maternal negative parenting at age 15 via a number of pathways: 1) via greater child depression at age 6, which led to greater maternal negative parenting at ages 9 and 12 (β = .058, p < .05, 95% CI [.031, .089]) and 2) via greater child depression 6, which led to greater maternal depression at ages 9 and 12 (β = .005, p < .05, 95% CI [.001, .016]). There was no significant reciprocal relation from maternal negative parenting at age 3 to child depression at age 15.

Model 2: Father and child indirect effects **(Figure 2).** Paternal depression at age 3 predicted greater paternal negative parenting at age 15 via greater paternal negative parenting at ages 6, 9, and 12 (β =.047, p < .05, 95% CI [.006, .103]). The reciprocal effect was also significant: paternal negative parenting at age 3 predicted

greater paternal depression at age 15 via greater paternal depression at ages 6, 9, and 12 (β =.025, p < .05, 95% CI [.001, .074]).

Child depression at age 3 predicted greater paternal negative parenting at age 15 via greater paternal negative parenting at ages 6 through 12 (β =.079, p < .05, 95% CI [.030, .145]). However, paternal negative parenting at age 3 did not predict child depression at age 15.

Sensitivity analyses

We conducted a number of sensitivity analyses and presented them in Supplementary Materials. First, we controlled for parental education to assess whether accounting for socioeconomic status (SES) influenced our models, given that SES has consistently been linked to child depression, parental depression, and parenting in prior work (Kaiser et al., 2017; Sullivan et al., 2019). Results were similar after controlling for parental education. Next, we examined all models with a subsample of White, non-Hispanic participants only. Because our sample was largely White and non-Hispanic, we did not have the power to examine differences across each racial/ethnic group. Collapsing across racial and ethnic minority groups could risk overlooking racial/ethnic minority group differences (Burlew et al., 2019). Thus, conducting our analyses with the White, non-Hispanic subset of our sample served to remove noise attributed to culture and assess whether our results were driven by, and should only be generalized to, the majority group. Our results were largely similar, and more robust, with the White only subsample, suggesting that the findings may be driven by this subsample. Finally, we examined both models with parental positive parenting, instead of negative parenting, to examine whether these effects were

specific to parental negative parenting. Models with positive parenting were largely similar. However, we found fewer significant indirect effects in the models with positive parenting. See Appendices 4 -6 for more details on these models.

Chapter 4: Discussion

Despite much theoretical interest, this was the first study to empirically test reciprocal relations among mother's and father's depression, parenting, and child depression from early childhood through adolescence. Our results supported reciprocal relations between maternal and child depression: maternal depression at age 3 predicted greater child depression at age 15 and child depression at age 3 predicted greater maternal depression at age 15 via a number of mediating pathways. Contrary to hypotheses, we did not find evidence of reciprocal relations between paternal depression and child depression and pathways between paternal depression and youth depression were not observed. Moreover, while child depression at age 3 led to greater maternal and paternal negative parenting from ages 3 to 15, this effect was not reciprocal. Our findings highlight mediating pathways across development in parent depression and youth depression.

Parental depression and youth depression

Our reciprocal findings between mothers and children support theoretical models that mothers and children mutually influence one another and increase each other's risk for depression (Coyne, 1976; Sameroff, 2010). Our findings are also consistent with prior empirical studies in young children showing reciprocal relations between maternal depression and child internalizing symptoms (Hails et al., 2018; Kuckertz et al., 2018; Wiggins et al., 2014). We extend this work by identifying serial mediators in these reciprocal relations from early childhood to adolescence. We found

a significant pathway from maternal depression at age 3 to child depression at age 15 via greater child depression at ages 6 through 12. Contrary to our hypothesis, child depression, and not maternal parenting, mediated relations from maternal to youth depression, suggesting that maternal depression directly increases children's risk for depression throughout childhood and adolescence. This pathway is consistent with prior longitudinal studies with three timepoints that largely did not identify parenting as a mediator in the relation between parental depression and child depression (Hails et al., 2018; Kopala-Sibley et al., 2017; Villodas et al., 2018). While these studies focused on a single developmental period (early childhood or middle childhood) and did not test other mediators in this relation, our work focused on multiple developmental periods (from preschool to adolescence) and identified child depression as a serial mediator in the relation from maternal to youth depression. Our findings demonstrate that once maternal depression influences child depression, child depression continues to influence itself throughout childhood and adolescence (Gaffrey et al., 2018; Luby et al., 2014). This finding is consistent with research suggesting that mothers transmit depression to their youth directly, rather than through parenting because they may be effective at compartmentalizing their depressive and parenting behaviors (Cummings, Goeke-Morey, & Raymond, 2004; Stevenson et al., 2014). There are likely other mediators in the link from maternal depression to youth depression, including interactions among children's biological and other environmental factors (Goodman, 2007; Natsuaki et al., 2014). Research should also investigate child-level mediators, including emotion regulation, cognitive

vulnerabilities, and life stressors that maintain youth depression throughout development.

Interestingly, child depression at age 3 predicted greater maternal depression at age 15 via multiple pathways, one of which involved maternal negative parenting. Specifically, child depression at age 3 led to greater child depression at age 6, which led to greater maternal negative parenting at ages 9 to 12, which finally led to increased maternal depression at age 15. This pathway is consistent with prior work demonstrating that adolescent depression led to greater maternal depression via poorer maternal parenting (Hou et al., 2020) and theoretical models that posit children with depression elicit negative parenting behaviors (Sameroff, 2009, 2010). Parents, especially those with a biological loading for internalizing problems (i.e., often those whose young children show depressive symptoms (Goodman et al., 2011), may ruminate on their negative parenting behaviors, increasing their risk for depression (Coyne, 1976; Sameroff, 2009, 2010). Child depression at age 3 also led to greater maternal depression at age 15 through a second pathway: greater child depression at age 6, which led to greater maternal depression at ages 9 through 15. It is notable that both significant pathways showed stability from age 3 to 6 in child depression, at which point child depression impacted maternal parenting or maternal depression symptoms. Childhood depression around age 6 may be a particularly salient age for influencing maternal behaviors for a number of reasons. First, this finding may reflect mother's negative reactions to their children's rare and possibly concerning depressive symptoms at such a young age, as depression that lasts from ages 3 through 6 may not be as transient as the parent expected (Luby et al., 2014). Another

explanation may be that in young children, depression tends to manifest with increased irritability, anger, and externalizing behaviors that may influence mother's responses and moods in more extreme ways than later childhood/adolescent depression, characterized by low mood and withdrawal (Luby et al., 2014). These externalizing behaviors may be more challenging for parents and create more family stress. Furthermore, early childhood depression that persists may also be more disruptive to the family environment. Finally, this pattern may be a function of the substantial time spent between mothers and young children and thus, greater influence children's depressive symptoms have on mothers' behaviors (Bowlby, 1979).

In contrast to findings with mothers, no reciprocal indirect relations were observed between paternal depression and child depression and pathways between paternal and child depression were not observed in either direction. This is consistent with some work suggesting that maternal depression has a stronger influence on young children's internalizing symptoms than paternal depression (Connell & Goodman, 2002; Hou et al., 2020; Weijers et al., 2018). Although our findings didn't support this, some work has found that fathers may have a greater influence on their youth's depression at later stages of development relative to earlier stages of development, whereas mothers' influences on youth's depression may remain stable into early adulthood (Connell & Goodman, 2002; Tyrell et al., 2019). Future research with a longer follow-up period into early adulthood may be beneficial. It is possible that this difference reflects the mother's more common role as the primary caregiver who spends more time with her children earlier in their development. Another

possibility is that at younger ages, fathers may transmit risk for depression through paternal externalizing psychopathology. Weijers and colleagues (2018) found that paternal externalizing psychopathology predicted greater youth internalizing symptoms more strongly than maternal or paternal internalizing symptoms in a study of youth ages 6-20 years old. It will be important for future work to consider other forms of parental psychopathology.

Parental depression and parenting

We also found a reciprocal relation between maternal depression and maternal negative parenting and between paternal depression and paternal negative parenting: both maternal and paternal depression at age 3 led to greater maternal and paternal negative parenting at age 15, respectively and maternal and paternal negative parenting at age 3 led to greater maternal and paternal depression at age 15, respectively via a number of pathways. Both mothers and fathers with depression were more likely to use negative parenting behaviors early in their children's lives and maintain these negative behaviors throughout their child's development. In turn, mothers and fathers who used negative parenting strategies early in their child's development developed greater symptoms of depression, but did so at different points in their youth's development. Mothers who used negative parenting strategies early in their child's development maintained these negative behaviors throughout their child's development and were at increased risk for developing depressive symptoms when their youth transitioned to adolescence. Fathers who used negative parenting strategies early in their child's development were at increased risk for developing depressive symptoms early in their child's life and maintained these depressive

symptoms throughout their child's development into adolescence. These pathways may suggest that although mothers and fathers experience similar impacts of depression on their parenting behaviors and vice versa, they also function differently within families; this is possibly due to differences in amounts of time spent with their children or sex differences in stress responsivity. These subtly different pathways may help to explain why mothers and fathers have different kinds of influences on their children's depressive symptoms throughout development.

