DOCTORAL THESIS

The impact of postnatal depression on mother-infant interaction and infants' communication skills
A video-based analysis

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The impact of postnatal depression on mother-infant interaction and infants' communication skills: A video-based analysis

By

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Abstract

Background: Postnatal depression (PND) is the most common complication observed in women following delivery, affecting approximately 17% of mothers. Research shows that mothers with PND are less involved in playful and stimulating interactions with their babies, such as face-to-face contact, play and maternal singing. These deficits in mother-child interactions have been found to negatively affect the child's development, with infants of mothers with PND being at increased risk of poor developmental outcomes. However, there is limited research focused on infants' verbal and non-verbal communication skills during interactive activities with mothers with PND, especially in the context of an inpatient Mother-Baby Unit (MBU).

Aim: To examine the effect of maternal PND on both mother-infant interaction and infant development, with special focus on infants' verbal and non-verbal communication skills, in the context of mothers with severe PND who have been hospitalised with their infants in an inpatient MBU.

Research questions:

1) Are there any differences in the quality of mother-infant interaction between mothers with and without PND and their babies?
2) Do infants of mothers with PND differ in their non-verbal communication skills when compared to infants of mothers without PND?
3) Do infants of mothers with PND differ in terms of the ways in which they use a toy during a play interaction with their mothers when compared to infants of mothers without PND?
4) What is the impact of PND on maternal vocal behaviour and, consequently, on infants' verbal communication skills?

Method: A total of 52 videos that contain footage of 104 participants (52 mother-infant pairs) were analysed and compared. In particular, the clinical group consists of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months); their interaction has been video-recorded for intervention purposes in the clinical context of an MBU. A comparison group of

30 mothers without PND was recruited from several Children's Centres in London, and their play interaction with their infants (aged 3-12 months) was also video-recorded.

Video-recordings of mother-infant interactions of the two groups (n=52) were compared and analysed using the Infant CARE-Index (Crittenden, 2005) and the Global Rating Scale (Murray & Karpf, 2000). Additionally, a micro-analytic approach was employed to evaluate the infants' communication skills, as well as to assure the detailed examination of complex and extremely rapid behaviours that occur during mother-infant interaction.

Results: Significant group differences were found in the quality of the mother-infant interaction, with the presence of PND playing a crucial role. In the communicative domains of facial affect, vocal behaviour, touch and gaze, the behaviours of the dyads from the clinical group diverged from the respective behaviours of the comparison group. Mother-infant pairs from the clinical group (vs the comparison group) showed less engagement in a mutually enjoyable play interaction and differences in the use of a toy as part of their play interaction. Overall, infants of mothers with PND showed neurodiversity in their verbal and non-verbal communication skills in comparison with the infants of mothers without PND.

Conclusion: The findings of the present study call for paying more attention to mothers with severe PND and their infants, in order to reinforce maternal abilities and simultaneously address their challenges, so as to create an optimal developmental milieu for their infants. These findings could contribute to the improvement of treatment options focused on enhancing the mother-child relationship among mothers with PND through play, maternal speaking/singing and face-to-face contact, thereby promoting a better quality of life for this population. Another practical implication of the findings of this study could be to further inform guidelines and strategies for intensive educational programmes especially designed for pre-schoolers of mothers with depression – who are at high risk for cognitive and language difficulties – in order to support young children to develop their verbal and non-verbal communication skills more effectively.

Key words: Postnatal depression (PND); Mother-Baby Unit (MBU), Mother-infant interaction; Infants' Communication skills; Infant development; Microanalysis

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List of abbreviations used in this thesis

ADHD = Attention Deficit Hyperactivity Disorder

APA = American Psychological Association

BPS = British Psychological Society

CBT = Cognitive Behavioural Therapy

CSBS-DP = Communication and Symbolic Behaviour Scales Developmental Profile

DSM = Diagnostic and Statistical Manual of Mental Disorders

EC = Event Count

ECEC = Early Childhood Education and Care

EPDS = Edinburgh Postnatal Depression Scale

GRS = Global Ratings Scale

ICC = Intraclass Correlation Coefficient

ICD = International Classification of Diseases

ID singing = Infant-directed singing

IDS = Infant-directed speech

IPT = Interpersonal Therapy

LA = Local Authorities

M = Mean

MBU = Mother-Baby Unit

NHS = National Health System

NICE = National Institute for Health and Clinical Excellence

NICHD = National Institute of Child Health and Human Development

NOMS = National Offender Management Service

NVC = Non-Verbal Communication

PND = Postnatal Depression

PND mothers = Postnatal depressed mothers

PPVT-R = Peabody Picture Vocabulary Test-Revised

RC= Rating Scale

RCT = Randomised Control Trial

SD = Standard Deviation

SF = Still Face

SF+T = Still Face and Touch

SLaM = South London and Maudsley National Health System Foundation Trust

SSRIs = Selective Serotonin Re-Uptake Inhibitors

ZPD = Zone of Proximal Development

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Dedication

I dedicate this PhD to my parents and my sister Eleni, who have given me more than they will ever know.

Ethics Declaration

The research for this project was submitted for ethics consideration under the reference PSYC 18/ 321 in the Department of Psychology and was approved under the procedures of the University of Roehampton's Ethics Committee on 09.01.19.

