

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

COLLEGE OF NURSING

The Impact of Postpartum Depression on Infant Cognitive Development: A Systematic Review

NIA M. TOMLINSON
SPRING 2022

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Nursing
with honors in Nursing

Reviewed and approved* by the following:

Rachel Allen
Assistant Research Professor
Thesis Supervisor

Susan J. Loeb
Professor of Nursing
Honors Adviser

* Electronic approvals are on file.

ABSTRACT

PURPOSE: The purpose of this systematic review is to analyze a broad collection of literature to assess whether postpartum depression influences infant cognitive development specifically.

METHODS: An initial literature search was conducted using three databases: PubMed, CINAHL, and PsycINFO. Using the key terms “maternal depression OR postpartum depression OR postnatal depression” AND “infant development” AND “cognitive” this search yielded a total of 4 articles. An ancestry search was then conducted using a compiled reference list from the 4 original sources. The ancestry search produced an additional 5 articles to be included for review. Each article was evaluated using the John Hopkins Evidence Level and Quality Grade.

RESULTS: After analysis of the nine articles, the findings uncovered that postpartum depression does negatively influence infant cognitive development. Infants born to a depressed mother are more likely to score lower on infant cognitive assessment tests. Furthermore, these infants are more likely to take an increased amount of time to develop specific cognitive processes such as object perception and imitation. Also, findings revealed infant boys develop cognitively at a slower pace compared to infant girls. Additionally, the chronicity of postpartum depressive symptoms may influence the severity of infant cognitive developmental delay.

DISCUSSION: Postpartum depression remains underdiagnosed and undertreated. Efforts should be made to increase the prevention, identification, and treatment of postpartum depression to decrease the potentially harmful effects on infant development. Early identification of both postpartum depression and infant delays are critical to produce the best outcomes for the mother and infant. Future research should focus on the creation of a standard and universal assessment tool for postpartum depression and infant cognitive development.

TABLE OF CONTENTS

LIST OF FIGURES	iii
LIST OF TABLES	iv
ACKNOWLEDGEMENTS	v
Chapter 1 Introduction	1
Significance of Problem	2
Purpose.....	3
Summary	4
Chapter 2 Background	5
Changes in Pregnancy	5
Postpartum Depression.....	6
Infant Cognitive Function	8
Measures of Infant Cognitive Development	12
Conclusion	14
Chapter 3 Methods	16
Chapter 4 Results	20
Study Design	20
Study Focus.....	21
Sample Size.....	21
Setting and Recruitment.....	22
Infant Demographics	23
Inclusion and Exclusion Criteria	23
Outcome Measures.....	25
Level and Quality of Evidence.....	27
Research Findings	28
Summary	31
Chapter 5 Discussion	41
Summary of Findings.....	41
Strengths and Limitations	43
Nursing Implications/Recommendations	45
Future Research.....	48
Conclusion	50
Appendix A John Hopkins Nursing Evidence-Based Practice Evidence Level and Quality Grade.....	51

References.....52

LIST OF FIGURES

Figure 1. PRISMA Flowchart of Article Selection.....	19
---	----

LIST OF TABLES

Table 1. Definitions.....	3
Table 2. Cognitive Developmental Milestones	10
Table 3. Red Flags in Cognitive Development	12
Table 4. Postnatal depression and infant cognitive development and motor development in the second postnatal year: The impact of depression chronicity and infant gender.....	32
Table 5. A prospective study of maternal anxiety, perceived stress, and depressive symptoms in relation to infant cognitive development.....	33
Table 6. A prospective longitudinal study of the impact of early postnatal vs. chronic maternal depressive symptoms on child development.....	34
Table 7. Maternal depression and sex differences shape the infants' trajectories of cognitive development	35
Table 8. Object perception in 5-month-old infants of clinically depressed and nondepressed mothers.....	36
Table 9. Impact of postpartum anxiety and depression on child's mental development from two peri-urban communities of Karachi, Pakistan: A quasi-experimental study	37
Table 10. Does mothers' postnatal depression influence the development of imitation?.....	38
Table 11. Effects of maternal postpartum depression in a well-resourced sample: Early concurrent and long-term effects on infant cognitive, language, and motor development	39
Table 12. Maternal depression, anxiety, psychoticism, and paranoid ideation have effects on developmental delay types of infants: A study with clinical infant-mother dyads	40

ACKNOWLEDGEMENTS

I would like to thank my amazing advisor Dr. Rachel Allen for guiding and supporting me through this challenging yet rewarding process. Additionally, I would like to thank Dr. Susan Loeb for her support. I would also like to thank my dad and my brother for helping me every step of the way. For being my biggest supporters in everything I do, I could not have achieved any of my goals without their support.

Chapter 1

Introduction

Postpartum depression is a persistent feeling of sadness, hopelessness, and emptiness lasting longer than 2 weeks after or during pregnancy (Office on Women's Health, 2019). Postpartum depression is characterized by depressed mood, mood swings, difficulty bonding with the infant, intense irritability or anger, loneliness, and feelings of shame, guilt, and worthlessness (Mayo Clinic Staff, 2018). In the United States alone, it is estimated that one in seven women experience postpartum depression (Torres, 2020). In relation to the number of live births that occur each year in the United States (roughly 4 million) that equates to approximately 600,000 cases of clinical depression in postpartum women (Langdon, 2019). Postpartum depression not only effects the well-being of mothers', but it can also influence the development of children. It has been estimated that each year roughly 400,00 infants are born to a mother with postpartum depression (Earls & The Committee on Psychosocial Aspects of Child and Family Health, 2010).

While the incidence of postpartum depression is incredibly high, postpartum depression remains the most underdiagnosed obstetric complication in the United States (Earls & The Committee on Psychosocial Aspects of Child and Family Health, 2010). The symptoms of postpartum depression are not widely recognized with only about 50% of women with major depression symptoms being identified (Yawn et al., 2012). The symptoms of postpartum depression are often minimized by mothers and providers as a normal consequence of childbirth

(Anokye et al., 2018). There is also an increased reluctance of mothers to report symptoms of postpartum depression due to the stigma associated with depression (Anokye et al., 2018).

Significance of Problem

Infancy is an incredibly susceptible time period in which the environment has a great potential to influence cognitive development (Sohr-Preston & Scaramella, 2006). Healthy development is dependent on the interactions of the genes the infants possess and the environment they are reared in (Center on the Developing Child at Harvard University, 2009). Mothers play a substantial role in children's social environment and growth (Sohr-Preston, Scaramella, 2006). When reared by a chronically depressed mother, children are seen to perform at lower levels on cognitive, emotional, and behavioral assessments compared to children of non-depressed mothers (Center on the Developing Child at Harvard University, 2009). The influence of this depression can have lasting effects on the cognitive processes of children. When maternal depression is experienced earlier in life there is an alteration in brain structure and a continual interruption in stress response systems in children (Center on the Developing Child at Harvard University, 2009). These alterations can lead to a decreased engagement with objects in the environment, a lower activity level and poor state regulation (Earls & The Committee on Psychosocial Aspects of Child and Family Health, 2010).

Although there is a clear negative connection between postpartum depression and the cognitive development of an infant, postpartum depression is severely underreported (Earls & The Committee on Psychosocial Aspects of Child and Family Health, 2010). When left untreated maternal depression has the potential to adversely influence infants' neurosynaptic development,

regulatory development, and achievement of developmental milestones (Hoffman et al., 2017). A major goal of nursing is to promote positive patient outcomes and to help clients achieve an optimal state of well-being. Early screening and intervention are necessary to promote healthy brain development and future success in society (Earls & The Committee on Psychosocial Aspects of Child and Family Health, 2010). Once the effects of postpartum depression have been identified, research can be conducted to determine the most effective interventions to mediate these unfavorable effects.

Purpose

The goal of this systematic review is to identify and critique relevant research studies to ascertain the relationship between postpartum depression and the presence of cognitive impairments in infants. This study aims to answer the following question:

1. How does maternal depression influence the cognitive processes of an infant?

Table 1. *Definitions*

<i>Anhedonia</i>	A loss of interest in activities once found pleasurable and a decreased ability to feel pleasure (Gorwood, 2008).
<i>Baby blues</i>	Mild mood changes occurring after pregnancy. Characterized by emotional lability, irritability, confusion, anxiety, and frequent episodes of crying (Rai et al., 2015).
<i>Failure to Thrive</i>	A child with delayed physical growth. Not progressing normally on the growth curve (Johns Hopkins Medicine, 2022).

<i>Infant</i>	Birth to twelve months.
<i>Multigravida</i>	A woman who has been pregnant more than once (Merriam-Webster, n.d.).
<i>Newborn</i>	Birth to one month.
<i>Object permanence</i>	An infant's understanding that an object still exists although it cannot be seen (Wilks et al., 2010).
<i>Postpartum</i>	The period just after delivery (Office on Women's Health, 2019).
<i>Postpartum Depression</i>	A persistent feeling of sadness, hopelessness and emptiness lasting longer than 2 weeks after pregnancy (Office on Women's Health, 2019).
<i>Representational Competence</i>	The ability to create and manipulate a mental image of an object that is not seen (Wilks et al., 2010).
<i>Somatic symptoms</i>	Physical symptoms such as pain, weakness, shortness of breath, etc. (Muskin, 2021).

Summary

The incidence of postpartum depression is exceedingly high and underreported. An overwhelming number of infants will have a mother with postpartum depression. There are a multitude of negative infant developmental outcomes associated with postpartum depression. It is important to determine the impact of postpartum depression on infant development so the correct interventions can be implemented to promote optimal infant development. In this systematic review, the relationship between mothers' postpartum depression and the cognitive development of their infants will be examined and synthesized from reports of findings from previously completed research that is published in peer reviewed journal articles.

Chapter 2

Background

The purpose of this chapter is to outline the factors affecting the occurrence of postpartum depression. This chapter also depicts how infant cognitive processes evolve over time. Additionally, background information regarding how infant cognitive development is assessed will also be provided.

Changes in Pregnancy

Psychological changes in the postpartum period are a natural course of pregnancy (Wallace, 2020). Hormonal changes in the body can account for many of the psychological alterations experienced (Wallace, 2020). The hormones present during pregnancy cause a fluctuation between negative and positive emotions with an increased occurrence of negative emotions during the third trimester (International Forum for Wellbeing in Pregnancy, 2019). The complex process of transitioning to parenthood adds to the psychological stress the postpartum woman is already experiencing (International Forum for Wellbeing in Pregnancy, 2019). Life stressors, hormonal changes, and adjusting to the physical and emotional demands after childbirth all contribute to the variations in mental health during the postpartum period (National Institute of Mental Health, 2020).

With an incidence as high as 40-85%, it is very common for women to experience postpartum blues or “baby blues” after their infant is born (Rai et al., 2015). This is a period characterized by emotional lability, consisting of irritability, confusion, anxiety, and frequent episodes of crying (Rai et al., 2015). Postpartum blues may appear within the first 10 days of the

postpartum period and should last no longer than 2 weeks. Postpartum blues is defined as **mild** mood changes occurring after pregnancy, while postpartum depression is a more severe case of mood disturbance (National Institute of Mental Health, 2020). A mother presenting with the symptoms of postpartum blues longer than 2 weeks may be at an increased risk for a more severe psychiatric disorder such as postpartum depression (Rai et al., 2015).

Postpartum Depression

Postpartum depression is a multifactorial psychiatric disorder with a prevalence between 5% and 60.8% worldwide (Ghaedrahmati et al., 2017). There are a multitude of risk factors for postpartum depression stemming from psychological, obstetric, biological, social, lifestyle, and hormonal aspects (Ghaedrahmati et al., 2017). A major predictor for postpartum depression includes women with a previous history of psychiatric illnesses, especially anxiety and depression (Rai et al., 2015). Women with a history of psychiatric illnesses have been found to be more susceptible to the hormonal changes that accompany pregnancy (Ghaedrahmati et al., 2017). Obstetric predictors of postpartum depression include multiparous women, complications during childbirth, and women who did not breastfeed their infants during the postpartum period (Ghaedrahmati et al., 2017). Additionally, increased life stressors, such as a low socioeconomic status and a lack of social support can substantially increase the risk for the occurrence of postpartum depression (Ghaedrahmati et al., 2017).