Parenting and child depression

Interestingly, child depression at age 3 led to greater maternal and paternal negative parenting at age 15, but this effect was not reciprocal. The pathways from child depression to maternal parenting differed from the pathway to paternal parenting. There were two significant pathways from child depression to maternal negative parenting. First, child depression at age 3 predicted greater child depression at age 6, which led to greater maternal negative parenting at ages 9 through 15. Second, child depression at age 3 predicted greater child depression at age 6, which led to greater maternal depression at ages 9 and 12, which led to greater maternal negative parenting at age 15. Interestingly, this second pathway highlights the role of maternal depression in mediating links between child depression and maternal negative parenting. There was one significant pathway from child depression to paternal negative parenting. Child depression at age 3 predicted greater paternal negative parenting from ages 6 through 15 years old. These findings, along with prior work (Hails et al., 2018; Hipwell et al., 2008; Hou et al., 2020; Kuckertz et al., 2018; Reitz et al., 2006; Wiggins et al., 2014, 2015), provides further support for effects of

child depression in early childhood on later parenting, emphasizing the importance of conceptualizing children as having impactful influences on their parents throughout development.

Strengths and limitations

This work has several strengths, including the use of longitudinal repeated assessments of parental depression, parenting, and child depression from the preschool period to adolescence, which allowed us to test reciprocal effects and serial mediators. We also used dimensional scores to capture the full continuum of each of these constructs and the full range of symptoms. Moreover, we measured youth depression using a multi-informant from ages 9 to 15 years old, semi-structured clinical interview that was sensitive to the developmental level of our sample. Clinical interviews may also be more accurate at capturing clinically-elevated symptoms, particularly in children, given trained interviewers could distinguish clinically significant from typical variations in children's behaviors and code accordingly (Bufferd et al., 2011).

Our findings are not without limitations. First, the current study was conducted with a community sample of largely White and educated families, limiting the generalizability of our findings to more diverse samples and clinical settings. Second, although we used a parent-report parenting measure at all timepoints to maintain the same informant across all waves, the measure may be limited by potential parents' biases of their own parenting styles (Althubaiti, 2016). Third, Baumrind's parenting dimensions were determined in European-American/White families and aggregate a number of parenting behaviors (e.g., warmth, control) that

may not accurately map onto parenting styles across different racial/ethnic groups (Bean et al., 2006; Bornstein, 2012). Future studies should examine specific parenting behaviors (e.g., warmth, control) in more diverse samples (Bean et al., 2006). Fourth, because we collected data every three years of children's development, our model makes certain assumptions about the timing of the effects. The three-year assessments may have missed important changes taking place in shorter intervals of time. For example, it is possible that mother's depression predicts behavior, which may in turn impact children's depression, but not behavior and depression that are separated in time by 3 years. Fifth, given that we used different clinical interviews to measure child depression over time and our parenting measure changed at different timepoints, we were not able to partial out within- and between-person associations. An important avenue for future research is to employ random-intercept cross lagged panel models (RI-CLPM; Hamaker et al., 2015) with the same measures over time to examine within-person changes in parental depression, parenting, and youth depression from early childhood through adolescence. Parsing within-person reciprocal effects would capture how parental depression, parenting, and youth depression fluctuate within the same individual over time (Curran & Bauer, 2011; Wang & Maxwell, 2015). This approach may reveal unique associations between parental and youth depression over time. For example, when examining within-person effects, Tyrell and colleagues (2019) found that while maternal depressive symptoms in adolescence predicted greater youth internalizing symptoms in young adulthood, paternal depression in adolescence predicted fewer youth depressive symptoms in young adulthood. To identify whether these findings extend to younger children,

more work is needed examining within-person reciprocal relations among maternal depression, paternal depression, and youth depression from early childhood through adolescence.

Conclusions

The current study was the first to examine reciprocal relations among parental depression, parenting, and child depression from early childhood through adolescence. Maternal depression and youth depression reciprocally influenced one another from ages 3 through 15 years old through a number of serial mediating pathways, involving child depression and maternal negative parenting. In contrast, we did not find effects between paternal depression and youth depression in either direction. Moreover, child depression at age 3 led to greater maternal and paternal negative parenting from ages 3 to 15, but this effect was not reciprocal. Our findings support theoretical models that posit while parents with depression interact with children in ways that may increase risk for child depression, child depressive symptoms also impact parents' behaviors and increase their risks for depressive symptoms.

We furthered the field by identifying serial mediators in links between parental and child depressive symptoms. These pathways may aid in the identification of risk factors for depression in families and the development of family-focused interventions. Based on our results, it may be beneficial to target maternal depression, rather than parenting, to reduce depressive symptoms in mothers and youth. Prior intervention work has shown that targeting parental depression improves youth depressive symptoms (Gunlicks & Weissman, 2008; Weissman et al., 2015). Future

work should examine the benefits of targeting both maternal and youth depression across multiple developmental stages and how they reciprocally improve depression in one another over time with the ultimate goal of reducing the burden of depression within families.

Appendices

Table 1.
Sample characteristics (n=609).

	Age 3 *n*=543	**Age 6** *n*=517	**Age 9** *n*=491	**Age 12** *n*=482	**Age 15** *n*=464
Child mean age: years	3.56 (.26)	6.11 (.44)	9.23 (.42)	12.66 (.46)	15.25 (.41)
SD; range	2.93-4.18	5.13-7.67	8.38-11.00	11.50-14.17	14.44-17.65
Mother's mean age:	36.02 (4.46)				
years SD; range	20-49				
Father's mean age:	38.29 (5.41)				
years SD; range	22-60				
Child sex[a]: female *n* (%)	248 (45.7)	234 (44.9)	226 (46)	225 (6.8)	201 (43.7)
Child race[a]: *n* (%)					
White	513 (94.5)	458 (87.9)	437 (89)	431 (89.6)	414 (90)
Black/African-American	14 (2.6)	48 (9.2)	40 (8.1)	34 (7.1)	32 (7)

Asian	11 (2)	14 (2.7)	13 (2.6)	13 (2.7)	10 (2.2)
Multiracial/other	5 (.9)	1 (.2)	1 (.2)	3 (.6)	4 (.9)
Child Hispanic ethnicity[a]: *n* (%)	50 (9.2)	67 (12.9)	61 (12.4)	62 (12.9)	59 (12.8)
Biological parents' marital status[a]: *n* (%)					
Married	510 (94.1)	459 (88.6)	436 (89.2)	434 (90.4)	413 (90.4)
Divorced, separated, or widowed	12 (2.2)	18 (3.5)	18 (3.7)	17 (3.5)	11 (2.4)
Never married	20 (3.7)	41 (7.9)	35 (7.2)	29 (6)	33 (7.2)
At least one parent with a 4-year college degree[c] *n* (%)	368 (68)	341 (66)	324 (66.4)	327 (68.3)	296 (64.9)
Household income[a]: median	$70,000-$90,000				
Parental depression, parenting, and child depression					
Maternal depressive symptoms	5.46 (5.34) 0-27	5.02 (5.71) 0-35	4.15 (6.00) 0-43	3.80 (5.14) 0-36.88	4.17 (5.19) 0-43
Paternal depressive symptoms	4.48 (5.61) 0-44	4.62 (5.90) 0-36	3.80 (5.38) 0-48	4.25 (5.68) 0-40	4.31 (5.90) 0-40

Child depressive symptoms	1.95 (2.29)	4.17 (3.37)	.56 (1.81)	.42 (1.66)	.70 (2.65)
	0-20	0-21	0-17	0-18	0-22
Maternal authoritarian parenting	19.95 (4.33)	19.81 (4.15)	4.66 (2.60)	3.97 (2.85)	4.19 (2.98)
	12-40	12-39	0-15	0-17	0-18
Paternal authoritarian parenting	20.43 (4.66)	20.38 (4.68)	4.77 (2.75)	4.11 (2.77)	3.92 (2.80)
	12-38	12-38	0-14	0-18	0-17

Notes: Child depression was assessed using the Preschool Age Psychiatric Assessment (PAPA) at ages 3 and 6 and the Kiddie Schedule of Affective Disorders (K-SADS) at ages 9-15 years old. Parental depression was assessed using the Diagnostic Inventory of Depression (DID) at all timepoints. Parenting was assessed using the Parenting Styles and Dimensions Questionnaire (PSDQ) at ages 3 and 6 and the Children's Report of Parent Behavior Inventory (CRPBI) at ages 9-15 years old. [a]Child sex coded: 1=male; 2=female; [b]parental education coded: 0=neither parent with college degree; 1=at least one parent with college degree.

Figure 1. Cross-lagged panel analyses for child depressive symptoms, maternal depressive symptoms, and maternal negative parenting.
Notes: Standardized values presented (*B*). Bolded paths are involved in indirect pathways. All cross lagged paths were included in analyses and significant ones or those involved in indirect pathways are presented in this figure for readability. Covariances are not shown in this figure, but were included between all variables measured in the same assessment wave. *** $p<.001$, ** $p<.01$, * $p<.05$.