I hereby declare that this thesis represents my own work and does not, to the best of my knowledge, infringe upon anyone's copyright. The material included in this volume has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted. Where information has been derived from other sources, I confirm that this has been indicated in the thesis; it has correct use of sources, references and quotes, and contains all relevant literature which has been used in the reference list.

Vasiliki Eirinaki

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Chapter 1: Introduction

1.1 Impact Statement

Postnatal depression (PND) is the most common complication observed in women following delivery (Barsky & Silbersweig, 2017; Rai et al., 2015; Arifin et al., 2018; Makkar, 2018; Hahn-Holbrook et al., 2018; Rasmussen et al., 2017), affecting approximately 17% of mothers (Sholey et al., 2018). Research shows that mothers with PND are less involved in enriching and educational interactions with their infants, such as play, singing songs, face-to-face contacts and smiling (Paulson et al., 2006; Lovejoy et al., 2000; Humphreys et al., 2018; Field, 2010; Muzik et al., 2017; Deave et al., 2008; Music, 2011). These deficits in mother-child interactions have been found to negatively affect the child's development of verbal and non-verbal communication skills (NVC) (Colegrove & Havighurst, 2017; Stein et al., 2010; Beebe & Steele, 2016; Sohr-Preston & Scaramella, 2006). Hence, children of mothers with PND are at increased risk of poor developmental outcomes, such as emotional difficulties as well as poor cognitive capacities, language outcomes and academic attainment (Alhusen et al., 2013; Music, 2011; Sohr-Preston & Scaramella, 2006; Kawai et al., 2017; Colegrove & Havighurst, 2017; Milgrom et al., 2014; MacLean et al., 2014). However, there exists only limited research focused on infants' verbal and non-verbal communication skills during interactive activities with mothers with PND, especially in the context of an inpatient Mother-Baby Unit (MBU). The novel aspect of this study is that it focused on a neglected population (Pawlby et al., 2010) – that is, infants and their mothers who suffer from PND sufficiently to warrant hospitalisation in an MBU.

MBUs provide psychiatric care for mothers with severe mental health problems, including PND, and therapeutic input for mothers in order to address their relationship difficulties (Kenny et al., 2013). In this inpatient ward, mothers are admitted with their babies, and the mother-infant interaction is video-recorded for interventions purposes (Pawlby et al., 2010). For the purpose of this study, pre-existing video footage from the largest MBU in the UK, which contains recordings of mothers with PND interacting with their babies, was used. A comparison group of mothers without PND interacting with their infants was video-recorded to illustrate the differences in the interaction between mothers with PND and their infants. While the pre-existing videos from the largest inpatient MBU in the UK have been used in various studies in mother-infant interaction (i.e., Rigby et al., 2016; Kenny et al., 2013; Pawlby et al., 2005; 2010; Steadmann et al., 2007), this video-recorded material had thus far not been analysed in terms of the infants' non-verbal and verbal communication skills that are linked to child development. To fill this gap, this study provides a detailed examination of the use of verbal and non-verbal communication skills in infants during play with their mothers in this population.

To our knowledge, this is the first study focusing on inpatient mothers with PND and their infants to provide a detailed examination of the main modalities of communication (i.e., vocal, affect, gaze and touch) that are catalytic for forming their relationship and enhancing their well-being (Rocha et al., 2020; Puura et al., 2019), while also taking into account emotional qualities, such as mother-infant reciprocity, maternal sensitivity and infant self-regulation. Also, it was considered essential to investigate parallel maternal and infant verbal and NVC behaviours in both groups, so as to produce a comprehensive picture of the interrelated maternal and infants' communication cues. Specifically, there is evidence that maternal verbal and NVC behaviours play a significant role in and set the foundation for the development of infants' verbal and NVC skills (Colegrove & Havighurst, 2017; Stein et al., 2010; Trevarthen & Aitken, 2001; Tronick, 1989; Tronick and Weinberg, 1997).

The findings of this study will add to the literature on the importance of mother-infant interaction, contributing to early childhood outcomes in vulnerable women with PND and their infants. An enhanced understanding of the impact of this interaction in samples of infants at risk for poor developmental outcomes is of importance for promoting child well-being and designing intervention. The research findings will contribute to the improvement of treatment options focused on enhancing mother-child relationship among mothers with PND through play, song and face-to-face contact, thereby promoting a better quality of life for this population.

Ultimately, the findings of the present study may make an important contribution to the improvement of existing policies on early intervention with disadvantaged children whose mothers suffer from PND. Although the UK was one of the first countries where early intervention and prevention were a national policy focus, early intervention began to develop significantly only from the 1990s onwards (Bate, 2017). In 2016, the then prime minister gave a clear indication that early intervention and prevention had to become a central agenda in educational and NHS settings, highlighting the importance of working with children under 5 (Bate, 2017). Thus, this study is highly relevant to the current climate of early intervention and prevention for at-risk groups in both educational and clinical settings.

1.2 Aims and Research Questions

The principal aim of this research project is to examine the effect of maternal PND on both mother-infant interaction and infant development – with a focus on infants' non-verbal and verbal communication skills – through the lens of a particular sub-category: mothers with severe PND who have been hospitalised with their infants (aged 3-12 months) in an MBU. A comparison group of mothers without PND interacting with their infants (aged 3-12 months) were recruited to illustrate the real differences (both strengths and challenges) in the interaction between mothers with PND and their infants. For the purpose of this research, video-recorded material that contains footage of mothers (with and without PND) interacting with their infant during a play session was used. More specifically, a total of 52 videos (22 videos of infants and mothers with PND, and 30 of infants and mothers without PND) were analysed and compared.

