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A Longitudinal Study of Fathers' and Young Children's Depressive Symptoms

Marianne H. Tichovolsky,

Department of Psychological and Brain Sciences, University of Massachusetts Amherst

Shayl F. Griffith,

Department of Psychological and Brain Sciences, University of Massachusetts Amherst

Benjamin Rolon-Arroyo,

Department of Psychological and Brain Sciences, University of Massachusetts Amherst

David H. Arnold, and

Department of Psychological and Brain Sciences, University of Massachusetts Amherst

Elizabeth A. Harvey

Department of Psychological and Brain Sciences, University of Massachusetts Amherst.

Abstract

Objective: Considerable research has examined the effects of maternal depression on children, but few studies have focused on the relation between paternal and child depressive symptoms, particularly during early childhood. Even fewer studies have been longitudinal, leaving open questions about how paternal and child depression covary over time. The present study sought to address this gap by examining the relation between fathers' and children's depressive symptoms over a 3-year period.

Method: Participants were 153 preschool children with behavior problems and their parents. Three longitudinal analytic approaches were used to examine how father and child depression change together and predict one another over time. Additional analyses examined whether externalizing problems or maternal depression might account for the associations between fathers' and children's depressive symptoms.

Results: Changes in paternal depression significantly predicted changes in father-reported and mother-reported child depressive symptoms. These effects were evident both in year-to-year fluctuations as well as in linear trajectories across the 3-year period. Cross-lagged analyses suggested that these relations may have been driven by father-effects; paternal depression at one time point predicted child depression at the next time point, but child depression did not significantly predict later paternal depression. We found little evidence that externalizing problems or maternal depression accounted for the relations between fathers' and children's depressive symptoms.

Conclusions: Results provide convergent evidence that fathers' depression may play an important role in the development of depressive symptoms in young children, and underscore the importance of including fathers in studies of depression in families.

Keywords

depression; fathers; children; longitudinal study

Depression is one of the most common psychological disorders, affecting men, women, and children. Approximately 10–25% of women and 5–12% of men experience major depressive disorder (MDD) at some point during their life (American Psychiatric Association, 2000), and many more will experience sub-clinical symptoms that cause significant distress and impairment. One-year prevalence rates for MDD have been estimated at about 2% for children and 4–7% for adolescents (Costello et al., 2002), and approximately 15–20% of teenagers will experience MDD by the time they reach 18 years of age (Birmaher et al., 1996). Several researchers have found that children who experience depressive symptoms are at significantly higher risk for experiencing depression later in life (e.g., Harrington, Fudge, Rutter, Pickles, & Hill, 1990; McGee & Williams, 1988), and even depressive symptoms in preschool (assessed at ages 2–5) have been found to predict higher levels of depression and other internalizing problems several years later (Lavigne et al., 1998; Luby, Gaffrey, Tillman, April, & Belden, 2014; Mesman & Koot, 2001).

Depression is typically a chronic, recurrent condition that takes a tremendous toll in terms of mental suffering, decreased quality of life and productivity, and disability (World Health Organization, 2008). There is some evidence that depression is developing at earlier ages and that rates of depression are increasing (Birmaher et al., 1996). Early-onset depression tends to be more recurrent and chronic than later forms, and is associated with a greater risk of suicide (Kovacs, 1996; Zisook et al., 2004), underscoring the importance of early identification and treatment. Given the high rates, frequent recurrence, and detrimental effects of this disorder, it is essential that we gain a better understanding of its early development.

Children of Depressed Parents

An extensive body of research has demonstrated that parental depression puts children at risk for a variety of social, emotional, and behavioral difficulties, and higher rates of psychiatric disorders, especially depression (Beardslee, Versage, & Gladstone, 1998; Downey & Coyne, 1990). Indeed, children of depressed parents have been found to be at three times greater risk for experiencing a major depressive episode during their lifetime, and the risk is even higher if both parents suffer from mood disorders (Birmaher et al., 1996). However, most of the studies examining parental depression and child outcomes have focused on mothers.

What about Dads?

Historically, there has been a lack of focus on fathers and their effects on child development, especially on the development of psychopathology (Phares, Fields, Kamboukos, & Lopez,

2005). In their review of the literature examining parental influences on child psychopathology, Cassano, Adrian, Veits, and Zeman (2006) found that over half (55%) of the studies in this area published between 1992 and 2005 included only mothers, whereas just 1% included only fathers. Because fathers have been so rarely the focus of research, our understanding of their mental health issues, and how they may influence their children's development, is particularly limited. Fortunately, recent studies have begun to examine depression in fathers, and its effects on children.

The Prevalence and Course of Paternal Depression

Although the percentage of fathers with depression is lower than that of mothers, a substantial portion of fathers experience depression at some point during their children's lives. For example, Davé, Petersen, Sherr, and Nazareth (2010) found that by the time children reached 12 years of age, 21% of fathers had experienced a depressive episode. A recent meta-analysis of 43 studies estimated the overall rate of paternal depression during the postpartum period at 10.4% (versus a rate of 23.8% for mothers), with the highest prevalence rates of paternal depression (25.6%) occurring 3- to 6-months post-birth (Paulson & Bazemore, 2010).

Only a few studies have examined paternal depression over an extended period of time, and in those that have, fathers' depressive symptoms generally increased during their children's early development (Garfield et al., 2014; Giallo et al., 2012; Gross, Shaw, Moilanen, Dishion, & Wilson, 2008). For example, Garfield et al. (2014) found that fathers had the lowest depression scores just before the birth of their children, but their depressive symptoms significantly increased (by 68%, on average) from the child's birth to age 5. Gross et al. (2008) found that average fathers' depressive symptoms were moderate when children were 2 years old, increased slightly at age 3, and then decreased by age 4. Additional longitudinal studies are needed to give us a better understanding of how these changes in fathers' depressive symptoms affect children.

Paternal Depression and Child Outcomes

Recent studies have revealed that paternal depression, much like maternal depression, is related to poorer psychosocial, behavioral, and emotional outcomes for children. Paternal depression is associated with less prosocial behavior (Cummings, Keller, & Davies, 2005; Davé, Sherr, Senior, Nazareth, 2008), greater peer problems (Davé et al., 2008), poorer academic performance (Herbert, Harvey, Lugo-Candelas, & Breaux, 2013), and behavior problems in young children (Brennan, Hammen, Katz, & Le Brocque, 2002; Hanington, Heron, Stein, & Ramchandani, 2011; Herbert et al., 2013; Kane & Garber, 2009).

