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Depression Moderates Maternal Response to Preschoolers' Positive Affect

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Abstract

Maternal depression is associated with disrupted responsiveness during mother-infant dyadic interactions. Less research has evaluated whether responsivity between mother and offspring is altered in interactions during the preschool years, a period of vast socio-emotional development. In the current study, 72 mothers and preschoolers engaged in a positive emotion-eliciting task, in which they drew and talked about a recent fun experience, and independent coders separately rated mother and child emotion in 10-second intervals. Lagged multilevel models demonstrated that for dyads with *currently* depressed mothers, but not for healthy mothers or mothers with a *past* history of depression, greater child positive affect was associated with *lower* frequency and intensity of mother positive affect 10 seconds later. The effect of mother positive affect on child response was not significant. Findings suggest that the ability to acknowledge, imitate, and elaborate children's positive emotion during early childhood is altered in the context of depression, but that this altered responsiveness may improve with recovery from depression.

Keywords

Depression; Positive Affect; Maternal Responsiveness

Depression, a debilitating disorder characterized by low mood, is common especially in women of childbearing age (Kessler, 2003). One hallmark of depression is disrupted positive affect (PA) and social functioning (Hasler et al., 2004; Forbes & Dahl, 2012; Pizzagalli, 2014). Research has demonstrated that depressed individuals have difficulty finding pleasure in and motivation for positive experiences and show impairments in positive, interpersonal interactions (Hasler et al., 2004; Joiner & Coyne, 1999). Some work has supported the notion of emotion context insensitivity in depression, such that depressed individuals may show diminished capacity to respond to change in an emotional context, including in

Footnote.

¹ Mother depression status remained a significant moderator of the association between child PA on mother PA ten seconds later when we included only those 11 mothers who met criteria for a current Depressive Episode on the SCID ($\beta = -.14$, $t = -3.38$, $p = .001$).

Data Availability Statement.

The data that support the findings are available from the corresponding author upon reasonable request.

response to positive social interactions (Rottenberg & Hindash, 2015). Unfortunately, during a depressive episode, these affective and social impairments can extend to interactions with one's own child (Goodman & Garber, 2016).

Recent models suggest that maternal depression specifically interrupts dyadic mutual responsiveness, a normative pattern of affect and behavior matching that occurs in mother-infant dyads and that is thought to foster mother-infant bonding and infant psychophysiological development (Feldman, 2007; 2012). In healthy dyads, dyadic mutual responsiveness is characterized by shared gaze, maternal imitating and elaborating of child PA and expressions, and synchronization of physiology (e.g., heart rhythms). In contrast, depressed mothers have been demonstrated to respond less sensitively and warmly to their infant's cues (Bernard et al., 2018; Lovejoy et al., 2000). Furthermore, they appear to be less likely to mimic their infant's PA (i.e., smiling, cooing) and more likely to respond synchronously to their infant's negative affect (Field, 2010; Hummel, Kiel, & Zvirblyte, 2016). However, less work has evaluated whether these affective and social impairments in sensitive responding to child affect continue past the infancy period. Emerging work suggests that these aberrations likely continue, but the nature of the impairments may change with development (Dix, Moed, & Anderson, 2014; Feldman, 2007; Wu, Hooper, Feng, Gerhardt, & Ku, 2019).

The dynamic between mother and child changes gradually over the first years of life. During infancy, infants rely on mothers to regulate their affect and physiology and do so by mimicking their mothers' facial expressions and by synchronizing their heart rhythms to their mothers (Harrist & Waugh, 2002). However, as infants grow into the preschool period, greater autonomy and independence emerges and the child will begin to set the stage in certain interactions (e.g., during interactive play; Feldman, 2015; Harrist & Waugh, 2002). In these cases, mothers may allow the child to guide play and respond by imitation and elaboration of child facial expressions and behaviors (Feldman, 2015; Harrist & Waugh, 2002). Sensitive responding to child positive bids serves as a method of socialization—in that mothers' responses reinforce appropriate and regulated expression of positive affect and behavior (Thompson & Meyer, 2007). In this case, healthy and adaptive parenting during the preschool years may be characterized by child-led interactions in which mothers respond sensitively and warmly to child positive emotions and behaviors.