For the data analysis, valid and reliable assessment tools were used (i.e., Infant CARE-Index [Crittenden, 2005], Global Rating Scale [Murray & Karpf, 2000]). Furthermore, a micro-analytic approach served to evaluate infants' communication skills, as well as to assure the detailed examination of complex and extremely rapid behaviours that occur during mother-infant interaction.

Overall, this study aims to address four main research questions:

1) Are there any differences in the quality of mother-infant interaction between mothers with and without PND and their babies?
2) Do infants of mothers with PND differ in their non-verbal communication skills when compared to infants of mothers without PND?
3) What is the impact of PND on maternal vocal behaviour and, consequently, on infants' verbal communication skills?
4) Do infants of mothers with PND differ in terms of the ways in which they use a toy during a play interaction with their mothers when compared to infants of mothers without PND?

Four different studies, which stemmed from the above-mentioned research questions, were conducted. The aim of Study 1 was to present an overall picture of the quality of interaction between mothers with and without PND and their infants, as well as to explore in depth what emerges from this kind of interaction. To address the second research question, Study 2 explored the effect of PND on infants' verbal communication skills through the prism of maternal vocal behaviour, including maternal speech and singing. Study 3, which examines the third research questions, aimed to explore the differences in infants' non-verbal communication skills as linked to mother-infant interactive behaviours organised around the play situation between the two groups (i.e., infants and mothers with PND, and infants and mothers without PND). Finally, Study 4 investigated how mother-infant play interaction was organised around the use of toys in the case of PND and its impact on infants' verbal and non-verbal communication skills. A comparison between the clinical and the comparison group took place to illustrate the real differences.

1.3 Worldview

The present research project combined qualitative and quantitative methods; it is essential, therefore, to identify the theoretical framework that embraces and integrates these different perspectives (Yardley & Bishop, 2017). According to the literature, the philosophical framework that contains the cluster of beliefs, way of thinking and methodology that guide the practice of research is called 'worldview', or synonymously 'paradigm' (Bryman, 2016; Creswell, 2009). In particular, Morgan (2007) defined 'paradigm' as 'systems of beliefs and practices that influence how researchers select both the questions they study and the methods that they use to study them' (p. 49).

This study was designed in line with the beliefs and values of the pragmatic worldview, which serves as the basis for combining quantitative and qualitative inquiry (Biesta, 2010; Yardley & Bishop, 2017). As a philosophical underpinning for mixed-method studies, the pragmatic paradigm emphasises the relevance of the research question while focusing on the use of multiple approaches for collecting and analysing data in order to provide the best possible understanding of the research problem (Creswell, 2009; Creswell & Plano Clark, 2011). This pluralistic nature of the pragmatic paradigm and its (Tashakkori & Teddlie, 2003) comply with the main aim of mixed-method research design, which is to achieve a more complex understanding of the phenomenon under study (Shannon-Baker, 2015; Creswell & Plano Clark, 2011; Morse & Niehaus, 2009), while highlighting the need for practical application (Tashakkori & Teddlie, 2003). Therefore, the pragmatic approach is considered appropriate since this study argues that an enhanced understanding of the impact of the mother-infant interaction in samples of infants whose mothers suffer from mental health issues is pivotal for thinking about how best to promote mother-child well-being and to plan intervention accordingly.

According to Creswell and Plano Clark (2010), more than one worldview can be used in mixed-method research. Hence, adding to the pragmatic paradigm, this research was also conceived in line with elements of the post-positivist paradigm. The aims and methods of these two worldviews adopted in this study can be deemed fundamentally compatible. Similar to the pragmatic approach, post-positivism is a pluralistic and flexible research perspective that supports the use of multiple research methods in order to examine the variables that underpin the research questions and hypotheses (Panhwar et al., 2017). The integral elements that constitute the post-positivist approach are as follows: studying the individuals' behaviour, careful observation and measurement, and identification of causality and its effects or outcomes (Cohen et al., 2017). The knowledge that develops through a post-positivist lens derives from the above-mentioned elements (Creswell, 2009) and aims to provide a better understanding of the factors that influence humans' behaviour and ways of thinking (Yardley & Bishop, 2017). Since the exploration of the sensitive nature of the mother-infant interaction through video observation is at the core of this research, post-positivism constitutes a suitable approach for the present study.

The combination of the practice-oriented focus of the pragmatic paradigm and the object-oriented focus related to the realist perspective of the post-positivist paradigm presented the most suitable path to guide and enrich the research design's development. Both pragmatic and post-positivist worldviews contain elements that enable the researcher to adopt a pluralistic approach and to apply complementary methods of data collection and analysis in order to best address the aims of this research. In addition, the fact that these two worldviews support the enhancement of understanding of humans' behaviour and are oriented towards practice make them aptly aligned with the Froebelian thinking that frames the present research project, as Froebelian worldview contributed to the most radical and fundamental changes in both educational theory and practice that took place during the eighteenth and nineteenth centuries (Kibor, 2004).