Findings regarding the association between paternal depression and children's internalizing symptoms have been more mixed. Researchers have found that paternal depression was associated with concurrent internalizing problems in 4-year-olds (Marchand & Hock, 1998), 5-year-olds (Cummings et al., 2005), 11-year-olds (even controlling for current and past maternal depression; Kane & Garber, 2009), and teenagers (Ohannessian et al., 2005). Paternal depression has been found to predict children's depressive symptoms 2 years later

in a sample of preschoolers (Gross et al., 2008) and 1 year later in a sample of adolescents (Reeb, Conger, & Wu, 2010). In one longitudinal study (a previous analysis of the sample used in the present study), paternal depressive symptoms at age 3 were the strongest predictor of children's internalizing problems 3 years later (when compared to father involvement, overreactivity, laxness, warmth, paternal attention-deficit hyperactivity disorder symptoms, and paternal education; Herbert et al., 2013); they were also associated with changes in children's internalizing symptoms, with lower levels of paternal depression predicting decreases in children's internalizing symptoms over the 3-year period. However, several researchers have found that paternal depression was not associated with emotional difficulties in children (Davé et al., 2008; Hanington et al., 2011; Malmberg&Flouri, 2011), and others have suggested that the association between paternal depression and child internalizing problems might be accounted for, at least in part, by maternal depression (Ramchandani et al., 2005).

Are Changes in Paternal Depression Associated with Changes in Child Symptoms?

The extant literature on paternal depression is largely cross-sectional, and the few longitudinal studies have generally examined only whether paternal depression at one time point predicts child functioning at a later time point. This between-person approach provides evidence that children of fathers who experience more depressive symptoms are at greater risk of experiencing depression themselves. Longitudinal studies that take a within-person approach can provide information about whether changes in paternal depression are associated with changes in child functioning.

Few studies have examined whether improvements in parental depressive symptoms (generally treatment-related) are associated with improved child functioning, and of these, only five included fathers. In three cases, mothers and fathers were grouped together in analyses, and reductions in parental depressive symptoms were associated with decreases in children's (age 4–17) emotional and behavioral problems (Byrne et al., 2006; Garber, Ciesla, McCauley, Diamond, & Schloedt, 2011; Timko, Cronkite, Berg, & Moos, 2002). Only two studies were located that specifically examined whether changes in fathers' depressive symptoms were associated with changes in children's depressive symptoms. Pilowsky et al. (2014) found that decreases in paternal depression had little effect on children's (age 7–17) symptoms, whereas reductions in maternal depressive symptoms predicted significant decreases in children's depressive symptoms. However, there were very few fathers in this study ($n=7$), and the children of depressed fathers had few symptoms at baseline, so they had little room for improvement. By contrast, in a large longitudinal study of children aged 11–15, Papp (2012) found that changes in mothers' and fathers' depressive symptoms both predicted changes in children's depressive symptoms, but paternal depression was the stronger predictor. Additional studies that explore whether changes in paternal depressive symptoms are related to changes in children's symptoms are sorely needed, particularly early in development.

Bidirectional Effects of Father and Child Depressive Symptoms

Extant longitudinal research on parental depression has focused on examining how parents' symptoms relate to later child functioning, rather than vice versa (e.g., Beardslee et al., 1998; Cummings et al., 2005; Gunlicks & Weissman, 2008). However, it is plausible that children's depressive symptoms could influence parents' symptoms. Theoretical models of child development point to the bidirectionality of development processes, where parents and children both influence and are influenced by each other (e.g., Belsky, 1984; Bronfenbrenner, 1977; Cicchetti & Toth, 1997; Sameroff, 2000). From a transactional perspective, for example, parent and child symptoms influence ongoing parent-child interactions and the home environment, which in turn affects both parent and child outcomes (Sameroff, 2009). Studies have demonstrated bidirectional relations between maternal depressive symptoms and young children's behavior problems, and between adolescent depressive symptoms and mother-child hostility (Choe, Sameroff, & McDonough, 2013; Choe, Shaw, Brennan, Dishion, & Wilson, 2014; Lewis, Collishaw, Thapar & Harold, 2014). The only study located that examined bidirectional relations between parent and child depression found that maternal depression predicted adolescent depression, but not vice versa (Brown et al., 2015). Whether bidirectional relations exist between parents' and young children's depression symptoms remains to be examined.

Analyzing Change over Time and Directionality of Effects

In research on the effects of parental psychopathology on children, longitudinal studies predicting future child outcomes from parent symptoms are more compelling than studies employing simple cross-sectional designs. Three newer growth modeling techniques can provide a fuller picture of the unfolding of paternal and child depression. First, growth curve analysis using time-varying covariates is a multi-level modeling technique that allows examination of year-to-year changes in a predictor (e.g., paternal depression) and year-to-year changes in an outcome (e.g., child depression), helping to rule out potential time-invariant confounds (Duckworth, Tsukayama, & May, 2010). Second, parallel process longitudinal growth curve modeling allows evaluation of whether growth trajectories in one variable (e.g., paternal depression) and growth trajectories in another (e.g., child depression) are interrelated, thus allowing for the examination of broad changes over time (Bollen & Curran, 2006; Choe et al., 2014; Wright, Pincus, & Lenzenweger, 2013). Finally, cross-lagged structural equation models can provide some insight into the possible direction of a relation between two variables; by testing predictive paths in both directions between two variables (Choe et al., 2014), one can evaluate whether, for example, data are consistent with paternal depression causing child depression, child depression causing paternal depression, or bidirectional relations. Cross-lagged models are also useful for examining whether these relations between variables vary across different developmental periods (Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007; Choe et al., 2014). Together, these three techniques could provide complementary and converging information regarding the interplay of paternal and child depression.

