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Postpartum depression and infantile colic: A systematic review

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ABSTRACT

BACKGROUND: Postpartum depression (PPD) involves feelings of depressed mood, agitation, loss of interest in previous activities, and feelings of worthlessness or guilt. Identifying a relationship between PPD and infantile colic will help provide necessary interventions to prevent PPD. Infantile colic consists of inconsolable infant crying for more than three hours per day, three days per week, lasting up to three weeks.

PURPOSE: The purpose of this systematic review is to identify an association between infantile colic and PPD, and to determine interventions to prevent the development of PPD in postpartum mothers of infants diagnosed with infantile colic.

METHODS: As a systematic review, ten research studies were included, retrieved from PubMed, CINAHL, and PsychINFO, to represent the research question. Five of the studies focused on the relationship between infantile colic and PPD while four provided education interventions.

RESULTS: A consistent association was found between infantile colic and PPD in all the represented literature. Mothers who had infants diagnosed with infantile colic had increased feelings of depression and a higher risk of developing PPD when compared to mothers whose infants did not have infantile colic. Amongst the interventions, providing necessary education and support for mothers regarding infantile colic was the best intervention to help prevent and treat PPD. In terms of treating infantile colic, *Lactobacillus reuteri* showed positive effect on improving the infant's temperament and excessive crying habits.

DISCUSSION: There is a relationship found between infantile colic and PPD and implementing educational materials and probiotic interventions to the infant will help prevent PPD. Future research studies should identify a deeper connection between the two and more definitive interventions to help treat both infantile colic and PPD.

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Chapter 1

Introduction

Postpartum depression (PPD) affects approximately one in seven females within the first four weeks or up to 12 months after delivery (Stewart & Vigod, 2016). Contrary to the normal feeling of "baby blues" (intensified emotions immediately after childbirth which decrease two weeks after delivery), PPD is diagnosed when the mother exhibits at least five depressive symptoms lasting at least two weeks (Mughal et al., 2021). These symptoms include depressed mood for most of the day, loss of interest in previous activities, insomnia or hypersomnia, increased agitation, worthlessness or guilt, fatigue, suicidal ideation, impaired concentration, and a change in weight or appetite (Mughal et al., 2021). These depressive symptoms can negatively impact the infant by interfering with the mother's response and behavior towards their child and disrupting crucial bonding time between the two. Untreated PPD can lead to worse outcomes surrounding the child's physical, psychological, and behavioral development when compared to children whose mothers were not diagnosed with PPD (Mughal et al., 2021).

A variety of risk factors can be identified which can predict the chance of developing PPD. Psychological risk factors involve a history of depression or anxiety and having a negative attitude towards the baby or their gender (Mughal et al., 2021). Furthermore, a diagnosis of PPD can also increase the mothers' chance of chronic depression, PPD in multiple gestations, and bipolar disorder (Mughal et al., 2021). Approximately 20% of mothers still experience PPD symptoms one year after delivery, around 13% after two years, and around 40% have an increased risk of relapse with multiple gestations (Stewart et al., 2016). Some more recognizable risk factors include lack of social support and lifestyle of the mother. These refer to emotional support from family or partners, financial support, employment status, food intake, sleep status,

and physical activities (Ghaedrahmati et al., 2017). Infant behavior also plays a major role in disrupting the mother's lifestyle. An infant that is overly distressed or diagnosed with excessive crying can elevate levels of fatigue and frustration in the mother, ultimately leading to PPD symptoms.

Infantile colic (also known as excessive crying) consists of crying lasting more than three hours per day, for more than three days a week, and lasting over three weeks (Radesky et al., 2013). This behavior most commonly peaks at around six weeks post-delivery and occurs in approximately 20% of infants (Radesky et al., 2013). Infants with colic are difficult to console which creates a stressful environment for the caregiver. Exhaustion and agitation built up in the caregiver due to the inconsolable child and contribute to the mother's risk of developing PPD. The most concerning aspect associated with infantile colic and PPD is the elevated risk of infant abuse and maltreatment (Petzoldt, 2017). Properly treating and educating mothers with an infant who has colic and are themselves struggling with PPD will help to decrease unwanted intrusive thoughts surrounding the infant and strengthen the mother-infant bond (Lawrence et al., 2017).

Significance to Nursing

While the statistics establish that PPD is a common disorder that new mothers experience, more than half of mothers will go undiagnosed due to an unwillingness to disclose their feelings to close family members, their spouse, or their doctor (Zauderer, 2009). Embarrassment and fear of abandonment are two significant reasons why mothers are hesitant to reach out for support and treatment for their symptoms. Eliminating the stigma surrounding PPD and emphasizing the importance of identifying risk factors early on will benefit both the mother and the infant in the long run. It is crucial that nurses educate their patients on potential symptoms of both PPD and infantile colic and provide materials on who to reach out to if help is

needed. Timing is key to preventing and managing PPD, and nurses must implement these teaching interventions as early and efficiently as possible.

Purpose

The purpose of this review is to identify an association between PPD and infantile colic, and possible interventions to treat and prevent PPD associated with infantile colic. The literature reviewed will consist of published research studies identifying a correlation between PPD and infantile colic and the effectiveness of interventions. This review will aim to answer the following:

1. To investigate the relationship between infantile colic and PPD.
2. To identify the effect of interventions on the prevention of PPD in a mother with an infant with colic.

Table 1: Key Terms

Key Terms	
Postpartum depression (PPD)	Major depressive symptoms that can occur within 4 weeks or up to 12 months after childbirth. These symptoms can last up to 2 years and can interfere with care of the infant (Stewart et al., 2016).
Infantile Colic	Infant crying that lasts more than 3 hours per day, for more than 3 days per week, and lasting at least 3 weeks (Radesky et al., 2013). Also known as excessive crying.
Baby Blues	Women can develop crying episodes, irritability, anxiety, appetite changes, fatigue, and sadness. It does not affect the mother long-term or the ability to take care of the infant (Mughal et al., 2021). Can occur as early as 2-5 days and dissolves around 2 weeks post-delivery.
Intrusive Thoughts	A mother can form intentional harmful thoughts towards one's infant due to a distressful postnatal period (Lawrence et al., 2017).

Period of PURPLE Crying	An acronym introduced to parents of infants with colic to decrease frustration of this developmental stage. P: peak of crying, U: unexpected, R: resists soothing, P: pain-like face, L: long-lasting, E: evening (Barr, n.d.).
Infant Temperament	Can be perceived as early as three months postpartum. Can be measured by infant's reactivity to stimuli, emotional regulation, and attention (Vedova, 2014).

Chapter Summary

This chapter discussed the background of both PPD and infantile colic. PPD is common and treatable medical condition in mothers, however if left undiagnosed, it can be disabling to the mother, infant, and family (Stewart et al., 2016). Colic is also a common disorder in infants that does not have an established etiology. With proper education, mothers can learn how to cope with an infant with colic and ultimately decrease the chances of developing psychological issues. Both disorders are not discussed enough in women's health, and the significance of studying the association is to determine how to identify and treat PPD and infantile colic. Eliminating the stigma between both colic and PPD can help to improve the overall wellbeing of the mother and infant.

Chapter 2

Review of Literature

This chapter will discuss further background information on PPD and infantile colic. This information will discuss the necessary concepts needed for further understanding of both disorders and the importance of a systematic review. There are an abundance of components that can cause PPD and infantile colic. Risk factors vary depending on the mother's psychiatric history, socioeconomic status, and support system. Treatment of these risk factors can prevent future complications in both the mother and the infant; however, there are circumstances in that PPD can lead to harming the infant if untreated. The most common forms of treatment for PPD include early screening and prevention, pharmacological treatment, or psychological treatments. On the contrary, infantile colic does not have distinct risk factors to influence the disorder. While previous literature has found no scientifically established reason for the cause of infantile colic, there are proposed correlations to why this disorder occurs (Johnson et al., 2015). With approximately 10% to 40% of infants worldwide affected by infantile colic, it is important to emphasize the normality of the disorder to anxious mothers (Johnson et al., 2015).