Friedrich Froebel (1782-1852) was one of the most influential educationalists of the nineteenth century (Wetson, 1998), greatly contributing to our knowledge and understanding of children's behaviours and needs (Read, 2018). He is among the pioneers who shaped and still influences Early Years Education (El Gemayel, 2020; Department for Education, 2021), while his child-centred educational approach has had significant impact over the centuries (Kibor, 2004). In particular, Froebel recognised the need for a stimulating environment in which children can grow, learn and flourish (Lilley, 1967). Thus, he became 'the father of the kindergarten' (Russell & Aldridge, 2009) and the first to provide a structured curriculum focused on children's physical and mental development (Smith, 2002). He also inspired a new understanding of the importance of play in child development; therefore, he was one of the key 'play pioneers' (El Gemayel, 2020).

Furthermore, Froebel pioneered the method of keeping detailed records about observations of babies (Tovey, 2018); he developed his ideas and theories through observing children (Werth, 2018), as a means of gathering important information about children's needs and abilities that could in turn guide the primary care-givers and teachers in how best to support the child (Tovey, 2020; Whinnett, 2020). Moreover, the importance of mother-infant interaction during infancy played a central role in Froebel's educational approach, with the mother holding a catalytic role in the child's learning process (Dyke, 2019). The death of his mother before he had reached the age of 1 made him deeply value the importance of the maternal role and the presence of a feminine figure in a child's life, education and well-being (Werth, 2018; Manning, 2005). Consequently, he established the first training college for women-teachers in the world (Leibschner, 1993).

Overall, the pragmatic and post-positivism worldviews along with the Froebel's theory as theoretical framework guided the research decisions and have been pivotal both to the approach of this project as well as to the analysis of the findings. The following section will discuss the Froebelian theory in detail, focusing on his beliefs regarding the maternal role, maternal singing and play in child development; concepts that are at the core of this research project.

1.4 Froebel's Theory as Theoretical Background

Froebel, through his work with children, developed progressive ideas that cultivated an idealist philosophy of early childhood education, a philosophy that is governed by specific values and principles and has laid the foundation for modern education. This section presents and discusses some of the key values of Froebelian theory (i.e., maternal role, maternal singing and play) by revisiting his theory and integrating it with the contemporary literature. In particular, the following sections will look closely at the Froebelian approach regarding the importance of the maternal role, maternal singing and play in child development, which constitute strategic themes of his theory that also intersect with the present study. The last part of this section elaborates on how this study's focus on mother-child interaction, which includes specific activities, makes it aptly aligned with Froebelian principles, as it embraces the notion that play and family relationships hold a central role in every child's integral development and well-being. Ultimately, and in accordance with Froebel's principles, the main aim of this research is to support the right of every child to achieve his/her full potential.

1.4.1 The Maternal Role in Froebel's Theory

The maternal role as first educator in the child's life is of fundamental importance in Froebel's theory (Werth, 2018). Accordingly, an integral part of the maternal role is to secure a safe, stimulating and educational environment for her child (Ellighton, 2002) where the child will be able to form close, trusting and intellectually engaged relationships, enabling them to flourish and live a fulfilled life (Tovey, 2016). Froebel's belief in the essential role of mothers for the child's well-being is evident in his words: 'Mothers know that the first smile marks an epoch in child development, for it comes, not from self-feeling only, but from a social feeling also' (Froebel, in Liebschner, 1985, p. 38). Specifically, Froebel saw mothers not only as helpers, but also as orchestrators of children's learning and development (Bruce, 2012); he supported that education does not only take place in schools (Bruce & Dyke, 2017), but that the starting and most crucial point is in the years of infancy and early childhood (Kibor, 2004), during which the mother and the infant are learning together (Dyke, 2019).

Froebel adopted an innatist view of mothering (Froebel, 1886), according to which there is a dominant natural maternal state that enhances the maternal ability to instinctively and naturally parent well (Werth, 2018). The following quote encapsulates his key ideas about innate yet latent mothering:

> Without any teaching, without any demands, without any learning, the natural mother does this spontaneously; but that is not enough: it is necessary, besides that she should do it as a conscious being ... Therefore, placing before her what she has unconsciously done according to its nature, its significance and its connection, may bring her to

> consciousness. True, the most simple mother could do this; but observing mothers could do still more truly, completely, and deeply; yet through incompleteness man mounts to completeness. So this bringing forward the mother's work may awaken true, silent, thoughtful, and reasonable parental love, and bring us to an insight and consciousness of the course of development in our childhood in an entire presentation of its expressions. (Froebel, 1885, in Werth, 2018, p. 66)

As derived from his statement, Froebel recognised that the maternal instinct is embedded in feminine nature, and this in turn underpinned his reasoning about training women to become early childhood teachers in order to reinforce children's learning experience under the supervision of a caring and sensitive adult (Werth, 2018). Froebel also aimed to transform parenting from an unconscious process to a conscious one; he believed that parents, especially women, should acquire a better and in-depth understanding of the importance and function of child-care, which would help them raise their children more effectively (Werth, 2018). However, it is worth mentioning that one of the key Froebelian principles supports 'respect for parents rather than passing judgement and seeing them as deficient in their skills in bringing up their children' (Bruce, 2019, p. 127). To illustrate this point, Froebel did not aim to teach people how to be parents; rather, his primary goal was to strengthen and empower parental abilities (Tovey, 2016). For instance, according to him, an effective way was to encourage parents to develop a close and respectful partnership with practitioners as well as to become active members of a learning community – all with the shared aim of providing children with the opportunity to receive better education (Tovey, 2016).