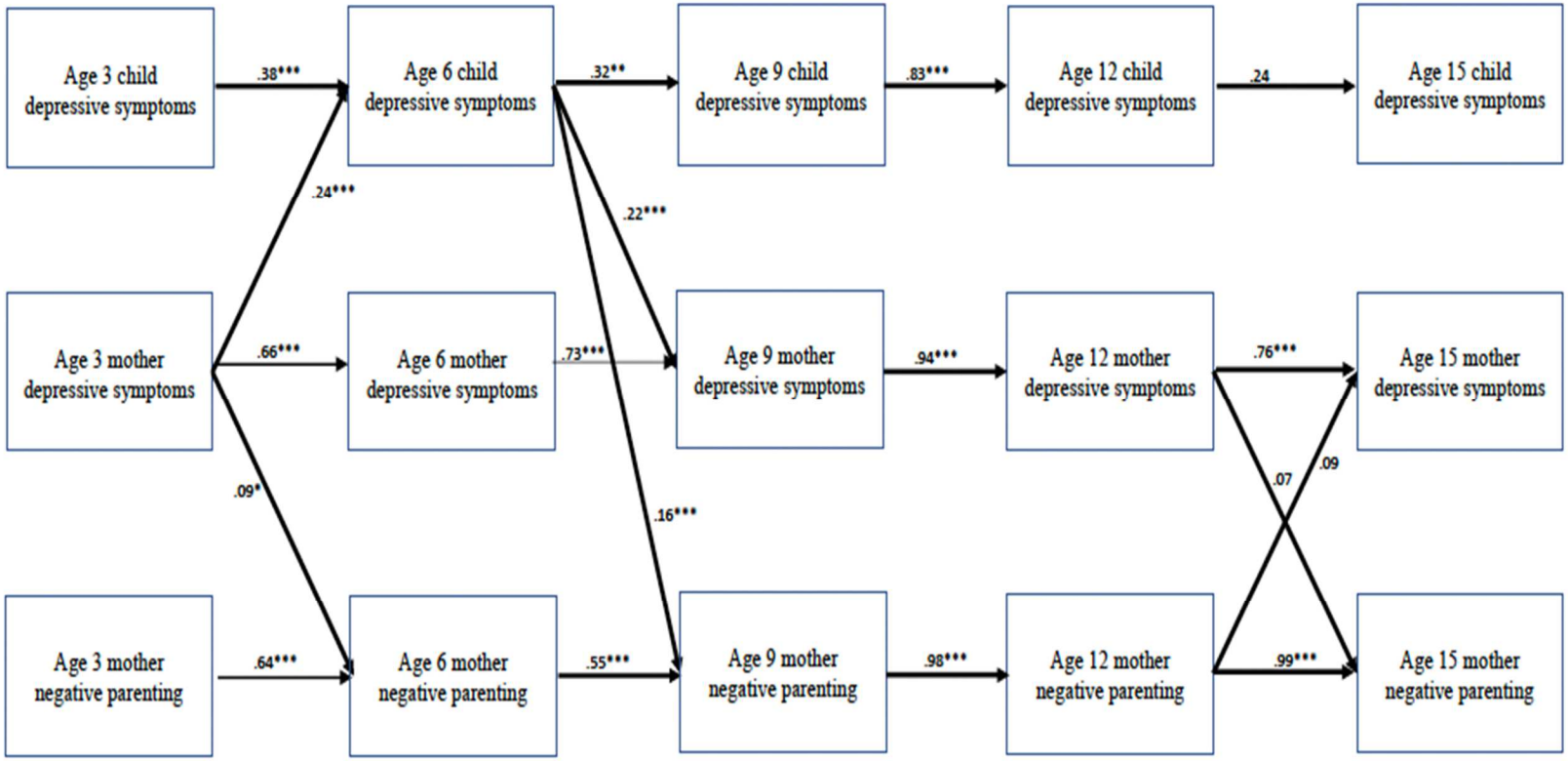
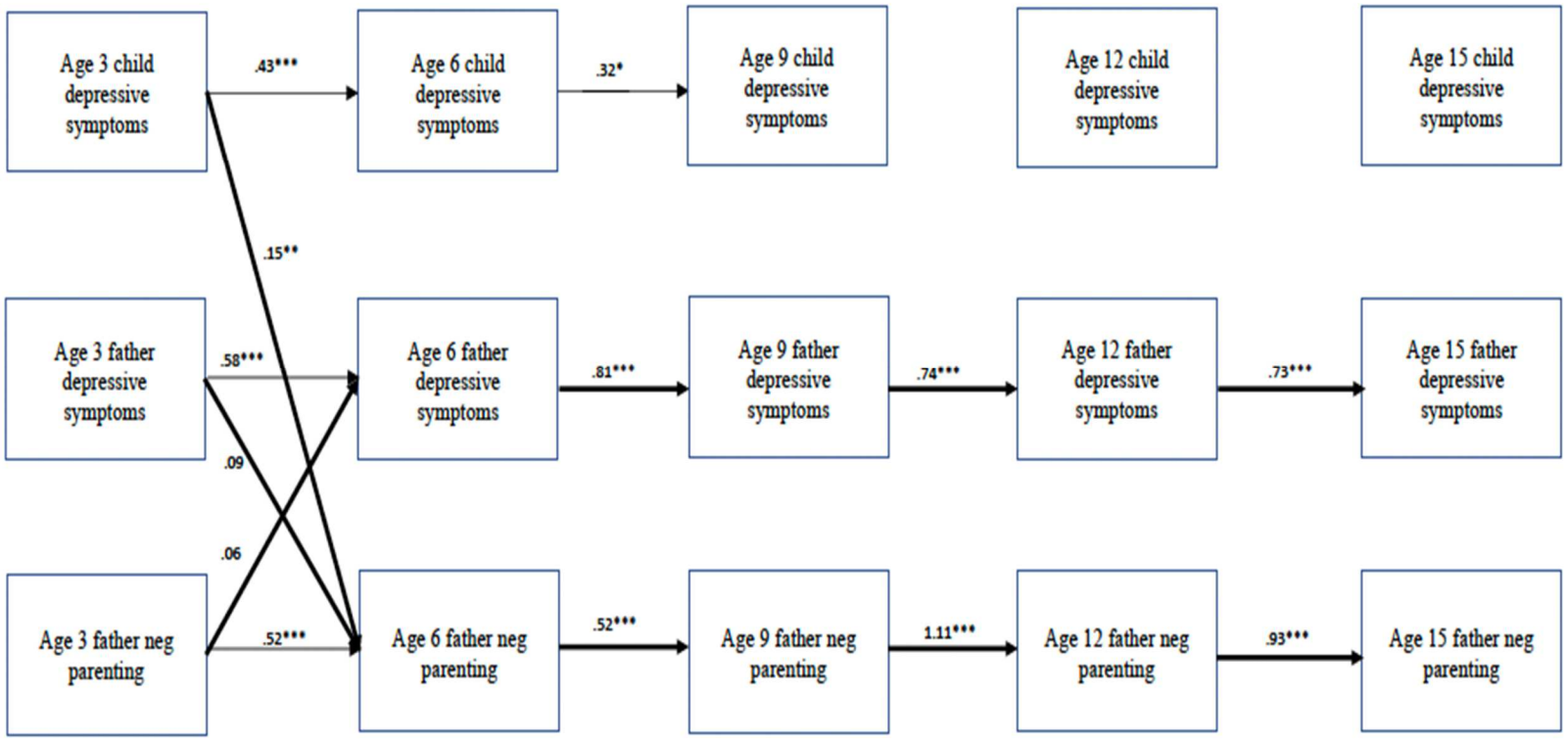


Figure 2. Cross-lagged panel analyses for child depressive symptoms, paternal depressive symptoms, and paternal negative parenting.
Notes: Standardized values presented (*B*). *B* >1 are a reflection of collinearity (but not multicollinearity). Bolded paths are involved in indirect pathways. All cross lagged paths were included in analyses and significant ones or those involved in indirect pathways are presented in this figure for readability. Covariances are not shown in this figure, but were included between all variables measured in the same assessment wave. ** $p < .01$, * $p < .05$.



Appendix 1. Expanded Introduction and Method

In the U.S., more than 15 million children live with an adult who has experienced major depression (England & Sim, 2009); this is concerning because these children have a three-fold risk for developing depression themselves compared to offspring of nondepressed parents (Weissman et al., 2006, 2016). Furthermore, by the time they are 18 years old, about a fourth of all children will have experienced clinically significant depression, making depression among the most prevalent psychiatric problems among youth (McLeod et al., 2007). Most work has examined effects of parental, largely maternal, depression on child symptoms and the mediating role of negative parenting (England & Sim, 2009; Weijers et al., 2018). However, much less work has examined the effects of child depression on later parental depression and parenting. Theories on the interactional nature of families suggest that while parent's psychopathology influences their ability to respond to their children's strong emotions, children's behaviors also elicit responses from their parents, which may further impact parent's and children's moods (Coyne, 1976a; Eberhart & Hammen, 2006; Hammen, 1991, 1992; Sameroff, 2009, 2010). Thus, research is needed to examine reciprocal relations between parents' depression, parenting, and children's depression across childhood to better understand pathways of risk for depression within families and inform family-based interventions.