Risk Factors to Postpartum Depression

Psychological Factors

Mothers with previous histories of mental illness, such as depression, anxiety, or OCD, are at a higher risk to develop PPD. In addition to the previous history, the occurrence of depression during pregnancy has a stronger correlation to PPD than mothers without depression. (Ghaedrahmati et al., 2017). Approximately 33% of mothers experience depression during their pregnancy (Becker et al., 2016). The association of depression during pregnancy has been connected to poorer compliance with prenatal care, an increase in risky behaviors during

pregnancy, and reduced responsiveness during motherhood (Becker et al., 2016). Without any treatment, antenatal depression has been linked to gestational diabetes, hypertension, and preeclampsia in the mother, and premature birth, low birth weight, and fetal growth restriction in the infant (Becker et al., 2016). In addition to a history of depression, anxiety correlates to an increase in PPD symptoms (Chojenta et al., 2012). Feeling anxious during pregnancy and postpartum correlates to the stress of birth and motherhood, the feeling of dread or fearful situations, and the fear of inadequate motherly instincts. Failure to diagnose or treat antenatal depression and anxiety can negatively impact the mother and the postpartum infant during the vulnerable first couple weeks of life (Becker et al., 2016).

Social Factors

Young Age

Various socioeconomic factors have been linked to PPD. The most recognized factors contributing to PPD include young age, low economic status, and education status. Young mothers are at a vulnerable age and developmental stage to be giving birth to a child. The highest level of depression has been found in mothers 13-19 years of age compared to the lowest level being 31-35 years of age (Ghaedrahmati et al., 2017). Giving birth forces the transition from childhood to adulthood allowing more difficulties to arise postnatally. Furthermore, the intense physical and mental strain on young mothers providing care to an infant increases the chance of PPD and chronic forms of depression down the road (Agnafors et al., 2019).

Socioeconomic Status

Low socioeconomic status establishes a barrier for mothers to provide the best care to their infants. The most apparent characteristics of low socioeconomic status involve low-income, unemployed, and multiparous single mothers. The stress of low financial support and the

likelihood of inadequate access to necessary medical care contribute to the risk of PPD (Goyal et al., 2010). In fact, in a study conducted by Goyal et al. (2010), 35% of low-income mothers experienced depressive symptoms during the third trimester than 17% of women with high income. After two to three months postpartum, the low-income mothers still reported significantly high depression levels than higher income mothers. Decreased medical care, transportation, and social support were identified as the main components of the spike in PPD symptoms (Goyal et al., 2010). The lack of necessary healthcare-related resources can prevent the mother from seeking aid for PPD symptoms or impede their seeking of healthcare support in case of an emergency surrounding their child. In addition to low-income complications, employment for postpartum mothers is harder to accomplish due to the necessary time off to care for the newborn. Most mothers with a full-time job before pregnancy do not receive paid time off for maternity leave. This contributes greatly to the financial stress of childbirth, especially in lower economic classes (Goyal et al., 2010).

Social Support

The lack of social support from family or a partner increases the risk of PPD in overwhelmed mothers. A mother with an adequate social system allows for a support person to care for her own needs, readily available assistance, and support from an abundance of people at hand (Zhang & Jin, 2014). A strong support system endorses self-efficacy in the mother, which can decrease mental and physical health complications. Self-efficacy allows the mother to have confidence that they have control over themselves and promotes positive handling of unfamiliar situations (Zhang & Jin, 2014). Establishing support systems during pregnancy can facilitate the transition to postpartum and ultimately decrease the chance of PPD.

Treatments of Postpartum Depression

Screenings

The most effective treatment for PPD involves prevention and screening procedures. It is crucial to implement early and accurate screening processes to identify potential risk factors that could lead to PPD. The most common scales used for PPD include the Edinburgh Postnatal Depression Scale (EPDS), the Postpartum Depression Screening Scale (PDSS), and the 9-item Physician's Health Questionnaire (PHQ-9) (Fitelson et al., 2011). The screening tools do not diagnose a patient with PPD but emphasize the emotional and functional risk factors associated with PPD (Fitelson et al., 2011). In addition to screenings, proper education and information given to the mother during and after pregnancy can prevent the development of PPD. Understanding the normalcy of PPD is encouraging for mothers to seek aid if any depressive symptoms occur.

Antidepressants

Pharmacological treatments are not the preferred first line of approach for managing PPD in most mothers. However, there are some antidepressants, especially the serotonin reuptake inhibitors (SSRI) and the serotonin and norepinephrine reuptake inhibitor (SNRI), that can significantly reduce the symptoms of PPD (Berle & Spigset, 2011). The speculation surrounding taking antidepressants postpartum involves transmitting the drug to the infant through breastfeeding. Breastmilk is the ideal resource for infants to obtain adequate nutrition to grow properly physically and developmentally. Therefore, a safety index was established to assess the severity of adverse effects on the infant through breastmilk (Gentile & Fusco, 2019). There is no definitive answer on whether taking antidepressants during breastfeeding can cause negative effects on the infant but enforcing careful evaluation on the infant is crucial to their health

(Gentile & Fusco, 2019). Mothers who choose not to breastfeed may have an easier time choosing pharmacological options as their preferred treatment. While non-pharmacological treatments are the safest option for the infant, antidepressants may be the best option to manage the mother's mental wellbeing.

Psychological Treatment

With increased hesitancy to take antidepressants during and immediately after pregnancy, psychological therapies are the best treatment options. The two most common forms of psychotherapy are cognitive behavioral therapy and interpersonal therapy (Nguyen, 2017). Cognitive behavioral therapy revolves around the ideology that perceptions and behaviors are linked to overall mood (Fitelson et al., 2011). The focus of intervention is changing patterns of negative thinking and reinforcing efficient coping mechanisms to decrease stress (Fitelson et al., 2011). Frequent visits with a psychologist can help significantly in decreasing PPD symptoms and preventing further symptoms from occurring. Interpersonal therapy typically lasts for 12-20 weeks and addresses how interpersonal problems interact with mood (Fitelson et al., 2011). This type of therapy focuses on the social context of PPD and strives for better relationships and social support for the patient. There are four main concepts discussed between patient and psychologist: role transition, role dispute, grief, and interpersonal deficits (Fitelson et al., 2011). Interpersonal therapy emphasizes the current demands of mothers struggling with PPD and provides problem-focused analysis to decrease depressive symptoms.

Impact of Infantile Colic on the Infant

Etiology

While there is an abundance of proposed theories of what causes infantile colic, the disorder remains primarily idiopathic. The various theories range in all body systems including gastrointestinal, hormonal, neurodevelopmental, and psychosocial factors (Mai et al., 2018). The theory of gastrointestinal issues is the most recognized etiology for colic. This is because researchers noticed that infants lift their legs and pass gas while exhibiting an excessive crying spell (Mai et al., 2018). After this observation, researchers conducted studies on cow's milk protein, maternal diet, gas production, lactose intolerance, and poor feeding technique (Mai et al., 2018). The other common etiology discussed were psychosocial factors contributing to infantile colic. The focus of the study included inadequate parent-infant interaction, parental anxiety, maternal smoking, and maternal depression (Mai et al., 2018). While there are a considerable number of etiologies that can cause infantile colic, parents should be reminded that infantile colic is a temporary disorder.