Postpartum depression can consist of a variety of debilitating emotions. The diagnostic criterion for postpartum depression includes a combination of depressed mood, anhedonia, change in weight or appetite, sleep disturbances, inappropriate guilt, fatigue, diminished

concentration, or thoughts of suicide (DelRosario et al., 2013). To receive a diagnosis of postpartum depression five key symptoms lasting longer than 2 weeks with impairment in normal function must be present (Hirst et al., 2010). Women with an increased risk for PPD and those exhibiting symptoms of PPD, should undergo screening immediately. With such a high occurrence, it has been recommended that postpartum depression be screened as soon as the first postpartum visit (Sit et al., 2009). The Edinburg Postnatal Depression Scale (EPDS) is the most widely used tool to evaluate postpartum depression (Sit et al., 2009). The EPDS is a self-administered screening questionnaire that consists of 10 statements, ranked 0-3, that reflect on the patient's experiences during the past week (Sit et al., 2009). Women that score 12 or above on the EPDS are considered for a clinical diagnosis of postpartum depression (Hirst et al., 2010).

Once identified for postpartum depression, mothers may be beginning treatment with non-pharmacological and/or pharmacological methods. Non-pharmacological interventions used to treat postpartum depression include the use of psychotherapy, familial and social support, and psychoeducation. The use of psychotherapy has proven to be an integral asset in the treatment of postpartum depression (Rai et al., 2015). Specifically, interpersonal therapy has shown to improve the patient's social functioning with a focus on the emotions associated with transitioning to motherhood (Rai et al., 2015). In contrast, the objective of cognitive behavioral therapy is to alter the maladaptive thinking patterns and behaviors that accompany depression (Fitelson et al., 2010). Familial and social support benefit the mother by increasing her self-esteem and confidence. Pharmacological interventions used to treat postpartum depression include the use of antidepressants and hormone therapy (Fitelson et al., 2010). Regarding hormones, low levels of estrogen and progesterone are said to be a trigger for the onset of postpartum depression (Fitelson et al., 2010). Based on evidence found in prior research, studies

suggest estrogen replacement may be a promising treatment for low estrogen levels caused by postpartum depression (Fitelson et al., 2010).

Infant Cognitive Function

Cognitive development is a complex concept comprised of a multitude of processes that ultimately creates the foundation for intelligence (Wilks et al., 2010). This intelligence encompasses a child's ability to learn, think, and problem solve (CDC, 2020). Cognitive development incorporates four fundamental elements. These four elements include memory, representational competence, attention, and speed processing (Wilks et al., 2010). Healthy cognitive development will comprise advancement in all four areas (Wilks et al., 2010).

Developmental theory

To achieve healthy cognitive development, Piaget hypothesized children needed to progress through and complete a multitude of developmental tasks. Piaget determined infants are in the sensorimotor stage of cognitive development until age 2 (Wilks et al., 2010). To complete the sensorimotor stage the child needs to demonstrate object permanence, causality, and symbolic thinking (Oswalt, n.d.). During infancy, object permanence and causality are the main developmental tasks of cognitive development (Wilks et al., 2010). Piaget separated the cognitive development of infants into six sub-categories (Oswalt, n.d.). These categories consist of reflexive activity (birth-1 month), primary circular reactions (1 month-4 months), secondary circular reactions (4 months-8 months), coordination of secondary schemes (8 months-12 months), tertiary circular reactions (12 months-18 months), and representational thought (18 months-24 months) (Oswalt, n.d.).

The infancy period lasts from birth until 12 months; therefore, this section will only focus on the sub-categories' reflexive activity, primary circular reactions, secondary circular reactions, and coordination of secondary schemes. From birth to one-month newborns are in the stage reflexive activity. During this stage, the initial interaction between a newborn and their environment is solely based on instinct with the use of reflexive behaviors only (i.e., sucking, grasping, staring, etc.) (Oswalt, n.d.).

From one-month to four-months infants are in the stage primary circular reactions (Oswalt, n.d.). Through exploration of their environment infants start to engage in intentional behaviors (Oswalt, n.d.). In this stage, infants begin to have a gradual awareness of the impact of their actions on the environment (Wilks et al., 2010). This phenomenon is known as causality. Infants will deliberately repeat a behavior on their own body that has brought them pleasure (Oswalt, n.d.). The appearance of causality begins to develop in this stage and further matures in the stage thereafter (Wilks et al., 2010).

From four-months to eight-months infants are in the stage secondary circular reactions (Oswalt, n.d.). Within this stage, infants further evolve the previous skill learned by repeating actions that produce a desirable outcome onto their environment (Oswalt, n.d.). Infants continue in the learning process by using their senses to interact with the environment (Oswalt, n.d.) The influx of information from exploration of the environment helps to strengthen the infant's memory (Oswalt, n.d.).

Finally, from eight months to twelve months, infants are in the coordination of secondary schemes stage (Oswalt, n.d.). Building off the previous three stages, the infants begin to mimic behaviors they witness in their environment (Oswalt, n.d.). At this age, infants will begin to demonstrate the phenomenon object permanence (Oswalt, n.d.). Object permanence is an infant's

understanding that an object still exists although it cannot be seen (Wilks et al., 2010). With a firm understanding of these concepts, the infant can transition into the next sub-category of cognitive development.

Developmental milestones

As the infant progresses through the infancy period, they are assessed at two months, four months, six months, nine months, and twelve months to monitor their cognitive status. At each assessment, the infant should be meeting the criteria for their cognitive developmental milestones.

Table 2. *Cognitive Developmental Milestones*

Month	Cognitive Developmental Milestones
Two Months	<ul style="list-style-type: none"> • Pays attention to faces • Begins to follow things with eyes and recognize people at a distance • Begins to fuss if activity does not change
Four Months	<ul style="list-style-type: none"> • Shows different emotions • Responds to affection • Uses hands and eyes together • Watches faces closely
Six Months	<ul style="list-style-type: none"> • Looks around at items nearby • Brings items to mouth • Shows curiosity and reaches for items out of reach • Begins to pass items from one hand to the other
Nine Months	<ul style="list-style-type: none"> • Watches the path of an item as it falls • Looks for items that have been hidden • Plays peek-a-boo • Smoothly moves items from one hand to the other • Pincher Grasp
Twelve Months	<ul style="list-style-type: none"> • Explores items in different ways, by shaking, banging, throwing • Finds hidden items with ease

	<ul style="list-style-type: none">• Looks at a picture or item when named• Mimics behaviors• Bangs two items together• Puts items in a container, takes items out of a container• Releases items without help• Points with index finger• Follows simple one step directions
--	---

Centers for Disease Control and Prevention (2020)

Red flags in cognitive development.

Infants not meeting their cognitive developmental markers during the first year of life may indicate a cognitive delay. An infant that loses the ability to complete a developmental task or does not gain the ability to complete the developmental task should be evaluated further.

Table 3. Red Flags in Cognitive Development

Month	Red Flags in Cognitive Development
Two Months	<ul style="list-style-type: none"> • Does not follow moving objects with eyes
Four Months	<ul style="list-style-type: none"> • Does not bring objects to mouth
Six Months	<ul style="list-style-type: none"> • Does not try to retrieve items within reach • Does not show caregivers affection • Difficulty bringing items to mouth
Nine Months	<ul style="list-style-type: none"> • Does not transfer toys from one hand to other • Does not recognize familiar people • Does not look to where you point
Twelve Months	<ul style="list-style-type: none"> • Does not search for items hidden • Losing an already acquired skill • Does not point to items

Centers for Disease Control and Prevention (2020)

Measures of Infant Cognitive Development

A wide array of developmental tools may be utilized to assess the cognitive functioning in an infant. The use of these developmental tools may be crucial in recognizing the need for early intervention services. The research studies included in this systematic review utilize three different developmental scales to assess cognition in infants. Background information pertaining to each measure is essential to understand what factors were assessed in the child.

Bayley scale of infant development – III edition

The Bayley Scales of Infant and Toddler Development (BSID) is a widely used developmental screening tool designed to assess developmental delays in infants and toddlers (Palanikumar, 2020). Originally published in 1969, the scale evaluates development in five

domains – physical, cognitive, social-emotional, linguistic, and behavioral milestones (Palanikumar, 2020). Each domain is scored using a dichotomous approach ranging from zero to one. The cognitive domain specifically assesses 91 items related to cognitive development (Palanikumar, 2020). Once the assessment is completed a raw score is calculated (Armstrong et al., 2010). The raw score is then converted into a scaled score using a table provided by the BSID (Armstrong et al., 2010). After a scaled score is calculated, the composite score can be determined (Armstrong et al., 2010). A composite score of the cognitive and language domain less than 85 may be indicative of a moderate-severe neurodevelopmental impairment (Johnson et al., 2014).

The ankara developmental screening inventory

The Ankara Developmental Screening Inventory is a Turkish developmental tool used to assess the current developmental status of infants and children up to six years old (Oztop et al., 2007). The test is comprised of 154 items and tests the following domains of development— language-cognitive, fine motor, gross motor, social skill-self-care (Aydin, 2012). The inventory measures the child’s developmental level based on the information gathered from the child’s caretaker (Aydin, 2012).

Mullen scales of early learning

The Mullen Scales of Early Learning, created in 1995, is an assessment tool created to measure development in infants and preschool aged children (Shank, 2011). This assessment contains 124 items measuring specific tasks in gross motor function, fine motor skills, visual reception, receptive language, and expressive language (Shank, 2011). Four cognitive scales – visual reception, fine motor, receptive language, and expressive language – are combined to produce an Early Learning Composite that is representative of overall cognitive functioning

(Shank, 2011). The visual reception scale consists of 33 items primarily assessing discrimination and memory skills (Bradley-Johnson, 1998). The fine motor scale consists of 30 items appraising a wide array of fine motor skills (Bradley-Johnson, 1998). The receptive language scale consists of 33 items measuring comprehension and memory (Bradley-Johnson, 1998). The expressive language scale consists of 28 skills assessing language production (Bradley-Johnson, 1998). Each test item may receive a score ranging from zero to five (Shank, 2011). After three consecutive scores of zero the test is discontinued (Shank, 2011). Once the test is completed a raw score is calculated and converted into a T score (Shank, 2011). A T score of less than 30 may indicate developmental delays, while a T score ranging from 31 to 35 is considered at risk (Shank, 2011).

Conclusion

The United States has the highest incidence of postpartum depression (Slomian et al., 2019). Along with a high incidence of postpartum depression, the rates of maternal morbidity and mortality are steadily increasing (Association of State and Territorial Officials, 2019). Mental health disturbances accounted for 8.8% of all pregnancy-related deaths during the years 2008 to 2017 (Davis et al., 2019). During this time period, Davis et al. 2019, found that 233 or 65% of pregnancy-related deaths were preventable. Postpartum depression has not only been reported to negatively affect the mother's outcome health and wellbeing, but it has also been documented to negatively influence infant development. When raised in an unfavorable environment, infants are at a greater risk for delayed psychological, cognitive, neurobehavioral, and motor development (Gjerdingen et al., 2007). These developmental delays increase the

child's risk for abuse or neglect, failure to thrive, increased irritability and crying, and for a poor attachment to their mother (LA Best Babies Network, 2011). Healthcare professionals are ethically bound by the principle of beneficence to participate in actions that will benefit their client and to act in the best interest of their patient (Smok et al., 2020). Increasing awareness of postpartum depression risk factors and negative effects, increased screening and access to treatment and support services would help to address the issue of postpartum depression and its negative effects (Association of State and Territorial Officials, 2019).

Chapter 3

Methods

This chapter outlines the process for identifying the articles included in this systematic review to analyze the current research on postpartum depression and infant development. To examine the current literature on the consequences of postpartum depression on the cognitive development of an infant, a literature search was conducted using a multitude of databases. The databases PubMed, CINAHL, and PsycINFO were selected due to their relevance to postpartum depression and infant outcomes.