The transmission of depression from parents to children and parenting as a mediator

Research has consistently documented short- and long-term effects of parental depression on child symptomatology across development (England & Sim, 2009; Hammen et al., 2008; Rohde et al., 2005; Weissman et al., 2006, 2016). The transmission of depression from parents to offspring is a multifaceted process involving biological (e.g., genetics, in-utero exposure to maternal stress, brain structure and function, immune function) and environmental factors (e.g.,

maternal emotion dysregulation, parental modeling, and less positive and more negative parenting behaviors), which interact with one another to predict child outcomes (England & Sim, 2009; Goodman & Gotlib, 1999; Goodman, 2007; Natsuaki et al., 2014). Considerable research has focused on parenting behaviors as an important, modifiable mechanism in the transmission of depression from parents to children (England & Sim, 2009; McLeod et al., 2007). This work is grounded in Attachment Theory and Interpersonal Theory, which emphasize the critical role of early parenting (consistency, responsiveness) in shaping the quality of the parent-child relationship (Bowlby, 1969, 1979; Cicchetti & Toth, 1995; Coyne, 1976b). The early parent-child relationship provides the foundation upon which children learn how to interact with others, and develop emotional and cognitive functioning (Bowlby, 1969; England & Sim, 2009; Sameroff, 2009). Parents suffering from depression experience a number of symptoms and underlying cognitive impairments (e.g., anhedonia, anergia, irritability, low mood, limited affect, negative cognitive biases, etc.) that can interfere with their abilities to consistently attend to their children and use effective parenting skills during early childhood, negatively impacting children's development of emotion regulation and increasing their risk for emotional problems across development (Bowlby, 1979; Elgar et al., 2004; Goodman & Gotlib, 1999). Indeed, parental depression has consistently been linked with more hostile parenting, less warmth, less engagement, and other more negative and less positive parenting strategies that do not meet children's developmental needs (England & Sim, 2009; Foster et al., 2008; Frye & Garber, 2005; Goodman, 2007; Kopala-Sibley et al., 2017; Lovejoy et al., 2000). These negative parenting behaviors have in turn, been consistently shown to impact children's emotional well-being and increase their risk for the development of depression, with parenting explaining about 8% of the variance in child depression (Collins et al., 2000; del Barrio et al., 2016; England & Sim, 2009;

King et al., 2016; Kuckertz et al., 2018; McLeod et al., 2007, 2007; Sheeber et al., 2001). A meta-analysis of 181 studies identified lack of parental warmth, high inter-parental conflict, over-involvement, high hostility, less autonomy-granting, and low levels of monitoring as associated with depression among children (Yap et al., 2014). While more prior work has examined maternal depression, the prior work on paternal depression and parenting has found similar patterns of effects (Connell & Goodman, 2002; Gross et al., 2008; Kane & Garber, 2004; Reeb et al., 2010, 2015; Sweeney & MacBeth, 2016; Wilson & Durbin, 2010).

Parenting styles. Baumrin's (1967, 1971) three parenting styles serve as a useful framework to examine broader negative and positive parenting factors, rather than specific behaviors. Baumrin's three parenting dimensions emerge consistently in factor analyses: authoritative (high warmth and appropriate control), authoritarian (high control, low warmth), and permissive (high warmth, low control) parenting (Lee, Daniels, & Kissinger, 2006; Robinson, Mandleco, Olsen, & Hart, 2001; Robinson, Mandleco, Olsen, & Hart, 1995; Schludermann, & Schludermann, 1970; Schaefer, 1965). Research in the current sample and others has found associations between parental depression history and reduced authoritative, increased authoritarian, and increased permissive parenting in largely white middle class samples (Allmann et al., 2016; England & Sim, 2009; Kopala-Sibley et al., 2017). Low levels of authoritative parenting and high levels of authoritarian parenting (low parental warmth and high levels of hostility and withdrawal) have also been related to childhood depression in largely white middle class (del Barrio et al., 2016; King et al., 2016; Allman et al., in press).

Parenting as a mediator. Despite theoretical models (Bowlby, 1978; Bowlby, 1969) and supporting evidence of causal links from parenting to child depression (Kopala-Sibley et al., 2017; Yap et al., 2014), empirical studies testing mediation of parenting have been limited by

methodological factors. Prior mechanistic work has relied on cross-sectional designs or two data points (Elgar et al., 2007; England & Sim, 2009; Sherryl H. Goodman, 2007; Sherryl H. Goodman et al., 2011; McLeod et al., 2007; Wolford et al., 2019). However, studies testing mediation of parenting models *must* consider a developmental framework, characterized by use of large samples and at least three timepoints to establish temporal precedence (Maric et al., 2012). The use of a developmental framework is critical, as parental depression, parenting, and child depression are dynamic processes that impact each other over time throughout development; these processes can only be captured by examining the temporal unfolding of these variables. Nevertheless, only a few studies to our knowledge that examined parenting as a mediator met such criteria. One study found that parent-reported parental psychological aggression (e.g., shouting, threatening, name calling) in early childhood (age 5 years old) partially mediated the effects of maternal depression (at age 3 years old) on subsequent child internalizing symptoms (at age 9 years old; Kuckertz et al., 2018). In contrast, other work did not find evidence of mediation of observed parent-child coercion from maternal depression at age 2 to child internalizing symptoms at age 4 years old (Hails et al., 2018) or mother-reported aggression from maternal depressive symptoms in infancy to child depressive symptoms in middle childhood (Villodas et al., 2018). In sum, prior literature supports longitudinal associations between parental depression, parenting styles, and child depressive symptoms, with some evidence supporting negative parenting as a mediator of the longitudinal association between parent and child internalizing symptoms (England & Sim, 2009; Kuckertz et al., 2018; McLeod et al., 2007). Although research has examined, effects of parental depression on parenting and child depression over time, limited work has examined reciprocal pathways (i.e., parental depression to parenting to child depression *alongside* child depression to parenting to

parent depression; Davidov et al., 2015); this is particularly important given that parenting explains some, but not all of the transmission of depression from parents to offspring.

Reciprocal relations among parent symptoms, parenting, and child symptoms over time

Family systems theory, dynamic systems theory, and Sameroff's Transactional Model (2009) suggest that each member of a family influences one another in a dynamic system that contributes to each individual's outcome (Cox & Paley, 1997, 2003; Perone & Simmering, 2017). While parents interact with children in ways that impact their development, children's behaviors and responses also elicit reactions from their parents and impact their emotional wellbeing (Sameroff, 2009). Furthermore, the bioecological theory posits that the family is nested within a developmental and cultural system (Bronfenbrenner & Morris, 2006; Bronfenbrenner, 1986). Thus, reciprocal models should be examined to capture the dynamic influences of parents' and children's psychopathology over time. In the following sections, I will first define key terms to capture nuanced aspects of reciprocal associations. Second, I will review studies of reciprocal relations between parental depression and child depression and parenting behavior and child depression. Finally, I will note limitations of the prior literature on reciprocal relations.

Definitions of terms: bidirectional, transactional, and reciprocal. Studies of parent-child relations have used the following terms to describe dynamic patterns: bidirectional, transactional, and reciprocal. Although these terms tend to be used interchangeably, they capture nuanced aspects of associations between individuals. For the purposes of this study, we define bidirectional as a relation in both directions over two timepoints, such as the effects of age 3 maternal depressive symptoms on age 6 child depressive symptoms, and age 3 child depressive symptoms on age 6 maternal depressive symptoms. Transactional describes the stability of a

process overtime via a mediating variable, such as the effect of age 3 child depressive symptoms on age 9 child depressive symptoms via age 6 negative parenting. Finally, reciprocal describes both bidirectional and transactional effects unfolding simultaneously within the same set of processes, such as the simultaneous effects of 1) age 3 maternal parenting on ages 6 and 9 child depressive symptoms, and age 3 child depressive symptoms on ages 6 and 9 maternal parenting symptoms (bidirectional) and 2) age 3 child depressive symptoms on age 9 child depressive symptoms via age 6 negative parenting (transactional). For the current project, we are interested in *reciprocal* relations to capture the unfolding of all of these processes over time. When reviewing the findings below, we will highlight the research on each of these effects.

Parental depression and child depression. Some work provides support for reciprocal relations between maternal depression and child depressive symptoms in childhood (Hails et al., 2018; Kuckertz et al., 2018; Wiggins et al., 2014). Wiggins and colleagues (2014) found reciprocal relations between maternal depression and child irritability, a symptom of youth depression: Maternal depression at ages 1 and 3 predicted child irritability at ages 3 and 5, which in turn predicted maternal depression at ages 5 and 9 (transactional) and child irritability at age 3 predicted maternal depression at age 5 and vice versa (bidirectional) (Wiggins et al., 2014). The two other studies found reciprocal relations between maternal depression and child internalizing symptoms, which include depressive symptoms. Kuckerts and colleagues (2018) found that maternal depression at age 2 predicted internalizing symptoms at age 3, which in turn predicted maternal depression at age 4 and vice versa (Kuckertz et al., 2018). Similarly, Hails and colleagues (2018) found that maternal depression at age 2 predicted child internalizing symptoms at age 3, which in turn predicted increased maternal depression age 4, and child internalizing symptoms at age 2 predicted maternal depression at age 3 (Hails et al., 2018). In contrast, other

work in early childhood did not find evidence of reciprocal relations (Paquin et al., 2020; Tichovolsky et al., 2018). Although these studies found effects of maternal depressive symptoms on subsequent child internalizing symptoms from ages 1.5 to 5 years old (Paquin et al., 2020) and paternal depressive symptoms on subsequent child depressive symptoms from ages 3 to 6 years old (Tichovolsky et al., 2018), child depressive symptoms did not predict later maternal or paternal depression (no bidirectional effects). Similar patterns were observed in adolescence to adulthood. While maternal depressive symptoms predicted next wave depressive symptoms in adolescence, the bidirectional or transactional paths were not supported (Mennen et al., 2018). Similarly, while elevated rates of mothers' within-person depressive symptoms in early adolescence were associated with higher levels of youth internalizing symptoms in young adulthood, changes in youths internalizing symptoms did not affect parents' depressive symptoms. Interestingly, this study also found that increased rates of fathers' depressive symptoms in early adolescence were associated with lower levels of youth internalizing symptoms in young adulthood, although changes in youths internalizing symptoms did not affect parents' depressive symptoms (Tyrell et al., 2019). In contrast, another study found reciprocal relations between maternal and adolescent depressive symptoms (Hou et al., 2020). For mothers, adolescent depressive symptoms predicted greater maternal depressive symptoms later in adolescence, which in turn predicted increases in adolescent depressive symptoms (transactional effect); bidirectional effects between adolescent and maternal depressive symptoms were also found. Whereas for fathers, adolescent depression predicted greater paternal depression, but neither the bidirectional or transactional paths were supported (Hou et al., 2020). In sum, some prior work provides some support for reciprocal relations between maternal depression and child depressive symptoms, but not paternal depression and child depression in early childhood (Hails

et al., 2018; Kuckertz et al., 2018; Tichovolsky et al., 2018; Wiggins et al., 2014) and limited support for reciprocal effects between maternal depression and depression in adolescence (Hou et al., 2020; Mennen et al., 2018; Tyrell et al., 2019). Nevertheless, no study has examined reciprocal effects from early childhood to adolescence, when youth are at increased risk for developing depression.

