

2014

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Impact of paternal and maternal postpartum depression
on infant language development: a quasi meta-analysis

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Abstract

This paper presents a quasi meta-analysis of 16 different articles published between 2004 and 2014 examining the impact of maternal and paternal postpartum depression (hereafter PPD) on language development, specifically in infants up to 2 years old. The purpose of this meta-analysis was to adapt this methodology at the undergraduate level reducing the number of steps from 12 to 10. To achieve this goal, the author synthesized the results of the studies following selected themes of risk factors, synchrony and interaction patterns, meaning making, and connections within the family system. While significant results were reported throughout the studies, a presenting problem for the meta-analysis was the lack of consistency in the reporting of effect sizes, and in the type of reported effect sizes. This barrier is most likely reflective of the *recent* implementation (6th ed., 2010) by the *Publication Manual of the American Psychological Association* to report effect size statistics for publication. Further, the body of literature concerning postpartum depression in fathers is considerably smaller as was the combination with the relationship between mother and infant, and mother and father. We discuss how these particular limits signal where the effort of the scientific community should focus.

Keywords: Postpartum depression; maternal; paternal; language development; synchrony, meaning

Impact of paternal and maternal postpartum depression on infant language development: a quasi meta-analysis

Nowadays, multiple syndromes are related to the postpartum period: postpartum blues, postpartum depression, and postpartum psychosis (Sohr-Preston & Scaramella, 2006). The focus of this meta-analysis is on the impact of the syndrome of postpartum depression, which falls between postpartum blues and postpartum psychosis in the severity of its symptomology, on particular aspects of the linguistic development of the infant. Postpartum depression reflects symptoms of major depressive disorder (e.g. sadness, lost of interest in activities preciously found pleasurable, insomnia, agitation, feelings of worthlessness and guilt; with no association to bereavement) that begin, or last into, the postpartum period that begins immediately after birth, and continues until twelve months after delivery (O'Hara, Neunaber, & Zekoski, 1984; Clay & Seehusen, 2004).

Traditionally, postpartum depression and research concerning its prevalence and risk factors have been limited to mothers, with approximately 13% women that gave birth affected (O'Hara & Swain, 1996). Previous work notes that when mothers experience postpartum depression, this may impact the development of cognitive and language skills in their infants (Sohr-Preston & Scaramella, 2006). Recently, however, a growing body of research has examined the prevalence of postpartum depression in fathers. In a family where there is both a mother and father, postpartum interactions are not limited to one parent or the other. Instead the family can be seen as a system, with a particular dynamics, and massive interdependence. Following this train of thought, we felt it was important to consider the implications of the relationships between the infant and both parents and their impact on its language development. A review of recent literature found that new fathers experience depression during the postpartum period and that a moderate correlation of postpartum depression exists between mothers and

fathers (Paulson & Bazemore, 2010). This lead the authors to consider that like mothers with postpartum depression, early paternal depression may have substantial emotional, behavioral, and developmental effects on children (ibid.).

Method

Procedure

The current meta-analysis followed a modified methodology based on the 12-step method modeled by Erford (2010). In adapting this paper to the resources available at the undergraduate level, we followed two less steps: we limited our search to two databases and we did not compute the effect sizes. The first step in completing this analysis was to define the area/topic of interest and the research questions/focuses (step 1 and 2). Since the author's interest lays in depression and language development, we sought to examine the relationship between parental postpartum depression and language development in infants. Following this was a meeting with the psychology department's library liaison at Grand Valley State's Mary Idema Pew Library. It was during this meeting that the standards for executing a database search were explained and relevant key terms were defined in order to establish the final search criteria for study inclusion in the meta-analysis (step 3).