For the databases PubMed, PsycINFO, and CINAHL, the following key terms “maternal depression OR postpartum depression OR postnatal depression” AND “infant development” AND “cognitive” were utilized. The literature search in PubMed and CINAHL was further narrowed by limiting the titles and abstract. The abstracts in CINAHL had to include the terms postpartum depression, child development, cognition, and mothers. The inclusion criteria included: articles published within the last 11 years (2010 – 2021); written in the English language; conducted inside and outside of the United States; focused on age range of birth – 12 months; and included the use of human participants only. The exclusion criteria consisted of articles conducted using preterm infants, children older than 1 year old, or infants with increased risk factors for developmental delays (i.e., low socioeconomic status, perinatal alcohol/drug use, etc.). The literature included in the present review targets the impact of maternal depression on the cognitive development of an infant.

With the use of the inclusion and exclusion criteria, this initial search yielded a total of 415 articles; PubMed produced 221 articles, CINAHL returned 6 articles, and PsycINFO resulted

in 188 articles. After reviewing the title and abstract, a total of 403 articles were excluded with 11 articles being duplicates; 211 articles excluded from PubMed, 5 articles excluded were from CINAHL, and 187 articles were excluded from PsycINFO. As aforementioned, the previous articles were excluded due to irrelevance to the topic being researched. Excluded articles included studies discussing postpartum depression treatment, premature infants, infants at an increased risk for developmental delays, infant temperament, and infants older than 13 months. As a result, the exclusion of these articles produced a total of 11 articles to be thoroughly reviewed for relevancy for this systematic review; 10 yielded by PubMed, 1 yielded by CINAHL, and 1 yielded by PsycINFO. The 1 article yielded from CINAHL was later excluded because it was identified as a duplicate. After a thorough assessment of the 10 relevant articles yielded by this initial search, 7 articles were discarded, leaving 4 articles to be included in this systematic review.

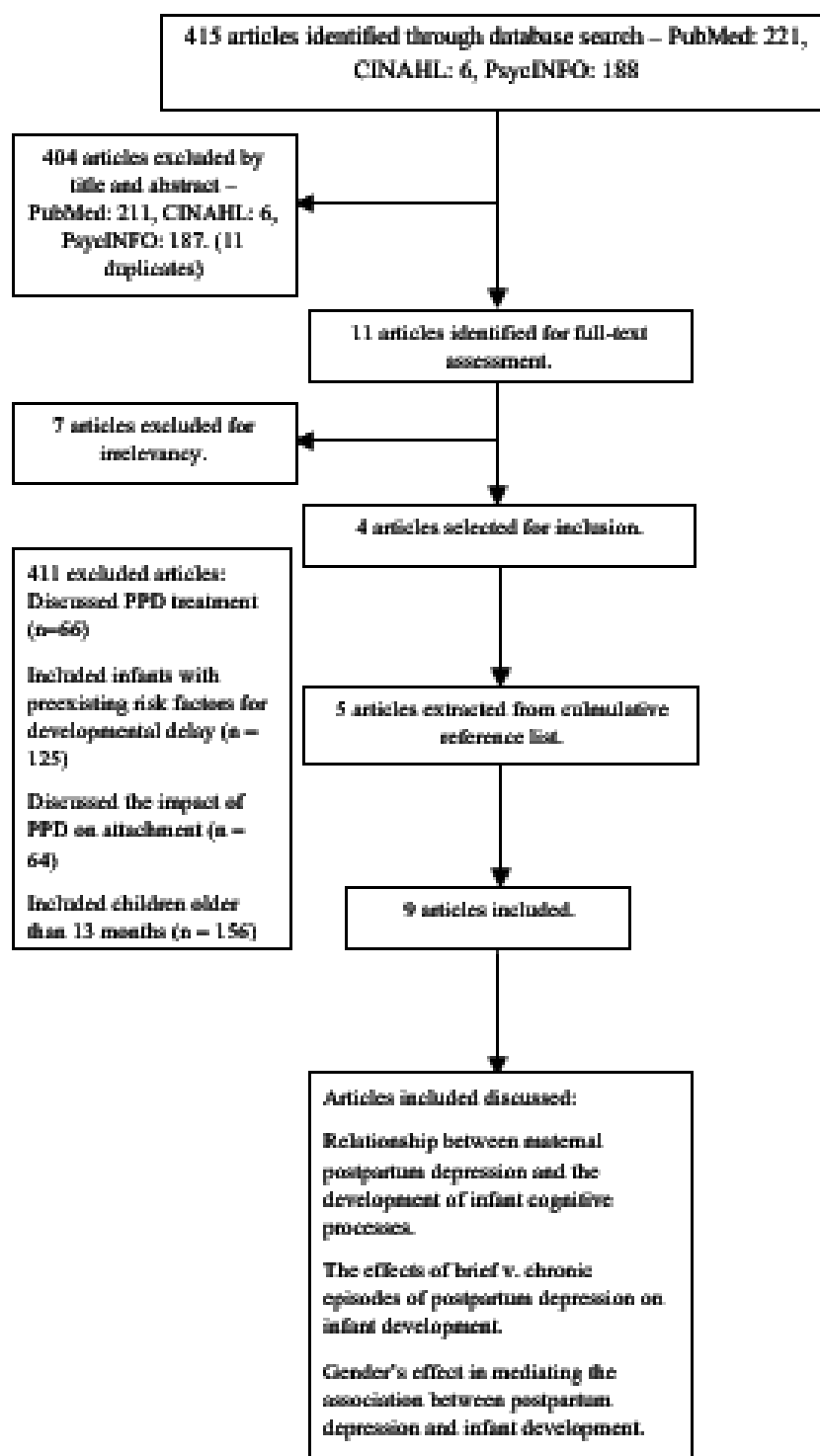
The initial search yielded an insufficient number of viable articles for review. Thus, an ancestry search was conducted for additional articles relevant to the topic. New parameters were set to widen the search for literature pertinent to the topic at hand. Initially the inclusion criteria were set to only include articles in a 10-year range (2010 – 2021). Due to the lack of research focusing specifically on infant development during this time (2010 – 2021), relevant articles older than 2010 were included for this systematic review. Through investigation of the reference lists from the 4 selected articles, 5 additional articles were extracted for review.

As a result, the literature search in PubMed, CINAHL, and PsycINFO returned 9 relevant for this systematic review. PubMed yielded 4 articles (Azak, 2012; Gul et al., 2020; Nielsen-Smith et al., 2016; Perra et al., 2015). The search of the combined reference lists returned an

additional 5 articles (Ali et al., 2013; Bornstein et al., 2011; Cornish et al., 2005; Keim et al., 2011; Sutter-Dallay et al., 2011). The data in each article were reviewed, rated, and extracted according to the Matrix Method (Garrard, 2017).

Using The Johns Hopkins Research Appraisal Tool along with The Johns Hopkins Evidence Level and Quality Guide, a critical appraisal was conducted for all nine articles (Dang & Dearholt, 2017). Each article was rated based on their level and quality of evidence. Level of evidence was given a rating from level I to level V, with level I being the highest level of evidence. Once level of evidence was determined, each article was assigned a grade for quality of evidence. Grades ranged from A to C, with A being the highest quality of evidence and C being the lowest quality of evidence.

Figure 1. PRISMA Flowchart of Article Selection



Chapter 4

Results

The previous chapters provide background knowledge related to the effects of postpartum depression on infant cognitive development, as well as the design approach used to conduct this current systematic review. The purpose of this chapter is to review and analyze the current literature available pertaining to the ramifications of postpartum depression in relation to infant cognitive development.

Study Design

Nine studies, published between 2005 and 2020, were selected to be included in this systematic review (Azak, 2012; Ali et al., 2013; Bornstein et al., 2011; Cornish et al., 2005; Gul et al., 2020; Keim et al., 2011; Nielsen-Smith et al., 2016; Perra et al., 2015; Sutter-Dallay et al., 2011). Six articles had a correlational study design (Azak, 2012; Cornish et al., 2005; Gul et al., 2020; Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011), one article had an experimental study design (Bornstein et al., 2011), one article had a quasi-experimental design (Ali et al., 2013), and one article was a randomized control trial (Perra et al., 2015).

Of the studies examined, three were published in the journal *Infant Behavior and Development* (Azak, 2012; Bornstein et al., 2012; Cornish et al., 2005). The remaining six articles were published, one each, in the following six journals, *BMC Psychiatry* (Ali et al., 2013), *Early Human Development* (Keim et al., 2011), *Archives of Psychiatric Nursing* (Gul et al., 2020), *Scandinavian Journal of Psychology* (Nielsen-Smith et al., 2016), *Journal of Child*

Psychology and Psychiatry (Perra et al., 2015) and *European Psychiatry* (Sutter-Dallay et al., 2011).

Study Focus

Of the nine studies included in this systematic review, six studies focused specially on the relationship between maternal postpartum depression and overall cognitive development in infants (Azak, 2012; Ali et al., 2013; Cornish et al., 2005; Gul et al., 2020; Nielsen-Smith et al., 2020; Sutter-Dallay et al., 2011). In addition, one study examined the effects of particular features of postpartum depression (i.e., maternal avoidance and depressive symptoms) on overall cognitive development in infants (Keim et al., 2011). Finally, two studies focused on the effects of maternal postpartum depression on a specific cognitive ability in infants – object perception, and imitation (Bornstein et al., 2012; Perra et al., 2015). All of the articles included in this systematic review were analyzed for relevancy to the topic at hand.

Sample Size

Of these nine articles, sample sizes ranged from 36 to 515 mother-infant dyads. Four of the nine studies had sample sizes including less than 100 mother-infant dyads (Azak, 2012; Bornstein et al., 2011; Gul et al., 2020; Nielsen-Smith et al., 2016). Adult women who had delivered at least one child were the only adult participants included in all studies. The sample size for infants born to a mother experiencing postpartum depression ranged from 14 to 38 infants. One study did not explicitly state or measure the number of infants born to a mother

experiencing postpartum depression (Gul et al., 2020). Four studies recorded a mean age of infants participating in the study, which ranged from 119 days to 1095 days old (Azak, 2012; Bornstein et al., 2011; Cornish et al., 2005; Gul et al., 2020). However, five studies did not report the mean age range of infant participants (Ali et al., 2013; Keim et al., 2011; Nielsen-Smith et al., 2016; Perra et al., 2015; Sutter-Dallay et al., 2011). Additionally, two studies reported the mean gestational age of infant participants to be approximately 40 weeks for both (Keim et al., 2011; Nielsen-Smith et al., 2016).

Setting and Recruitment

Studies picked to be included in this systematic review were conducted in many areas of the world. One study was conducted in Norway (Azak, 2012), one study was conducted in Pakistan (Ali et al., 2013), one study was conducted in Australia (Cornish et al., 2005), one study was conducted in Turkey (Gul et al., 2020), one study was conducted in the United States (Keim et al., 2011), one study was conducted in Denmark (Nielsen-Smith et al., 2016), one study was conducted in Wales (Perra et al., 2015), one study was conducted in France (Sutter-Dallay et al., 2011). In contrast, one study did not specify the region where the study was conducted but based on the author's affiliations it was determined the study was conducted in a large metropolitan catchment in the United States (Bornstein et al., 2011).

Of the nine studies, three studies recruited mother-infant dyads through mass media – mailings, newspapers, internet, flyers (Azak, 2012; Bornstein et al., 2011; Nielsen-Smith et al., 2016), two studies recruited mother-infant dyads through prior prospective studies (Keim et al., 2011; Sutter-Dallay et al., 2011), five studies recruited mother-infant dyads through referrals

from psychiatric hospitals, general hospitals, and clinics (Azak, 2012; Cornish et al., 2005; Gul et al., 2020; Perra et al., 2015; Sutter-Dallay et al., 2011), one study recruited mother-infant dyads by visiting homes of pregnant women living in the defined site (Ali et al., 2013), and one study recruited mother-infant dyads during nursing home health screenings for postpartum depression (Nielsen-Smith et al., 2016). In one study infant participants were given an inexpensive toy for participation (Azak, 2012).