The preschool period is a time of vast socio-emotional development, including growth in self-regulation, in social approach and competence, and in prosocial behavior (Saarni, 2011). Normatively, from ages 3 to 5, children show decreases in disruptive and aggressive behavior and increases in prosocial behavior (such as sharing, helping, and complying with others' demands). Further, children begin to demonstrate capacities for friendship, engaging in joint, interactive play rather than solitary or parallel play that is more typical in the toddler period (Saarni, 2011). Much of these normative changes appear to develop in response to positive environmental influences, such as parental modeling and coaching (Silk et al., 2011, Thompson & Meyer, 2007; Zahn-Waxler, 2010). As noted by Morris et al. (2007), socialization of children's emotion regulation likely involves a combination of three factors—observation (i.e., modeling, emotion contagion), parenting practices (i.e., emotion coaching), and emotional climate (i.e., attachment, expressiveness in the home). In

particular, positive, reciprocal interactions between parent and child during the preschool period may provide a context through which preschoolers learn many of these social behaviors—including regulated emotion, back-and-forth play, and sharing or helping (Thompson & Meyer, 2007). Thus, understanding whether depression may interfere with maternal responding to child's positive affective expression during mother-child social interactions during the preschool period is developmentally critical. Prior work has demonstrated that offspring of depressed mothers show lower levels of PA across development from infancy through adolescence (Olino et al., 2011). Lower maternal responsiveness to child PA may be one early socialization mechanism through which this difference develops.

Given that positive reciprocity between mother and child during the preschool period has been less well-studied relative to during the infancy period, it is unclear whether mothers are likely to respond to their children's affect or vice versa, during this period in which children are becoming more autonomous and independent (Feldman, 2007; Harrist & Waugh, 2002). Beyond infancy, the parent-child relationship becomes more complex and parents need to be able to allow children to initiate and lead talk and play with parents responding sensitively and in kind (Feldman, 2015). Further, mother-child responsiveness is a dyadic, bidirectional process in which both partners must be able to respond to one another sensitively and appropriately. In this regard, maternal depression may influence PA responsiveness in both the mother and the child. Because depression may contribute to an emotional climate of lower emotional expressiveness in the home, both mothers and children may imitate and reinforce one another's PA expressions less frequently in the context of maternal depression, especially as children age and become more autonomous.

Examining how this pattern of parent-child responsiveness during the preschool period may be modulated by maternal depression is needed (i.e., whether one member or both members of the dyad are showing lower levels of responsiveness in the context of maternal depression). Parent-child responsiveness may be modulated by current levels of depression, given models of attenuated positive emotion responses, but not by a history of depression—as these response patterns may have changed with remission. Further, evaluating these questions requires the use of repeated methods that allow for measurement of timing and directionality. The use of hierarchical linear modeling (HLM) to evaluate repeated assessment of affect in both mothers and children is advantageous for these reasons (see Morris, Silk, Morris, Steinberg, Aucoin, & Keyes, 2011). HLM also provides an opportunity to test how between-subject factors, such as maternal depression, may be related to short-term dynamic and temporal changes in interpersonal affect (i.e., emotion expressions and responses between a mother and child).

The current study evaluated how mothers may respond to their 3- to 5-year old children's positive affective expression during a positive emotion-eliciting laboratory interaction using a repeated measures hierarchical linear model. Further, we examined whether maternal depression may interfere with this responding, by testing whether current depression may predict mother response to children's positive emotion expression across the interaction. We predicted that for mothers coping with current depression, but not for mothers with a history of depression, the association between child's affect and mother's responding would be

weakened. We also explored whether maternal current depression would influence child response to mother's positive emotion expression across the interaction, based on prior research on emotional climate as a socialization factor.

Method

Participants were 72 3- to 5-year old typically developing children ($M_{age}=3.88$ years, $SD=.80$) and their biological mothers ($M_{age}=35.36$ years, $SD=5.79$). Of these 72 children, 61% were female and 64% were White/Caucasian, 13% Black/African-American, 4% Asian, and 18% Multiracial; 3% were Hispanic/Latino. Further, 66% of mothers in the study had completed a college level degree (Bachelor's or Graduate level) and 13% had a high school degree or lower. Children and their mothers were recruited from the community (e.g., daycares, preschools) and from existing studies on depression at our University and affiliated health system to evaluate the role of maternal history of depression on child socio-emotional functioning during the preschool period. To be eligible for the study, mothers had to either have a lifetime history of depression but be free of psychotic disorders or Bipolar Disorder or have no lifetime history of any Axis I disorder. Children were required to be free of developmental disabilities. Originally, 78 families were enrolled into the study. However, of these, four participants were removed due to suspected child developmental disabilities and two were removed due to mother history of Bipolar Disorder. There were no significant differences between the 72 dyads that remained in the study and the 6 that were removed from analyses on child gender, child age, or mother depressive symptoms ($\chi^2 = 1.77$, $p=.18$; $F_s = .08-.74$, $p_s=.15-.94$).