Coping with Infantile Colic

Considering there is not a distinguished etiology for infantile colic, there is also no definitive treatment. There should be a strong emphasis to parents that infantile colic is a temporary disorder with almost 100% of infants recovering in two to three months (Mai et al., 2018). There are some interventions that can slightly benefit the infant such as swaddling, white noise, gentle stimulation, and *Lactobacillus reuteri* probiotic drops (Mai et al., 2018). The soothing techniques may decrease the amount of crying for a short period of time but are not a treatment plan for infantile colic. In addition, the *Lactobacillus reuteri* has been recently studied for its effectiveness against infantile colic. While three studies recorded seeing a statistically

significant decrease in excessive crying for infantile colic, two studies find no trend of improvement (Mai et al., 2018). Without robust research on treatment options, the best intervention is to educate parents and provide coping mechanisms. Encouraging the parents to have patience with the baby can help to decrease the chances of having intrusive thoughts, harmful actions, or developing mental health issues.

Negative Outcomes from Infantile Colic and PPD

Intrusive Thoughts

Experiencing unwanted intrusive thoughts is normal for exhausted first-time mothers. These thoughts can include images or impulses of infant-related harm that is intentional or accidental (Fairbrother et al., 2018). Approximately half of the general population has experienced intrusive thoughts of harming one's child (Lawrence et al., 2017). The more stressful situations are with an infant, the more frequent these intrusive thoughts appear. Inconsolable infant crying is the most recognized stimulus for triggering unwanted intrusive thoughts (Fairbrother et al., 2018). Crying provokes frustration in mothers and exhaustion from trouble soothing. Mothers with PPD are more likely to develop these harmful thoughts and have an increased possibility of following through with harmful behaviors (Collardeau et al., 2019). Interventions must be established for vulnerable mothers diagnosed with PPD. This can include extensive monitoring of the mother or removal of the infant from the home for precautionary measures (Collardeau et al., 2019).

Shaken Baby Syndrome

A debilitating form of child abuse that involves intense shaking of the baby is called shaken baby syndrome. This abuse is primarily caused by excessive and inconsolable crying which can cause harmful levels of frustration in the parents (Gelfand, 2016). It is estimated that

about 1% of parents have admitted to shaking their baby to stop crying while 2.2% of parents have admitted to shaking, slapping, or smothering the baby to stop the crying (Gelfand, 2016). The burst of aggression due to hours of excessive crying can lead to life-long neurologic morbidity and death of the infant. Education on infantile colic and the associated excessive crying can help significantly to decrease the chance of shaken baby syndrome out of uncontrolled frustration. After mothers give birth in the hospital, no matter how many gestations, it is a requirement to watch the shaken baby syndrome educational video to teach the deathly outcomes of violently shaking an infant.

Conclusion

Both infantile colic and PPD are underrepresented disorders in the medical community. The stigma surrounding PPD still remains a roadblock for mothers reaching out for treatment or advice for the overwhelming experience of motherhood. Most of the population discusses the joyous moments of motherhood and leaves out some harsh realities a respectable amount of mothers' experiences. It is crucial to emphasize the importance of discussing PPD symptoms with medical professionals, a partner, or family. In terms of infantile colic, this disorder requires further research to help establish a better understanding of the disorder itself and possible treatment plans. It is important to undertake a systematic review to analyze research evidence on the association between infantile colic and PPD. The findings can help to develop interventions to improve the mother and infant's overall well-being. It is important to have adequate education in both fields to provide the best quality care for postpartum mothers and infants.

Chapter 3

Methods

The use of multiple databases is necessary to gather relevant, scientific literature to analyze. Compiling enough resources to further understand an association between infant crying and postpartum depression included using PubMed, CINAHL, and PsycINFO. The same key terms were used for each database which included (postpartum depression OR post-partum depression OR PPD) AND (infantile colic OR inconsolable crying OR excessive crying OR infant crying). After that initial search, 90 articles from PubMed, 21 articles from CINAHL, and 67 articles from PsycINFO were identified. After adding some related terms, the new search consisted of (postpartum depression OR post-partum depression OR PPD OR post-natal depression OR PND) AND (inconsolable crying OR excessive crying OR infant crying OR infant colic). A date refinement from 2005 to 2022 and clinical trial filters were added which eventually brought the results to 14 articles from PubMed, 27 articles from CINAHL, and 59 articles from PsycINFO. The few articles left from the search allowed for in-depth critiquing on the type of methods used, the results, and the topic's connection amongst all articles chosen. Additionally, most articles were excluded due to lack of relevancy with the topic specifically; however, after further investigation, 10 research articles met the inclusion criteria for this systematic review.

Each article received a grade and level based off the Johns Hopkins Hospital quality guide to determine the value of the study. These grades are given to research studies to determine the quality and reliability of the study. Level I is the best grade given to quantitative research studies while level V is the lowest evidence level which includes literature reviews and case reports. Along with the evidence levels, the studies receive a quality grade as well. Receiving an A, or high-quality grade, involves consistent and generalizable results with a sufficient sample

size. On the contrary, receiving a C, or a low-quality grade, indicates that there is little evidence with inconsistent results. Using the John Hopkins evidence level and quality guide is the best grading scale to determine reliable and high-quality research studies.

Some inclusion criteria used in the search consisted of the date, type of article, and the key terms in the title/abstract. All articles are dated between 2005 and 2022 with an article published in 2006 being the oldest source included. The articles were also filtered to peer reviewed clinical trials instead of systematic reviews or meta-analyses.