Infant Demographics

In five of the studies, male infants were the primary participants (Cornish et al., 2005; Gul et al., 2020; Keim et al., 2011; Perra et al., 2015; Sutter-Dallay et al., 2011). In contrast, female infants were the predominant participants in two of the studies (Ali et al., 2013; Nielsen-Smith et al., 2016), and two studies had an equal amount of female and male infant participants (Azak, 2012; Bornstein et al., 2011). Four out of nine studies reported an ethnic breakdown of study participants. Of those four studies, the majority of participants were of Caucasian or European descent (Azak, 2012; Bornstein et al., 2011; Cornish et al., 2005; Perra et al., 2015).

Inclusion and Exclusion Criteria

Inclusion criteria varied per each study. Five out of nine studies explicitly stated inclusion criteria for each participant (Cornish et al., 2005; Gul et al., 2020; Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Three out of the five studies required the mothers to only have carried and given birth to one child at a time (Cornish et al., 2005; Nielsen-Smith et

al., 2016; Sutter-Dallay et al., 2011). One study had specific inclusion criteria for maternal participants, requiring mothers to be primiparous, living with the child's father at time of recruitment, and to possess the ability to answer questionnaires and understand English (Cornish et al., 2016). In a prospective study, women were eligible to participate if they participated in an earlier study and did not become pregnant again in the first year postpartum (Keim et al., 2011). Three studies required participants to be able to read and write in Norwegian (Azak, 2012), English (Cornish et al., 2005) and French (Sutter-Dallay et al., 2011). Furthermore, two studies had specific criteria for infant participants, requiring healthy infants born at term and lacking any known risk factors for delayed development (Gul et al., 2020; Keim et al., 2011). Of the four studies that did not definitively state inclusion criteria, the overarching theme for inclusion in the comparison group required a diagnosis or symptoms of depression (Azak, 2012; Ali et al., 2013; Bornstein et al., 2011; Perra et al., 2015).

Out of the nine studies included in this systematic review, only four studies clearly defined their exclusion criteria (Gul et al., 2020; Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Gul et al. (2020) and Nielsen-Smith et al. (2016) excluded infants experiencing any major physical or mental disabilities after birth, such as visual issues, hearing loss, bone deficits, cerebral palsy, autism spectrum disorders, and epilepsy. Sutter-Dallay et al. (2011) excluded women experiencing pregnancy complications resulting in a hospital stay longer than one week, women with a planned c-section delivery method, and women with a history of psychotic illness. Additionally, one study excluded maternal participants who experienced drug or alcohol abuse, psychotic symptoms, or developed any severe neurological or physical illnesses 12 months after giving birth (Nielsen-Smith et al., 2016). Another study excluded infants older than 12 months at the beginning of the study (Keim et al., 2011).

Outcome Measures

Many of the articles selected used various scales to assess maternal depression symptoms. The Center for Epidemiological Studies Depression Scale (CES-D), used by three out of nine articles, was the most used scale to assess maternal depression (Azak, 2012; Cornish et al., 2005; Keim et al., 2011). The CES-D is a 20-item scale used to measure the frequency and duration of depressive symptoms in the prior week. Scores range from 0 to 60, with a score of 16 or greater indicating high depressive symptoms and the need for further investigation. The Edinburgh Postnatal Depression Scale (EPDS), used by three studies, was the second most used scale to assess maternal depression (Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). The EPDS is a 10-item self-reported questionnaire used to assess depressive symptoms and severity in postpartum women. A cut off score of 12 is used to indicate a clinical diagnosis of postpartum depression. One study used the Aga Khan University Anxiety and Depression Scale (AKUADS) to assess anxiety and depression (Ali et al., 2013). The AKUADS is a 25-item scale that assesses a majority of the characteristics related to anxiety and depressive disorders. A score equal to 19 or greater, is considered an indication of depression. Another study used the Beck Depression Inventory (BDI-II) to assess postpartum depression (Bornstein et al., 2011). The BDI-II is a 21-item self-reported questionnaire, with a score greater than 12 indicating a potential diagnosis of depression. Additionally, one study used a modified version of The Composite International Diagnostic Interview (CIDI) to establish a diagnosis of maternal depression in the postpartum period. The CIDI is a structured tool used to diagnosis depression based on criteria in the DSM-IV (Cornish et al., 2005). Gul et al. (2020) used the Brief Symptom Inventory (BSI) to assess psychiatric disturbance. The BSI is a 53-item inventory assessing nine

symptom domains, including depression. Scores are dependent on answers provided in each domain; however, overall high scores indicate the frequency and severity of psychiatric symptoms. Finally, one study assessed maternal postpartum depression symptoms with Schedules for Clinical Assessment in Neuropsychiatry (SCAN) (Perra et al., 2015). SCAN interviews are used to code depression symptoms according to the criteria in the DSM-IV.

Assessment tools used to ascertain infant cognitive ability varied between all nine studies. The Mullen Scales of Early Learning (MSEL), used by two studies, was the most used assessment tool to establish a composite score of infant cognitive abilities (Azak, 2012; Keim et al., 2011). The Mullen Scales of Early Learning is an assessment tool used to determine a composite score for infant early learning abilities equating to cognitive ability. Three studies used a variation of The Bayley Scales of Infant Development (BSID-II; BSID-III) to assess the development of infants (Cornish et al., 2005; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Another study used the Danish version of the BSID-III, however the researchers used American norms for scoring (Nielsen-Smith et al., 2016). The Bayley Scales of Infant Development is a standardized test that covers five domains of infant development—cognitive, language, motor, social-emotional and adaptive. One study used the Early Childhood Development (ECD) tool to gauge infant development. The ECD evaluates five domains of child development – gross motor, fine motor, language, cognitive, and socio-emotional. The cognitive portion of the ECD specifically evaluates child perception and learning. Likewise, one study used the Ankara Developmental Screening Inventory (ADSI) to assess infant abilities (Gul et al., 2020). The ADSI is a 154-item assessment covering four developmental domains, language-cognitive, fine motor, gross motor, and social and self-help, with the language-cognitive domain being the largest portion evaluated. Two studies did not use a standardized scale to assess infant

development and instead assessed specific cognitive abilities such as object perception and imitation (Bornstein et al., 2011; Perra et al., 2015). In addition, one study found infant girls overall had a greater increase on scores of the Mullen Scales of Early Learning from 6 to 18 months compared to boys (Azak, 2012).

Level and Quality of Evidence

Each article included in this systematic review was examined and assigned a grade for the quality of evidence presented. One randomized control trial was included in this review which is classified as a Level 1 for strength of evidence (Perra et al., 2015). For the quality of evidence, Perra et al. (2015) was given a grade of B, or good. Two studies were not randomized control trials and were classified as a Level 2 for strength of evidence (Ali et al., 2013; Bornstein et al., 2011). Ali et al. (2013) received a grade of B, or good, while Bornstein et al. (2011) received a grade of A, or high, for quality of evidence. The remaining six articles were non-experimental studies and were classified as a Level 3 for strength of evidence (Azak, 2012; Cornish et al., 2005; Gul et al., 2020; Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Out of these six articles, five articles were given a grade of A, or high, for quality of evidence (Azak, 2012; Cornish et al., 2005; Gul et al., 2020; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Keim et al. (2011) was given a grade of B, or good, for quality of evidence.

Research Findings

Out of the nine studies included in this review, six studies found a statistically significant association between maternal postpartum depression and infant cognitive development or ability to accomplish cognitive tasks (Azak, 2012; Ali et al., 2013; Bornstein et al., 2011; Gul et al., 2020; Nielsen-Smith et al., 2016; Perra et al., 2015). Each study, except Ali et al. (2013), determined the results to be statistically significant if the p-value was less than .05. After measuring the trajectories of cognitive development in infants, Azak (2012) determined infants with a depressed mother had a stable lower MSEL score over an 18-month period. Similarly, when studying the cognitive process object perception, Bornstein et al. (2005) discovered infants reared by clinically depressed mother's discrimination scores were significantly lower than chance when compared to infants reared by non-depressed mothers. The discrimination scores between these two groups of infants were found to be significant at a p level of 0.003. Likewise, when studying the cognitive task imitation, Perra et al. (2015) found only 10 infants whose mothers suffered from postpartum depression imitated the task at least once, while 160 infants whose mothers did not have postpartum depression imitated the task at least once. Interestingly, while Gul et al. (2020) found maternal depression to be associated with infant cognitive development, it was also determined that maternal depression increases the risk for total developmental delay.

Two studies discovered a non-significant relationship between postpartum depression and infant cognitive development (Cornish et al., 2005; Sutter-Dallay et al., 2011). Initially, Sutter-Dallay et al. (2011) found maternal depressive symptoms at 6 weeks significantly predicted poor cognitive development in infants. Yet once follow-up maternal depressive scores were also

considered this association was reduced to trend level (Sutter-Dallay et al., 2011). While Cornish et al. (2005) determined there was not a statistically significant relationship between these two variables, a nonsignificant association between the two variables was noticed. Despite the above findings, Keim et al. (2011) found no relationship between postpartum depressive symptoms and the development of infant cognitive processes. Maternal depressive symptoms were found to have little negative effect on infant cognitive processes (Keim et al., 2011). However, in certain conditions maternal depressive symptoms were found to accelerate particular domains of infant development (Keim et al., 2011; Perra et al., 2015).

Gender as a Mediator

Four out of nine studies investigated whether infant gender influenced the effects of maternal depression on infant cognitive development scores (Azak, 2012; Cornish et al., 2005; Nielsen-Smith et al., 2016; Perra et al., 2015). One study found infant gender was associated with maternal depression and infant cognitive development (Azak, 2012). It was discovered that infant boys reared by depressed mothers consistently scored lower in The Mullen Scales of Early Learning (Azak, 2012). In contrast, three studies found infant gender had no association with maternal depression and infant cognitive abilities (Cornish et al., 2005; Nielsen-Smith et al., 2016; Perra et al., 2015). Although five studies did not explore whether there was a relationship between infant gender and the effects of postpartum depression, two articles observed overall, infant girls performed better than infant boys on developmental tests regardless of maternal depression status (Cornish et al., 2005; Nielsen-Smith et al., 2016).

Postpartum Depression Chronicity

Out of the nine studies that investigated a relationship between maternal depression and infant development, an interesting trend related to the duration of maternal depression or

depressive symptoms and infant development emerged in six of the studies (Ali et al., 2013; Azak, 2012; Cornish et al., 2005; Keim et al., 2011; Nielsen-Smith et al., 2016; Sutter-Dallay et al., 2011). Three studies found a significant association between chronic maternal depression and infant cognitive development (Ali et al., 2013; Cornish et al., 2005; Keim et al., 2011). However, two studies found the duration of maternal depression or depressive symptoms did not have an impact on infant cognitive development (Azak, 2012; Nielsen-Smith et al., 2016).

Of the studies reporting a significant relationship between these variables, one study found brief periods of maternal depression (i.e., during the first four months postpartum only and resolved by 12 months) did not significantly impact infant development, yet longer durations of depression (i.e., depression lasting 12 months) did have a significant impact on infant cognitive development when assessed at 15 months (Cornish et al., 2005). Infants raised by chronically depressed mothers were 3.36 times more likely to score less than optimal scores (<85) on the MDI when compared to infants raised by non-depressed mothers (Cornish et al., 2005). Similarly, one study found that by the sixth month, the impact of postpartum depression on infant cognitive development was three times as great as the impact at one month postpartum, and by 12 months the impact of postpartum depression more than doubled (Ali et al., 2013). Furthermore, another study found when women experienced high levels of depressive symptoms at more than one point in time there was a positive association between depressive symptoms and cognitive development (Keim et al., 2011).

In contrast, out of the studies that reported no relationship between duration of postpartum depression and infant development, one study found cognitive developmental differences between infants with a clinically depressed mother and a non-depressed mother at four months, that had resolved by 13 months (Nielsen-Smith et al., 2016).