Parenting behavior and child depression. The prior work on reciprocal links between parenting behavior and child depressive symptoms is similarly mixed. Although Kuckertz and colleagues (2018) and Hails and colleagues (2018) also examined relations between parenting behavior and child internalizing symptoms, neither found reciprocal effects. Instead, both studies found unidirectional effects of negative parenting on next wave child internalizing symptoms in early childhood (Hails et al., 2018; Kuckertz et al., 2018). In contrast, another study only examined and found bidirectional links over one year: negative parenting (low parental warmth and harsh punishment) predicted girls' depressive symptoms one year later, and girl's depressive symptoms predicted their parent's decreased use of warmth and increased harsh punishment over one year in girls 7-12 years old (Hipwell et al., 2008). However, a recent study in the current sample (Allman and colleagues, in press) identified a transactional, but not a bidirectional, relation in mothers, but not fathers. In mothers, child depression at age 3 led to reduced maternal authoritative parenting at age 6, which in turn led to increased child depression at age 9 (transactional effect), but maternal parenting at age 3 did not lead to child depression at 6, or to parenting at age 9 (no bidirectional effect). In fathers, there were no bidirectional or transactional effects: paternal overprotection at age 6 predicted increased child depressive symptoms at age 9, but not vice versa, and child depressive symptoms at 6 did not predict paternal parenting at age 9 (Allman and colleagues, in press). Other work did not find bidirectional or transactional relations

(and no reciprocal effects) between maternal, paternal, or composite maternal and paternal parenting and child internalizing symptoms. Two studies found that child internalizing symptoms predicted later parenting, but not vice versa (Reitz et al., 2006; Wiggins et al., 2015). Specifically, Wiggins and colleagues (2016) found that although child internalizing symptoms at age 3 predicted maternal harsh parenting at age 5, there was no bidirectional effect. There was also no support for a transactional effect, as parenting at age 5 did not in turn predict later internalizing symptoms at age 9. Similarly, Reitz et al. (2006) found that internalizing problems in adolescents predicted parental involvement one year later, but not vice versa (no bidirectional effect); this study did not examine transactional or reciprocal effects. In contrast, a study in adolescence found that although maternal and paternal physical punishment predicted increases in adolescents' depressive symptoms, adolescent depression did not predict later maternal or paternal parenting (Wang & Kenny, 2014). Distinct from all other findings, a study in the current sample did not find relations in either direction between mother's and father's parenting style (authoritarianism and permissiveness) and child internalizing symptoms from ages 3 to 9 years old (Kopala-Sibley et al., 2017). In sum, the limited prior work has found some evidence of bidirectional or transactional, but none for reciprocal (simultaneously both bidirectional and transactional) relations between parenting behavior and child depressive symptoms in childhood or adolescence.

Although some research examined reciprocal relations between parental depression and child depressive symptoms or parenting behavior and child depressive symptoms, few of these studies included parental depression, parenting, and child symptoms in the same model (Hails et al., 2018; Kuckertz et al., 2018) and even the ones that did only examined maternal, but not paternal depression or parenting. An examination of *both* parents' depression and parenting may

reveal more nuanced reciprocal relations that involve paths from one parent's depression to another parent's parenting and child depressive symptoms (Kopala-Sibley et al., 2017).

Gaps in prior literature

An examination of reciprocal models including mothers, fathers, and child depressive symptoms would capture the dynamic interactional nature of families and allow for a nuanced examination of pathways to depression within families. No study to our knowledge has examined reciprocal models of mothers, fathers, and child depressive symptoms and parenting measured repeatedly from early childhood through adolescence. This approach allows us to examine mediation of parenting behavior over time, as well as effects of parenting behaviors on later parent depression, controlling for both parents' prior parenting behaviors and depression. Few studies have examined whether negative parenting predicts greater parental depression, despite theoretical and empirical evidence that depressed individuals tend to behave in ways (e.g., reassurance seeking) that alienate others and foster stressful environments that may maintain and increase depression (Coyne, 1976a; Fisher, 2016; Hails et al., 2018; Kuckertz et al., 2018; Nordsletten et al., 2016; Paulson & Bazemore, 2010; Whisman, 2017). Thus, parental depression, which may lead to negative parenting, may in turn predict increased depressive symptoms in parents.

Furthermore, most longitudinal work has been limited to a few years, relied on one informant, focused on mother's psychopathology rather than fathers or both parents, and examined child externalizing disorders or broadband measures of internalizing and externalizing problems, rather than child depressive symptoms. In addition, research has mostly measured parent's depression using categorical diagnoses, despite support for continuous approaches, given no discrete cutoff point separating seriously depressed individuals from those experiencing

subclinical depression (see Hankin, 2006). Most work has also focused on one developmental period (early childhood, middle childhood, or adolescence), despite evidence that young children at-risk for and who show symptoms of depression tend to increase in symptoms from childhood to adolescence (Gaffrey et al., 2018; Luby et al., 2014). Finally, most prior work on reciprocal models used three timepoints. Designs with three timepoints can only capture reciprocal relations between two distinct variables at a time (e.g., between child depression and maternal depression or between child depression and parenting but cannot examine reciprocal relations between three variables simultaneously. Rather, reciprocal models incorporating parent's depression, parenting, and child symptoms would be more appropriate for studies that measure 5 timepoints and longer periods of child development to capture patterns that may unfold over many years (for example: parental depression to parenting to child depression to parenting to parental depression, and child depression to parenting to parent depression to parenting to child depression) (Weissman et al., 2006, 2016). In sum, this fine-grained reciprocal approach incorporating both parents and child would allow for a more targeted and nuanced identification of pathways to child and parental depression across childhood and adolescence. Further, results would inform prevention strategies and treatment targets for family-based interventions that can decrease maladaptive parent-child interaction patterns, as the parent-child relationship is a foundation for development of interpersonal relationships and psychological functioning throughout the lifespan (Thompson, 2000; Cix & Harter, 2003).

Expanded Method

Participants

Participants were selected from the Stony Brook Temperament Study, a longitudinal study examining the role of early temperament on the development of internalizing disorders (for

detailed description of the study sample and recuitment see Klein & Finsaas, 2017). Families with a 3-year-old child were recruited within 20 contiguous miles of Stony Brook University and identified via commercial mailing lists. Eligible families had a child between 3- and 4-years old with no developmental disabilities or serious medical conditions and at least one English-speaking biological parent. The study was approved by the human subjects review committee. Parents provided informed consent and children ages 9 and older provided assent. Families were compensated for participating in the study.

Participants were assessed at ages 3, 6, 9, 12, and 15 years-old. At baseline (age 3: *M*= 3.55 years, *SD*=.26), 559 families entered the study and 473 mothers and 398 fathers completed a measure about their depressive symptoms, 500 mothers and 400 fathers completed a measure about their parenting, and 541 parents completed an interview about their child's depressive symptoms. At the age 6 assessment (age *M*=6.11 years, *SD*=.44), an additional 50 minority/non-White families were recruited to increase the diversity of the sample, and 470 mothers and 365 fathers completed measures about their depressive symptoms, 470 mothers and 367 fathers completed measures about their parenting, and 516 parents completed an interview about their child's depressive symptoms. At ages 9 (age *M*=9.23 years, *SD*=.42), 12 (age *M*=12.66 years, *SD*=.46), and 15 (age *M*=15.25 years, *SD*=.41) assessments, mothers and fathers completed measures about their depressive symptoms (mother: 9: *n*=482, 12: *n*=469, 15: *n*=449; fathers: 9: *n*=410, 12: *n*=370, 15: *n*=365) and parenting (mother: 9: *n*=482, 12: *n*=469, 15: *n*=449; fathers: 9: *n*=410, 12: *n*=376, 15: *n*=369) and a parent and their child completed an interview about their child's depressive symptoms. The current study included all children whose mothers or fathers completed at least one assessment about their own or their child's depressive symptoms (*n*=609, 45.2% female). See Table 1 for demographic information and sample characteristics.

Procedure

At all assessments, mothers and fathers completed a measure about their depressive symptoms, parenting behaviors, and one parent completed an interview about their child's depressive symptoms. At ages 9-15 years old, children and parents completed the same clinical interview about their own depressive symptoms.

Measures

Parental depressive symptoms. Parent's depression at all timepoints was assessed using the 19-item symptom severity subscale of the Diagnostic Inventory for Depression (DID; (Zimmerman et al., 2004). The DID is a self-report scale used to assess symptoms of DSM-IV depression in adults. The DID has achieved high levels of internal consistency, test-retest reliability, and construct validity and is a valid measure of symptom change over time (Zimmerman et al., 2004). In the current sample, internal consistency was excellent at all timepoints (α's collapsed across parents; *Median*= α=.88, *range*=α=.85-.90).

Parenting behaviors. At ages 3 and 6, parents completed the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson et al., 2001) to assess their parenting styles. The PSDQ is a 37-item self-report measure that assesses three styles of parenting for young children: authoritative, authoritarian, and permissive parenting. The scale has shown good concurrent and predictive validity (Olivari et al., 2013). Reliability in the current sample was good. Coefficient alphas collapsed across informants and time points ranged between .82-.88 (*Median* = .86) for Authoritative (15 items), .74-.77 (*Median* = .76) for Authoritarian (12 items), and .67-.74 (*Median* = .72) for Permissive (5 items).