Once the criterions were established, two databases PsycINFO and PsycARTICLES were searched (normally many more database are searched, this is one of the modifications we did), and relevant articles screened using the criteria. After ensuring ineligible articles were excluded (step 4), the remaining articles underwent a title and abstract review for possible inclusion in the final meta-analyses set (step 5). After determining the final set of studies to include in the meta-analysis, all studies were read to identify themes related to the independent and dependent variables of interest (step 6). Once relevant themes throughout the studies were identified, each was defined in relation to the topic of interest (step 7). Each article was charted and organized by

these themes once defined, and color-coded in accordance to whether the study focused on the mother-infant relationship, father-infant relationship, or mother-father-infant relationship.

After organizing each study by relationships and themes, each study was annotated manually to identify and extract relevant effect size data for coding (step 8). Reported effect size statistics were included in the table to keep all information together. Due to a lack of reported effect sizes and limitations on the data availability to run the statistics ourselves, we were unable to run statistics on overall effect sizes for each theme (second step we omitted). Finally the data was examined to draw conclusions about current research (step 9), and to identify possible limitations or moderating variables (step 10).

Search Strategy•

To identify possible studies for this meta-analysis we utilized database searches in PsycINFO and PsychARTICLES. To determine possible relevant studies, the search terms determined applicable were inputted. These terms were as follows: (postpartum depression) AND (maternal OR mother) AND (paternal OR father) AND (verbal learning) AND su.exact ("Infancy (2-23 months)"). Additionally, there was a time frame placed on the search results to encompass only studies from the past ten years, those dates being January 2004-January 2014. All accessible and relevant studies presented in scholarly journal articles, book chapters, and dissertations were included as possible inclusions for the meta-analysis.

Included Studies•

After utilizing the set search criterion of “verbal learning” withheld initially, 391 potentially relevant studies were identified. Of these initial studies, a majority (n = 332) were excluded once the time limit of the articles was checked. This left 69 studies as potentially eligible for inclusion in the current meta-analysis, with most found in scholarly journals (n=67), and the remaining two being a dissertation (n=1) and a book (n=1). Of these studies most (n=35)

were excluded following the abstract and title review (e.g., articles on other topics). Of the remaining 34 articles retrieved for full-text review, over half (n=18) were excluded for a variety of reasons (e.g., outside of infancy timeframe, related to more general health, different disorder-maternal rejection, duplicate sample, and unavailable in English). This left us with 16 articles eligible for inclusion in the meta-analysis (FIGURE 1).

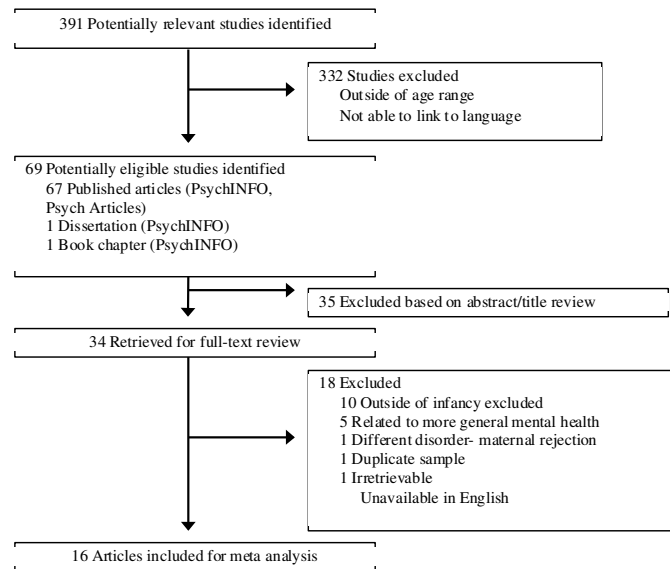


Figure 1. Study Selection for inclusion in meta-analysis: 391 potentially relevant studies