Summary

The current literature investigating the widespread effects of postpartum depression offer various perspectives on how exactly postpartum depression impacts infant development. A majority of the articles included in this review identified a relationship between postpartum depression and infant cognitive development. However, a few articles did not find a significant relationship, or found there to be no relationship between postpartum depression and infant cognitive development. The literature explored found specific factors such as the duration of the depressive episode and the infant's gender potentially influences the effect postpartum depression already has on infant cognitive development.

Table 4. *Postnatal depression and infant cognitive development and motor development in the second postnatal year: The impact of depression chronicity and infant gender*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
Cornish, A.M., McMahon, C.A., Ungerer, J.A., Barnett, B., Kowalenko, N., Tennant, C. (2005). Postnatal depression and infant cognitive and motor development in the second postnatal year: The impact of depression chronicity and infant gender. <i>Infant Behavior and Development</i> .	The purpose of this study is to examine the effects of brief v. chronic maternal postpartum depression on infant developmental outcomes.	<p>Type of Study: Correlational, longitudinal study</p> <p>Sample: 112 mother-infant dyads</p> <ul style="list-style-type: none"> • 39 briefly depressed mothers • 38 chronically depressed mothers • 35 non-depressed mothers <p>Setting: Australia</p>	Maternal postpartum depression scores were measured using The Composite International Diagnostic Interview at 4 and 12-months. Depressive symptoms were assessed using the Center for Epidemiology Studies Depression Scale at 4, 12, and 15 months. Infant cognitive development was assessed using the Bayley Scales of Infant Development, 2 nd edition	Discovered a nonsignificant trend between postpartum depression and infant cognitive development. <ul style="list-style-type: none"> • $p < 0.1$ Female infants consistently scored higher than male infants – significant finding <ul style="list-style-type: none"> • $p < 0.5$ Chronic depression was significantly related to lower cognitive scores for infants. <ul style="list-style-type: none"> • $p < 0.25$ Infants of chronically depressed mothers were nearly 4 times more likely to receive a less than optimal score on the MDI. <ul style="list-style-type: none"> • $p < 0.25$ 	<p>Strengths: Strict inclusion and exclusion criteria for maternal participants. High retention rates. Psychiatric interviews were conducted to confirm a DSM-IV diagnosis. Non-poverty sample. Infant examiners were blind to maternal depression status.</p> <p>Limitations: No inclusion or exclusion criteria listed for infants. Non-diverse sample</p> <p>Level & Grade: IIIA</p>

Table 5. *A prospective study of maternal anxiety, perceived stress, and depressive symptoms in relation to infant cognitive development*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
Keim, S.A., Daniels, J.L., Dole, N., Herring, A.H., Siega-Riz, A.M., Scheidt, P.C. (2011). A prospective study of maternal anxiety, perceived stress, and depressive symptoms in relation to infant cognitive development. <i>Early Human Development</i> .	To investigate the effects of maternal anxiety, perceived stress, and depressive symptoms on infant development outcomes.	<p>Type of Study: Correlational, prospective, longitudinal study</p> <p>Sample: 357 mother-infant dyads</p> <ul style="list-style-type: none"> • 193 male infants • 164 female infants <p>Setting: The United States</p>	<p>Maternal postpartum depressive symptoms were assessed at four months using the Edinburg Postnatal Depression Scale.</p> <p>Infant cognitive developmental scores were evaluated at 12 months postpartum using the Mullen Scales of Early Learning.</p>	<p>Postpartum depressive symptoms were not associated with infant cognitive development.</p> <p>Mothers experiencing depressive symptoms at several points during pregnancy and postpartum were positively associated with infant cognitive development.</p>	<p>Strengths:</p> <p>Large sample size</p> <p>Trained interviewers were used to assess infant development</p> <p>Well-established, validated, and reliable instruments used to assess maternal postpartum depressive symptoms and infant cognitive development.</p> <p>Limitations:</p> <p>Did not conduct diagnostic interviews for postpartum depressive scores.</p> <p>Non-representative sample, unable to generalize findings</p> <p>Level & Grade: IIIB</p>

Table 6. *A prospective longitudinal study of the impact of early postnatal vs. chronic maternal depressive symptoms on child development*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Sutter-Dallay, A.L., Murray, L., Dequae-Merchadou, L., Glatigny-Dallay, E., Bourgeois, M.L., Verdoux, H. (2011). A prospective longitudinal study of the impact of early postnatal vs. chronic maternal depressive symptoms on child development. <i>European Psychiatry</i>.</p>	<p>The purpose of this study is to investigate the effects of brief episodes of postpartum depression versus chronic episodes of postpartum depression on child development.</p>	<p>Type of Study: Correlational, longitudinal study</p> <p>Sample: 515 mother-infant dyads</p> <ul style="list-style-type: none"> • 269 male infants • 246 female infants <p>Setting: France</p>	<p>Maternal postpartum depressive symptoms were measured at 3 days, 6 weeks, 3, 6, 12, 18, and 24 months using the Edinburgh Postnatal Depression Scale.</p> <p>Infant developments were assessed at 3, 6, 12, 18, and 24 months using the Bayley Scales of Infant Development II. The Mental Development Index (part of the BSID-II) was used to evaluate the infant's cognitive abilities.</p>	<p>Severe postpartum depression symptoms at 6 weeks predicted poorer infant cognitive performance.</p> <ul style="list-style-type: none"> • $p = 0.007$ <p>Severe postpartum depressive symptoms at 6 weeks predicted maternal Edinburgh postpartum depression scores at follow-up assessments.</p> <p>The association between maternal postpartum depressive symptoms and infant cognitive development were reduced to a nonsignificant trend level once 6 weeks passed.</p> <ul style="list-style-type: none"> • $p = 0.07$ 	<p>Strengths: Strict inclusion and exclusion criteria</p> <p>Trained psychologist delivered the assessment to the infants.</p> <p>Psychologist were blind to maternal depression status.</p> <p>Extensive sample size</p> <p>Repeated assessments of maternal depression and infant development</p> <p>Limitations: Did not conduct psychiatric interviews to confirm a diagnosis of maternal postpartum depression</p> <p>Level & Grade: IIIA</p>

Table 7. *Maternal depression and sex differences shape the infants' trajectories of cognitive development*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
Azak, S. (2012). Maternal depression and sex differences shape the infants' trajectories of cognitive development. <i>Infant Behavior and Development.</i>	The purpose of this study is to establish if a relationship between maternal depression and infant cognitive development exists, while also determining if infant gender mediates the effects of maternal depression.	<p>Type of Study: Correlational, longitudinal</p> <p>Sample: 26 infants with depressed mothers. 24 infants with non-depressed mothers.</p> <p>Setting: Psychiatric hospitals and general care institutions, well baby clinics and shopping centers in <i>Oslo, Norway.</i></p>	<p>Maternal depression measured using the Center for Epidemiological Studies Depression Scale (CED-S)</p> <p>Infant cognitive development was assessed using the Mullen Scales of Early Learning (MSEL)</p>	<p>Maternal depression is significantly related to MSEL scores (estimate: -6.73, SE: 2.72).</p> <p>Stable lower MSEL score for infants with depressed mothers compared to infants with nondepressed mothers.</p> <p>Infant girls had an increase in MSEL scores from 6-18 months compared to infant boys for both groups.</p> <ul style="list-style-type: none"> • Infant boys with depressed mothers had lowest trajectories in MSEL scores. 	<p>Strengths: No significant difference in maternal and infant demographics between the two groups.</p> <p>Limitations: Small sample size Non-diverse sample size = majority Caucasian infants and families, so we are unable to generalize findings to a more diverse population of moms and babies.</p> <p>Self-reported assessment used for maternal depression</p> <p>CED-S prone to producing false positives</p> <p>Level & Grade: IIIA</p>

Table 8. *Object perception in 5-month-old infants of clinically depressed and nondepressed mothers*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Bornstein, M.H., Mash, C., Arterberry, M.E., Manian, N. (2012). Object perception in 5-month-old infants of clinically depressed and nondepressed mothers. <i>Infant Behavior and Development</i>.</p>	<p>The purpose of this study is to establish a relationship between maternal postpartum depression and an infant's cognitive ability, object perception.</p>	<p>Type of Study: Experimental Study</p> <p>Sample: 36 mother-infant dyads</p> <ul style="list-style-type: none"> • 17 clinically depressed mothers <p>Setting: Large metropolitan catchment</p>	<p>Maternal postpartum depression was measured between 3 and 5 months using the Beck Depression Inventory II (BDI-II). Depression scores were confirmed with a clinical interview.</p> <p>To assess object perception, infants were familiarized to a new object. Once familiarized their discrimination times were tested while looking at the object in a familiar view and again in a new perspective.</p>	<p>Mean discrimination times for infants reared by a clinically depressed mother were marginally less than chance when compared to infants in the control group.</p> <ul style="list-style-type: none"> • $p = 0.052$ <p>Infants with nondepressed mothers (control group) discrimination scores were significantly higher than chance.</p> <ul style="list-style-type: none"> • $p = 0.027$ <p>Discrimination scores significantly differed between the two groups</p> <ul style="list-style-type: none"> • $p = 0.003$ <p>Overall, infants with depressed mothers failed to discriminate the object.</p>	<p>Strengths: All infant participants were term, normal birth weight, and healthy.</p> <p>Socioeconomic status, age, and parity for depressed and nondepressed participants were similar.</p> <p>Experimenters conducting the study were blind to maternal depression scores.</p> <p>Limitations: Non-diverse sample</p> <p>Small sample size</p> <p>Level & Grade: IIA</p>

Table 9. *Impact of postpartum anxiety and depression on child's mental development from two peri-urban communities of Karachi, Pakistan: A quasi-experimental study*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Ali, N.S., Mahmud, S., Khan, A., Ali, B.S. (2013). Impact of postpartum anxiety and depression on child's mental development from two peri-urban communities of Karachi, Pakistan: A quasi-experimental study. <i>BMC Psychiatry</i>.</p>	<p>The purpose of this study is to examine the effects of postpartum maternal anxiety and depression on the five domains of infant mental development</p>	<p>Type of Study: Quasi-experimental</p> <p>Sample: 420 mother-infant dyads</p> <p>Setting: Two peri-urban cities in Karachi, Pakistan – Qayoomabad and Manzoor Colony</p>	<p>Maternal postpartum depression scores were initially assessed seven to 10 days postpartum with seven follow-up assessments using the Aga Khan University Anxiety and Depression Scale (AKUADS).</p> <p>Infant cognitive abilities were assessed using the Early Childhood Development tool (ECD).</p>	<p>A significant adverse association between maternal postpartum depression and infant cognitive development was present at 6 months. The severity of this association nearly doubled at 12 months postpartum.</p>	<p>Strengths: Prospective longitudinal study with a large sample size. Continually assessed maternal postpartum depression</p> <p>PPD assessments were conducted by trained psychologist and confirmed with DSM-IV criteria.</p> <p>Limitations: Decreased participation rates Did not include a diverse sample (participants were from two underserved urban communities). Infant development was reported by mothers.</p> <p>Level & Grade: IIB</p>