One powerful Froebelian principle refers to unity: 'it is all unity; everything is based on unity, strives towards and comes back to unity' (Froebel, in Lilley 1967, p. 45). According to this principle, home/family, educational settings and community should be closely connected, united and in harmony, so that children can learn about unity and wholeness through their personal meaningful experience of it (Werth, 2018). Froebel therefore held the belief that parents and educational practitioners working together could constitute a powerful force of positive change in children's learning experiences, by providing them with the most favourable conditions during the educational process (Bruce & Dyke, 2017; Werth, 2018). In particular, educators and parents working in collaboration could exchange useful information derived from observations about the children's specific strengths and difficulties, so that they could decide on the most fulfilling and effective ways to help and support young children learning and developing optimally (Tovey, 2016).

Being aware of each child's unique needs, both parents and professionals should secure a stimulating environment in which the young children can be exposed to a wealth of experiences that in turn contribute to their development and learning (Bruce, 2012). In parallel, Froebelian pedagogy argued for the determent role of significant adults to provide young children with freedom and guidance in order to help them become autonomous and able to lead a rich intellectual life (Bruce, 2012). In other words, Froebel highlighted that a combination of freedom, support and guidance presupposes the mothers' ability to 'give the right help in the right way at the right time' (Bruce & Dyke, 2017, p. 27). In the literature, this is nowadays referred to as maternal sensitivity and responsiveness, and there exists a substantial body of research indicating their catalytic role in mother-infant bonding and well-being, as well as in child holistic development (for further information, see Chapter 4, Section 4.2) (Vaever et al., 2020; Verhage et al., 2016; Bernard et al., 2018).

Overall, one of the most salient Froebelian principles is the integrity of childhood in its own right (El Gemayel, 2020). Due to his personal difficult childhood experiences, Froebel devoted himself to improving children's lives through educational activities and the development of trusting and loving relationships (Tovey, 2016). Froebel placed great emphasis on the role of the mother as the first educator. According to him, her role should be in line with and inextricably linked to the role of the entire family, educational professionals and the community, so as to help children expand their knowledge and interests in educationally worthwhile ways (Werth, 2018; Bruce, 2012). He was fond of asserting that one of the most efficient ways to enhance a child's knowledge and development was through maternal singing (Powell & Gooch, 2015). The Froebelian approach encourages spontaneous singing as a pedagogical tool (Dyke, 2019; Powell & Gooch, 2015), and the following section will discuss Froebel's ideas about the significant role of maternal singing in the child's well-being through the prism of the current literature.

1.4.2 Maternal Singing in Froebel's Theory

Maternal singing has been found to be ubiquitous across different historical periods and cultures (Trehub et al., 2002; Shenfield et al., 2003; de l'Etoile, 2006). This universal care-giving behaviour has been documented throughout time (de l'Etoile, 2006; Trehub, 2001; Lewkowicz, 1998). More specifically, the prioritising of maternal singing has a long tradition dating back to Froebel (1782-1852) (Ouvry, 2012). In the nineteenth century, Froebel, highlighting the importance of maternal singing for child development, published a book of songs and hand activities, *Mutter und Koselieder* (Froebel, 1843), which was especially designed for mothers of infants and very young children (Powell et al., 2013). Froebel's book *Mother songs and movement games* intended to promote such educational activity enhancing the child's learning experience (Powell & Gooch, 2015). The content of (his) songs conveys for the mother-infant pair a better understanding of their relationship, their link to the environment and, finally, their position in the world (Powell et al., 2013). Froebel actively encouraged mothers and teachers to use singing in their interaction with children in order to emotionally connect with them and reinforce their development (Bruce, 2012):

> You long to nourish your baby's feelings, to stir the pulses of his heart. … In some way, in some slight degree, you must make him feel the love which inspires all you do. Hence, as the little play goes on, you begin to sing; and love, the melody of the heart, is revealed in the melody of the voice (Froebel, 1895, p. 74).

Since Froebel's time, a large body of research has been conducted, indicating that already from birth mothers universally use a sing-song version of speaking to communicate with their infants, known as 'motherese' or 'infant directed speech' (Bruce, 2012; Music, 2011). This musicality in mother-infant communication strengthens their bonding and facilitates the infant's emotional and cognitive development (Malloch & Trevarthen, 2009). In addition, it has been suggested that maternal singing is developed directly out of motherese (Falk, 2004) (for further information about the importance of infant directed speech in mother-infant interaction and infant development, see Chapter 5, Section 5.5).

In line with the Froebelian approach, evidence shows that the practice of maternal singing persists across cultures and historical periods, having traditionally been an integral part of the mother-child daily routine (Shienfield et al., 2003). This is supported by current research findings; indicatively, Custodero et al. (2003), using a sample of over 2,000 families, showed that 60% of the participant parents were playing music or singing to their babies every day, while 32% reported these activities on a weekly basis. Of the 88 mothers interviewed by Young (2008), 88% reported that they sang to their babies. In a study conducted by Ilari (2005), 100 mothers were interviewed; they stated that singing was the main way in which they engaged with their baby musically. Also, in a study by Street et al. (2003), not one single mother out of the 91 participants did not ever sing to her baby. Finally, the findings of Persico et al. (2017) showed that during pregnancy 55.4% of the women sang lullabies 1-3 times per week, 22.9% 4-5 times per week, and 21.7% 6 or more times. These findings highlight that maternal singing forms part of the daily routine even in the prenatal period.