Procedure

Mothers and children were invited into the laboratory for a one-time research visit in which mothers completed a clinical interview detailing their lifetime history of psychiatric illness. Mothers also completed questionnaires about their current psychiatric functioning, including their depressive symptoms. Children and mothers completed positive emotion-eliciting laboratory tasks, including a mother-child event recall and planning task. The study was approved by the University's Human Research Protection Office and all participants provided informed consent and assent. All participants were compensated for their participation.

Depression.

Mothers completed the Structured Clinical Interview for DSM-IV Diagnoses (SCID; Spitzer, Williams, Gibbon, & First, 1992), a semi-structured clinical interview designed to assess lifetime psychiatric history based on DSM-IV criteria, with a trained clinical interviewer. Fifteen percent of interviews ($n=11$) were double coded by a licensed clinical psychologist to ensure reliability (89% agreement; Kappa=.74 for current depression & 1.00 for past depression). Mothers also completed the Center for Epidemiological Disorders-Depression (CES-D) scale, a widely used measure of depressive symptoms (Radloff, 1977). A sample item from this measure is "I felt depressed". The CES-D has a clinical cutoff score of 16, which represents significantly elevated depressive symptoms. Internal consistency for the CES-D was high ($\alpha=.91$). For the current study, we defined maternal current depression as

having a clinical diagnosis of current MDD on the SCID and/or having a score of 16 or higher on the CES-D (i.e., the clinical cutoff).

Mother and Child Affect.

Mothers and children completed a 5-minute event recall and planning task in which they were asked to draw and talk about a recent fun event that the child had enjoyed and plan for the next time they would engage in this activity (Hollenstein et al., 2004). This widely used task has successfully elicited positive emotion in parent-child dyads in prior work (e.g., see McMakin et al., 2011, Schwartz et al., 2011; Schwartz et al., 2012). Dyads could choose the topic for this 5-minute recall and planning task. Examples of topics discussed included a trip to grandparents' house, going to a birthday party, and getting ice cream (see Table 2). The interaction was videotaped and coded on PA by observers who were naïve to diagnostic status of mothers and study hypotheses, and who were trained to 80% agreement with a master coder.

Similar to other research evaluating level of responsiveness of affect and behavior between mother and child, separate coders provided codes for child and mother PA in 10-second intervals (Feldman, Eidelman, Sirota, & Weller, 2002). Positive and negative affect for each dyad member (child, parent) was coded regardless of other dyad member's affect. Thus, each member of the dyad could receive up to 30 codes for the 5-minute task. Of the 72 dyads in the study, 8% of children and 22% of mothers were missing partial affect data (i.e., had fewer than 30 epochs of coded data). For children, the average number of missing epochs was 3.00 ($SD=3.95$, Range=1–11). For mothers, the average number of missing epochs was 3.45 ($SD=3.32$, Range=1–12). Data were missing primarily because the mother or child was temporarily not visible on camera for a given epoch. One dyad had a shortened task due to a camera malfunction and thus both mother and child were missing the final 11 epochs. There were no significant differences in child age or sex or for mother current or past depression status for dyads with and without partial affect data ($p=.10-.71$). Thus, because HLM can handle missing Level 1 data, all 72 dyads were included in analyses.

Based on the AFFEX coding system (Izard, Dougherty, & Hembree, 1983), PA was characterized as the presence of facial, vocal, or bodily expression of happiness/joy or excitement. NA was characterized as the presence of facial, vocal, or bodily expressions of anger, contempt, sadness, or fear. Facial expressions of PA included, but were not limited to, smiling and brightening of eyes. Vocal expressions of PA included lilting voices and exclamations of joy (e.g., yay!). Bodily expressions of PA included clapping one's hands or bouncing up and down. Facial expressions of NA included, but were not limited to, tightened jaw, furrowed eyebrows, and frowns. Vocal expressions of NA included raised voice or crying. Bodily expressions of NA included rigid body postures or repetitive movements. Both PA and NA were coded by intensity of these expressions on a 0–2 scale (0= no presence of affect, 1= low-intensity affect, 2=high-intensity affect). Twenty-one percent ($n=15$) of videos were double coded by the master coder and inter-rater reliability for PA was high (ICCs for each coder=.81-.92).

Data Analytic Strategy

Because the base rate of NA was low in our sample for both children and mothers (see *Descriptives*) and because alterations in positive affect appear to distinguish depression (and risk for depression) from other affective disorders (e.g., see Durbin et al., 2005), we chose to focus our models on mother-child PA. Similar to prior work (Gunthert et al., 2007; Moberly & Watkins, 2008), we used a lagged multilevel modeling approach to evaluate mother response to child positive affect. First, we created a lagged variable of child PA at $t-1$ (i.e., where 1 equals 10 seconds based on use of 10-second epochs). Likewise, to test that mothers were responding to children (and not vice versa), we also created a lagged variable of mother PA at $t-1$. Both lagged variables were centered around their group (i.e., participant's) mean. Models were run in Hierarchical Linear Modeling (HLM, Raudenbush & Bryk; 2002) which allows for evaluation of nested data (i.e., repeated assessments within persons) using multilevel models where Level 1 is the individual level and Level 2 is the dyad level.