Depression and Child Behavior Problems

Children with behavior problems are at risk for developing comorbid depression (e.g., Greene et al., 2002; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002). Preschoolers with externalizing problems have been found to have higher levels of concurrent internalizing symptoms (Burlaka, Bermann, & Graham-Bermann, 2015; Gilliom & Shaw, 2004) and develop more internalizing symptoms later on (Fischer, Rolf, Hasazi, & Cummings, 1984; Gilliom & Shaw, 2004; Lavigne et al., 1998). In addition, children's dysthymic symptoms have been found to last longer (by nearly 2 ½ years) when they experience comorbid externalizing problems (Kovacs, Obrosky, Gatsonis, & Richards, 1997). Moreover, parents of children with behavior problems may be more likely to develop depression (Choe et al., 2013; Choe et al., 2014; Shaw, Gross, & Moilanen, 2009), which in turn may contribute to the development of depressive symptoms in children. Several studies have examined the relations between parental depression and child behavior problems longitudinally and bidirectionally (Choe et al., 2013; Shaw et al., 2009), and examining relations between paternal and child depression for children with existing behavior problems is therefore an important extension of this literature.

The Current Study

The current study examined the relation between paternal and child depressive symptoms using time-varying covariates in hierarchical linear models, parallel process growth curve modeling, and cross-lagged models, in a clinical sample of young children with behavior problems. The study examined this relation longitudinally over a 3-year period, beginning when children were 3 years old. Paternal depression studies have indicated that fathers are particularly vulnerable to depression during this early period (Garfield et al., 2014; Gross et al., 2008), and early-onset depression in children has been shown to have a more recurrent, severe course (Kovacs, 1996; Zisook et al., 2004). It is therefore particularly important to examine links between paternal and child depression at this early developmental stage. It was hypothesized that changes in paternal depressive symptoms would be associated with similar changes in children's depressive symptoms, both year-to-year (evaluated with time-varying covariate models), and across the whole 3-year period (evaluated with parallel process models). It was further hypothesized that father and child symptoms would be related bidirectionally (evaluated with cross-lagged models). Finally, it was hypothesized that relations between fathers' and children's depressive symptoms would exist independently of the effect of externalizing problems and maternal depressive symptoms.

Method

Participants

Participants were 153 children (84 boys, 69 girls) with behavior problems and their fathers and mothers who took part in a longitudinal study of the early development of behavior problems. Families were selected from a larger sample ($n = 199$) if fathers completed at least one assessment of their own depressive symptoms during the study. Children were 3 years of age at screening and were 36–50 months of age ($M = 44.4$ months, $SD = 3.3$) at the first home visit (T1). Data were collected from families at 1-year (T2), 2-year (T3), and 3-year

(T4) follow-up visits. The sample included European American (60%), Latino American (mostly Puerto Rican; 15%), African American (7%), and multiethnic children (17%). Families came from varied socioeconomic backgrounds. Household income ranged from \$5,500 to \$380,000 (with a median of \$55,000). Mothers averaged 13.63 years of education ($SD = 2.80$), and fathers averaged 13.50 years of education ($SD = 2.73$). Most fathers lived with their children (79%), but those that did not were invited to participate if they spent at least 5 hours per week with their children. Seven mothers and 21 fathers did not participate at T1, but participated in at least one follow-up assessment. One hundred forty-one mothers and 120 fathers participated at T2, 127 mothers and 102 fathers participated at T3, and 131 mothers and 102 fathers participated at T4.

Procedure

Children with significant externalizing problems ($n = 199$) were recruited from 3-year-old children ($n = 1,752$) whose parents completed a screening packet that they received through mail (using state birth records), pediatrician offices, child care centers, and community centers in western Massachusetts. A smaller group of non-problem children were also recruited but were not included in this study. Inclusion criteria for the externalizing problems group were (a) no evidence of intellectual disability, deafness, blindness, language delay, cerebral palsy, epilepsy, autism, or psychosis; (b) parent-reported concern about the child's activity level, defiance, aggression, or impulse control; and (c) T -scores at or above 65 on the Hyperactivity and/or Aggression subscales of the Behavior Assessment System for Children–Parent Report Scale (BASC-PRS; Reynolds & Kamphaus, 1992). Parents were told that the goal of the study was to understand factors that help young children with behavior problems outgrow their difficulties, and they were paid for participating. Fifty-nine percent of the families with children who met criteria agreed to participate. Written consent was obtained from all parents, and the study was conducted in compliance with the university's Institutional Review Board.

Measures

Parental depressive symptoms.—At each time point, fathers and mothers completed the Major Depression, Dysthymia, and Depressive Personality subscales of the Millon Clinical Multiaxial Inventory–III (MCMI-III; Millon, Davis, & Millon, 1997), a self-report questionnaire consisting of 175 true-false items that measures a wide range of adult psychopathology, including depressive symptoms. The internal consistency for these subscales in a clinical population ranged from .88 to .90; test-retest reliabilities ranged from .91 to .95 (Millon et al., 1997). Respondents read a series of statements and indicate whether the statements describe them; “True” responses are assigned one point, and “False” responses are assigned zero points. Because the objective of this study was to analyze changes in depression, all 33 items from these three scales were reviewed, and eight items that assessed symptoms over a long time-frame were removed (e.g., “I’ve had sad thoughts much of my life since I was a child,” “I’ve always had a hard time stopping myself from feeling blue and unhappy,” “I’ve never been able to shake the feeling that I’m worthless to others”). Responses to the 25 remaining items (e.g., “I feel weak and tired much of the time,” “I feel guilty much of the time for no reason that I know,” “Few things in life give me pleasure,” “I feel that most people think poorly of me”) were summed to create a raw score,

with higher scores indicating greater depression. Following scoring instructions (Millon et al., 1997), the six items considered prototypical for the Major Depression subscale (e.g., “I feel terribly depressed and sad much of the time now”) were double-weighted (assigned two points if marked “True”) when calculating raw scores. Internal consistency for these 25 items was excellent (α ranged from .90 to .94) for fathers and mothers at each time point. Typically, scores on these scales are converted to standardized base rate (BR) scores, and scores ≥ 75 are considered to be indicative of a clinical disorder or personality trait. In the present sample, at T1, approximately 8% of mothers and 5% of fathers had BR scores above 75 on the major depression subscale, 8% of mothers and 14% of fathers were elevated on the dysthymia subscale, and 16% of mothers and 33% of fathers were elevated on the depressive personality subscale. Since some scale items were omitted, raw scores (which could range from 0 to 31) were used instead of standardized base rate scores in analyses.