Recent research has also corroborated Froebel's emphasis on singing as an effective vehicle of emotional communication between mother and infant in the first year of life (Powell et al., 2013; Creighton et al., 2013). Regarding the mother-infant relationship that Froebel valued so deeply (Werth, 2018), he purported that the act of singing promoted the affectionate bond and emotional connections between the mother and the infant (Powell et al., 2015). In particular, in these singing encounters, the baby learns to listen, pay attention and show interest in those caring for them (Powell et al., 2015; Ouvry, 2014). The current literature confirms the importance of maternal singing, suggesting that infants direct and sustain their attention to their mothers during maternal singing, and this in turn creates a reciprocal communication and more intense engagement between them (Fancourt & Perkins, 2017; de l'Etoile, 2006a). Maternal singing can, therefore, promote mother-infant bonding (Fancourt & Perkins, 2017).

Froebel also saw singing as a pedagogical tool that contributed to language and social development (Powell & Gooch, 2015). Recent research shows that language nutrition through maternal singing is crucial for children's neurodevelopment, including cognitive and language abilities (Sun et al., 2016). Moreover, given that Froebel emphasised physical and aesthetic knowledge (Bruce, 2012), his mother songs aimed to enhance the infants' awareness in terms of their physical self, by using hand activities (Bruce and Duke, 2017; Ouvry, 2012). Hence, Froebel conceived of singing as an opportunity for the child's self-expression and experimentation with oneself and the surroundings:

> But singing is no less essential. For even the easily resulting and again easily vanishing, echoing tone produced in one's own throat or by one's own members or by ringing and resonant objects (glass, bell, metal, etc.) must serve for creative representations of inner conceptions, sensations, feelings and indeed ideas (Froebel, 1899, p. 62).

Froebel also conceptualised the cultural value of songs in terms of the infants' link to the environment and their position in the world. In particular, he created songs with content relevant to nature, occupation and everyday people's life (Bruce & Duke, 2017). Consequently, he turned songs for children into powerful ways of connecting with, learning about and participating in cultural events (Dyke, 2019; Tovey, 2016). Ouvry (2012) argued that, based on Froebel's theory, songs convey a means to create meaningful connections among home, early-year educational settings and community. Recent literature, in line with Froebelian theory, suggests that songs serve as a means of enculturation in terms of musical, conceptual and social aspects that promote family traditions (Byrn & Hourigan, 2010), while nowadays children could also be introduced to different cultures through songs (Dyke, 2019).

Froebel firmly believed that songs contributed to physical, social, cognitive and spiritual child development (Baidya et al., 2015), and over the years his view has repeatedly been supported by a large body of research in the field. Indicatively, the Froebel's Trust Baby Room Project (2013-2015) demonstrated the educational benefits of singing in child development and well-being; it also revealed that singing reinforces closeness and connectedness among families, infants and practitioners (Powell et al., 2015). Similarly, Bruce and Spratt (2011) stated that Froebel' s mother songs and movement games, which currently are described as action songs, 'encourage creativity, memory, sensitivity to others, coordinated movement, communication, an increased vocabulary, language development, music, dance and drama, as well as sequencing, predicting and an awareness of detail and anticipation' (p. 101). The fact that maternal singing enhances child holistic development – including emotional, social, intellectual and physical development (Bruce, 2012) – resonates with one of the main Froebelian principles; according to Froebel, there is a certain unity in children's learning (Bruce, 2012; Ouvry, 2012), and maternal singing is one of the vital mechanisms for promoting child development (Powell & Gooch, 2015).

Undoubtedly, Froebel's nineteenth-century ideas about maternal singing as well as one of his main principles that babies need to sing and be sung to (Powell & Gooch, 2015; Ouvry, 2014) are still relevant. While there exists a large body of research supporting that maternal singing to infants is universally dominant in the course of care-giving (Trehub et al., 1993; Dyke, 2019), a growing body of literature documents the equal importance of maternal singing both for child development and the mother-child relationship (i.e., Blumenfeld and Eisenfeld, 2006; Bellieni et al., 2007; Cevasco, 2008; McDonald et al., 2009; Carolan et al., 2012; Hernandez-Reif et al., 2018). Recognising the importance of maternal singing, the present research investigated the qualities of this activity between mothers with PND and their infants, and the respective effects on their interaction (for further information, see Section 5.10.3). The following section will focus on another activity – that is, play in childhood, which also lies at the core of both Froebelian philosophy and the present study. This activity will be discussed in light of the recent literature.