At ages 9, 12, and 15, parents completed the widely used Children's Report of Parent Behavior Inventory (CRPBI; Schaefer, 1965; Schludermann & Schludermann, 1970). The

CRPBI is a 30-item questionnaire assessing parenting practices and behaviors with children and adolescents. Although it was originally designed for youth to complete, we used a parent version that was administered to mothers and fathers. The CRPBI assesses three parenting dimensions that map onto Baumrind's model: acceptance (authoritative parenting), psychological control (authoritarian parenting), and lax discipline (permissive parenting) (Baumrind, 1967; Baumrind, 1971), with higher scores indicating greater levels of acceptance, psychological control, and lax discipline respectively. The CRPBI has been demonstrated to have good internal consistency and test-retest reliability and validity in prior work (Alderfer et al., 2008; Schaefer, 1965; Schwarz et al., 1985). The parenting dimensions showed acceptable to good reliability in the current sample. Coefficient alphas collapsed across informants and time points ranged between .74-.84 (*Median* α=.83) for the acceptance subscale, .70-.75 (*Median* α=.74) for the psychological control subscale, and .59-.68 (*Median* α=.62) for the lax discipline subscale (10 items in each subscale).

Child depressive symptoms. At ages 3 and 6, parents (age 3: 98.0% mothers, age 6: 92.8% mothers) were interviewed using the Preschool Age Psychiatric Assessment (PAPA; Egger et al., 2006; Egger & Angold, 2004) to assess their child's depressive symptoms. The PAPA is a parent-reported structured clinical interview that assesses emotional and behavioral problems in preschool aged-children during the past 3 months. Each item was coded as present (a rating of 2 or 3 on a 3-point scale) if the behavior was intrusive, interfering, and generalizable across activities at a threshold level. Current symptoms of depression coded as present were summed to create a current depressive symptoms scale at each time point (age 3: *M*=1.95, *SD*=2.29, *range*=0-20; age 6: *M*=4.17, *SD*=3.37, *range*=0-21). Doctoral students in clinical psychology and a master's-level clinician administered interviews. Internal consistency and

inter-rater reliability, based on independent raters of audiotapes, was excellent (age 3: α =.72, Intra class correlation [ICC]=.98, *n*=21 audiotapes, age 6: α= .74, ICC=.95, *n=35* audiotapes;).

At ages 9-15, one parent (age 9: 92.2% mothers, age 12: 89.5% mothers, age 15: 91.3% mothers) and the youth were interviewed about the youth's depressive symptoms using the Kiddie-Schedule of Affective Disorders and Schizophrenia-Present and Lifetime (K-SADS-PL; Axelson et al., 2009). Doctoral students in clinical psychology and a master's-level clinician administered the K-SADS first to the parent and then to the child. Further information was obtained to reconcile discrepancies. Summary ratings for each symptom were derived based on the combination of parent and child reports. Administration of the K-SADS was supervised in a group format by an experienced child psychiatrist and licensed clinical psychologist. Current symptoms of any depression were rated on a 3-point scale (0=not present; 1=subthreshold; 2=threshold) and were summed to create a current depressive symptoms scale at each time point (α range=.84 - .98). To assess interrater reliability, a second rater independently rated videotapes (*n*=74 videotapes at age 9 and *n*=25 videotapes at ages 12 and 15). ICCs for the depressive scale ranged from .76 to .97.

Appendix 2: Mother and Father model (Supplementary model 1)

An additional CLPM model was used to examine relations among maternal and paternal depressive symptoms and maternal and paternal parenting. We applied equality constraints for mother's and father's depressive symptoms (e.g., age 3 to age 6, age 6 to age 9, age 9 to age 12 etc.), given relative stability of depressive symptoms in adults (Moffitt et al., 2010).

***Supplementary model 1: Mother and Father model: Relations among maternal depression, paternal depression, maternal negative parenting, and paternal negative parenting (*Supplementary Figure 1).** The mother and father model yielded the following fit statistics: $\chi 2$ (108, N = 599) = 295.70, p<.001, CFI = .930, RMSEA = .054, 95% confidence interval (95% CI) [.047, .062], SRMR = .059. This model demonstrated acceptable fit to the data.

***Direct effects (*Supplementary Figure 1).** Maternal depression at age 3 predicted greater paternal depression and maternal negative parenting at age 6. Maternal depression at age 6 predicted greater maternal negative parenting at age 9. Paternal depression at age 12 predicted greater paternal negative parenting at age 15. Maternal negative parenting at age 12 predicted greater maternal depression at age 15. Maternal negative parenting at ages 3 and 9 predicted greater paternal negative parenting at ages 6 and 12 respectively. Paternal negative parenting at age 6 predicted greater paternal depression at age 9.

***Indirect effects (*Supplementary Figure 1).** Maternal depression at age 3 predicted greater maternal depression at age 15 via greater maternal depression at age 6, which led to greater maternal negative parenting at ages 9 and 12 (β=.004, p < .05, 95% CI [.001, .015]). Maternal depression at age 3 predicted greater paternal depression at age 15 via greater paternal depression at ages 6, 9 and 12 (β=.028, p < .05, 95% CI .002, .071]). Maternal depression at age 3 predicted greater maternal negative parenting at age 15 via multiple pathways: 1) via greater

maternal negative parenting at ages 6, 9, and 12 (β=.056, p < .05, 95% CI .015, .117]), 2) via greater maternal depression at age 6, which led to greater maternal negative parenting at ages 9 and 12 (β=.070, p < .05, 95% CI .021, .135]), and 3) via greater maternal depression at ages 6, 9, and 12 (β=.036, p < .05, 95% CI .001, .097]). Maternal depression at age 3 predicted greater paternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at ages 6 and 9, which led to greater paternal negative parenting at age 12 (β=.005, p < .05, 95% CI .001, .014]), 2) via greater maternal depression at age 6, which led to greater maternal negative parenting at age 9, which led to greater paternal negative parenting at age 12 (β=.006, p < .05, 95% CI .002, .016]), and 3) via greater paternal depression at age 6, 9, and 12 (β=.005, p < .05, 95% CI .001, .019]).

Paternal depression at age 3 predicted greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12 (β=.005, p < .05, 95% CI .001, .014]). Paternal depression at age 3 predicted greater paternal negative parenting at age 15 via two pathways: 1) via greater paternal negative parenting at ages 6 through 12 (β=.034, p < .05, 95% CI .004, .075]) and 2) via greater paternal depression at ages 6 through 12 (β=.040, p < .05, 95% CI .010, .120]).

Maternal negative parenting at age 3 predicted maternal depression at 15 via greater maternal negative parenting at ages 6 and 9, which led to greater maternal depression at 12 (β=.020, p < .05, 95% CI .003, .050]). Maternal negative parenting at age 3 predicted greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12 (β=.012, p < .05, 95% CI .005, .025]). Maternal negative parenting at age 3 predicted greater paternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at ages 6 and 9, which led to greater

paternal negative parenting at age 12 (β=.029, p < .05, 95% CI .009, .056]), 2) via greater paternal negative parenting at ages 6 through 12 (β=.077, p < .05, 95% CI .044, .130]), and 3) via greater negative paternal parenting at age 6, which led to greater paternal depression at ages 9 and 12 (β=.002, p < .05, 95% CI .001, .007]).

Paternal negative parenting at age 3 predicted greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12 (β=.034, p < .05, 95% CI .017, .062]). Paternal negative parenting at age 3 predicted greater paternal negative parenting at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12 (β=.006, p < .05, 95% CI .001, .016]).

Appendix 3: Child sex analyses

Child sex analyses

We used a multi-group design to examine whether each model differed for males and females.

Model 1: Child and Mother model: Relations among maternal depression, child depression, and maternal negative parenting. The constrained Child and Mother model yielded the following fit statistic: $\chi 2$ (147, N = 599) = 213.581, p=.003. Allowing paths of theoretical interest to vary across child sex yielded the following fit statistics: $\chi 2$ (141, N = 599) = 224.774, p<.001. A chi-square difference test revealed that this latter model did not fit the data significantly differently than a model in which paths are constrained to be equal, $\Delta\chi^2$ (6) = 11.19, p > .05. This indicates that the model does not vary significantly as a function of child sex.

Model 2: Child and Father model: Relations among paternal depression, child depression, and paternal negative parenting. The constrained Child and Father model yielded the following fit statistic: $\chi 2$ (117, N = 599) = 125.457, p=.28. Allowing paths of theoretical interest to vary across child sex yielded the following fit statistics: $\chi 2$ (93, N = 599) = 97.592, p=.35. A chi-square difference test revealed that this latter model did not fit the data significantly differently than a model in which paths are constrained to be equal, $\Delta\chi^2$ (24) = 27.87, p > .05. This indicates that the model does not vary significantly as a function of child sex.

Supplementary Model 1: Mother and Father model: Relations among maternal depression, paternal depression, maternal negative parenting, and paternal negative parenting. The constrained Mother and Father model yielded the following fit statistic: $\chi 2$ (256, N = 599) = 388.59, *p<.001*. Allowing paths of theoretical interest to vary across child sex yielded the following fit statistics: $\chi 2$ (222, N = 599) = 445.54, *p<.001*. A chi-square difference

test revealed that this latter model did not fit the data significantly differently than a model in which paths are constrained to be equal, $\Delta\chi^2$ (34) = 56.95, $p < .05$. This indicates that the constrained model is a significantly better fit and the model does not vary significantly as a function of child sex.