We ran two mixed effect models. For both models, we specified our outcome variables (i.e., either mother PA or child PA at t) as ordinal variables because it was coded on a 3-point Likert scale. The ordinal outcome variable was scored such that higher values reflected higher scores in analyses.

Model 1 included random effects for the intercept, the lagged child PA, and the lagged mother PA variable. Mother PA at t was our outcome variable. A dummy coded variable for mother depression status (i.e., depression as defined by either MDD on SCID or CESD above clinical cutoff) was entered as a fixed effect predictor of the intercept and of the association between lagged child PA at $t-1$ on Mother PA (i.e., the slope). We also included mean level of mother PA as a level 2 predictor to measure lagged response to child PA above and beyond mother's tendency to display PA in general. Including a centered, group average of mother PA at the between-person level allows for separating within and between person effects so that the lagged variables are focused solely on the within-person level effects (see Curran & Bauer, 2011). Child age and child sex were entered as level 2 predictors of the intercept to control for their influence on mother's overall levels of positive affect. This model served to evaluate how mothers responded to child PA, and whether maternal depression moderated this maternal response.

Level-1 Model (Individual Level)

$$MPA_{ti} = \pi_{0i} + \pi_{1i}^*(LAGCPA_{ti}) + \pi_{2i}^*(LAGMPA_{ti}) + e_{ti}$$

Level-2 Model (Dyad Level)

$$\begin{aligned}\pi_{0i} &= \beta_{00} + \beta_{01}^*(CHILDAge_i) + \beta_{02}^*(CHILDSEX_i) + \beta_{03}^*(DEPRESSION_i) + \\ &\quad \beta_{04}^*(MEANMPA_i) + r_{0i} \\ \pi_{1i} &= \beta_{10} + \beta_{11}^*(DEPRESSION_i) + r_{1i} \\ \pi_{2i} &= \beta_{20} + r_{2i}\end{aligned}$$

Mixed Model

$$\begin{aligned} MPA_{ti} = & \beta_{00} + \beta_{01}^* CHILDAGE_i + \beta_{02}^* CHILDSEX_i + \beta_{03}^* DEPRESSION_i \\ & + \beta_{04}^* MEANMPA_i + \beta_{10}^* LAGCPA_{ti} + \beta_{11}^* DEPRESSION_i^* LAGCPA_{ti} \\ & + \beta_{20}^* LAGMPA_{ti} + r_{0i} + r_{1i}^* LAGCPA_{ti} + r_{2i}^* LAGMPA_{ti} + e_{ti} \end{aligned}$$

Model 2 included random effects for the intercept, the lagged child PA, and the lagged mother PA variable. Child PA at t was our outcome variable and was specified as an ordinal variable because it was coded on a 3-point Likert scale. Further, mother depression status (i.e., depression as defined by either MDD on SCID or CESD above clinical cutoff) was entered as fixed effect predictor of the intercept and of the association between lagged Mother PA at $t-1$ on Child PA at t (i.e., the slope). Once again, we also included mean level of child PA as a fixed effect to measure lagged response to mother PA above and beyond child's tendency to display PA in general. We also included child age and sex as covariates in the model. This model served to evaluate how children responded to mother PA, and whether maternal depression moderated this child response.

Level-1 Model (Individual Level)

$$CPA_{ti} = \pi_{0i} + \pi_{1i}^*(LAGMPA_{ti}) + \pi_{2i}^*(LAGCPA_{ti}) + e_{ti}$$

Level-2 Model (Dyad Level)

$$\begin{aligned} \pi_{0i} = & \beta_{00} + \beta_{01} * (CHILDAGE_i) + \beta_{02} * (CHILDGENDER_i) + \beta_{03} * (DEPRESSION_i) \\ & + \beta_{04} * (MEANCPA_i) + r_{0i} \\ \pi_{1i} = & \beta_{10} + \beta_{11} * (DEPRESSION_i) + r_{1i} \\ \pi_{2i} = & \beta_{20} + r_{2i} \end{aligned}$$