Figure 1: Decision Tree of Literature

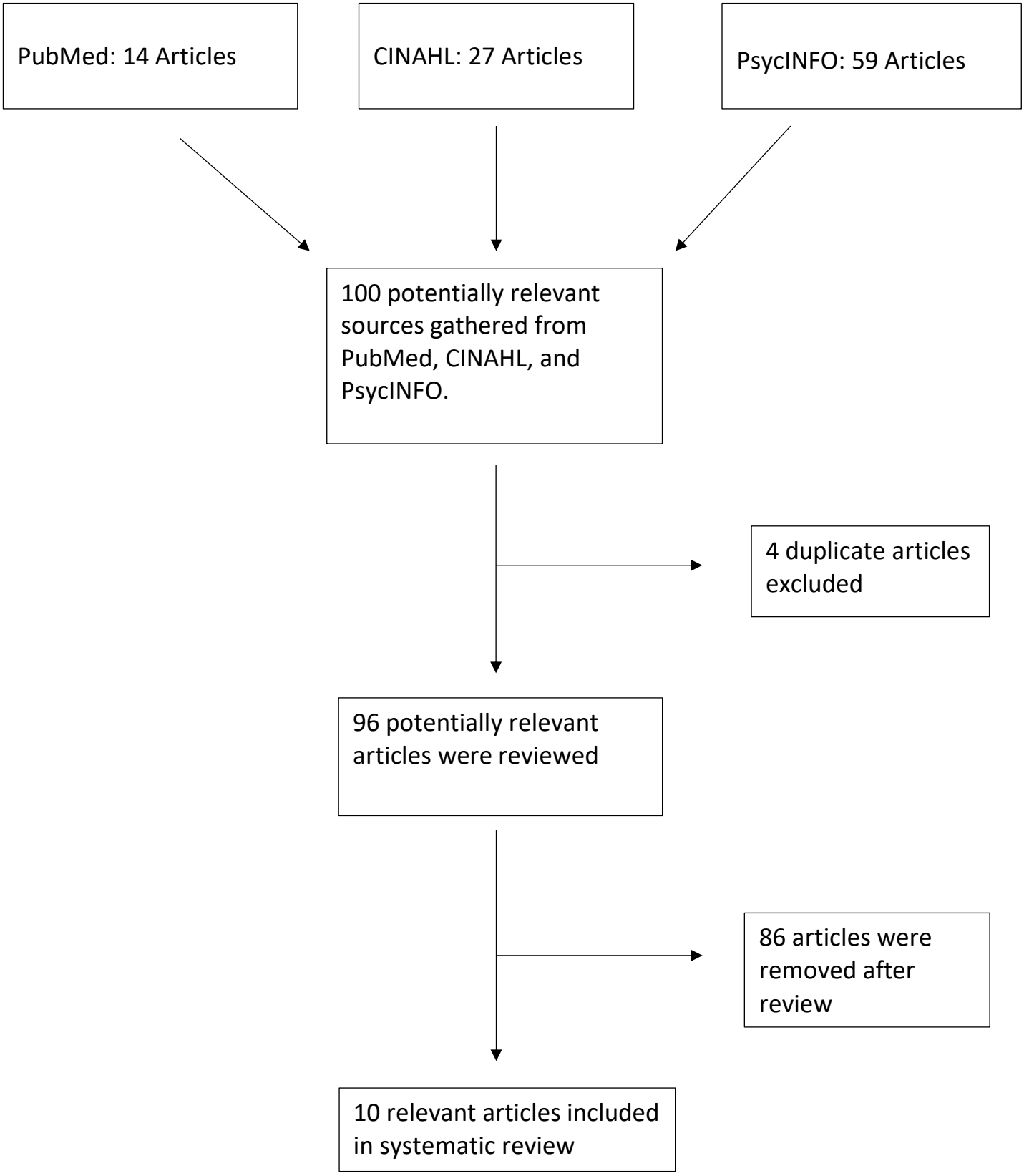

Table 2: ***Mothers' postpartum psychological adjustment and infantile*** **colic**

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Akman, I., Kuscu, K., Ozdemir, N., Yurdakul, Z., Solakoglu, M., Orhan, L., … Ozek, E. Published: 2006 Mothers' postpartum psychological adjustment and infantile colic	To examine the relationship between infantile colic and its effect on attachment style and levels of depression and anxiety in mothers throughout 4-6 months after giving birth.	**Type of Study** • Mixed Methods Longitudinal Study **Setting** • 77 mothers and newborns from Marmara University Hospital (Istanbul, Turkey) **Participants** • 17 infants diagnosed with infantile colic • 60 infants not diagnosed with infantile colic	• Semi-structured interview within first week of delivery • Given the Adult Attachment Scale (AAS), Edinburgh Postnatal Depression Scale (EPDS), and the State-Trait Anxiety Inventory (STAI) within the first postpartum month	• 23.5% of mothers with infants diagnosed with infantile colic scored > 13 on EPDS (high risk for postpartum depression) – not statistically significant • 62.5% of mothers with infants diagnosed with infantile colic exhibited insecure attachment through AAS – statistically significant • The median STAI score in mothers with infants diagnosed with infantile colic was 44.0 versus 41.0 for the infants without colic – not statistically significant	**Strengths** • Used qualitative and quantitative data • Valid and reliable assessment tools (AAS, EPDS, STAI) **Limitations** • Small sample with diagnosed infantile colic • Need further studies to identify a stronger relationship with a more diverse sample of participants • Fair number of the results were not statistically significant **Grade** Level I Grade B

Table 3: ***Infantile colic, prolonged crying and maternal postnatal depression***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations, & Grade**
Vik, T., Grote, V., Escribano, J., Socha, J., Verduci, E., Fritsch, M., Carlier, C., Kries, R., Koletzko, B. Published: 2009 Infantile colic, prolonged crying and maternal postnatal depression.	To identify the association between infant crying and maternal postnatal depression	**Type of Study** • Mixed Methods Longitudinal Study **Setting** • Participants were recruited from Belgium, Germany, Italy, Poland, and Spain **Participants** • 1,015 mothers and infants included in the final sample	• Completion of Edinburgh Postnatal Depression Scale (EPDS) and questions regarding infant's behavior and crying habits at 2 and 6 months after birth • Mothers were asked at each visit if their infant cried at least 3 hours per day for at least 3 days per week	• After 2- and 6-months post-birth, mothers of infants who have colic had increased odds of having higher EPDS scores than mothers of infants without colic • Younger mothers (below the average age by 1.5 years) had higher EPDS scores at 2 months after birth • Infantile colic recognized at 2 months was associated with high EPDS scores 4 months later	**Strengths** • Large sample size • Valid and reliable assessment tools (EPDS) **Limitations** • Needs further research to support the association • Mothers self-reported excessive crying of infant **Grade** Level I Grade B

Table 4: ***Inconsolable crying and maternal postpartum depressive symptoms***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Radesky, J.S., Zuckerman, B., Silverstein, M., Rivara, F.P., Barr, M., Taylor, J.A., Lengua, L.J. Published: 2013 Inconsolable crying and maternal postpartum depressive symptoms	To investigate the association of inconsolable infant crying and maternal postpartum depression	**Type of Study** • Descriptive Correlational Study within a completed randomized controlled trial **Setting** • Mothers enrolled in the *Period of PURPLE Crying* educational program at Seattle Children's Hospital, the University of British Columbia, and Boston University Medical Center **Participants** • 587 mothers included in final sample	• Baseline interviews • 24-hour record of infant and caregiver behaviors to completed when infant was 5-6 weeks old • Edinburgh Postnatal Depression Scale (EPDS) • Follow-up telephone interview by 8 weeks postpartum	• Mothers with an 8-week postpartum score >9 experienced an average of 170.5 minutes of total daily distress • EPDS score >9 was approximately twice as high in mothers with infant colic than those whose infants did not have colic	**Strengths** • Large sample size • Randomized controlled trial eliminates chances of bias **Limitations** • None of the interaction terms (comparing baseline maternal depression symptoms and infant inconsolable crying durations) were statistically significant • Results may not be generalizable to minority or low-income populations, because most participants were older (age > 35), well-educated, and white **Grade** Level II Grade C

Table 5: ***Preventing early infant sleep and crying problem and postnatal depression: A randomized trial***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Hiscock, H., Cook, F., Bayer, J., Le, H.N., Mensah, F., Cann, W., … St. James-Roberts, I. Published: 2014 Preventing early infant sleep and crying problems and postnatal depression: A randomized trial	To evaluate the effectiveness of a prevention program for infant cry and sleep problems and the association with postnatal depression	**Type of Study** • Randomized Controlled Trial **Setting** • 42 well-child centers in Melbourne, Australia **Participants** • 781 Infants in • Randomly assigned to experimental (received interventions) or control groups (no intervention)	• Mailed a 27-page booklet and 23-minute DVD on infant sleep and crying patterns • Baseline questionnaire on infant details • Maternal Cognitions About Infant Sleep Questionnaire (MCISQ) • Socio-Economic Indexes for Areas (SEIFA) • Edinburgh Postnatal Depression Scale (EPDS) • Pittsburgh Sleep Quality Index	• Caregivers that receive interventions were less likely to score >9 on the EPDS (7.9% versus 12.9%), less likely to spend greater than 20 min attending to infant outbursts (41% versus 51%),	**Strengths** • Large sample size • Randomized controlled trial helps to eliminate sample bias • Valid and reliable assessment tools **Limitations** • Few published articles on preventing infant crying and the association with postpartum depression • Results have not been replicated **Grade** Level I Grade B

Table 6: ***Maternal psychological state and infant's temperament at three months***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Vedova, A.M.D. Published: 2014 Maternal psychological state and infant's temperament at three months	To investigate the relationship between maternal psychological state and their child's temperament at 3 months postpartum	**Type of Study** • Descriptive Correlational Study **Setting** • National Health System conducted the study in northern Italy at 2 local antenatal clinics and 2 hospitals **Participants** • The participants were of Italian nationality, ages 18-40 years old, partnered, nulliparous, low-risk pregnancy, and attending prenatal classes • 107 mothers included in the final sample	• Mothers completed self-report measures in the third trimester and three months postpartum • Edinburgh Postnatal Depression Scale (EPDS) • Early Infant Temperament Questionnaire (EITQ) • The Parental Bonding Instrument • The Center for Epidemiological Studies – Depression Scale	• Higher antenatal depression and postnatal anxiety were observed with an increase in infant temperamental difficulties (low soothability, excessive crying, low adaptability, and tendency to withdraw) – statistically significant ($p < 0.001$)	**Strengths** • Longitudinal study followed the mother's progression from pre-birth to 3 months postpartum **Limitations** • Self-report scales have higher chance of untruthful responses • Mother self-reported the infant's temperament problems **Grade** Level II Grade B