1.4.3 Play in Froebel's Theory

Froebel, through his radical and innovative ideas, was among the first who recognised the importance of play as a fundamental element in child development and learning (Tovey, 2016) and established play as a pedagogical tool (Kuschner, 2015; Werth, 2018). According to Gutek, 'Froebel's exaltation of the role of play was a striking different approach from that of many conventional educators up to the nineteenth century … [he is] one of the pioneers in legitimizing the concept of play in Western educational history' (1997, p. 249). Froebel, as a passionate advocate of play (Brehony, 2013), placed this activity at the core of his educational philosophy from infancy to childhood (Bruce & Dyke, 2017). He valued play as the highest form of learning that would foster child development holistically (Brown, 2012; Bruce, 2012), and this is clearly articulated in his writings:

> Play is the highest level of child development. It is the spontaneous expression of thought and feeling, and an expression which his inner life requires … It promotes enjoyment, satisfaction, serenity, and constitutes the source of all that can benefit the child … At this age play is never trivial; it is serious and deeply significant. (Froebel, 1885, p. 30, in Lilley, 1967).

Froebel believed that play cultivated children's inner world through connections to external stimuli, encouraging creativity, imagination, experiment and problem-solving, as they moved into the future (Walsh et al., 2002). Through play, children learn to reflect, innovate and think in an abstract way, so that they gradually become competent symbol users and makers (Bruce, 2012). In parallel, Froebel recognised children as part of the community from the very first day of their lives (Werth, 2018). Therefore, he saw play not only as a way for children to externalise their inner nature and gain self-knowledge (Ellighton, 2002), but also as a way to better understand others and the 'whole universe' (Smeldey & Hoskins, 2019). In Froebel's view, 'play is an integrating mechanism which makes learning whole and not compartmentalised and fragmented' (Bruce, 2012, p. 14).

Froebel, through his observations, inspired a new approach and understanding of the significance of play in a child's learning process, by emphasising the need for manifold experiences related to play in order for the children to achieve awareness of themselves and the world (Lilley, 1967). His belief in the imperative need for meaningful play in which the child can be actively engaged, led him to make a significant contribution to education by inventing 'gifts' and 'occupations' (Provenzo, 2009; Correia & Fisher, 2014). The development of these pedagogical objects and purposes stemmed from three governing tenets in Froebelian philosophy: unity, respect and play (Manning, 2005). In particular, 'gifts' are specifically designed objects such as balls, free-standing wooden blocks and other materials (Saracho, 1991), while 'occupations' are activities that include, for instance, the use of clay, sand, water, sewing and paper-folding (Bruce & Dyke, 2017) and are designed to reinforce the learning derived from play with the 'gifts' (Manning, 2005). Recognising the importance of the use of objects in play, Froebel stated in relation to the perceived educational benefits of 'gifts':

> By means of this manifestation of form and movement these solids and the play with them give many opportunities for the observation and consideration of form, size and number (particular for a somewhat advanced stage of childhood), and in many ways introduce the child into the phenomena of nature and life around him. They are therefore, as it were, the middle point and source of the later training for school and life, as well as for the union of these. (Froebel, 1899, p. 317)

The engagement with Froebel's 'gifts' and 'occupations' has great positive impact on children's holistic development (Vallotton et al., 2016), with recent research revealing that these activities enhance child cognitive development and mathematical ways of thinking (Jeynes, 2006; Weida, 2013), sensory-motor development (Jeynes, 2006; Bakker, 2013), language development (Manning, 2005), as well as social development, by reinforcing working with others in an effective way (Tovey, 2016). In addition, the engagement with these 'gifts' and 'occupations' leads to an exploratory and progressive learning (Werth, 2018) that contributes to children's development of imagination (Weida, 2013), creativity (Read, 2013), symbolic representation (Whinnett, 2012), drawing abilities (Weida, 2013) and interconnectedness (Wellhousen & Keif, 2001). Overall, Froebel's theory of the beneficial role of play, including free-play and play with objects, in child development resonates with the findings in the current literature. Chapter 7 will discuss in detail the significance of play and includes a literature review on this topic, confirming that Froebelian theory is still relevant, in that it has inspired many theorists over time (for example, Vygotsky) and that it finds support from recent scientific evidence.

Finally, as mentioned above, an important component of the Froebelian approach concerns the role of the mother in child development and early education (Werth, 2018). In interactive play, the mother needs to secure a safe and stimulating environment for the child in order to help him/her engage with and have an impact on the environment (Tovey, 2016). Through play with the mother, the child formulates a relationship with the external world (Bruce, 2019). The quality of this relationship depends on the unique conception of the environment that the child develops during the playtime (i.e., interesting/boring, safe/dangerous), and in this context, the role of the mother is of pivotal importance (Bruce, 2012). According to Froebel, as the mother constitutes the link between the child, the community and the wider word, she should encourage play, offer freedom with guidance and mutually enjoy this creative and productive play interaction that benefits the child holistically and helps him/her flourish (Bruce & Dyke, 2017). However, not all mothers are able to enjoy the play process with their children. There is substantial evidence that mothers with postnatal depression (PND) are more likely to display disengagement, anger and higher levels of hostile behaviours during play with their infants, in comparison to mothers without PND (Cornish et al., 2008; Oyserman et al., 2000; Reissland et al., 2005; Lovejoy et al., 2000). Therefore, PND interferes with the mothers' ability to promote children's emotional, cognitive and language skills by using play (Sohr-Preston & Scaramella, 2006; Rayment, 2013; Righetti-Veltema et al., 2003; Hipwell et al., 2005; McFadden & Tamis-LeMonda et al., 2013).