Child depressive symptoms.—Mothers and fathers completed the BASC-PRS (Preschool or Child version, depending on the child’s age) at all four time points. The BASC-PRS is a widely used rating scale that assesses a broad range of psychopathology and demonstrates good reliability and validity (Reynolds & Kamphaus, 1992). The Depression subscale, which assesses sadness, negative self-perceptions, and irritability (and is comprised of 13 items in the Preschool version and 12 items in the Child version), was used. Parents are asked to consider their child’s behavior over the past 6 months, and rate each item from 0 (“Never”) to 3 (“Almost Always”), with higher scores indicating greater symptoms. Sample items include: “Cries easily,” “Says, ‘Nobody likes me’,” “Is sad,” and “Says, ‘I’m not very good at this’.” The internal consistency for this subscale in the current sample was adequate at each time point (α ranged from .78 to .87 and .79 to .85 for mothers’ and fathers’ reports of child symptoms, respectively). The BASC Depression subscale correlates with other measures of early depression symptoms (e.g., the Child Behavior Checklist; see Reynolds & Kamphaus, 1992), and the factor structure for preschoolers is the same as for older children. The Depression subscale loads more strongly onto the internalizing (.60 for both child and preschool versions) than the externalizing broadband (.45 for the child version and .49 for the preschool version; Reynolds & Kamphaus, 1992), suggesting at least some discriminant validity (see discussion section for more on issues around measuring depression at this age). *T*-scores were used in analyses because slightly different items load on these scales in the Child version versus the Preschool version. Based on maternal reports, approximately 18–23% of children (depending on the time point) were considered “at-risk” for depression ($T = 60$ – 69), and 8–19% of children had clinically significant depressive symptoms ($T \geq 70$). Based on paternal reports, about 11–20% of children were considered “at-risk” for depression, and 5–14% of children had clinically significant depressive symptoms.

Data Analysis—Two sets of analyses were carried out to examine whether changes in fathers’ depressive symptoms were associated with changes in children’s depressive symptoms. Because depression has both an episodic and achronic element, one set of analyses examined changes in symptoms that may occur relatively quickly (year-to-year fluctuations) and the other examined changes that may occur gradually (over the course of the 3-year study). Analyses were conducted separately for mothers’ and fathers’ ratings of children’s depression. In the first set, a time-varying covariate approach, using Hierarchical

Linear Modeling (HLM; Raudenbush&Bryk, 1992), was used to analyze the relation between fathers' and children's year-to-year changes in depressive symptoms. HLM is a multi-level modeling technique that allows one to estimate change over time within individuals (Level 1) as well as the variability in that change across individuals (Level 2). A Level 1 equation models an individual's (j 's) repeated measures of a variable (y) across multiple time points (from 1 to i). At Level 1, ratings of child depression were regressed on a time variable (which was centered at T1 and coded 0, 1, 2, and 3) and on paternal depression as a time-varying covariate as follows:

$$\text{Level 1 Model: Child Depression}_{ij} = \beta_{0j} + \beta_{1j} * \text{Time}_{ij} + \beta_{2j} * \text{Paternal Depression} + r_{ij}$$

β_2 was of interest in the present study as an estimate of the relation between year-to-year changes in paternal depression and year-to-year changes in child depressive symptoms.

Level 2 of the model estimates the average growth trajectory across individuals:

$$\text{Level 2 model: } \beta_{0j} = \gamma_{00} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j}$$

In the second set of analyses, parallel process growth curve modeling (using MPLUS 6; Muthén&Muthén, 1998–2010) was used to estimate trajectories of paternal and child depressive symptoms across the course of the study, and whether these trajectories were significantly related over the 3-year period. Latent intercepts and linear slopes were estimated separately for fathers and children. Latent linear slopes for child depression were regressed on latent linear slopes and intercepts for paternal depression, and latent linear slopes for paternal depression were regressed on intercepts for child depression (see Figure 1).

Third, to examine the bidirectional relations between paternal and child depression, cross-lagged models were created using MPLUS 6 (Muthén&Muthén, 1998–2010). Four different models were evaluated. First, a baseline model was created in which child depression at one time point was regressed on child depression at the previous time point, and paternal depression at one time point was regressed on paternal depression at the previous time point (Model A). Autoregressive pathways were first allowed to vary across time to evaluate whether there might be changes in the stability of variables in question. If fixing paths to be equivalent across time did not result in a significantly worse fit, paths were fixed across time. Next, parent-to-child pathways only (Model B) were added to test for parent-to-child effects on child depression, and goodness of fit was compared. Third, child-to-parent pathways only (Model C) were added to the baseline Model A. Within Models B and C, lagged pathways were first allowed to vary across time points to test whether the effects of these variables differed across time points, then they were held constant across time. If fixing paths across time did not result in a significantly worse model fit, those paths were fixed. Lastly, if Models B and C resulted in improved fit compared to Model A, we tested a model that included bidirectional cross-lagged paths (Model D). Model fit was evaluated using four

indicators: χ^2/df (< 2 indicates good model fit), Root Mean Square Error of Approximation (RMSEA; values of .08 and lower represent acceptable model fit), Bentler's Comparative Fit Index (CFI; values higher than .90 indicate acceptable model fit), and Standardized Root Mean Square Residual (SRMR; values lower than .08 indicate adequate model fit; Hu & Bentler, 1998). Full information maximum likelihood was used to address missing data. In this method, all available information is used to estimate parameters.

Given the high correlation between child externalizing and depressive symptoms, and to evaluate whether maternal depression may be playing a role in the relation between paternal and child depression (Ramchandani et al., 2005), additional analyses were run. Unfortunately, neither child externalizing symptoms nor maternal depression could be added as a control variable in the time-varying covariate models, because a fifth time point would be needed to add a second time-varying covariate.¹ In the parallel process growth curve modeling approach, analyses were run examining the relation between paternal and child depressive symptom trajectories, controlling for child externalizing trajectories or maternal depressive symptom trajectories. In the cross-lagged modeling approach, final selected models were re-run regressing child depression at each time point on child externalizing (or maternal depression) from the previous time point to control for child externalizing (or maternal depression) and determine whether paternal depression remained a significant predictor.