Table 7: ***Effectiveness of Lactobacillus reuteri in infantile colic and colicky induced maternal depression***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Guo-lin, M., Lei, Z., Dong-Dong, Q., Wen-Qing, K., Mao-Qin, T., Jin-Ke, X. Published: 2015 Effectiveness of *Lactobacillus reuteri* in infantile colic and colicky induced maternal depression: A prospective single blind randomized trial.	To determine if Lactobacillus reuteri can help reduce the excessive crying from infants with colic and overall decrease colicky induced maternal depression	**Type of Study** • Single blind randomized trial **Setting** • Children's Hospital of Zhengzhou China **Participants** • 42 infants were included in the study and were randomized with 21 in the treatment group and 21 in the placebo group • The treatment group received 5 L. reuteri drops for 21 days • The placebo group received 5 placebo drops for 21 days	• The treatment and placebo groups had follow-ups at 1, 2, 3, and 4 weeks while receiving the drops • The mothers of both groups completed the Edinburgh Postnatal Depression Scale (EPDS)	• There was a statistically significant reduction in the mean daily crying time (baseline >180 min/day) in the treatment group (average 32.05 min/day) compared to the placebo group (120.63 min/day) ($p < 0.01$) • The EPDS score in the treatment group decreased significantly after the fourth week (baseline 8.3, fourth week 5.6) compared to the placebo group (baseline 10.8, fourth week 8.1) ($p < 0.01$)	**Strengths** • Randomized trial decreases chance of sample bias • Valid and reliable assessment tools (EPDS) **Limitations** • Self-report scales have higher chance of untruthful responses • Small sample size • Further studies need to confirm findings **Grade** Level I Grade B

Table 8: ***Mental health and well-being in parents of excessively crying infants: Prospective evaluation of a support package***

Author(s), Year, and Title	Purpose	Design	Measures	Findings	Strengths, Limitations & Grade
Powell, C., Bamber, D., Long, J., Garratt, R., Brown, J., Rudge, S., … St. James, R.I. Published: 2018 Mental health and well-being in parents of excessively crying infants: Prospective evaluation of a support package.	To observe if providing an educational package will improve the well-being and mental state of parents with excessively crying infants	**Type of Study** • Quasi-experimental Longitudinal Study **Setting** • East Midlands UK National Health Service Trust **Participants** • Group 1: "Referred Crying" sought help because of excessive infant crying (30 participants) • Group 2: "New Birth Visit" parents introduced to the Surviving Crying materials 10-14 days after childbirth (27 participants) • Both groups received the educational package	• Baseline assessment: EQ-5D Quality of Life Questionnaire, Edinburgh Postnatal Depression Scale (EPDS), GAD-7 Scale, Maternal Confidence Questionnaire (MCQ) • Parents were given support packages and re-evaluated 4-6 weeks later (Baseline measures repeated)	• 53% of parents were classified as depressed at the baseline assessment • After intervention, 26% of parents were classified as depressed • 11 parents reported moderately anxiety at baseline assessment, after intervention, only 2 reported being moderately anxious and severely anxious at baseline was 4 and dropped to 2 • The MCQ scores increased from 2.02 to 2.15 • 50% of parents reported crying to be a severe problem, after intervention, only 6% reported it still being a severe problem	**Strengths** • Valid and reliable assessment tools (EQ-5D, EPDS, MCQ, Generalize Anxiety Scale) **Limitations** • Parents self-reporting infant's excessive crying • Small sample size • Lack of a control group and randomization **Grade** Level II Grade A

Table 9: ***Preventing postpartum depressive symptoms using an educational video on infant crying: A cluster randomized trial***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Doi, S., Fujiwara, T., Isumi, A., Mitusda, N. Published: 2020 Preventing postpartum depressive symptoms using an educational video on infant crying: A cluster randomized controlled trial.	To observe how watching an educational video on infant crying at 1-week postpartum effects the prevalence of postpartum depression symptoms at 1 month	**Type of Study** • Cluster Randomized Controlled Trial **Setting** • Mothers who gave birth between October 1, 2014, and January 31, 2015, in Osaka Prefecture, Japan **Participants** • Intervention group: 1,040 participants • Control group: 1,561 participants	• Intervention group: Watched the educational video during admission after delivery (1 week after birth) • Control group: Completed distributed anonymous questionnaire, watched the educational video (1 month after delivery) • Video included National Center on Shaken Baby Syndrome's Period of PURPLE Crying • Edinburgh Postpartum Depression Scale (EPDS)	• 250 participants in the control group reported >9 EPDS • 142 participants in the intervention group reported >9 EPDS • The educational video had no effect in preventing postpartum depressive symptoms in mothers >25 – statistically significant ($p < 0.05$) • Mothers <25 years old reduced postpartum depression symptoms by 72.0%	**Strengths** • Large sample size • Randomized controlled trial helps to eliminate sample bias **Limitations** • Possible self-reporting bias • Varying demographic factors amongst participants (age of mother, education, and income) • Did not assess baseline mental health • Further studies are needed to confirm findings **Grade** Level I Grade B

Table 10: ***Infant crying problems related to maternal depressive and anxiety symptoms during pregnancy***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Ölmestig, T.K., Siersma, V., Birkmose, A.R., Kragstrup, J., Ertmann, R.K. Published: 2021 Infant crying problems related to maternal depressive and anxiety symptoms during pregnancy: A prospective cohort study.	To explore the relationship of maternal depressive or anxiety symptoms during pregnancy and the chance of crying problems in the newborn child	**Type of Study** • Descriptive Correlational Study **Setting** • Participants live in Denmark registered with a general practitioner **Participants** • 1290 pregnant women and their newborn children followed from birth until 8 weeks postpartum • Screened during the first, second, and third trimester and 8 weeks postpartum	• Major Depression Inventory (MDI) was completed in the first, second, and third trimester and at 8 weeks postpartum • Maternal perception of infant crying assessed at 8 weeks postpartum • Anxiety Symptom Scale (ASS) given in the first, second, and third trimester and at 8 weeks postpartum	• At 8 weeks postpartum, 18.2% (235) of infants had crying problems • Association between high depressive score (MDI>31) in first trimester and crying problems – statistically insignificant (due to previous psychological problems) • Mothers with severe depressive symptoms (MDI >31) and a high score of anxiety symptoms in the third trimester were more likely to have a baby with crying problems – statistically significant	**Strengths** • Large sample size and response • Chose MDI instead of EPDS, because it is widely recognized in general practice in Denmark **Limitations** • Crying problems were self-reported from the mothers **Grade** Level II Grade A

Table 11: ***Mothers' implicit and explicit attitudes towards infant crying: Predicting postpartum depressive symptoms***

Author(s), Year, and Title	**Purpose**	**Design**	**Measures**	**Findings**	**Strengths, Limitations & Grade**
Sun, A., Peng, W., Ansari, A., Li, X., Xu, Y., Yan, N. Published: 2021 Mothers' implicit and explicit attitudes towards infant crying: Predicting postpartum depressive symptoms.	To determine whether mothers' implicit and explicit attitudes towards infant crying are related to postpartum depressive symptoms	**Type of Study** • Descriptive Correlational Study **Setting** • Chongqing, China (23-42 years of age) **Participants** • 71 participants during their third trimester	• Infant Crying Questionnaire (ICQ) • Used GNAT to assess affective valence and cognitive attribution • Center for Epidemiologic Studies Depression Scale (CES-D) • Assessments given at third trimester to one-month postpartum	• Mothers had more negative implicit thoughts than positive towards infant crying ($p < 0.001$) • Mothers who are less likely to associate infant crying with positive attributes have an increased chance of developing postpartum depressive symptoms ($p < 0.05$)	**Strengths** • Valid and reliable assessment tools used (ICQ, GNAT, CES-D) **Limitations** • Lack of a longitudinal follow-up • Small sample size • Self-reporting bias **Grade** Level II Grade A

Chapter 4

Results

The purpose of this systematic review is to identify the association between infantile colic and PPD as well as useful interventions to prevent the development of PPD. Each study included demonstrates possible outcomes exhibited by the mother in response to the excessive crying associated with infantile colic. The previous chapters provided an introduction and background of postpartum depression and infantile colic. This chapter will further analyze and synthesize the results of the literature included in this systematic review. A total of 10 eligible articles were identified and included in this review.