Mixed Model

$$\begin{aligned} CPA_{ti} = & \beta_{00} + \beta_{01}^* CHILDAGE_i + \beta_{02}^* CHILDSEX_i + \beta_{03}^* DEPRESSION_i \\ & + \beta_{04}^* MEANCPA_i + \beta_{10}^* LAGMPA_{ti} + \beta_{11}^* DEPRESSION_i^* LAGMPA_{ti} \\ & + \beta_{20} * LAGCPA_{ti} + r_{0i} + r_{1i}^* LAGMPA_{ti} + r_{2i}^* LAGCPA_{ti} + e_{ti} \end{aligned}$$

For both models, as a further test of specificity, we evaluated how maternal prior history of depression on the SCID (instead of mother current depression) predicted the association between mother and child responding on PA (i.e., substituted history of depression dummy code for mother current depression dummy code). This test was run as a separate model rather than including both current and history in the same model as the two variables were highly correlated (i.e., 12 of the 15 mothers with current depression also reported a past depressive episode).

Results

Descriptives

Based on the SCID, 38 mothers reported a lifetime history of depression or dysthymia ($M_{\text{number of episodes}}=2.05$, $SD=1.44$, Range 1–9). Of those, 11 mothers (15%) met criteria for a current depressive episode on the SCID. Additionally, 12 mothers reported clinically significant depressive symptoms on the CES-D (at or above the cutoff score of 16; $M=25.18$; $SD=7.57$, Range=18–39). Altogether, we had 15 mothers (21%) with current clinically significant depressive symptoms on the SCID and/or CES-D in our study. As expected, mothers with clinically elevated depression reported higher depressive symptoms on the CES-D than mothers who did not ($M_{\text{DEP}}=21.94$, $M_{\text{NON}}=5.73$; $F=84.63$, $p<.001$).

On average, mothers were observed expressing either low- or high-intensity positive affect (i.e., rating of 1 or 2) for 31% of the epochs of the mother-child talk task ($M=.31$, $SD=.20$, Range=.00-.80) and either low- or high-intensity negative affect (i.e., rating of 1 or 2) for 1% of the epochs ($M=.01$, $SD=.04$, Range=.00-.27). Children were observed expressing either low- or high-intensity positive affect for 39% of epochs ($M=.39$, $SD=.22$, Range=.00–1.00) and either low- or high-intensity negative affect for 5% of epochs ($M=.05$, $SD=.10$, Range=.00-.50). Mothers with clinically elevated depression showed lower levels of mean positive affect compared to mothers without depression ($M_{\text{DEP}}=.27$, $M_{\text{NON}}=.48$, $F=6.96$, $p=.010$). Children of depressed mothers did not differ on PA relative to children of non-depressed mothers ($M_{\text{DEP}}=.37$, $M_{\text{NON}}=.51$, $F=2.71$, $p=.104$). There were no group differences for child or mother negative affect ($M_{\text{DEP}}=.07$, $M_{\text{NON}}=.05$, $F=.40$, $p=.529$; $M_{\text{DEP}}=.02$, $M_{\text{NON}}=.01$, $F=1.14$, $p=.290$, respectively).

Mother-Child PA Responsiveness

Model 1 revealed that mother current depression status moderated the association between child PA at $t-1$ on mother PA ten seconds later at t ($\beta=-.49$, $t=-3.153$, $p=.002$). Specifically, simple slope analyses revealed that the association between child PA and mother PA 10 seconds later differed for depressed and healthy mothers (see Figure 1). For dyads with depressed mothers, the more children expressed positive affect, the less mothers expressed positive emotions in frequency and intensity 10 seconds later ($\beta=-.45$, $t=-3.28$, $p=.002$, Table 3).¹ However, for dyads with healthy mothers, this association was non-significant; child expression of positive emotions was unrelated to frequency and intensity 10 seconds later in these dyads ($\beta=.04$, $t=.45$, $p=.654$). Mother depression status did not predict overall mother PA ($\beta=.01$, $t=.15$, $p=.884$), in the model. Further, maternal *history* of depression as assessed by the SCID was *not* a significant predictor of the association between child PA and mother PA ten seconds later ($\beta=-.01$, $t=-.08$, $p=.940$) nor did it predict mother overall PA ($\beta=.07$, $t=-1.37$, $p=.174$).

Model 2 revealed that mother PA at $t-1$ did *not* predict child PA ten seconds later ($\beta=.14$, $t=1.66$, $p=.101$), nor was it moderated by mother current depression status ($\beta=.00$, $t=-.01$, $p=.986$) or maternal history of depression ($\beta=-.03$, $t=-.17$, $p=.866$). Mother current depression status did not predict lower overall child PA ($\beta=.04$, $t=.14$, $p=.886$).