Themes

Studies included in the meta-analysis subsequently were coding as fitting into one or more of the themes found during the full-text review. These themes were defined as follows: (1) risk factors: reported variables associated with an increased risk of impact on the infant's development, specifically language; (2) synchrony/interaction patterns: reported types of interactions between depressed mothers and/or fathers with the infant; either synchronized or unsynchronized rhythm, in addition to patterns including attentiveness, level of focus on infant, negativity of speech, etc.; (3) meaning making: shared attention to events and objects in the

world. Aids infants in making sense of the world around them; and (4) connections: links between maternal and paternal postpartum depression, with and without the inclusion of a language component, and the implication for infant language development. This in turn enabled us to formulate specific research questions:

- 1) What are the risk factors most highly correlated with the influence of postpartum depression on infant language development?
- 2) Are there differences in the interactions patterns of synchrony of parent-child interaction in mothers and father with postpartum depression on infant language development?
- 3) What is the magnitude of the impact of postpartum depression in mothers and fathers on the emergence of meaning making in the infant's language development?
- 4) What is the magnitude of the relationship between postpartum depression in mothers, father, or both parents and language development in infancy?

Results

Sample

The total sample consisted of 16 studies published between 2004-2014. 16 (100%) of the studies were journal articles. Eight studies (50%) took place in the United States, four (25%) the United Kingdom, and two each (13%) in Canada and Brazil.

Sample sizes varied widely across studies ($N = 11-5,089$), where dyads were calculated to include parent and infant and families calculated to include the numbers of mothers, fathers, and infants included in the sample. Across the 16 included studies, the median sample size was 296 participants (first quartile = 145; third quartile = 730). In all, using initial sample sizes across the 16 studies, a total of 10,816 participants are represented in this meta-analysis. When reported, participants were predominately European American with approximately equal distribution in the

number of participants across gender for both parents and infants. In all studies, English was the first language of participants.

The measurement approach for postpartum depression was based on self-report of depressive symptomatology in 14 (88%) of the studies. Only two (13%) of the studies used a formal diagnostic assessment. A longitudinal research design was overwhelmingly used in six (38%) studies while five (31%) studies employed a cross sectional design, one used a matched pair method (6%), and two (13%) did not specify. Twelve (75%) studies used convenience sampling, two (13%) matched pairs, and two (13%) did not specify.

Postpartum Depression Measurement

In this meta-analysis, depressive symptomatology for included studies was measured most frequently by the Edinburgh Postnatal Depression Scale in five studies (31%), (Cox, Holden, & Sagovsky, 1987), followed in frequency by the Center for Epidemiological Studies-D Scale (Radloff, 1977) in three studies (19%). An array of other self-report instruments were used once each and were the Mini International Neuropsychiatric Interview (MINI; Amorim 2000), Hospital Anxiety and Depression Scale, HADS (Zigmond & Snaith, 1983), Posttraumatic Stress Diagnostic Scale, PDS (Foa, Cashman, Jaycox, & Perry, 1997), and Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). In the studies that utilized a formal diagnostic assessment of postpartum depression, the interview used was the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID; First et al., 2002).

Language Development Scales

In studies that directly measured language development, only the Global Rating Scales (GRS) (Murray, Fiori-Cowley, Hooper, and Cooper, 1996) was used in two studies. Otherwise, there was no trend in the measurement tool used. The studies that did measure language used the Bayley Scales of Infant Development III (Bayley, 2006), Reynell Developmental Language

Scale (Reynell, 1990), Denver II test (Frankenburg et al., 1992), coded CHAT conventions of the Child Language Data Exchange System (CHILDES; MacWhinney, 2000), and inter-rater observations on varying tasks.

Effect size statistics

For all studies included in this meta-analysis, effect size statistics, when reported, were indicated by either Pearson's r or an Odd Ratio (OR). The former, r , is the coefficient of correlation measures and the degree to which the two variables are related linearly. This indicator is reported with both a magnitude and direction, either positive or negative, and has a range of values from -1 to 0 to +1. The correlational strength is independent of the direction or the sign of r . The closer the value of r is to positive or negative 1, the stronger the association is between the two variables of interest (Taylor, 1990). To interpret findings of the meta-analysis, it is important to note that an r value of .1 or less is considered a small effect, between .1 to .3 is a medium effect, and .5 or larger is a large effect.