Study Design

Out of the 10 studies included in the review, two were randomized controlled trials (Doi et al., 2020; Hiscock et al., 2014), one was quasi-experimental (Powell et al., 2018), four were descriptive correlational studies (Olmestig et al., 2021; Radesky et al., 2003; Sun et al., 2021; Vedova, 2014), two were mixed methods longitudinal study (Akman et al., 2006; Vik et al., 2009), and one was a single blind randomized trial (Guo-Lin et al., 2015).

The studies were conducted across different countries throughout the world. The variety of countries include Turkey, United States, Australia, Italy, China, the UK, Canada, Japan, and Denmark. Using articles that are based in various locations allows for further exploration of different demographics of participants. Having similar results amongst the studies leads to more generalizable results to be interpreted.

Quality of Evidence

Of the 10 studies included in this review, five articles received a Level I evaluation for utilizing randomized controlled trials and longitudinal studies (Akman et al., 2006; Doi et al., 2020; Guo-Lin et al., 2015; Hiscock et al., 2014; Vik et al., 2009), and five received a Level II for descriptive correlational studies (Olmestig et al., 2021; Powell et al., 2018; Radesky et al., 2003; Sun et al., 2021; Vedova, 2014). In addition, three articles received an A grade for having a large sample size and strong assessment tools (Olmestig et al., 2021; Powell et al., 2018; Sun et al., 2021), six were evaluated for a B grade (Akman et al., 2006; Doi et al., 2020; Guo-Lin et al., 2015; Hiscock et al., 2014; Vedova, 2014; Vik et al. 2009), and one article received a C grade for non-generalizable results (Radesky et al., 2003).

Participant Demographics

The sample sizes varied depending on the setting and type of study. Four of the articles had a sample size less than 100 (Akman et al., 2006; Guo-Lin et al., 2015; Powell et al., 2018; Sun et al., 2021; Vedova, 2014) while the other six had significantly larger sample sizes ranging from 500 to 1,000 participants (Doi et al., 2020; Hiscock et al., 2014; Olmestig et al., 2021; Radesky et al., 2003; Vik et al., 2009). The articles also included mothers specifically of all ages and included new mothers along with mothers with previous children.

Outcome Measures

All the studies utilized assessment tools that measured maternal depression or anxiety scales. The capability of quantifying the extent that infantile colic has on a mother's psychosocial wellbeing is crucial to help identify a direct link and possible interventions to prevent postpartum depression. The studies included in this review all used a type of depression scale such as the Edinburgh Postnatal Depression Scales (EPDS), the Major Depression

Inventory (MDI), and the Center for Epidemiologic Studies Depression Scale (CES-D). Eight of the studies utilized the EPDS (Akman et al., 2006; Doi et al., 2020; Guo-Lin et al., 2015; Hiscock et al., 2014; Powell et al., 2018; Radesky et al., 2003; Vedova, 2014; Vik et al., 2009). The questionnaire determined the level of depression in mothers in the postpartum period with scores greater than ten indicating possible depression. In addition, three of the studies administered anxiety questionnaires along with depression scales. These anxiety questionnaires included the Anxiety Symptom Scale (ASS) (Olmestig et al., 2021), the Generalized Anxiety Disorder-7 scale (GAD-7) (Powell et al., 2018), and the State-Trait Anxiety Inventory (STAI) (Akman et al., 2006).

Four studies administered interventions to prevent postpartum depression in mothers. Hiscock et al. (2014) distributed a 27-page booklet and 23-minute video on infant sleep and crying patterns. Powell et al. (2018) gave a support package to mothers to improve overall well-being. They provided Surviving Crying materials to mothers after childbirth to encourage education on how to manage infants who cry excessively. Both groups received the support package; however, the timing of support package distribution was different after childbirth. Doi et al. (2020) provided an educational video on infant crying during admission and after delivery (approximately one week after birth). This included a control group who did not receive the video and an experimental group who watched the educational video. Guo-Lin et al. (2015) provided interventions for mothers who identified having infants with colic. They provided five drops of *Lactobacillus reuteri* (L. reuteri) to infants daily for three weeks while also studying the trends in the EPDS from the mothers.

Relationship Between Infantile Colic and PPD

Association of Infantile Colic and PPD

Infantile colic presents as an added stressor for postpartum mothers. In addition to the care of a newborn child, the overstimulation from excessive crying and lack of soothing can negatively impact the mother's mental health. Radesky et al. (2003), concluded that an EPDS score >9 was twice as high in mothers with infants with infantile colic compared to mothers with infants who did not have infantile colic. Similarly, Akman et al. (2006) concluded that 23.5% of mothers with infants diagnosed with infantile colic scored greater than 13 on the EPDS. In addition, those mothers scored an average of 10.2 on the EPDS scale compared to an average of 6.3 for mothers of infants without colic (Akman et al., 2006). The association is further identified in Vik et al. (2009) which concluded that infantile colic is a risk factor for PPD symptoms up to 6 months after birth. Even if the infantile colic has resolved, the depressive symptoms remained if left untreated (Vik et al., 2009).

While researching an infantile colic and PPD association, Olmestig et al. (2021) conducted research on maternal depressive and anxiety symptoms during pregnancy and their children's likelihood of developing crying problems. They concluded that mothers with severe depressive symptoms (MDI >31) during the third trimester were more likely to have a baby with crying problems. At the 8-week follow-up, 18.2% of the infants screened had crying problems which indicated that depressive and anxiety symptoms have an association with infantile colic (Olmestig et al., 2021). They concluded that a mother's mental health may have an influence on the infant's emotional regulations, temperament, and crying habits (Olmestig et al., 2021). Furthermore, Vedova (2014) studied the effects of maternal psychological state and the infant's temperament. Their results demonstrated that maternal perinatal depression or anxiety was related to an increase in difficult temperament, such as low soothability, unpleasant behavior,

and increased crying time, in infants at three months old. There was a higher association with antenatal depression and infantile colic issues than PPD and infantile colic (Vedova, 2014).

Predicting PPD Symptoms with Infant Crying

Sun et al. (2021) led a research study on predicting PPD from mother's attitudes towards infant crying. They assessed mothers' implicit and explicit attitudes in response to a crying stimulus using the CES-D to assess PPD symptoms. The study concluded that the mothers included in the study had more negative implicit attitudes towards infant crying than positive attitudes ($p<0.001$). However, Sun et al. (2021) revealed that neither explicit nor implicit attitudes towards infant crying could fully predict the possibility of PPD symptoms in mothers. The only significant finding involved mothers who had fewer explicit attachment attitudes, such as comforting, tending to, and response to the infant, and communication towards infant crying predicted an increase in PPD symptoms ($p<0.05$) (Sun et al., 2021). Also, Vedova (2014) and Vik et al. (2009) concluded that PPD can be predicted by mental health issues during pregnancy and the temperament of the child postpartum.