Additional analyses (using all three approaches) examined whether the relations between paternal and child depression differed for boys versus girls; however, no clear gender differences emerged, so these results are not reported.

Results

Descriptive Statistics

Means, standard deviations, and intercorrelations for predictor and outcome variables at each time point are presented in Table 1. At each time point, fathers reported experiencing fewer depressive symptoms than mothers. Likewise, fathers rated their children as having lower levels of depression than mothers did at each time point. Fathers' and mothers' depressive symptoms were moderately to highly positively correlated at each time point. Paternal and maternal ratings of child depressive symptoms were also moderately positively correlated across all time points. Parent depression scores were significantly correlated with children's concurrent depressive symptoms, as reported by both parents, at each time point. Correlations between parents' ratings of their child's depressive symptoms and externalizing symptoms ranged from .62 to .74 for fathers and .52 to .63 for mothers at each time point.

Year-to-Year Changes in Paternal and Child Depression: Time-Varying Covariate Models

Results of time-varying covariate models are summarized in Table 2. Year-to-year fluctuations in paternal depression were significantly associated with fluctuations in fathers'

¹This model is not empirically identified if one more predictor is added. There are four data points per subject, and the current model uses all 4 degrees of freedom per person: Intercept, Time, Paternal Depression, and residual. To expand the model to include one more predictor, and thus 5 terms per person, at least 5 data points per person would be required.

ratings of their children's depressive symptoms ($b = 0.97$, $SE = 0.13$, $p < .001$) as well as with fluctuations in mothers' ratings of their children's depressive symptoms ($b = 0.73$, $SE = 0.13$, $p < .001$). This means that within families, children were reported to have higher levels of depression during years in which fathers reported more depressive symptoms themselves.

Trajectories of Paternal and Child Depression across the 3-Year Period: Parallel Process Growth Curve Models

Before evaluating whether changes in fathers' depressive symptoms predicted changes in children's depressive symptoms, unconditional linear growth models were fit for each rating of depression. On average, fathers' depressive symptoms changed little over the 3-year period ($b = 0.12$, $SE = 0.17$, $p = .48$), whereas children's average depressive symptoms decreased significantly over time based on fathers' ($b = -1.71$, $SE = 0.43$, $p < .001$) and mothers' ($b = -1.70$, $SE = 0.40$, $p < .001$) reports. There was significant individual variability in the change in depressive symptoms for children ($\sigma^2 = 16.42$, $SE = 3.84$, $p < .001$, and $\sigma^2 = 11.40$, $SE = 3.43$, $p = .001$, for paternal and maternal reports, respectively), but not for fathers ($\sigma^2 = 0.52$, $SE = 0.94$, $p = .58$) over the 3-year period.

Changes in paternal depression were significantly associated with changes in children's depressive symptoms as reported by fathers ($b = 4.08$, $SE = 1.24$, $p = .001$). Initial levels of paternal depression were also significantly associated with changes in father-reported child depression ($b = -.54$, $SE = .24$, $p = .02$), but initial levels of child depressive symptoms did not predict changes in fathers' depressive symptoms ($b = -.02$, $SE = .02$, $p = .41$). When maternal reports of child symptoms were used, changes in fathers' depressive symptoms did not predict changes in children's depressive symptoms ($b = 6.50$, $SE = 3.98$, $p = .10$). In this case, initial levels of paternal depression were not significantly associated with changes in children's symptoms ($b = -.70$, $SE = .74$, $p = .34$), and initial levels of child depression did not predict changes in paternal depression ($b = -.01$, $SE = .02$, $p = .68$). Because initial levels of child depression did not predict changes in paternal depression in either model (and were close to zero), this path was removed in subsequent analyses.

To ensure that these effects were not the result of children's high levels of behavior problems, these models were run again controlling for children's overall externalizing symptoms. In particular, latent intercepts and slopes were estimated for externalizing symptoms, and child depression slopes were regressed on externalizing intercepts and slopes (which were allowed to correlate with one another). In three out of four cases,² changes in paternal depression continued to significantly predict changes in child depression (p values ranged from .01 to .02). In all four of these models, changes in child externalizing behaviors, fathers' initial levels of depression, and children's initial levels of externalizing behavior were not significantly associated with changes in child depressive symptoms.

Controlling for maternal depressive symptoms, changes in paternal depression ($b = 4.01$, $SE = 1.32$, $p = .002$) and initial levels of paternal depression ($b = -.80$, $SE = .34$, $p = .02$) again

²Because both parents rated children's depressive symptoms and externalizing behaviors, there were four of these models: one using father-reported depressive symptoms and externalizing behaviors, one using mother-rated depressive symptoms and externalizing behaviors, one using father-reported depressive symptoms and mother-rated externalizing behaviors, and one using mother-reported depressive symptoms and father-reported externalizing behaviors.

predicted changes in fathers' reports of children's depressive symptoms. When maternal reports of child symptoms were used, neither changes in paternal depression ($b = 6.01$, $SE = 3.22$, $p = .06$) nor initial levels of paternal depression ($b = -1.23$, $SE = .90$, $p = .17$) predicted changes in children's depressive symptoms. In both of these analyses, mothers' initial levels of depression ($b = .28$, $SE = .28$, $p = .30$ and $b = .68$, $SE = .54$, $p = .21$ for father-reported and mother-reported child symptoms, respectively) and depressive symptom slopes ($b = -.30$, $SE = 1.27$, $p = .81$ and $b = 2.01$, $SE = 2.00$, $p = .31$ for father-reported and mother-reported child symptoms, respectively) were not significantly associated with children's depressive symptom slopes, controlling for fathers' depressive symptom trajectories.

Bidirectional Effects of Paternal and Child Depressive Symptoms: Cross-Lagged Models

Fathers' report of child depression.