The latter effect size indicator, OR , is a measure of relationship between an exposure and an outcome. This measure represents the odds that an outcome will occur given a particular exposure to the variable of interest, in comparison to the odds of the outcome occurring when the exposure to the variable of interest is absent. The OR statistic can be used to determine if a variable is a risk factor, and to compare the odds of different risk factors for a particular outcome (Szumilas, 2010). To interpret OR for this meta-analysis, an OR equal to 1 indicates that exposure to the variable does not affect odds of the outcome, when OR is greater than one the exposure is associated with higher odds of the outcome, and when OR is less than 1 exposure is associated with lower odds of the outcome occurring. Most frequently OR statistics are coded to reflect a statics equal to or greater than 1, where an OR of 1.5 or less is small, between 1.5 to 3.5 is medium, and 3.5 or above is considered large.

Risk Factors

The relationship between risk factors related to mothers and fathers with postpartum depression and infant language development was investigated in ten studies. These risk factors included birth order, child gender, parent education level, economic status, involvement of other parent, maternal language and literacy skills, quality of caregiving, and duration of depressive symptoms. In seven of these ten studies effect size statistics were reported. As indicated in Table 1, the types of effect size statistics reported included r and OR . Across all studies where r was the effect size indicator, statistics ranged from -0.22 to 0.68; when OR was the effect size indicator the range was -2.87 to -1.11 (small to moderate). The relationship between risk factors related to mothers with postpartum depression and the impact on language development in the infant were considered to be a moderate effect size, with r as the effect size indicator ranging from -0.10 to 0.37 for language, and with 0.68 reported in one study for overall development where language was not differentiated from other cognitive measure such as memory recognition and decision making. The relationship between fathers with postpartum depression and the impact on language development in the infant varied in the effect size indicator, with OR as the effect size indicator ranging from 0.54 to 1.11 (small).

Most effects of the risk factors combined go from moderate to medium, except in one study, possibly because in this study the development of language was not differentiated in the scales from cognitive ability, which perhaps affected the reported effect of postpartum depression on language development.

Synchrony

The relationship between synchrony and interaction patterns between parents with postpartum depression and infants, and the infant's language development were investigated in ten studies. In six of these ten studies effect size statistics were reported. As indicated in Table 1,

the types of effect size statistics reported included, r and OR . Across all studies where r was the effect size indicator, statistics ranged from -0.32 to 0.53 (moderate to medium); when OR was the effect size indicator the range was 1.42 to 3.15 (medium to strong). The relationship between synchrony and interaction patterns between mothers with postpartum depression and infants, and the impact on language development in the infant had only one reported effect size, $r = 0.53$ (medium). The relationship between fathers with postpartum depression and language development in the infant varied in the effect size indicator, with OR as the effect size indicator ranging from 1.42 to 3.15 (medium to strong), and r from -0.32 to -0.12 (moderate).

In brief, most effects in this were moderate to medium, with the effects tending towards a negative effect of interaction patterns in parents with postpartum depression on language development in infants.

Meaning Making

The relationship between risk factors related to mothers and fathers with postpartum depression and meaning making in infant language development was investigated in four studies. In only one of these four studies effect size statistics were reported. As indicated in Table 1, the type of effect size statistic reported included r . This effect size, $r = -0.20$, (moderate) was reported in relation to the relationship between mothers with postpartum depression and the development of meaning making in the infant's language.