Discussion

Our findings demonstrate that maternal current depression may compromise synchronous and reciprocal responding to child PA during the preschool period. Specifically, we found that current depression, but not lifetime history of depression, was associated with less frequent and lower intensity of maternal positive responding to child PA ten seconds later. Further, our results provided some support for directionality. Although we found that depressed mothers showed lower overall mean levels of PA compared to healthy mothers and that maternal depression moderated maternal responsiveness to child PA, we did not find that maternal depression was related to child responsiveness to mother PA. Together, these findings suggest that the dynamic between mothers and children during positive interactions may be disrupted for mothers who are currently coping with depressive symptoms, specifically via maternal but not child responsiveness. Further these findings suggest that current symptoms likely disrupt maternal positive affect responsiveness but healthy mothers who have coped with depression in the past do not show difficulty responding to their children's positive affect in kind.

Maternal positive responsiveness to child positive affect is important as it serves as an indirect method of emotion socialization (Morris et al., 2007). Specifically, responding to child positive emotional bids (e.g., smiles, laughs, phrases indicating joy or pleasure) with one's own positive emotion serves to reinforce positive emotions in children especially during the preschool years, a period of rapid emotional development. Mothers may imitate or elaborate on their children's positive vocal, facial, or bodily expressions, which may encourage children to experience and express positive emotions even more. Unexpectedly, we did *not* find a significant positive association between child positive affect and mother positive responsiveness for healthy mothers. Mother-child responsiveness is a dyadic, bidirectional process and both members must be able to flexibly respond to one another. This non-significant association may reflect the ability for dyads with healthy mothers to flexibly respond to one another with neither mother nor child initiating or responding more so than the other. Further, these findings may demonstrate greater variability in mother response to child affect for healthy mothers but consistently less reciprocal responding for currently depressed mothers. Depression has been demonstrated to influence capacity to respond adaptively to emotion context, such as in positive social interactions (see Rottenberg & Hindash, 2015). Our study found that mothers coping with depressive symptoms may have difficulty facilitating this positive bidirectional exchange with their young children.

Maternal socialization of child positive emotion may also occur in the context of maternal negative responses to child PA (Morris et al., 2007). In this regard, responding to child positive affect with negative emotion (e.g., frowns, scolding tones, dismissive bodily expressions) may serve to dampen child PA. We were unable to test this possibility in this study as the base rate of maternal negative affect was relatively low in our sample, likely because our task was designed to elicit positive emotions. Future work should test this possibility using tasks designed to elicit both positive and negative emotions.

Indeed, our findings that maternal current depression moderated maternal positive responding to child PA fall in line with prior depression models (see Rottenberg's emotion

context insensitivity model; Rottenberg & Hindash, 2015) and extend prior developmental literature demonstrating depression's effect on sensitive and synchronous responding during infancy (see Bernard et al., 2018; Field, 2010; Feldman, 2012). Depressive symptoms may continue to interfere with sensitive and positive responding during the preschool period given that depression is often characterized by lack of pleasure or interest in positive experiences. Maternal anhedonia and withdrawn behavior may limit mothers' ability to display PA even during positive, fun tasks with their child. Depression is associated with dampening of positive affect, both when anticipating upcoming, potentially fun experiences and savoring past positive events (Olino et al., 2010; Raes et al., 2010). In contrast to reinforcement of PA via high levels of acknowledgement, imitation, and/or elaboration of children's positive emotion expression, dampening of PA may also take the form of less frequent or intense levels of imitation or elaboration of children's positive affective expressions in addition to the aforementioned negative, hostile, or dismissive responses. Thus, depressed mothers may be, whether consciously or unintentionally, attempting to dampen their children's PA during this event-planning task to protect their children from disappointment (Thompson & Meyer, 2007). This may especially be the case as we did not find a significant association for child PA predicting mother PA ten seconds later in non-depressed mothers.

We did not find that maternal depression was associated with child responsiveness to mother PA. In this case, children of depressed mothers may not respond differently to their mothers' affect relative to children of non-depressed mothers. Although prior studies have demonstrated that preschool age children of depressed mothers may show lower overall levels of PA (see also Durbin, Klein, Hayden, Buckley, & Moerk, 2005), we did not find this group difference in our study. We note that emotional exchanges within the mother-child dyad are bidirectional and both members influence one another, to some degree, across development. One possibility is that alterations in child responsiveness to mothers may require longer and more frequent interactions with their depressed mother over time to emerge (i.e., interacting with mothers with chronic and recurrent depression or postpartum depression, Reck et al., 2016), however a longitudinal study is required to test this possibility. Further, our finding may be related to timing of assessment. During the preschool period, the mother-child dynamic shifts to allow children to initiate and lead interactions and for mothers to imitate and elaborate on child affect and behavior. At this time, *maternal* positive responsiveness may be what is disrupted by maternal depression rather than child responsiveness. Future work with larger samples and longitudinal designs (e.g., following children across development and tracking maternal symptoms) may better elucidate this possibility.