In Model A for paternal depression and fathers' reports of child depression, holding autoregressive paths equal across time for both variables resulted in a significantly worse model fit, $\chi^2(4) = 46.01$, $p < .001$. Therefore, this model was constructed with time variant autoregressive paths for paternal depression and child depression. Next, paths were added from paternal depression at one time point to child depression at the next time point (Model B). Constraining these paths to be equal across time did not result in significantly worse model fit, $\chi^2(2) = 1.61$, $p = .45$, so they were fixed across time. Paternal depression at each time point significantly predicted child's depression at the next time point (see Figure 2). Model B significantly improved fit over Model A, $\chi^2(1) = 11.05$, $p < .001$. Next, paths were added from child depression at one time point to paternal depression at the next time point (Model C). Constraining these paths to be equal across time did not result in significantly worse model fit, $\chi^2(2) = .93$, $p = .63$, so paths were fixed across time. Child depression did not predict paternal depression (T1 to T2: $\beta = .03$, $SE = .05$; T2 to T3: $\beta = .02$, $SE = .03$; T3 to T4: $\beta = .02$, $SE = .03$; $ps = .57$). Model C did not significantly improve fit over Model A, $\chi^2(1) = .43$, $p = .51$. Thus, Model B was selected as the final model (see Figure 2); paternal depression at each time point significantly predicted child's depression at the next time point. All four fit indices indicated that this model had an adequate fit, $\chi^2/df = 1.89$, RMSEA = .08, CFI = .98, and SRMR = .04.

This model was then run regressing child depression at each time point on child BASC Externalizing scores as reported by fathers from the previous time point, to control for behavior problems. Paternal depression remained a significant predictor of child depression (T1 to T2: $\beta = .15$, $SE = .06$; T2 to T3: $\beta = .12$, $SE = .04$; T3 to T4: $\beta = .17$, $SE = .06$; $ps = .002$) and BASC Externalizing scores as reported by fathers did not predict child depression (T1 to T2: $\beta = .01$, $SE = .04$; T2 to T3: $\beta = .01$, $SE = .03$; T3 to T4: $\beta = .01$, $SE = .04$; $ps = .82$). Child depression was also regressed on child BASC Externalizing scores as reported by mothers from the previous time point, to also control for behavior problems and informant variance. Paternal depression remained a significant predictor of child depression (T1 to T2: $\beta = .15$, $SE = .05$; T2 to T3: $\beta = .11$, $SE = .04$; T3 to T4: $\beta = .17$, $SE = .06$; $ps = .002$) and

BASC Externalizing scores as reported by mothers did not predict child depression (T1 to T2: $\beta = .01$, $SE = .04$; T2 to T3: $\beta = .01$, $SE = .03$; T3 to T4: $\beta = .01$, $SE = .04$; $ps = .82$).

The final model was also run regressing child depression at each time point on maternal depression from the previous time point, to control for maternal depression. Paternal depression remained a significant predictor of child depression (T1 to T2: $\beta = .13$, $SE = .05$; T2 to T3: $\beta = .10$, $SE = .04$; T3 to T4: $\beta = .14$, $SE = .06$; $ps = .02$), and maternal depression did not predict child depression (T1 to T2: $\beta = .07$, $SE = .04$; T2 to T3: $\beta = .06$, $SE = .04$; T3 to T4: $\beta = .08$, $SE = .05$; $ps = .09$).

Mothers' report of child depression.

In Model A for paternal depression and child depression, as reported by mothers, holding paths equal across time for both variables resulted in a significantly worse model fit, $\chi^2(4) = 43.43$, $p < .001$. Therefore, this model was conducted with time variant autoregressive paths for paternal depression and child depression. Next, in Model B, constraining parent-to-child paths to be equal across time did not result in significantly worse model fit, $\chi^2(2) = 4.63$, $p = .10$, so they were fixed across time. Paternal depression at each time point significantly predicted child's depression at the next time point (see Figure 2). Model B significantly improved fit over Model A, $\chi^2(1) = 9.71$, $p = .002$. Next, in Model C, constraining child-to-parent paths to be equal across time did not result in significantly worse model fit, $\chi^2(2) = 1.80$, $p = .41$, so they were fixed across time. Child depression did not predict paternal depression (T1 to T2: $\beta = -.05$, $SE = .04$; T2 to T3: $\beta = -.03$, $SE = .03$; T3 to T4: $\beta = -.04$, $SE = .03$; $ps = .23$). Model C did not significantly improve fit over Model A, $\chi^2(1) = 1.31$, $p = .25$. Thus, Model B was selected as the final model (see Figure 2); paternal depression at each time point significantly predicted child's depression at the next time point. Two out of the four fit indices indicated that this model had an adequate fit, CFI = .96 and SRMR = .06; the remaining two fit indices indicated a mediocre fit, $\chi^2/df = 2.52$ and RMSEA = .10.

This model was then run regressing child depression at each time point on child BASC Externalizing scores as reported by mothers from the previous time point, to control for behavior problems. Paternal depression remained a significant predictor of child depression (T1 to T2: $\beta = .11$, $SE = .04$; T2 to T3: $\beta = .09$, $SE = .03$; T3 to T4: $\beta = .12$, $SE = .04$; $ps = .004$) and BASC Externalizing scores as reported by mothers did not predict child depression (T1 to T2: $\beta = .02$, $SE = .03$; T2 to T3: $\beta = .02$, $SE = .03$; T3 to T4: $\beta = .02$, $SE = .03$; $ps = .54$). Child depression was also regressed on child BASC Externalizing scores as reported by fathers from the previous time point, to also control for behavior problems and informant variance. Paternal depression remained a significant predictor of child depression (T1 to T2: $\beta = .10$, $SE = .03$; T2 to T3: $\beta = .09$, $SE = .03$; T3 to T4: $\beta = .12$, $SE = .04$; $ps = .003$) and BASC Externalizing scores as reported by fathers only predicted child depression at Time 2 (T1 to T2: $\beta = .20$, $SE = .06$, $p = .001$; T2 to T3: $\beta = -.08$, $SE = .07$, $p = .26$; T3 to T4: $\beta = .02$, $SE = .06$; $p = .79$).

The final model was also run regressing child depression at each time point on maternal depression from the previous time point, to control for maternal depression. In this case, neither paternal depression (T1 to T2: $\beta = .08$, $SE = .04$; T2 to T3: $\beta = .07$, $SE = .04$; T3 to

T4: $\beta = .09$, $SE = .05$; $ps = .06$) nor maternal depression (T1 to T2: $\beta = .08$, $SE = .04$; T2 to T3: $\beta = .07$, $SE = .04$; T3 to T4: $\beta = .08$, $SE = .04$; $ps = .06$) significantly predicted child depression.