Table 10. *Does mothers' postnatal depression influence the development of imitation?*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Perra, O., Phillips, R., Fyfield, R., Waters, C., Hay, D. (2015). Does mothers' postnatal depression influence the development of imitation? <i>Journal of Child Psychology and Psychiatry</i>.</p>	<p>The purpose of this study is to determine if postnatal depression (PND) interferes with the early learning ability imitation.</p> <p>Hypothesis: PND may specifically interfere with an infants' imitation, and early learning ability that features in early mother-infant interaction and is linked to memory, causal understanding, and joint attention.</p>	<p>Type of Study: Random Controlled Experiment</p> <p>Sample: 306 mothers</p> <ul style="list-style-type: none"> 34 diagnosed with PPD in the first 6 months pp 253 infants <p>Setting: Two Antenatal Clinics in National Health Service Healthcare Trust in <i>Wales</i>.</p>	<p>Mothers' postpartum depression scores were assessed during the third trimester and at six months using: Schedules for Clinical Assessment in Neuropsychiatry.</p> <p>Infants completed two imitation tasks at twelve months – any imitation across the two tasks were scored</p>	<p>48% (10) of infants with mothers diagnosed with PPD imitated the model at least once. 70% (160) of other infants imitated the model at least once. A statistically significant difference was assessed:</p> <ul style="list-style-type: none"> $p = .03$ <p>A 72% reduction in the odds of occurrence of any imitative action by the infant with a mother diagnosed with PPD was observed.</p> <p>Findings support hypothesis, postpartum depression may cause an effect on early learning abilities/cognition</p>	<p>Strengths: Randomized Controlled Trial</p> <p>Control Group Present</p> <p>Trained psychiatrist diagnosed postpartum depression according to the DMS-IV criteria.</p> <p>Limitations: Small sample of mothers with PPD</p> <p>Brief assessment of imitation.</p> <p>Level & Grade: IB</p>

Table 11. *Effects of maternal postpartum depression in a well-resourced sample: Early concurrent and long-term effects on infant cognitive, language, and motor development*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Nielsen-Smith, J., Thamer, A., Krogh, M.T., Vaever, M.S. (2016). Effects of maternal postpartum depression in a well-resourced sample: Early concurrent and long-term effects on infant cognitive, language, and motor development. <i>Scandinavian Journal of Psychology</i>.</p>	<p>The purpose of this study is to determine the short-term and long-term effects of maternal depression on infant's cognitive, language, and motor development.</p>	<p>Type of Study: Correlational, longitudinal</p> <p>Sample: 28 postpartum depressed mother-infant dyads. 55 healthy mother-infant dyads.</p> <p>Setting: <i>Copenhagen, Denmark</i></p>	<p>Maternal depression was measured using The Edinburgh Postpartum Depression Scale. Baseline assessments were collected at 12 and 16 weeks postpartum.</p> <p>Infant cognitive development was measured using the Danish version of the Bayley Scales of Infant and Toddler Development III at 4 and 13 months.</p>	<p>A significant difference between the cognitive development of infants with a depressed mother and an infant without a depressed mother was observed at 4 months.</p> <ul style="list-style-type: none"> • $p = 0.017$ <p>Infants of mothers with postpartum depression had lower scores on the cognitive scales at 4 months.</p> <p>At 13 months, no differences in cognitive scores were noted between the two groups of infants.</p> <ul style="list-style-type: none"> • 79% of the mothers were no longer depressed 	<p>Strengths: Clinical interviews were used to diagnose mothers with postpartum depression.</p> <p>No significant difference in socio-demographic variables for both groups.</p> <p>Only evaluated healthy infants.</p> <p>Limitations: Small sample of clinically depressed mothers.</p> <p>Test reliability for the Bayley Scales of Infant and Toddler Development Scales is low.</p> <p>Level & Grade: IIIA</p>

Table 12. *Maternal depression, anxiety, psychoticism, and paranoid ideation have effects on developmental delay types of infants: A study with clinical infant-mother dyads*

Author, Year, Title, Journal	Purpose	Design	Measures	Key Findings	Strengths and Limitations, Level and Grade
<p>Gul, H., Gul, A., Kara, K. (2020). Maternal depression, anxiety, psychoticism, and paranoid ideation have effects on developmental delay types of infants: A study with clinical infant-mother dyads. <i>Archives of Psychiatric Nursing.</i></p>	<p>The purpose of this article is to ascertain if there is a relationship between maternal psychiatric disorders and developmental delays in healthy infants.</p>	<p>Type of Study: Correlational, cross-Sectional Study</p> <p>Sample: 79 mother-infant dyads</p> <ul style="list-style-type: none"> • 26 female infants • 53 male infants <p>Setting: Department of Child and Adolescent Psychiatry in Gulhane Research and Training Hospital. <i>Ankara, Turkey</i></p>	<p>To evaluate maternal depressive symptoms the Brief Symptom Inventory</p> <p>To assess infant level of functioning the Anara Developmental Screening Inventory was used.</p>	<p>58.2% (46) of infants had a language and cognitive delay</p> <p>Compared to healthy infants, infants with a cognitive-language delay were reared by mothers with more severe psychological symptoms (i.e., depression).</p> <p>An increase in “maternal depression” is significantly related to an increase in total developmental delay for infants</p> <ul style="list-style-type: none"> • $p = < .001$ 	<p>Strengths: Control group present.</p> <p>100% response rate</p> <p>Limitations: Small sample size</p> <p>The Anara Developmental Screening Inventory is self-reported and completed by mothers</p> <p>Mothers self-reported BSI scores = potential for bias</p> <p>Level & Grade: IIIA</p>

Chapter 5

Discussion

This systematic review examines research literature surrounding the relationship between maternal depression and the development of infant cognitive processes. Earlier chapters have presented the purpose of this systematic review, reviewed relevant background information and the significance of this topic, examined research methods, and synthesized results. The following chapter aims to provide a conclusive summary of findings, present strengths and limitations, recommendations for nursing practice, future directions for research, and conclusions.

Summary of Findings

Regarding the original research question presented for this systematic review, maternal postpartum depression was found to be associated with poorer cognitive outcomes including delayed cognitive development, decreased imitation and failure to develop object permanence in infants. Furthermore, maternal depressive symptoms were found to increase the risk for overall developmental delay in infants.

Through analysis of present literature, there is a consensus that depressed mothers potentially lack the ability to provide an optimal environment for the development of infant cognitive processes. Symptoms of depression may interfere with the mother's capacity to provide a consistent, attentive, and responsive caregiving environment that would nurture the infant's developmental skills. Clinically depressed mothers have been found to be more withdrawn and with an increase in intrusive thoughts, while also being less responsive to infant

needs and cues. Azak (2012) noted depressed mothers would display less than optimal parenting behavior during play time with their 6-month-old infant. These behaviors lead to a compromised maternal-child interaction, which is detrimental to providing a supportive and stimulating environment that is imperative for infant growth and development. Studies have also concluded postpartum depression may negatively influence maternal perception of infant behaviors leading mothers to believe infant care is a greater hassle (Cornish et al., 2005). Although maternal depression has been linked to poorer infant cognitive outcomes, two studies did discover a positive relationship between these two variables (Keim et al., 2011; Perra et al., 2015). Keim et al., accredited these findings to the presence of positive buffers (i.e., good coping skills, paternal involvement, etc.) mediating the effects of the maternal depressive symptoms.

While findings related to the overall effects of postpartum depression on infant cognitive development were fairly consistent, findings concerning the effects of gender and brief versus chronic periods of depression were contrasting. Although the articles presented contrasting evidence regarding the influence of gender on developmental delay, statistics showed infant girls tend to perform better on developmental tests when compared to boys. In general, female infants were found to reach cognitive milestones much earlier than male infants regardless of maternal depression status. Additionally, a few of the articles reviewed determined that the duration of postpartum depression may also influence infant cognitive outcomes. Longer durations and severe depressive symptoms revealed stronger negative associations to infant cognitive development compared to acute phases of depressive symptoms.

Strengths and Limitations

This systematic review is one of the first of its kind to analyze the effects of postpartum depression on infant cognitive development specifically. Current research focuses more broadly on maternal depression effects on overall infant development with fewer discussions regarding cognitive development. One of the strengths of this systematic review is that all the articles included in this review received a grade of either A or B regarding their quality of evidence. Another strength of this review is that all of the articles reviewed utilized reliable and validated screening tools to assess postpartum depression and infant cognitive development. Additionally, this systematic review conducted an expanded literature search to three different databases along with an ancestry search to compile a comprehensive collection of literature.

However, with the current research that is available, there are a few limitations accompanying this review. One major limitation of this study is the lack of consistency and thoroughness concerning the inclusion and exclusion criteria in the studies that were included in this review. Initially, the goal of the review was to include articles based on strict criteria but the lack of strict inclusion/exclusion criteria in the nine included studies made it difficult to eliminate articles not meeting these standards. Similarly, another limitation of this review is the inability to control for the inclusion of mothers with a history of depression or antenatal depression. It is possible that mothers experiencing depression during pregnancy may have an unexpected effect on the infant's cognitive development. Another major limitation of this review is that many of the articles analyzed in this review included a majority of Caucasian participants, while other studies did not report the ethnic distribution at all. The results of this study are unable to be

generalized to the entire population due to lack of a representative sample from the included articles.

With this review being the first of its kind, the lack of research focusing specifically on the infant population contributed to the difficulty in conducting this study. Although it is generally accepted knowledge that the infancy period is from birth to 12 months, many of the articles used the term infant to describe participants who were older than 12 months. This led to the inclusion of articles examining children older than infancy. While these articles were included in this review, findings presenting the effects of postpartum depression on cognitive development in children older than 12 months were disregarded. The only data analyzed in these research studies were the findings related to the intended time frame (birth to 12 months).

Finally, articles were included that used a variety of scales to measure postpartum depression and infant cognitive development, providing an additional limitation to the study. Seven different scales were used to assess for the presence of postpartum depression in mothers. Out of the assessment measures used, not all scales were specific to postpartum depression, and some were used to determine if depression was present in general. Based on the specificity of maternal depression, different criteria may be assessed when deciding if postpartum depression is present. Also, not every study used a diagnostic interview to make a clinical diagnosis of postpartum depression. Additionally, five different scales were used to assess for infant cognitive development. While each scale assessed cognitive development in infants based on the standardized guidelines for developmental status in each country, the scoring criteria for the presence of a developmental delay in infants may be impacted. Overall, scales assessing for the presence of postpartum depression or infant cognitive delay, may vary significantly in sensitivity and reliability, consequently influencing the results.

Nursing Implications/Recommendations

While the negative effects of postpartum depression are well documented, there is still a lack of screening and awareness for postpartum depression. With the increased occurrence of postpartum depression, nurses and healthcare providers alike need to be aware of the negative effects postpartum depression produces in both mother and infant. To promote the best possible outcomes for both mothers and infants, we must take a proactive approach that begins with education along with increased screening and attention to postpartum depression.

It can be inferred that the mother-child relationship influences infant development. Therefore, a compromised relationship due to the mother's inability to provide an enriching environment for the infant will ultimately negatively affect the infant's development. The findings in this literature support the notion that early intervention is critical to promote optimal mental health for the mothers so that a positive relationship may be formed. Prenatal and postnatal visits should focus on early identification and treatment for depressive symptoms. With the present hormonal changes occurring during the postpartum period, this is an especially vulnerable time for the mothers. Routine home visits assessing maternal mental state, coping abilities for this transition, and infant development should be conducted during the first year by a nurse trained in postnatal care and infant health.

Risk factors of postpartum depression include previous episodes of depression or depressive symptoms, complications during pregnancy, lack of social support, and low socioeconomic status. Continual assessment of maternal psychological health during pregnancy should be conducted to identify higher risk individuals. Healthcare providers should be attentive to any risk factors the mother or infant may present with that can increase the risk for the

development of postpartum depression or infant delays. If risk factors are identified, steps should be taken to provide the family with resources such as support groups, educational information regarding coping skills and self-care, and referrals for further evaluation by specialized providers. The care plan for high-risk individuals should be adjusted to include longer term and closer follow-up. Healthcare providers should use assessment results to determine if counseling prior to delivery would be beneficial for mother and infant health.

Research has shown that depressed mothers participating in infant-mother therapy, cognitive behavioral therapy, or a similar treatment may experience an improvement in depressive symptoms. Two researchers have speculated that maternal participation in therapies focused on creating a nurturing mother-infant relationship is responsible for the lack of long-term effects of PPD on infant development (Azak, 2012; Nielsen-Smith et al., 2016). If so, participation in therapy during the height of depressive symptoms may be an effective intervention to mediate the effects of postpartum depression on infant cognitive development.