Table 1

Studies included in the meta-analysis, with effect size statistics reported by theme and article

Article Information			Impact on Language			
Article name	Authors	Year	Risk Factors	Synchrony/Interaction Patterns	Meaning Making	Connection
Maternal correlates of growth in toddler vocabulary production in low-income families*	Pan et al.	2005	$r = .22$	NR	-	-

Effects of maternal negativity and of early and recent recurrent depressive disorder on children's false belief understanding*	Rohrer et al.	2011	rs= -.19; -.22	-	r= -.20	r= -.25
The influence of maternal depression, caregiving, and socioeconomic status in the postnatal year on children's language development*	Stein et al.	2008	rs= -.1; -.1; .31; .28; .16; .14; .29; .37	-	-	-
Infants' meaning-making and the development of mental health problems*	Tronick & Beeghly	2011	-	NR	NR	-
The impact of maternal post-partum depression on the language development of children at 12 months*	Quevedo et al.	2011	OR= -2.87	-	-	-
Postpartum depression and child development in the first year of life*	Morais et al.	2013	NR	NR	-	-
Stress Contagion: Physiological Covariation Between Mothers and Infants*	Waters et al.	2014	r= .68	r= .53	-	-
Father Involvement Moderates the Effect of Maternal Depression During a Child's Infancy on Child Behavior Problems in Kindergarten**	Mezulis et al.	2004	NR	r= -.12	-	r= .12
Depressed fathers' speech to their 3-month old infants: a study of cognitive and mentalizing features in paternal speech**	Sethna et al.	2013	-	NR	NR	-
Do early father-infant interactions predict the onset of externalizing behaviors in young children? Findings from a longitudinal cohort study**	Ramchandani et al.	2013	-	ORs= 2.46; 3.15	-	-
Psychosocial factors associated with paternal postnatal depression**	deMontigny et al.	2013	ORs= 1.11; .54	-	NR	OR= .93
The impact of parent's mental health on parent-baby interaction: A prospective study***	Parfitt et al.	2013	r= .18	OR= 1.9	-	r= .21
Individual and combined effects of post-partum depression in mothers and fathers on parenting behavior***	Paulson et al.	2013	-	OR= 1.42	-	-
Influences of Maternal postpartum depression on fathers and father-infant interaction***	Goodman	2008	NR	rs= -.315; -.22	-	r= .34
Identifying the support needs of father affected by post-partum depression: a pilot study***	Letourneau et al.	2010	-	-	-	Qualitative
Prenatal and postpartum depression in fathers and its association with maternal depression: a meta-analysis***	Paulson & Bazemore	2010	-	-	-	r= .31

Note: Effect sizes were not reported for all studies; *: article relates to impact of maternal PPD; **: article relates to impact of paternal PPD; ***: article relates to the impact of both maternal and paternal PPD. NR= None Reported; - indicates theme was not found within the given article.

Connections between maternal postpartum depression, paternal postpartum depression and infant language development

The relationship between maternal and paternal postpartum depression and infant language development was investigated in seven studies. In six of these seven studies effect size statistics were reported. As indicated in Table 1, the types of effect size statistics reported

included, r and OR . Across all studies where r was the effect size indicator, statistics ranged from -0.25 to 0.34 (moderate); and one study with $r = 0.93$. In the study with a stronger relationship the sample size was considerably smaller, using a small convenience sample in comparison to a larger sample from a longitudinal study pool. Most effects reported were moderate to medium in general, with one study that reported a stronger relationship.

Discussion

The current meta-analysis of the impact of paternal and maternal postpartum depression on infant language development contributes three findings. First, the main finding was that the reported effect sizes for language generally varied from moderate to medium. The second finding indicates there is a limited amount of research available in postpartum depression's impact that includes the father and family. Finally, and the third finding is that research on language development in infants whose parents have postpartum depression is sparse.

Effect sizes

Looking at the result of moderate to medium effect sizes in general for the impact on language effect, there are several possible explanations for why these effects were not stronger. A potential factor of this finding relates to interference of mediating variables, which were not accounted for such as temperament of the child (Rothbart & Bates, 2006), goodness-of-fit between the rearing practices of the parents and the temperament of the infant (Tomas & Chess, 1956). Another potential reason for finding moderate to medium effects could be that in terms of sampling, there is an issue of variability and replication. The samples of these studies were not diverse and each reported new findings using methods unique to each study. In reporting new findings and using different measurement tools to assess the degree of depressive symptomology and language development, results do not strengthen findings or methods of previous work (Sherman, Brooks, Iverson, Slick, & Strauss, 2011). Our recommendations would be that prior to

any new study, the experimenters think of introducing a comparative tool as well as a previous meta-analysis (if available) into the protocol.