Discussion

The current study extended the largely mother-focused literature on parental depression by evaluating whether fathers' and children's depressive symptoms covaried over a 3-year period, beginning when children were 3 years of age. Three longitudinal modeling techniques were used to provide complementary evidence and examine different aspects of the relation between paternal and child depression. The study used a sample of young children with behavior problems, who were therefore at high risk for developing future difficulties, including depression. It was hypothesized that changes in paternal depressive symptoms would be associated with similar changes in children's depressive symptoms. It was further hypothesized that data would be consistent with bidirectional relations between fathers' and children's depression symptoms.

Results from the time-varying covariate and parallel process growth curve analyses generally supported the first hypothesis. Year-to-year fluctuations in paternal depressive symptoms predicted corresponding fluctuations in children's depressive symptoms. Likewise, fathers' and children's 3-year depressive symptom trajectories were significantly related to each other when paternal reports of child symptoms were utilized; effects were similar in magnitude using maternal reports, but were not significant. Although they do not prove causality, these findings are consistent with the hypothesis that paternal depression, much like maternal depression, has a detrimental effect on children's emotional health. Depression is thought to affect parents' behaviors, feelings towards family members, and interactions and relationships with children and partners. For example, paternal depression has been linked to the use of harsh discipline (Davis, Davis, Freed, & Clark, 2011), higher levels of father-child hostility and conflict (Kane & Garber, 2009; Low & Stocker, 2005), as well as more rejecting and fewer nurturing behaviors (Elgar, Mills, McGrath, Waschbusch, & Brownridge, 2007). These environmental factors are thought to interact with genetic vulnerabilities to contribute to the development of depression in children. Additional research is needed to further evaluate possible mechanisms through which paternal depression may affect the development of depression in children, and whether differences exist across culture and family structure.

Interestingly, paternal depression was found to be as strong or stronger a predictor of children's depressive symptoms than maternal depression. In both analytic approaches that took maternal depressive symptom trajectories into account, only paternal depressive symptom trajectories significantly predicted children's depressive symptom trajectories (when father-reported child symptoms were used). In the mother-report models, neither parent's depression slopes were uniquely predictive when both were included. Although this finding that paternal depression was a strong predictor of child depressive symptoms aligns with Papp (2012), it is in contrast to previous studies that found no relation between paternal and child depressive symptoms (e.g., Davé et al., 2008; Hanington et al., 2011; Malmberg & Flouri, 2011), as well as those where the relation between paternal

depression and child internalizing symptoms became non-significant after controlling for maternal depression (e.g., Cimino, Cerniglia, & Paciello, 2014; Ramchandani et al., 2005). One possible reason for this discrepancy may relate to how children's depressive symptoms were measured in each study. In the Papp (2012) study, children rated their own depressive symptoms, and in the present study, both maternal and paternal reports of child symptoms were utilized. Most of the previous studies that found significant effects for mothers but not fathers relied exclusively on maternal reports of children's internalizing symptoms (e.g., Malmberg & Flouri, 2011; Ramchandani et al., 2005); it is possible that some of the relations between maternal and child depressive symptoms were inflated due to shared method variance in these studies. This may also have been the case in the current study, as the relations between paternal and child depressive symptoms in the parallel process models were only significant when father-reported child symptoms were used. On the other hand, relations did hold even for mother-reported child symptoms in the current study for the time-varying covariate and cross-lagged approaches. Additionally, while previous studies have largely been conducted with community samples, the present study used an at-risk sample of children with behavior problems. It is possible that paternal influences within this sample are particularly important. Another plausible explanation may relate to the use of cross-sectional vs. longitudinal data. The previously mentioned studies were mostly cross-sectional or measured paternal depression early on and child internalizing symptoms a few years later. By contrast, the present study and Papp (2012) measured parents' and children's depressive symptoms multiple times over an extended period of time. These findings illustrate the importance of evaluating longitudinal relations among variables and including multiple sources of information.

In cross-lagged analyses, fathers' depressive symptoms predicted subsequent child depressive symptoms, but child depressive symptoms did not predict later father depressive symptoms. This is consistent with the theory that paternal depression has a negative impact on children's mental health. The findings do not support bidirectional relations between father and child symptoms. While young children are primarily dependent on and therefore heavily influenced by their family and home experiences (Bagner, Pettit, Lewinsohn, & Seeley, 2010; Connell & Goodman, 2002), adults' psychopathology may be more influenced by the broader factors on which they are more dependent, such as financial security, job or relationship quality, or their spouses' depression (e.g., Davé et al., 2008; Davis et al., 2011; Rosenthal, Learned, Liu, & Weitzman, 2013; Goodman, 2008). It is possible that child effects are more relevant as children become older and exert a more independent effect on the household.

Overall, the present study found converging evidence for a link between fathers' depressive symptoms and their children's depressive symptoms. The use of multiple longitudinal modeling techniques was a strength of the study, as it allowed examination of both short- and long-term change over time, and examination of possible directionality of relations between paternal and child depression.

Study Limitations

There are several limitations to this study. First, although the longitudinal analyses, especially in combination, provide stronger information about the interplay between paternal and child depression, they nonetheless come with important caveats. The growth curve analyses help rule out time-invariant third-variable explanations for the relations, but cannot rule out time-variant factors, such as marital conflict. The cross-lagged analyses allow for an examination of whether data are consistent with hypothesized causal pathways, but do not rule out the possibility that other models would also fit the observed data. Ultimately, experimental data (e.g., with targeted interventions) will provide the strongest test of causal models. Second, although the sample was ethnically diverse, the sample size was not large enough to examine differences among ethnic groups. It is possible that the relations between paternal depression and child depressive symptoms may vary depending on families' ethnicity and culture. Third, most participants were experiencing relatively few depressive symptoms. It will be important for future research to evaluate whether similar findings emerge in samples where participants are experiencing clinical levels of depression, and whether certain depressive symptoms are more important than others in predicting changes in family members' depression. Fourth, although we employed a widely used measure of child symptoms, it may not have accurately captured depressive symptoms in this age group. Some symptoms assessed by this scale (such as irritability and loneliness) cut across multiple diagnostic categories, and indeed, scores on the depression subscale were correlated with reports of overall externalizing symptoms; it is unclear whether this simply reflects the high comorbidity among emotional and behavioral diagnoses or a more critical measurement issue. Some researchers have found that current diagnostic criteria (used for children and adults) can be used to adequately assess depression in preschoolers (see Luby et al., 2014) and distinguish depression from certain behavioral disorders (Strickland et al., 2011); however, this research area is still in its infancy, and it is crucial that we learn more about how these symptoms develop and manifest themselves in very young children to aid early intervention efforts. Fifth, the study did not evaluate possible mechanisms of the link between fathers' and children's depression, such as parenting or family conflict. Future studies should examine possible mechanisms to provide a deeper understanding of the effects of paternal depression on children. Finally, this sample only included children with significant behavior problems; while this is a very important group, as they are at heightened risk for developing internalizing symptoms (e.g., Fischer et al., 1984; Lavigne et al., 1998), results may differ in families where children do not exhibit behavioral difficulties.