Nevertheless, level of maternal responsiveness during this type of child-led interaction is important given that sensitive maternal responding has been linked to healthy child functioning in prior research (Raby, Roisman, Fraley, & Simpson, 2015). Mothers who respond in kind to their children's positive emotional bids tend to have children with better emotional and behavioral outcomes during preschool in which children are learning affect regulation and prosocial behavior and in which frequency of disruptive behaviors should be decreasing (Saarni, 2011) and these positive outcomes extend past early childhood (see Raby et al., 2015). That depressed mothers showed lower positive responding to their children's

positive affect relative to healthy mothers may partially explain how children of depressed mothers typically show poorer child outcomes such as affect dysregulation and disruptive behaviors. Longitudinal studies that utilize repeated observations of mother-child interactions and repeated assessments of child behavior over time will better address this possibility. Importantly, *history* of depression (rather than current depression) was not negatively associated with maternal positive responsiveness suggesting that interventions and treatments that improve maternal mood may have an important influence on mothers' ability to acknowledge, imitate, and encourage their children's positive emotional bids.

Limitations of the study include its cross-sectional design which limited our ability to examine the longitudinal components (i.e., changes in child behavior with age) of our research question. Studies that include longer duration or more varied emotion-eliciting task may provide more opportunity to observe more frequent or higher intensity PA in children and mothers. Future work may also benefit from evaluating other aspects of parent-child responsiveness during emotion-eliciting tasks, such as frequency and content of speech (e.g., see Denham & Bassett, 2018) and parent-child response to negative emotional bids during negative emotion-eliciting tasks. We also only had 15 mothers with elevated depressive symptoms (11 who met criteria via a diagnostic interview), although this represented 15–21% of our sample which is comparable with depression rates in women (Kessler, 2003). We did not assess anxiety symptoms in the current study thus we cannot ascertain how clinically significant maternal anxiety may be related to maternal responsiveness in the current study. Children in our sample were mostly female, particularly in our currently depressed group. We evaluated the role of parental depression using biological mothers only. Thus, our findings may not generalize to father-child dyads, dyads with sons, or to dyads with non-biological parents (e.g., adoptive parents, grandparents etc.). A large portion of our sample was college-educated so our findings may also not generalize to dyads of other sociodemographic backgrounds. Although our sample was somewhat diverse, most of our participants (64%) identified as White/Caucasian and prior work has demonstrated that emotion socialization practices and their impact on child development may differ in relation to race/ethnicity (Hooper, Wu, Ku, Gerhardt, & Feng, 2018).

Nevertheless, our study had many strengths including (1) use of repeated observations to measure emotion expression in both mother and child and (2) assessment of depression with rigorous and widely used measures. The use of interval coding and hierarchical linear modeling allowed us to determine that mother responding to child PA, but not vice versa, is impaired in the context of maternal depression during the preschool years. Our findings also allowed us to specify that current symptoms, but not lifetime history, may interfere with reciprocal responding to child PA during the preschool period. This is hopeful news, as it implies that identifying and treating mothers' depressive symptoms during this preschool period (i.e., beyond the postpartum window) may have important implications on her caregiving. Prior intervention work has also demonstrated this possibility, showing that mother depression treatment was associated with improvement in child outcomes, partially via changes in parenting (Goodman & Garber, 2016; Swartz et al., 2016; Weissman et al., 2015). Overall, these findings highlight the importance of targeting maternal mental health and further implicate maternal caregiving as a critical mechanism through which maternal depression may exert its influence on child wellbeing.

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Figure 1.
Depression Moderates the Association between Child Positive Affect and Mother Positive Affect 10 seconds later

Table 1.

Descriptive Statistics for Study Variables

	Healthy (<i>n</i> =57)		Currently Depressed (<i>n</i> =15)		<i>F/χ²</i>	<i>p</i>
	<i>M/%</i>	<i>SD</i>	<i>M/%</i>	<i>SD</i>		
CES-D Score	5.73	4.76	21.94	9.68	84.63	<.001
Child Age in Years	3.84	.80	4.00	.85	.46	.502
Child Gender	54% Female		87% Female		5.21	.020
Mother Mean PA	.48	.25	.27	.26	6.96	.010
Child Mean PA	.51	.30	.37	.31	2.71	.104
Mother Mean NA	.01	.00	.02	.02	1.14	.290
Child Mean NA	.05	.09	.07	.13	40	.529

Note. CES-D = Center for Epidemiological Depression Scale, PA= Positive Affect, NA= Negative Affect.