Fathers and the family

This meta-analysis illuminated the fact that there are not currently enough research results on the role of fathers with postpartum depression and the family dynamics related to infant language development. This may be due to an outdated view of postpartum depression related solely to the mother and infant dynamic (Baradon, 2010). However, with research revealing the connections between mothers and fathers with postpartum depression (Paulson & Bazemore, 2010), and in some instances, fathers acting as a buffer (Mezulis et al., 2004), the impact on this infant's development and, particularly its language, should not be overlooked. Additionally, the support systems of these families are not typically limited to the mother alone; and in addition to the father as a part of the family system, the presence of other children and caretakers may play a role in the impact of postpartum depression on infant language development (Reid, Stahl, & Striano, 2010; van Balkom, Verhoeven, & van Weerdenburg, 2010). Future work in this area needs further attention, with an updated view of the family as a system and how this system relates to postpartum depression and infant language development.

Infant language development

After investigating the current findings of the impact of paternal and maternal postpartum depression on infant development, it was apparent that research focusing on the development of language is limited. Overall, we cannot draw too many conclusions because of the limited amount of research. Some studies conflict in their findings about the impact of postpartum depression on infant language development, a result that may be due to the lack of considering family systems and the way in which development was measured (Morais, Lucci, & Otta 2013). The use of different scales may have impacted the comparability of findings (Sommer &

Sommer, 2001), and future work should attempt to converge on those scales that differentiate between language and other cognitive processes. There is a need for more studies to be conducted replicating current findings and exploring the impact of maternal and paternal depression on infant language development more in-depth.

Limitations

For the current meta-analysis, limitations are reflected in the modified methodology. For the identification of potentially relevant studies, only two databases were used. Therefore, there is the need to expand the database to search to include more potential studies in reflecting the literature and findings on this topic. Also limited on the time available to conduct this meta-analysis with the demands of an undergraduate program where research is not the main focus of the curriculum required for graduation. This time restraint also relates to being unable to calculate Cohen's d for each study.

Conclusions

While the current meta-analysis had some limitations where we could not draw strong conclusions, it was a good first step in understanding the methodology and requirements of conducting a meta-analysis at the undergraduate level. The usefulness of this exercise at an undergraduate level cannot be understated. As an undergraduate, research methods courses are required, and important, but do not allow for the time to complete a meta-analysis. This exercise increased information science skills with development in the ability to search for studies utilizing set criterion, including accurate key words and rules. This modified methodology also increased the ability to organize a large amount of research, and both categorize and code the studies and results by themes.

Another important aspect of this meta-analysis was the increase in ability to identify, understand, and report different effect sizes (including r , Cohen's d , Odds ratio OR , and Eta-

squared ²⁾ and to recognize not that all studies included these statistics, where none are reported for qualitative data. In increasing the knowledge of effect size statistics, the capacity to make implicit and explicit connections between research findings is also strengthened.

This methodology also exposes junior researchers to a large range of unfamiliar topics within the literature. The range of research available on this topic, and what differentiates it from other areas of infant development research deepened the knowledge and perspective of postpartum depression and its implications regarding infant language.

There is the need for a willingness to dedicate a substantial amount of time to conduct the meta-analysis. Overall, the current meta-analysis on the impact of maternal and paternal postpartum depression on infant language development was a worthwhile exercise not typical at the undergraduate level. As a final note, its importance cannot be lost for the opportunity to identify a topic of interest for graduate school and potential future research opportunities in strengthening and clarifying the current findings of this meta-analysis.

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*: denotes inclusion in the quasi meta-analysis

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