Likewise, for infants identified to be cognitively delayed, parents should be educated on the importance of early intervention, along with play and behavioral therapy techniques they may use at home to enhance the infant's learning abilities (Erie County Care Management, 2022). Research findings have shown the possibility that non-persistent postpartum depressive symptoms may not result in lasting developmental delays in infants. Based on the prospect that developmental delays may be temporary, close monitoring of the infant's progress would be required to ensure they are achieving the best possible results. During each infant wellness check, infant progress should be assessed using a standardized scale. Along with this infant assessment, a short and standardized assessment should be administered to mothers to monitor for the occurrence of postpartum depressive symptoms. While arguments have arisen because of

the belief that this assessment is not within the pediatric clinician's scope of practice, it is the clinician's duty to promote optimal outcomes for the infant (Kerker et al., 2016). If the mother's assessment scores return abnormal, the pediatric clinician may refer the mother to a clinician equipped to deal with adult psychiatric issues.

Interestingly, researchers have found infant boys with depressed mothers were at an increased disadvantage for developmental delays compared to infant girls with a depressed mother. This is related to the infant girl's ability to reach cognitive milestones earlier. Previous studies have shown adverse outcomes specifically in the cognitive development of neonatal infant boys when exposed to a combination of risk factors, such as lower socioeconomic status and chronic maternal depression (Nielsen-Smith et al., 2016). Healthcare providers need to be cognizant of this information and provide extra screening and support for male infants reared by a mother with depression.

While these interventions are beneficial should postpartum depression arise, preventative measures should be implemented before symptoms of postpartum depression occur. Prevention for postpartum depression begins prenatally and should continue through the duration of pregnancy. Prior to delivery, clinicians should assess the mother's support systems, access to healthcare, comfort with seeking care and speaking about mental health issues, coping abilities, and any life stressors that may be a barrier to care, or risk factor for postpartum depression.

Overall, mental illness is a very stigmatized topic. Accordingly, mothers may not be forthcoming when experiencing depressive symptoms. This can present an issue because the timing of intervention is crucial in producing optimal outcomes for mothers and infants. Gul et al. (2020) highlights this, explaining that the stigma surrounding mental health forces mothers and infants to suffer in silence. The effects of postpartum depression may only be apparent

through an infant presenting with a developmental delay. Therefore, all mothers of infants presenting with a developmental delay should be screened for postpartum depression, so that both mother and infant may receive proper care and treatment. Additionally, efforts need to be made to destigmatize and eliminate the negative misconceptions related to mental health challenges. Open lines of communication related to mental health, assessing personal bias regarding mental health issues, and education about postpartum depression are a few ways healthcare workers can decrease stigma surrounding postpartum depression.

Future Research

With the current and limited research available it is imperative that additional studies are conducted to further assess the effects of postpartum depression on infant growth and development. Based on the findings in this systematic review future research should also focus on replicating these experiments while using a representative sample, including a diverse ethnic distribution of participants, so that the results may be generalized to the population. These future studies should also include strict inclusion and exclusion criteria, that control for the inclusion of mothers with a history of postpartum depression or those with antenatal depression. Therefore, the findings produced in future studies may be attributed to postpartum depression solely.

Additionally, each study included in this systematic review used a different assessment scale to determine the presence of postpartum depression and infant cognitive delays. Each scale used does not assess the same criteria to make the determination for postpartum depression or infant cognitive delays. Thus, another avenue that may be explored is the creation of a standard approach to diagnosing postpartum depression and assessing infant cognitive development.

Assessment using a reliable and valid scale along with early intervention will be integral in preventing the effects of maternal postpartum depression on infant development.

During their studies, researchers explained that mothers included in the depressed group participated in therapy, which was found to enhance cognitive development in their children. These researchers found mother-infant dyads did not display a further decline in cognitive performance over time. Findings were attributed to the possibility that the therapy prevented further decline in the infant's developmental stages. Future research should be conducted to determine if parent-infant therapy is an effective intervention to mitigate (or prevent) the negative effects of postpartum depression on infant development.

Questions regarding the influence of chronicity and severity of depressive symptoms on infant cognitive development frequently arise. The focus of future research should be shifted to ascertain whether infant cognitive delays are transient depending on the severity and chronicity of maternal depression. Researchers should also investigate if the timing of onset for maternal postpartum depressive symptoms influence the occurrence and duration of infant developmental delays. Additionally, researchers should investigate whether the timing of treatment for postpartum depression impacts the occurrence of cognitive developmental delays in infants. Current research has also indicated, maternal depression may negatively bias the mother's cognitions leading them to believe typical infant behaviors such as crying are inherently negative. Emerging studies may also focus on whether this negative bias results in the mother's belief that care for the infant is more difficult, which may ultimately result in more depressive symptoms in the mother.

While mothers are often thought of as the infant's main caregiver, partners also play a role in creating a stimulating environment for their children. During phases of maternal

postpartum depression, fathers may act a protective barrier by being sensitive and responsive to the infant's needs. Continued efforts should also research the effectiveness of protective factors such as paternal involvement and familial support, that may be utilized to combat the negative effects of maternal postpartum depression. Finally, additional research may explore the effect of paternal postpartum depression on infant development and the family dynamic.

Conclusion

This systematic review examines the present literature regarding maternal depression and outcomes related to infant cognitive depression. Through analyzing nine research articles maternal postpartum depression has been determined to influence the development of infant cognitive abilities. In the early stages of life, infants need a stimulating environment to promote healthy progression in growth and development. Unfortunately, depression may impact the mother's ability to provide a stimulating environment in which an infant can thrive. Other factors such as paternal involvement, familial support, life stressors, educational status, and age may also mediate the impact maternal postpartum depression has on the infant's cognitive development. With this knowledge, healthcare workers must implement assessment and interventions prepartum and postpartum that enhance the mother's ability to care for her infant. These interventions may include the use of a standardized screening tool for both maternal postpartum depression and infant cognitive delays, standardized guidelines for timing of the administration of assessments, postpartum care programs (educational materials and home visits), and treatment options for mothers and infants experiencing the effects of postpartum depression.

Appendix A

John Hopkins Nursing Evidence-Based Practice Evidence Level and Quality Grade

Evidence Levels	Quality Guides
<p>Level I Experimental study, randomized controlled trial (RCT) Systematic review of RCTs, with or without meta-analysis</p>	<p>A High quality: Consistent, generalizable results; sufficient sample size for the study design; adequate control; definitive conclusions; consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence</p>
<p>Level II Quasi-experimental study Systematic review of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis</p>	<p>B Good quality: Reasonably consistent results; sufficient sample size for the study design; some control, fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence</p>
<p>Level III Non-experimental study Systematic review of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only, with or without meta-analysis Qualitative study or systematic review with or without a meta-synthesis</p>	<p>C Low quality or major flaws: Little evidence with inconsistent results; insufficient sample size for the study design; conclusions cannot be drawn</p>
<p>Level IV Opinion of respected authorities and/or nationally recognized expert committees/consensus panels based on scientific evidence</p> <p>Includes:</p> <ul style="list-style-type: none"> • Clinical practice guidelines • Consensus panels 	<p>A High quality: Material officially sponsored by a professional, public, private organization, or government agency; documentation of a systematic literature search strategy; consistent results with sufficient numbers of well-designed studies; criteria-based evaluation of overall scientific strength and quality of included studies and definitive conclusions; national expertise is clearly evident, developed or revised within the last 5 years</p> <p>B Good quality: Material officially sponsored by a professional, public, private organization, or government agency; reasonably thorough and appropriate systematic literature search strategy; reasonably consistent results, sufficient numbers of well-designed studies; evaluation of strengths and limitations of included studies with fairly definitive conclusions; national expertise is clearly evident; developed or revised within the last 5 years</p> <p>C Low quality or major flaws: Material not sponsored by an official organization or agency; undefined, poorly defined, or limited literature search strategy; no evaluation of strengths and limitations of included studies, insufficient evidence with inconsistent results, conclusions cannot be drawn; not revised within the last 5 years</p>

References

- Ali, N. S., Mahmud, S., Khan, A., & Ali, B. S. (2013). Impact of postpartum anxiety and depression on child's mental development from two peri-urban communities of Karachi, Pakistan: A quasi-experimental study. *BMC Psychiatry* 13, 274.
<https://doi.org/10.1186/1471-244X-13-274>
- Anokye, R., Acheampong, E., Budu-Ainooson, A., & Akwasi, A. G. (2018). Prevalence of postpartum depression and interventions utilized for its management. *Annals of General Psychiatry*, 17, 18. <https://doi.org/10.1186/s12991-018-0188-0>
- Armstrong, K. H., & Agazzi, H. C. (2010). The Bayley III Cognitive Scale. In *Practical Resources for the Mental Health Professional* (pp. 29–45). Academic Press.
<https://doi.org/10.1016/B978-0-12-374177-6.10002-9>
- Association of State and Territorial Health Official. (2019). States look to address the impact of postpartum depression. <https://www.astho.org/StatePublicHealth/States-Look-to-Address-the-Impact-of-Postpartum-Depression/08-01-19/>
- Aydin, A. (2012). Turkish adaption of test of pretended play. *Educational Sciences: Theory and Practice*, 12(2), 916-925.
- Azak S. (2012). Maternal depression and sex differences shape the infants' trajectories of cognitive development. *Infant Behavior & Development*, 35(4), 803–814.
<https://doi.org/10.1016/j.infbeh.2012.07.017>.
- Bornstein, M. H., Mash, C., Arterberry, M. E., & Manian, N. (2012). Object perception in 5-month-old infants of clinically depressed and nondepressed mothers. *Infant Behavior & Development*, 35(1), 150–157. <https://doi.org/10.1016/j.infbeh.2011.07.008>

- Bradley-Johnson, S. (1998). Test reviews. *Psychology in the Schools*, 34(4), 379-382.
[https://doi.org/10.1002/\(SICI\)1520-6807\(199710\)34:4<379::AID-PITS14>3.0.CO;2-E](https://doi.org/10.1002/(SICI)1520-6807(199710)34:4<379::AID-PITS14>3.0.CO;2-E)
- Carberg, J., (2019, May 3). *Statistics on postpartum depression - Postpartum Depression Resources*. PostpartumDepression.org.
<https://www.postpartumdepression.org/resources/statistics/>
- Center on the Developing Child at Harvard University (2009). *Maternal depression can undermine the development of young children: Working Paper No. 8*. www.developingchild.harvard.edu
- Cornish, A. M., McMahon, C. A., Ungerer, J. A., Barnett, B., Kowalenko, N., & Tennant, C. (2005). Postnatal depression and infant cognitive and motor development in the second postnatal year: The impact of depression chronicity and infant gender. *Infant Behavior and Development*, 28(4), 407-417. 10.1016/j.infbeh.2005.03.004.
- Dang, D. & Dearholt, S. (2017). Johns Hopkins nursing evidence-based practice: model and guidelines. 3rd ed. Indianapolis, IN: Sigma Theta Tau International.
- Davis, N. L., Smoots, A. N., & Goodman, D. G. (2019). *Pregnancy-related deaths: Data from 14 maternal mortality review committees; 2008-2017*. U.S. Department of Health and Human Services.
https://static1.squarespace.com/static/56d5ca187da24ffed7378b40/t/5d26298da1409500011d11fd/1562782095111/MMR+Data+Brief_June+2019.pdf
- DelRosario, G. A., Chang, A. C., & Lee, E. D. (2013). Postpartum depression: Symptoms, diagnosis, and treatment approaches. *Journal of the American Academy of Physician Assistants*, 26(2), 50-54. doi:10.1097/01720610-201302000-00009
- Earls, M., & The Committee on Psychosocial Aspects of Child and Family Health. (2010).