Conclusions/Implications

Despite these limitations, this is one of the few studies that has specifically examined paternal and child depressive symptoms over an extended period of time. It is also the only one that has examined whether and how fathers' and children's depressive symptoms covary using three analytic approaches. The longitudinal nature of this study, combined with the fairly robust convergence of results across analytic approach, provides evidence that fathers' depressive symptoms likely have an important, unique relation with their children's depressive symptoms.

Knowing that fathers' and children's depressive symptoms follow similar patterns and trajectories across time can aid intervention efforts. Although men generally display low rates of help-seeking (see Addis & Mahalik, 2003), fathers may be more willing to seek treatment for their depressive symptoms if they think it might benefit their children. This knowledge should also prompt researchers to expand efforts to include fathers in research. In addition, it may encourage health providers and other professionals who work with children and families to more actively reach out to fathers to promote the psychological health of all family members.

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Figure 1.

Parallel process latent growth curve model. T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4. Separate models were estimated for father-reported and mother-reported child depressive symptoms.

a) Fathers' Report of Children's Depressive Symptoms

b) Mothers' Report of Children's Depressive Symptoms

Figure 2.

Models for paternal depression and child depression as reported by fathers and mothers.

Standardized coefficients are presented. T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time

4. * $p < .05$. ** $p < .01$. *** $p < .001$

Table 1

Descriptive Statistics and Correlations for Major Study Variables

	<i>n</i>	<i>M (SD)</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
PD																		
1. T1	132	3.73 (5.72)	-															
2. T2	119	3.56 (5.19)	.61***	-														
3. T3	102	3.97 (6.69)	.67***	.80***	-													
4. T4	102	3.54 (6.40)	.70***	.74***	***	-												
MD																		
5. T1	146	5.54 (6.35)	.37***	.46***	.49***	.43***	-											
6. T2	141	5.63 (6.66)	.44***	.54***	.54***	.46***	.82***	-										
7. T3	127	5.66 (7.15)	.33**	.57***	.54***	.49***	.76***	.84***	-									
8. T4	131	5.16 (6.75)	.47**	.55***	.47**	.41**	.65**	.75	.76**	-								
CD(PR)																		
9. T1	137	56.73 (14.98)	.33***	.26**	.11	.14	.30***	.29***	.30**	.46***	-							
10. T2	121	52.05 (11.67)	.30***	.41***	.40***	.46***	.43***	.37***	.44***	.48***	.59***	-						
11. T3	103	51.72 (13.54)	.42***	.46***	.60***	.54***	.41***	.39***	.39***	.46***	.45***	.66***	-					
12. T4	103	49.72 (11.14)	.30**	.41***	.55***	.57***	.41***	.36***	.36***	.50***	.32**	.52***	.72***	-				
CD(MR)																		
13. T1	153	59.17 (13.44)	.27**	.04	.05	.00	.31***	.24**	.16	.23**	.58***	.45***	.30**	.18	-			
14. T2	144	54.80 (11.95)	.11	.24**	.17	.07	.30***	.36***	.34***	.46***	.37***	.56***	.33***	.35***	.54***	-		
15. T3	127	54.79 (12.95)	.21*	.30**	.36***	.27**	.42***	.44***	.40***	.47***	.44***	.56***	.58***	.43***	.56***	.65***	-	
16. T4	131	53.28 (12.37)	.37***	.43***	.55***	.41***	.38***	.45***	.42***	.56***	.35***	.48***	.59***	.71***	.36***	.58***	.71***	-

Note. PD = paternal depression; MD = maternal depression; CD = child depression; PR = paternal-report; MR = maternal-report

T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Summary of Time-Varying Covariate Analyses

Fathers' Report of Children's Depressive Symptoms:					
Fixed effects	Coefficient	<i>SE</i>	<i>t</i>	Approx. <i>df</i>	<i>p</i>
Intercept (β_{00})	52.21	1.13	46.08	152	<.001
Time slope (β_{10})	-2.14	0.42	-5.06	152	<.001
Dad Depression slope (β_{20})	0.97	0.13	7.28	152	<.001
Random effects	<i>SD</i>	Variance Component	<i>df</i>	χ^2	<i>p</i>
Intercept (μ_0)	10.88	118.27	79	233.29	<.001
Time slope (μ_1)	3.17	10.07	79	181.33	<.001
Dad Depression slope (μ_2)	0.52	0.27	79	113.85	.006
Level-1 (<i>e</i>)	7.21	51.93			
Mothers' Report of Children's Depressive Symptoms:					
Fixed effects	Coefficient	<i>SE</i>	<i>t</i>	Approx. <i>df</i>	<i>p</i>
Intercept (β_{00})	55.91	1.11	50.20	152	<.001
Time slope (β_{10})	-2.60	0.41	-6.31	152	<.001
Dad Depression slope (β_{20})	0.73	0.13	5.85	152	<.001
Random effects	<i>SD</i>	Variance Component	<i>df</i>	χ^2	<i>p</i>
Intercept (μ_0)	10.97	120.44	80	211.57	<.001
Time slope (μ_1)	3.14	9.85	80	150.20	<.001
Dad Depression slope (μ_2)	0.51	0.26	80	86.46	0.29
Level-1 (<i>e</i>)	6.69	44.80			