Appendix 4: Controlling for parental education

Results were similar when including parental education as a covariate.

Model fit

Model 1: Child and Mother model: Relations among maternal depression, child depression, and maternal negative parenting. After controlling for parental education, the child and mother model yielded the following fit statistics: $\chi 2$ (69, N = 599) = 162.78, p<.001, CFI = .956, RMSEA = .047, SRMR = .045. This model demonstrated excellent fit to the data.

Model 2: Child and Father model: Relations among paternal depression, child depression, and paternal negative parenting. After controlling for parental education, the child and father model yielded the following fit statistics: $\chi 2$ (60, N = 606) = 158.85, p<.001, CFI = .906, RMSEA = .052, SRMR = .060. This model demonstrated acceptable fit to the data.

Supplementary model 1: Mother and Father model: Relations among maternal depression, paternal depression, maternal negative parenting, and paternal negative parenting. After controlling for parental education, the mother and father model yielded the following fit statistics: $\chi 2$ (124, N = 599) = 315.05, p<.001, CFI = .929, RMSEA = .050, SRMR = .057, demonstrating acceptable fit to the data.

Direct effects

Model 1: Child and Mother model. After controlling for parental education, child depression at age 6 continued to predict greater maternal depression at age 9 and greater maternal negative parenting at age 9. Maternal depression at age 3 continued to predict greater child depression at age 6 and marginally predicted greater maternal negative parenting at age 6.

Model 2: Child and Father model. After controlling for parental education, child depression at age 3 continued to predict greater paternal negative parenting at age 6.

Supplementary model 1: Mother and Father model. After controlling for parental education, maternal depression at ages 3 and 6 continued to predict greater maternal negative parenting at ages 6 and 9 respectively. Maternal negative parenting at ages 3 and 9 continued to predict greater paternal negative parenting at ages 6 and 12 respectively. Paternal negative parenting at age 6 continued to predict greater paternal depression at age 9.

Indirect effects

Model 1: Child and Mother model. After controlling for parental education, child depression at age 3 continued to predict greater maternal depression at age 15 via greater child depression at 6, which led to greater maternal depression at ages 9 and 12. Child depression at age 3 also continued to predict greater maternal negative parenting at age 15 via greater child depression at age 6, which led to greater maternal negative parenting at ages 9 and 12.

After controlling for paternal education, maternal depression at age 3 continued to predict maternal depression at age 15 via 1) greater child depression at age 6, which led to greater maternal negative parenting at ages 9 and 12 and 2) via greater child depression at age 6, which led to greater maternal depression at ages 9 and 12. Maternal depression at age 3 continued to predict greater maternal negative parenting 1) via greater maternal negative parenting at ages 6 through 12 and 2) via greater child depression at 6, which led to greater maternal negative parenting at ages 9 and 12.

Model 2: Child and Father model. Child depression at age 3 continued to predict greater paternal negative parenting at age 15 via greater paternal negative parenting at ages 6 through 12. Paternal depression at age 3 continued to predict greater paternal negative parenting at age 15 via greater paternal negative parenting at ages 6 through 12. Paternal negative parenting at age 3

continued to predict greater paternal depression at age 15 via greater paternal depression at ages 6 through 12.

Supplementary model 1: Mother and Father model. Maternal depression at age 3 continued to predict greater maternal depression at age 15 via greater maternal depression at age 6, which led to greater maternal negative parenting at ages 9 and 12. Maternal depression at age 3 continued to predict greater maternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at ages 6, 9, and 12 and 2) via greater maternal depression at age 6, which led to greater maternal negative parenting at ages 9 and 12. Maternal depression at age 3 continued to predict greater paternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at ages 6 and 9, which led to greater paternal negative parenting at age 12 and 2) via greater maternal depression at age 6, which led to greater maternal negative parenting at age 9, which led to greater paternal negative parenting at age 12.

Paternal depression at age 3 continued to predict greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12. Paternal negative parenting at age 3 continued to predict greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12. Paternal depression at age 3 continued to predict greater paternal negative parenting at age 15 via greater paternal depression at ages 6 through 12.

Maternal negative parenting at age 3 continued to predict greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12. Maternal negative parenting at age 3 continued to predict greater paternal negative parenting at age 15 via multiple pathways: 1) via greater maternal negative parenting at

ages 6 and 9, which led to greater paternal negative parenting at age 12, and 2) via greater paternal negative parenting at ages 6 through 12.

Paternal negative parenting at age 3 predicted greater paternal negative parenting at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 and 12.

Appendix 5: White only subsample

Because our sample was largely White and non-Hispanic, we did not have the power to examine differences across each racial/ethnic group. Collapsing across racial and ethnic minority groups to create a non-white group could risk overlooking racial/ethnic minority group differences (Burlew et al., 2019). Thus, conducting our analyses with the White, non-Hispanic subset of our sample served to remove noise attributed to culture and assess whether our results were driven by, and should only be generalized to, the majority group. Results in the White only sample were similar to the full sample results and should not be generalized to more diverse groups.

Model 1: Child and Mother model: Relations among maternal depression, child depression, and maternal negative parenting. The White only Child and Mother model yielded the following fit statistic: $\chi 2$ (57, N = 469) = 129.98, p<.001, CFI = .952, RMSEA = .052, SRMR = .052. This model demonstrated excellent fit to the data.

Direct effects. Child depression at ages 6, 9, and 12 predicted greater maternal depression at ages 9, 12, and 15 respectively. Child depression at age 6 predicted greater maternal negative parenting at age 9. Maternal depression at age 3 predicted greater child depression and maternal negative parenting at age 6. Maternal negative parenting at age 12 predicted greater maternal depression at age 15.

Indirect effects. Child depression at age 3 predicted greater maternal depression at age 15 via multiple pathways: 1) via greater child depression at age 6-12, 2) via greater child depression at ages 6-9, which led to greater maternal depression at age 12, and 3) via greater child depression at age 6, which led to greater

maternal depression at ages 9 to 12. Child depression at age 3 led to greater maternal negative parenting at age 15 via greater child depression at age 6, which led to greater maternal negative parenting at ages 9-12.

Maternal depression at age 3 predicted greater child depression at age 15 via greater child depression at ages 6-12. Maternal depression at age 3 led to greater maternal depression at age 15 via multiple pathways: 1) via greater child depression at ages 6-12, 2) via greater maternal depression at ages 6-9, which led to greater child depression at age 12, 3) via greater child depression from ages 6-9, which led to greater maternal depression at age 12, and 4) via greater child depression at age 6, which led to greater maternal depression from ages 9-12. Maternal depression at age 3 led to greater maternal negative parenting at age 15 via two pathways: 1) via greater child depression at age 6, which led to greater maternal negative parenting at ages 9-12 and 2) via greater maternal negative parenting from ages 6-12.

Maternal negative parenting at age 3 predicted greater maternal depression at age 15 via greater maternal negative parenting at ages 6-9, which led to greater maternal depression at age 12.

Model 2: Child and Father model: Relations among paternal depression, child depression, and paternal negative parenting. The White only Child and Father model yielded the following fit statistic: $\chi 2$ (48, N = 469) = 95.78, p<.001, CFI = .948, RMSEA = .046, SRMR = .053, demonstrating acceptable fit to the data.

Direct effects. Child depression at age 3 predicted greater paternal negative parenting at age 6. Paternal depression at age 6 predicted greater child depression at age 9.

Indirect effects. Child depression at age 3 predicted greater paternal negative parenting at age 15 via greater paternal negative parenting at ages 6-12. Paternal depression at age 3 predicted greater paternal negative parenting via greater paternal negative parenting at ages 6-12. Greater paternal negative parenting at age 3 predicted greater paternal depression at age 15 via greater paternal depression at ages 6-12.

Supplementary model 1: Mother and Father model: Relations among maternal depression, paternal depression, maternal negative parenting, and paternal negative parenting. The constrained Mother and Father model yielded the following fit statistic: $\chi 2$ (108, N = 469) = 253.45, $p<.001$, CFI = .930, RMSEA = .054, SRMR = .059, demonstrating acceptable fit to the data.

Direct effects. Maternal depression at ages 3 and 9 predicted greater paternal depression at ages 6 and 12. Maternal depression at ages 3 and 6 predicted greater maternal negative parenting at ages 6 and 9 respectively. Paternal depression at age 12 predicted greater paternal negative parenting at age 15. Maternal negative parenting at age 3 predicted greater paternal negative parenting at age 6. Maternal negative parenting at ages 9 and 12 predicted greater maternal depression at ages 12 and 15. Paternal negative parenting at age 6 predicted greater paternal depression at age 9.

Indirect effects. Maternal depression at age 3 predicted greater paternal depression at age 15 via greater maternal depression from ages 6-12. Maternal depression at age 3 predicted greater maternal negative parenting at age 15 via multiple pathways: 1) greater maternal negative parenting from ages 6-12 and 2) via greater maternal depression at age 6, which led to greater maternal negative parenting

from ages 9-12. Maternal depression at age 3 predicted greater paternal depression at age 15 via two pathways: 1) greater maternal depression at ages 6 to 9, which led to greater paternal depression at age 12 and 2) greater paternal depression from ages 6 through 12. Maternal depression at age 3 predicted greater paternal negative parenting at age 15 via greater paternal depression at ages 6 through 12. Paternal depression at age 3 led to greater paternal negative parenting at age 15 via greater paternal depression at ages 6 through 12.