Table 2.

Transcripts of Mother-Child Task

Topic	Excerpts of Mother and Child Positive Affect from Mother-Child Talk Task
Camping in a cabin	<p>Mother: "Would you like to go to the cabin again?"</p> <p>Child: "Uh-huh."</p> <p>Mother: "What would you like to do this next time?"</p> <p>Child: "Blow bubbles!"</p> <p>Mother: "And what else?"</p> <p>Child: "Have ice cream!!"</p> <p>Child: **draws ice cream cone**"Look at my vanilla!"</p> <p>Mother: "Ooh! That does look yummy!"</p>
Climbing at the park	<p>Child: "I got it all the way to the top!"</p> <p>Mother: "You did? You got all the way up to the top?"</p> <p>Child: *nods*</p> <p>Mother: "And I didn't even help you? That's because you're a big girl, huh?!"</p>
Going to grandparents' house	<p>Mother: "What toys did you bring to grandma and grandpa's house that you had fun playing with?"</p> <p>Mother: "Did you bring Pinky bear?"</p> <p>Child: "Mm-hmm."</p> <p>Mother: "Let's draw Pinky bear. I think that will be fun."</p> <p>Child: *laughs at Mother's drawing of pinky bear*</p> <p>Mother: *laughs too* "You like my drawing of pinky bear?"</p> <p>Mother: "I bet what we are going to do is swim in the pool next time we go there!"</p> <p>Child: "Yeah!"</p>
Going swimming	<p>Mother: "What is your favorite thing about swimming?"</p> <p>Child: "Swimming under water."</p> <p>Mother: "I'm so proud of you being able to swim under water with your goggles."</p> <p>Child: *points to picture* "Yeah, that's me—a big girl now."</p> <p>Mother: "You're a big girl now because you swim under water, huh?"</p>
Taking a family trip	<p>Mother: "What was your favorite part about our trip?"</p> <p>Child: "Jumping on the bed."</p> <p>Mother: "Jumping on the bed?!"</p>

Table 3.

Hierarchical Linear Model of Child PA on Mother PA ten seconds later

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For Intercept, π_{00}					
Intercept, β_{00}	-3.301	0.174	-18.923	67	<0.001
Child Age, β_{01}	-0.116	0.0306	-3.797	67	<0.001
Child Sex, β_{02}	-0.096	0.0498	-1.937	67	0.057
Maternal Current Depression, β_{03}	-0.013	0.091	-0.147	67	0.884
Mean Maternal Positive Affect, β_{04}	3.347	0.161	21.036	67	<0.001
For Lagged Child PA slope, π_{10}					
Intercept, β_{10}	0.042	0.094	0.450	70	0.654
Maternal Current Depression, β_{11}	-0.493	0.156	-3.153	70	0.002
For Lagged Mother PA, slope, π_{20}					
Intercept	0.488	0.076	6.412	71	<0.001
Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
Intercept, π_{00}	0.008	0.000	65	20.968	>0.500
For Lagged Child PA, slope, π_{10}	0.086	0.007	68	68.696	0.454
For Lagged Mother PA, slope, π_{20}	0.066	0.004	69	75.424	0.278

Note. Child Sex: 0=Male, 1=Female

Maternal Current Depression: 0=Healthy, 1=Depressed

Table 4.

Hierarchical Linear Model of Mother PA on Child PA ten seconds later

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For Intercept, π_0					
Intercept, β_{00}	-4.124	0.160	-25.779	67	<0.001
Child Age, β_{01}	-0.053	0.060	0.877	67	0.066
Child Sex, β_{02}	-0.055	0.104	0.529	67	0.318
Maternal Current Depression, β_{03}	-0.076	0.060	-.573	67	0.211
Mean Child Positive Affect, β_{04}	-3.413	0.146	23.382	67	<0.001
For Lagged Child PA, slope, π_1					
Intercept, β_{10}	0.432	0.077	5.605	71	<0.001
For Lagged Mother PA slope, π_2					
Intercept, β_{20}	0.147	0.098	1.506	70	0.137
Maternal Current Depression, β_2	0.003	0.196	0.015	70	0.988
Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
Intercept, τ_0	0.008	0.000	65	21.205	>0.500
For Lagged Child PA, slope, τ_1	0.025	0.001	69	57.349	>0.500
For Lagged Mother PA, slope, τ_1	0.367	0.135	68	75.424	0.073

Note. Child Sex: 0=Male, 1=Female

Maternal Current Depression: 0=Healthy, 1=Depressed