Prevention and Intervention of PPD Associated with Infantile Colic

Prevention Program

Considering infantile colic does not have a distinctive etiology or definitive treatment plan, prevention of PPD can benefit the mother and the baby. Hiscock et al. (2014) prepared a prevention program for parents which consisted of a 27-page booklet and a 23-minute DVD on infant sleep and crying patterns. They also offered an individual telephone consultation at 6-8 weeks postpartum and parent group sessions around 12 weeks postpartum. They concluded that at 6 months postpartum, caregivers who participated in the intervention were less likely to score > 9 on the EPDS (which indicated mild to moderate depression) when compared to caregivers

who did not participate. Intervention caregivers also demonstrated an increase in confidence managing their infant's sleep patterns, spent less time tending to their infant overnight, and worried less about sudden infant death (Hiscock et al., 2014). Improving sleep habits of the infant decreased the amount of crying and the caregiver needing to soothe the infant overnight. Also, providing better sleep habits for the caregiver decreased overall exhaustion and depression symptoms throughout the duration of the program (Hiscock et al., 2014).

Lactobacillus reuteri

Despite little research and success on potential treatments for infantile colic, *Lactobacillus reuteri* is a probiotic drop that could help ease gastrointestinal problems in colicky infants. Guo-Lin et al. (2015) gave 5 drops of L. reuteri to a treatment group and 5 placebo drops to a control group for 3 weeks. They found a statistically significant ($p < 0.01$) difference between the baseline crying pattern (> 180 minutes/day determined by inclusion criteria) at the end of the 3 weeks. They observed an average daily crying of 32.05 minutes/day in the treatment group while the average daily crying of 120.63 minutes/day in the placebo group (Guo-Lin et al., 2015). Furthermore, there was 100% treatment success found in the treatment group infants while only 15.7% treatment success was found in the placebo group infants. When comparing the maternal depression scores, they found a 51.3% decrease in postpartum depression compared to 27.6% decrease in the placebo group using the EPDS. The use of L. reuteri could also be more beneficial for infants who are breast fed and diagnosed with infantile colic rather than formula fed (Guo-Lin et al., 2015).

Educational Video

Doi et al. (2020) provided an educational video on the National Center on Shaken Baby Syndrome's Period of PURPLE Crying. Their intervention group watched the video during their admission after delivery with a 1-month health checkup while the control group did not watch the video. They also administered the EPDS during admission and at the checkup. The results concluded that the educational video had no significant effect on decreasing postpartum depression. However, mothers younger than 25 demonstrated a reduction of postpartum depression symptoms by 72.0% after watching the educational video.

Support Packages

Providing support and education to parents who have colicky babies may help to improve overall well-being and mental health status. Powell et al. (2018) performed an exploratory study which included two groups: the referred crying group, who had an excessively crying infant already; and the new birth visit group, who were visited 10-14 days postpartum. They introduced the support package called "Surviving Crying" to provide resources and educational materials to both groups. They found that the baseline frustration associated with crying was reduced from 55% to 2.0% after the support package. Also, parents at baseline scored an average of 10.08 on the EPDS scale; however, after the interventions, the average EPDS score decreased by 2.98 points with an average of 7.10 at the outcome (Powell et al., 2018). The MCQ confidence measure also increased slightly from baseline of 2.02 to the outcome score of 2.15 (Powell et al., 2018).

Chapter Summary

This chapter addressed the results amongst all the research articles included in this review. The literature exhibits different correlations and intervention measures between postpartum depression and infantile colic. There is a strong correlation between maternal depression with infantile colic and excessive crying symptoms. The interventions included varied in effectiveness with educational materials less impactful than the *L.reuturi* on managing and treating infantile colic.

Chapter 5

Discussion

Throughout this systematic review, a variety of research studies were analyzed to explore an association between PPD and infantile colic along with possible preventable interventions. This chapter includes discussion revolving around the findings from the included studies, their relevance to clinical practice, and directions for further research. In addition, this chapter will address the two research questions:

1. To investigate the relationship between infantile colic and PPD.
2. To identify the effect of interventions on the prevention of PPD in a mother with an infant with colic.

Summary of Findings

Research Question 1: Relationship between Infantile Colic and PPD

The first research question explores how infantile colic impacts postpartum mothers and the possibility of developing PPD. All the studies included identified a relationship between infantile colic and the development of PPD. An overall association between infantile colic and PPD can occur from a variety of situational factors and stressors. Infantile colic adds intense stress on mothers especially if they are new to motherhood. Inconsolable crying can increase frustration levels and stress levels while simultaneously decreasing maternal confidence (Radesky et al., 2003). Frustration and stress stimulate negative thoughts about the infant, and their uncontrollable crying ultimately changes the maternal response time and sensitivity to infant distress crying (Radesky et al., 2003). The study done by Vik et al. (2009) also supports the claim that mothers with infants diagnosed with infantile colic may feel less competent in their caretaking skills and may experience more family stress when compared to mothers with

infants without infantile colic. It is harmful for the mother psychologically to feel depressed during the immediate postpartum period, and it is harmful for the infant considering the mother has a decreased response time to infant crying. PPD is highly associated with infantile colic due to the overall maternal fatigue and heightened infant irritability (Vik et al., 2009).

Identifying an extensive relationship between infantile colic and PPD could help prevent both from happening. Mothers who scored high on both the MDI for depression and the ASS for anxiety, had a higher risk of their infant developing excessive crying problems (Olmestig et al., 2021). Similarly, mothers who had antenatal depression had an increased risk of having an infant with temperamental difficulties such as low soothability, excessive crying, and low adaptability (Vedova, 2014). While conducting research regarding the effects of the psychosocial wellbeing of the mother during pregnancy and the outcome of excessive crying, they concluded that infantile colic in the postpartum period also worsened those initial depression symptoms. A cycle results between maternal mental health and infant temperament reinforcing each other (Olmestig et al., 2021). Alternatively, this dynamic maternal-infant relationship can also be harnessed to implement interventions aimed at prevention or improvement.

Postpartum mothers may not recognize they are developing PPD symptoms in response to infantile colic. Not addressing or treating PPD can be detrimental to the infant at that time, but it could also influence future developmental, behavioral, and emotional problems (Akman et al., 2006). Mothers who report higher depression symptoms in response to infantile colic have been found to have a lower level of interaction with their infant and have an inconsistent care style (Akman et al., 2006). Not tending to an infant's needs in times of distress creates an untrusting relationship thus risking an insecure attachment between mother and baby. In addition, like

Olmestig et al. (2021), Akman et al. (2006) concluded that PPD can increase the risk of infantile colic due to the caregiver's impact on infant regulatory and behavioral problems.

Understanding explicit and implicit attitudes towards infantile colic in pregnant mothers could predict the likelihood of PPD. Implicitly, mothers react negatively and respond with bias to crying stimulus while explicitly they act in infant-oriented manners (Sun et al., 2021). Mothers have the urge to act in a comforting and sensitive way when an infant is in distress; However, these negative emotions linked to uncontrolled crying affect the mother's own emotional regulation. In the postpartum, the mothers should link implicit and explicit values to prevent PPD symptoms. Those who do not make that connection may adopt higher depressive symptoms and become more self-oriented than infant-oriented (Sun et al., 2021). Embracing positive attitudes and focusing on becoming more infant-oriented in response to crying could help decrease the risk for PPD. Furthermore, understanding that prolonged crying and infantile colic are risk factors for PPD should influence mothers to report any depressive symptoms to their primary care team (Vik et al., 2009). Emphasizing the importance of providing support and resources to mothers who report infantile colic or PPD symptoms is crucial for the mother's and the infant's health outcomes (Vik et al., 2009).