Maternal negative parenting at age 3 led to greater maternal depression at age 15 via greater maternal negative parenting from ages 6 to 9, which led to greater maternal depression at age 12. Maternal negative parenting at age 3 led to greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression form ages 9 to 12. Maternal negative parenting at age 3 led to greater paternal depression at age 15 via greater paternal negative parenting at ages 6 through 12. Paternal negative parenting at age 3 led to greater paternal depression at age 15 via greater paternal negative parenting at age 6, which led to greater paternal depression at ages 9 to 12.

Appendix 6: Positive Parenting

We also examined all models with positive parenting instead of negative parenting. We examined positive parenting in separate models to focus analyses on relations among child depression, parent depression, and one parenting construct. Including both parenting constructs in the same model would increase the number of pathways that were not of interest in the current study (e.g., reciprocal relations between negative and positive parenting over time), which would reduce power to detect effects of interest. As detailed below, models with positive parenting showed a similar pattern of effects.

Model fit

Model 1: Child and Mother model: Relations among maternal depression, child depression, and maternal positive parenting. The child and mother model yielded the following fit statistics: $\chi 2$ (72, N = 599) = 152.48, p<.001, CFI = .959, RMSEA = .043, SRMR = .050. This model demonstrated excellent fit to the data.

Model 2: Child and Father model: Relations among paternal depression, child depression, and paternal positive parenting. The child and father model yielded the following fit statistics: $\chi 2$ (57, N = 592) = 153.92, p<.001, CFI = .915, RMSEA = .054, SRMR = .061, demonstrating acceptable fit to the data.

Supplementary model 1: Mother and Father model: Relations among maternal depression, paternal depression, maternal positive parenting, and paternal positive parenting. The mother and father model yielded the following fit statistics: $\chi 2$ (108, N = 599) = 267.41, p<.001, CFI = .939, RMSEA = .050, SRMR = .057. This model demonstrated acceptable fit to the data.

Direct effects

Model 1: Child and Mother model. Child depression at age 6 predicted greater maternal depression at age 9 and less maternal positive parenting at age 9. Maternal depression at age 3 predicted greater child depression at age 6.

Model 2: Child and Father model. There were no significant direct effects among lagged paths.

Supplementary model 1: Mother and Father model. Maternal depression at age 3 predicted greater paternal depression at age 6. Greater paternal depression at age 6 predicted less maternal positive parenting at age 9. Greater maternal positive parenting at age 3 predicted greater paternal positive parenting at age 6. Greater paternal depression at age 6 predicted less maternal positive parenting at age 9. Greater paternal positive parenting at age 3 predicted greater maternal positive parenting at age 6. Surprisingly, greater paternal positive parenting at age 6 predicted greater maternal depression and less maternal positive parenting at age 9.

Indirect effects

Model 1: Child and Mother model. Child depression at age 3 predicted greater maternal depression at age 15 via child depression at age 6, which led to greater maternal depression at ages 9 and 12 (β=.062, $p < .05$, 95% CI [.036, .098]). Child depression at age 3 predicted less maternal positive parenting at age 15 via multiple pathways: 1) via less maternal positive parenting from ages 6 through 12 (β=.033, $p < .05$, 95% CI [.082, .004]), and 2) via greater child depression at age 6, which led to less maternal positive parenting at ages 9 and 12 (β=-.039, $p < .05$, 95% CI [-.064, -.014]).

Maternal depression at age 3 predicted less maternal positive parenting at age 15 via multiple pathways: 1) via less maternal positive parenting from ages 6 through 12 (β=-.028, p < .05, 95% CI [-.067, -.001]) and 2) via greater child depression at age 6, which led to less maternal positive parenting at ages 9 and 12 (β=-.024, p < .05, 95% CI [-.049, -.010]).

Model 2: Child and Father model. Child depression at age 3 predicted greater paternal depression at age 15 via greater child depression at 6, which led to greater paternal depression at ages 9 and 12 (β=.017, p < .05, 95% CI [.005, .043]).

Supplementary model 1: Mother and Father model. Maternal depression at age 3 predicted greater paternal depression at age 15 via greater paternal depression at ages 6 through 12 (β=.037, p < .05, 95% CI [.012, .078]). Maternal depression at age 3 predicted less maternal positive parenting at age 15 via multiple paths: 1) via less maternal positive parenting at ages 6 through 12 (β=-.042, p < .05, 95% CI [-.083, -.012]) and 2) via greater paternal depression at age 6, which led to less maternal positive parenting at ages 9 and 12 (β=-.013, p < .05, 95% CI [-.036, -.003]).

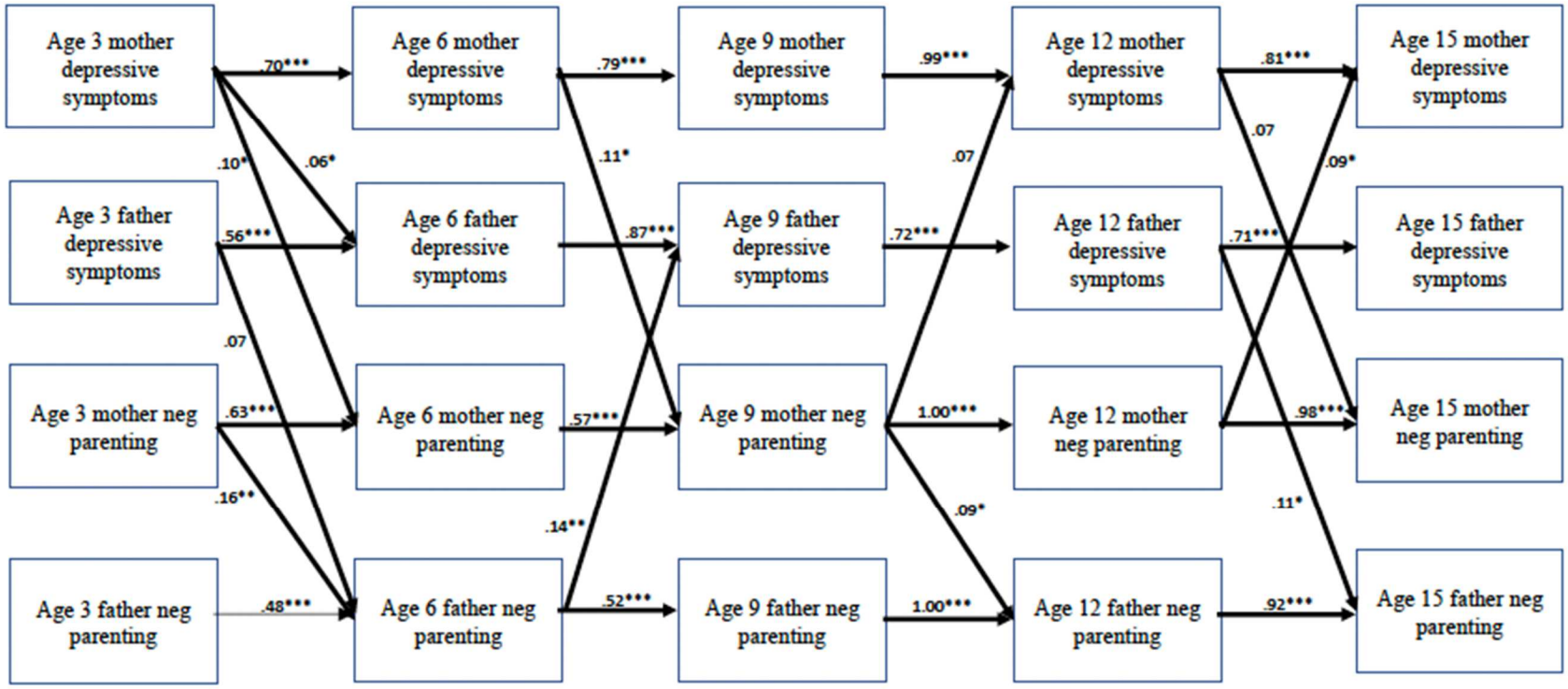
Paternal depression at age 3 predicted less maternal positive parenting at age 15 via greater paternal depression at age 6, which led to less maternal positive parenting at ages 9 and 12 (β=-.087, p < .05, 95% CI [-.153, -.031]).

Less maternal positive parenting at age 3 predicted greater maternal depression at age 15 via less paternal positive parenting at ages 6 to 9, which led to greater maternal depression at age 12 (β=-.003, p < .05, 95% CI [-.011, -.001]).

Less paternal positive parenting at age 3 predicted greater maternal depression at age 15 via multiple pathways: 1) via less paternal positive parenting at ages 6 to 9,

which led to greater maternal depression at age 12 (β=-.013, p < .05, 95% CI [-.033, -.001]) and 2) via less maternal positive parenting at age 6, which led to greater maternal depression at ages 9 and 12 (β=-.006, p < .05, 95% CI [-.016, -.001]). Less paternal positive parenting at age 3 predicted less maternal positive parenting at age 15 via 2 pathways: 1) via less maternal positive parenting at ages 6 through 12 (β=.063, p < .05, 95% CI [.026, .113]) and 2) via less paternal positive parenting from ages 6 through 12 (β=.020, p < .05, 95% CI [.003, .050]).

Supplementary Figure 1. Cross-lagged panel analyses for maternal depressive symptoms, paternal depressive symptoms, maternal negative parenting, and paternal negative parenting. *Notes:* Standardized values presented (*B*). *B* >1 are a reflection of collinearity (but not multicollinearity). Bolded paths are involved in indirect pathways. All cross lagged paths were included in analyses and significant ones or those involved in indirect pathways are presented in this figure for readability. Covariances are not shown in this figure, but were included between all variables measured in the same assessment wave. *** $p<.001$, ** $p<.01$, * $p<.05$.



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