- Incorporating recognition and management of perinatal and postpartum depression into pediatric practice. *Pediatrics*, 126(5) 1032-1039. DOI: <https://doi.org/10.1542/peds.2010-2348>
- Erie County Care Management, E. C. C. M. (2022). *Addressing the types of developmental delays - ECCM*. Erie County Care Management. Retrieved from <https://www.eccm.org/blog/addressing-the-types-of-developmental-delays>
- Fitelson, E., Kim, S., Baker, A. S., & Leight, K. (2010). Treatment of postpartum depression: Clinical, psychological, and pharmacological options. *International Journal of Women's Health*, 3, 1–14. <https://doi.org/10.2147/IJWH.S6938>
- Garrard, J., (2017). *Health sciences literature review made easy: The matrix method* (5th ed.). Burlington, MA: Jones & Bartlett Learning. ISBN-13: 978-1284115192
- Ghaedrahmati, M., Kazemi, A., Kheirabadi, G., Ebrahimi, A., & Bahrami, M. (2017). Postpartum depression risk factors: A narrative review. *Journal of Education and Health Promotion*, 6, 60. https://doi.org/10.4103/jehp.jehp_9_16
- Gjerdingen, D. K., & Yawn, B. P. (2007). Postpartum depression screening: Importance, methods, barriers, and recommendations for practice. *Journal of the American Board of Family Medicine: JABFM*, 20(3), 280–288. <https://doi.org/10.3122/jabfm.2007.03.060171>
- Goodman, J. H. (2019). Perinatal depression and infant mental health. *Archives of Psychiatric Nursing*, 33(3), 217–224. <https://doi.org/10.1016/j.apnu.2019.01.010>.
- Gorwood P. (2008). Neurobiological mechanisms of anhedonia. *Dialogues in clinical neuroscience*, 10(3), 291–299. <https://doi.org/10.31887/DCNS.2008.10.3/pgorwood>
- Gül, H., Gül, A., & Kara, K. (2020). Maternal depression, anxiety, psychoticism and paranoid

- ideation have effects on developmental delay types of infants: A study with clinical infant-mother dyads. *Archives of Psychiatric Nursing*, 34(3), 184–190.
<https://doi.org/10.1016/j.apnu.2020.04.009>.
- Hirst, K. P., & Moutier, C. Y. (2010). Postpartum major depression. *American Family Physician*, 82(8), 926–933.
- Hoffman, C., Dunn, D. M., & Njoroge, W. (2017). Impact of postpartum mental illness upon infant development. *Current Psychiatry Reports*, 19(12), 100.
<https://doi.org/10.1007/s11920-017-0857-8>.
- International Forum for Wellbeing in Pregnancy. (2019). *Psychological changes during pregnancy: An emotional upheaval*. <https://www.ifwip.org/psychological-changes-during-pregnancy/>
- Johns Hopkins Medicine. (2022). *Failure to thrive*. Johns Hopkins Medicine. Retrieved from <https://www.hopkinsmedicine.org/health/conditions-and-diseases/failure-to-thrive#:~:text=What%20is%20failure%20to%20thrive,other%20children%20the%20same%20age>.
- Johnson, S., Moore, T., & Marlow, N. (2014). Using the Bayley-III to assess neurodevelopmental delay: Which cut-off should be used? *Pediatric Research*, 75(5), 670–674. <https://doi.org/10.1038/pr.2014.10>
- Keim, S. A., Daniels, J. L., Dole, N., Herring, A. H., Siega-Riz, A. M., & Scheidt, P. C. (2011). A prospective study of maternal anxiety, perceived stress, and depressive symptoms in relation to infant cognitive development. *Early Human Development*, 87(5), 373–380.
<https://doi.org/10.1016/j.earlhumdev.2011.02.004>

Kerker, B. D., Storfer-Isser, A., Stein, R. E., Garner, A., Szilagyi, M., O'Connor, K. G.,

Hoagwood, K. E., & Horwitz, S. M. (2016). Identifying maternal depression in pediatric primary care: Changes over a decade. *Journal of Developmental and Behavioral Pediatrics: JDBP*, 37(2), 113–120. <https://doi.org/10.1097/DBP.0000000000000255>

LA Best Babies Network. (2011). Screening for Postpartum Depression at Well-Child Visits.

<https://www.yolocounty.org/home/showpublisheddocument?id=29431>

Liu, Y., Kaaya, S., Chai, J., McCoy, D. C., Surkan, P. J., Black, M. M., Sutter-Dallay, A. L.,

Verdoux, H., & Smith-Fawzi, M. C. (2017). Maternal depressive symptoms and early childhood cognitive development: A meta-analysis. *Psychological Medicine*, 47(4), 680–689.

Mayo Clinic. (2018). *Postpartum depression*. Mayo Clinic.

<https://www.mayoclinic.org/diseases-conditions/postpartum-depression/symptoms-causes/syc-20376617>.

Merriam-Webster. (n.d.). Multigravida. In *Merriam-Webster.com medical dictionary*. Retrieved

March 31, 2022, from <https://www.merriam-webster.com/medical/multigravida>

Muskin, P. R. (2021). *What is somatic symptom disorder*. Somatic Symptom Disorder. Retrieved

from <https://www.psychiatry.org/patients-families/somatic-symptom-disorder/what-is-somatic-symptom>

[https://www.psychiatry.org/patients-families/somatic-symptom-disorder#:~:text=Somatic%20symptom%20disorder%20is%20diagnosed,relating%20to%20the%20physical%20symptoms](https://www.psychiatry.org/patients-families/somatic-symptom-disorder/what-is-somatic-symptom-disorder#:~:text=Somatic%20symptom%20disorder%20is%20diagnosed,relating%20to%20the%20physical%20symptoms).

National Institute of Mental Health. (2020). *Perinatal depression*.

<https://www.nimh.nih.gov/health/publications/perinatal-depression/index.shtml>

Office on Women's Health. (2019). *Postpartum depression*.

<https://www.womenshealth.gov/mental-health/mental-health-conditions/postpartum-depression>.

Oswalt, A. (n.d.). *Infancy cognitive development*. <https://www.gracepointwellness.org/461-child-development-parenting-infants-0-2/article/10112-infancy-cognitive-development>

Oztop, D., Uslu, R. (2007). Behavioral, interaction and developmental symptomatology in toddlers of depressed mothers: A preliminary clinical study within the DC:0-3 framework. *The Turkish Journal of Pediatrics*, 49(2), 171-178.

Palanikumar, B., Avulakunta, D. I., (2020). Bayley Scales of Infant and Toddler Development.

In *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing.

<https://www.ncbi.nlm.nih.gov/books/NBK567715/>

Perra, O., Phillips, R., Fyfield, R., Waters, C., & Hay, D. F. (2015). Does mothers' postnatal depression influence the development of imitation? *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 56(11), 1231–1238.

<https://doi.org/10.1111/jcpp.12413>.

Rai, S., Pathak, A., & Sharma, I. (2015). Postpartum psychiatric disorders: Early diagnosis and management. *Indian Journal of Psychiatry*, 57(Suppl 2), S216–S221.

<https://doi.org/10.4103/0019-5545.161481>

Shank L. (2011). Mullen Scales of early learning. In J. S. Kreutzer, J. DeLuca, B. Caplan (Eds.), *Encyclopedia of clinical neuropsychology*, 123. Springer. https://doi.org/10.1007/978-0-387-79948-3_1570

- Sit, D. K., & Wisner, K. L. (2009). Identification of postpartum depression. *Clinical Obstetrics and Gynecology*, 52(3), 456–468. <https://doi.org/10.1097/GRF.0b013e3181b5a57c>
- Slomian, J., Honvo, G., Emonts, P., Reginster, J. Y., & Bruyère, O. (2019). Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's Health (London, England)*, 15. <https://doi.org/10.1177/1745506519844044>
- Smith-Nielsen, J., Tharner, A., Krogh, M. T., & Vaever, M. S. (2016). Effects of maternal postpartum depression in a well-resourced sample: Early concurrent and long-term effects on infant cognitive, language, and motor development. *Scandinavian Journal of Psychology*, 57(6), 571–583. <https://doi.org/10.1111/sjop.12321>.
- Smok, D., & Prager, K. (2020). The ethics of neurologically complicated pregnancies [Abstract]. *Handbook of Clinical Neurology*, 171, 227-242. doi: <https://doi.org/10.1016/B978-0-444-64239-4.00013-8>
- Sohr-Preston, S. L., & Scaramella, L.V. (2006). Implications of timing of maternal depressive symptoms for early cognitive and language development. *Clinical Child Family Psychology*, 9(1), 65–83. <https://doi.org/10.1007/s10567-006-0004-2>.
- Sutter-Dallay, A. L., Murray, L., Dequae-Merchadou, L., Glatigny-Dallay, E., Bourgeois, M. L., & Verdoux, H. (2011). A prospective longitudinal study of the impact of early postnatal vs. chronic maternal depressive symptoms on child development. *European Psychiatry: The Journal of the Association of European Psychiatrists*, 26(8), 484–489. <https://doi-org.ezaccess.libraries.psu.edu/10.1016/j.eurpsy.2010.05.004>

Torres, F. (2020). *What is postpartum depression?* American Psychiatric Association.

<https://www.psychiatry.org/patients-families/postpartum-depression/what-is-postpartum-depression>.

Tuovinen, S., Lahti-Pulkkinen, M., Girchenko, P., Lipsanen, J., Lahti, J., Heinonen, K.,

Reynolds, R. M., Hämäläinen, E., Kajantie, E., Laivuori, H., Pesonen, A. K., Villa, P. M., & Räikkönen, K. (2018). Maternal depressive symptoms during and after pregnancy and child developmental milestones. *Depression and Anxiety, 35*(8), 732–741.

<https://doi.org/10.1002/da.22756>.

Wallace, J. (2020). *Psychological effects of pregnancy*. Psychreg.

<https://www.psychreg.org/psychological-effects-of-pregnancy/>

Wilks, T., Gerber, J., Lalena-Erdie, C. (2010). Developmental milestones: Cognitive development. *Pediatrics Review, 31*(9); 364-367. DOI: 10.1542/pir.31-9-364

Yawn, B. P., Olson, A. L., Bertram, S., Pace, W., Wollan, P., & Dietrich, A. J. (2012).

Postpartum depression: Screening, diagnosis, and management programs 2000 through 2010. *Depression Research and Treatment, 2012*, Article 363964.

<https://doi.org/10.1155/2012/363964>.

ACADEMIC VITA

Nia M. Tomlinson

Email: nmt5302@psu.edu; niatomlinson1024@gmail.com

EDUCATION

The Pennsylvania State University , University Park, PA	<i>2018 - Present</i>
• Bachelor of Science, Nursing	<i>May 2022</i>
Schreyer Honors College , University Park, PA	<i>2020 – Present</i>

AWARDS/ACHIEVEMENTS

• Sigma Theta Tau International Honor Society of Nursing	<i>2020 – Present</i>
• Graham Open Doors Honors Scholarship	<i>2021 – Present</i>
• Schreyer Educational Equity Scholarship	<i>2021 – Present</i>
• Poole Family Honors Scholarship	<i>2020 – 2021</i>
• Alpha Lambda Delta Honor Society	<i>2019 – Present</i>
• Phi Eta Sigma Honor Society	<i>2019 – Present</i>
• The National Society of Collegiate Scholars	<i>2019 – Present</i>
• UP 4 Year Provost Award	<i>2018 – Present</i>

RESEARCH

Schreyer Honors College, University Park, PA	
<i>The Impact of Postpartum Depression on Infant Cognitive Development</i>	
IMPACT, Research Scholar	<i>Summer 2021</i>
• Participated in a research program assessing the impact of maternal postpartum depression on the coparenting dynamic.	

LEADERSHIP ACTIVITIES

Minorities in Schreyer, Treasurer	<i>Fall 2020 – Spring 2022</i>
• Managed funds for club events.	
Multicultural Student Nursing Association, Event Coordinator	<i>Spring 2020 – Spring 2022</i>
• Facilitated future event planning as the club is up and coming.	
UP Student Nursing Ambassador	<i>Fall 2019 – Fall 2021</i>
• Liaised virtually between university and prospective students during quarantine, answering questions regarding student life and activities.	
Campus Wide Days of Service: Fresh Start	<i>Fall 2018</i>
• Cleared pathways of overgrowth and debris from gardens, grounds, and parking lots.	
• Planted flowers in decorative planters and displays.	
• Cultivated soil on designated areas of land.	