Research Question 2: Effect of Interventions on the Prevention of PPD

The second research question addresses possible interventions that could prevent PPD in mothers with an infant with infantile colic. Since there is little research on treating infantile colic, preventing the occurrence of PPD is the best treatment option for postpartum mothers. Different interventions may work differently for different mothers, but providing that initial support system will give them the necessary resources to receive help if they experience symptoms of PPD. Providing educational materials and support packages to postpartum mothers was the most

used prevention method amongst the included studies during the immediate postpartum period (Doi et al., 2020; Hiscock et al., 2014; Powell et al., 2018). While there are more interventions focused on the mother and preventing PPD with infantile colic, there have been other research studies finding the best treatment intervention for infantile colic. Guo-lin et al. (2015) implemented a treatment option of *L. reuteri* to help soothe infants diagnosed with infantile colic and ultimately prevent PPD.

Education on how to manage an infant with excessive crying and potential interventions can help decrease the risk of developing PPD (Doi et al., 2020). Informative materials can improve overall understanding of infant sleeping patterns, soothing capabilities, and reactive behaviors towards excessive crying. Providing educational materials will help mothers to understand the expectations of infantile colic and reduce feelings of doubt or hopelessness in their care (Doi et al., 2020; Hiscock et al., 2014; Powell et al., 2018). In addition to improving overall education, increasing the confidence in new mothers, especially under the age of 25, can prevent PPD symptoms (Doi et al., 2020). Younger mothers are more likely to feel stressed and unprepared for motherhood (Doi et al., 2020). Having an infant with infantile colic may increase negative feelings, contributing to symptoms of PPD. Overall, working to improve caregiver competence in infant needs, confidence levels, and support systems can help to prevent PPD symptoms from occurring (Doi et al., 2020; Hiscock et al., 2014; Powell et al., 2018).

Another intervention that is arising is experimenting with how to treat infantile colic to prevent PPD. Infantile colic still has an uncertain etiology which makes treatment difficult to implement. One theory regarding the cause of infantile colic involves an imbalance in the infant's gastrointestinal tract which induces distress and discomfort. Administering oral drops of the probiotic *L. reuteri* may help to decrease gastric discomfort and overall decrease infantile

colic effects (Guo-lin et al., 2015). Treating infants with this probiotic led to a reduction in both the amount of crying in the infant, as well as maternal depression symptoms (Guo-lin et al., 2015). Considering Guo-lin et al. (2015) used exclusively breastfed infants, further research is needed regarding the reliability of this form of treatment and the difference between breastfed and formula fed infants.

Strengths and Weaknesses

The greatest strengths of this review comes from the type of studies and measures used. Utilizing randomized controlled trials and longitudinal studies allows for analysis of valid and reliable data included in this review. These types of studies allow easy replication to compare results for further understanding of the research question. In addition to the type of study, utilizing reliable assessment tools is another strength when considering the quality of research studies. The most prominent measurement tools identified in this review include the Edinburgh Postnatal Depression Scale (EPDS), Adult Attachment Scale (AAS), State-Trait Anxiety Inventory (STAI), Maternal Cognitions About Infant Sleep Questionnaire (MCISQ), Early Infant Temperament Questionnaire (EITQ), Maternal Confidence Questionnaire (MCQ), Major Depression Inventory (MDI), Infant Crying Questionnaire (ICQ), Anxiety Symptom Scale (ASS), and the Center for Epidemiologic Studies Depression Scale (CES-D).

The weaknesses observed in this review involve the lack of research about infantile colic and self-reported questionnaires. Little research is published surrounding infantile colic itself and the effect on postpartum mothers. Further research studies must be done to establish a clear association and understanding between the relationship. Another weakness identified in this review includes self-reported questionnaires. Participants' responses to questionnaires could be

exaggerated or could possibly be untruthful due to desirable reporting bias leading to altered results and conclusions.

Implications for Clinical Practice

Infantile colic and PPD are not adequately addressed in clinical practice. Having insufficient knowledge on either topic restricts possible interventions or necessary resources to those struggling with these disorders. Mothers should have access to current informational materials on how to recognize PPD and infantile colic symptoms during their pregnancy. The earlier they are informed about these conditions, the more prepared and educated they are if the mother is diagnosed with PPD, or the infant is diagnosed with infantile colic. Furthermore, early screening assessments could provide early diagnosis of PPD. Depression screenings during pregnancy could identify high risk mothers, and screenings in the postpartum could show signs and symptoms of PPD. Providers and nurses could implement necessary support services early to prevent further complications and promote the health of both the mother and the infant (Akman et al., 2006).

Implications for Future Research

This review identified relevant research studies about the association of PPD and infantile colic, as well as potential interventions for both the mother and the infant. Future research must be done to establish more relationships between infantile colic and the mother's psychosocial wellbeing. Identifying more mental health disorders associated with infant crying, in addition to depression, could help provide necessary prevention and intervention measures. Mental health in the postpartum is not paid attention to enough in practice today and implementing further research on postpartum anxiety, OCD, or bipolar disorders will bring awareness and decrease stigmatization. Additionally, future research on the best intervention processes would benefit the

overall health outcome for both the mother and the infant. There are uncertainties when it comes to infantile colic treatment; however, future studies should investigate the use of *L. reuteri* and probiotics as treatment measures for infantile colic. Providing further research studies are important as well as study replication to form more definitive relationships between PPD and infantile colic.

Conclusions

The relationship between infantile colic and PPD prove to be problematic to the mother and the infant if left untreated. Understanding the risk factors as well as signs and symptoms of PPD allows for quicker diagnosis and treatment. In this review, a variety of interventions were considered for educational materials for the mother and treatment measures for the infant. Researching how to best treat both PPD and infantile colic early is crucial to promote the best quality of life for the mother and infant. PPD needs more recognition in women's health to provide a safe and nonjudgmental environment for any mother struggling with depression. Additionally, while infantile colic is a temporary disorder, the effect it has on the infant's caregivers and support system can be detrimental. Prevention and early intervention for both PPD and infantile colic is key for optimal health outcomes for mother and baby.

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* All citations with an asterisk are included in literature review

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Bachelor of Science, Nursing — Expected Graduation: May 2023

SCHOLARSHIPS AND AWARDS:

Schreyer Honors College, Academic Excellence Scholarship (AES) — Fall 2019 – Present
Dean's List Honoree — Fall 2019 – Present

CLINICAL EXPERIENCE:

Nursing Capstone – Surgical Intensive Care Unit — Spring 2023
Hershey Medical Center – Hershey, PA
Nursing Care Adult – Neurological Critical Care Unit — Spring 2023
Hershey Medical Center – Hershey, PA
Nursing Care Adult – Heart and Vascular Progressive Care Unit — Fall 2022
Hershey Medical Center – Hershey, PA
Community and Family Nursing — Fall 2022
Dauphin County Outreach Locations – Hershey, PA
Nursing Care Adult – Medical/Surgical Unit — Fall 2021
Mount Nittany Medical Center – State College, PA

WORK EXPERIENCE:

Allegheny Health Network, Nurse Extern – Wexford, PA — June 2022-August 2022
- Monitored and assessed patients on a medical/surgical unit
- Demonstrated improvement in nursing skills, as supervised by an RN

Connected Health, LLC, Nursing Assistant – Wexford, PA — May 2021-August 2021
- Managed COVID test administration
- Organized COVID tests for summer camps

Connected Health, LLC, Medical Intern – Wexford, PA — May 2020-August 2020
- Documented updates in patient's medical records
- Assisted in patient assessments

VOLUNTEER ACTIVITIES:

Orchard Hill Church – Wexford, PA — Winter 2015 – Present
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CERTIFICATIONS:

American Heart Association, Basic Life Support Health Care Provider — Expires 2024
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References Available Upon Request