The principal aim of this study was to examine, within the Froebelian framework, the effect of maternal PND on the infants' verbal and non-verbal communication skills during common yet crucial activities – such as play, maternal speaking and singing, as well as face-to-face interaction – in child development. The research focused on a particular sub-category of mothers with PND – namely, mothers with severe PND who were hospitalised together with their infants in an MBU. The following section will discuss how the present study, endorsing Froebelian theory, attempts to take Froebel's ideas forward, by reflecting on the way in which they may be adopted and contribute to new scientific knowledge and understanding of young children's needs and development.

1.4.4 Froebel's Theory and the Present Study

The present research is based on the Froebelian approach, which places the child at the centre of attention, while it requires adults to have a comprehensive understanding of young children's needs. As Hoskins & Smedley (2016) pointed out, 'a Froebelian approach does not offer a prescriptive pedagogy, but rather sets out an understanding of young children, and of learning, which should guide and inform adults' interaction with them' (p. 3). Therefore, this research endeavours to arrive at a deeper understanding regarding the constellation of the needs of children whose mothers suffer from severe PND. This emotional disorder can negatively affect parenting skills, which in turn leads to the child's adverse socio-emotional, cognitive and language development (e.g., Kawai et al., 2017; Colegrove & Havighurst, 2017; Milgrom et al., 2014; Field et al., 2006; MacLean et al., 2014). However, according to Froebel, it is essential to enhance parental capacities rather than merely passing judgement about parents (Bruce, 2019). Embracing this Froebelian principle, the current research attempts to shed light on both maternal strengths and challenges in the case of PND, aiming to produce suggestions on how to empower and encourage them to activate and develop their parenting skills effectively.

Furthermore, concerning the care and education of children, Froebel's theory stresses the importance of play, the value of singing and the crucial need for high-quality interaction between the mother and the child (Bruce, 2012). These constitute central integrating elements in child development and learning. Consequently, the present research used play and maternal speaking and singing during mother-infant interaction as key research variables in examining infants' verbal and non-verbal communication with their mothers. This study focused on the educational aspect of the interactions; however, their emotional importance was also acknowledged and considered. In conjunction with this primary goal, another aim was to suggest how mother-infant interaction could be enhanced and how existing educational programmes can be adjusted to meet the needs of children whose mothers suffer from PND.

Specifically, in line with Froebelian principles and recognising their values, the research followed the proposition that an intellectually stimulating environment both at home and in educational settings is of pivotal importance for child development and personal fulfilment. Since, according to Froebel, every child has the right to achieve her/his potentials, the role of adults becomes to provide them with enabling contexts (Murray, 2018). Therefore, this research explored the possibility of applying the findings to a variety of contexts (i.e., home, Mother-Baby Units, educational settings). In particular, the aim of this study was to contribute to the promotion of children's overall well-being in both challenging and non-challenging environments and conditions, by building new and effective partnerships, one of Froebel's main principles (Werth, 2018).

Finally, this study offered an opportunity to revisit Froebelian principles, at a point in time after their initial conception and with the help of the more advanced research capacities that current technology offers (i.e., observation through video recordings), in order to demonstrate that his theory is still significant and relevant to education and child development research. Embracing the Froebelian view about the significance of child observation in early childhood, Tovey (2016) suggested that 'observations are important for the adult to think about, reflect on and perhaps question aspects of policy and practice' (p. 112). Today, even though care and education are child-centred and children's well-being lies at the core of educational programmes, there seem to be significant gaps in the provision of care for more disadvantaged children (Education Policy Institute, 2017). This research will hopefully contribute to the development of further and more robust initiatives concerning the psychosocial support of PND mothers and their infants, both at home and in clinical and educational settings, a necessary step towards a meaningful application of the primary Froebelian values.

1.5 Terminology

1.5.1. Postnatal Depression

Postnatal depression (PND) is a psychiatric disorder, typically characterised by a depressive episode occurring within the first year after birth (Dejong et al., 2016). While prevalence estimates vary (Swami et al., 2020), PND affects approximately 17% of mothers (Sholey et al., 2018). Chapter 2 is devoted to PND, providing a wider and in-depth understanding of the nature of this disorder. At this juncture, it is essential to recognise the number of terms that are currently being used to describe it, as well as the use of terminology found in this research. In the existing literature, PND also occurs as postpartum depression or maternal depression (Dejong et al., 2016), while the notion of 'mothers with PND' represents both mothers with and without a clinical diagnosis of PND. Specifically, a substantial body of research in the respective field has used self-report questionnaires to identify mothers with depressive symptoms (e.g., Mantis et al., 2019; Væver et al., 2015; Skotheim et al., 2013; Herrera, 2010; Reissland et al., 2005; Feldman et al., 2004; Carter et al., 2001; McMahon et al., 2001). This thesis adopted the term 'Postnatal Depression' (PND), while the use of this term for the clinical sample of this study refers to mothers with a clinical diagnosis of PND who have been jointly hospitalised with their infants in a Mother-Baby Unit (MBU).

1.5.2. Non-Verbal Communication (NVC)

NVC skills refer to the capacity to effectively convey and receive nonverbal information and are critical for forming and managing relationships (Colegrove & Havighurst, 2017). The coordination of the main expressive modalities (e.g., gaze, touch, facial affect and vocal tone) emerges toward the second month of life and marks the beginning of socio-emotional communication in infancy (Colegrove & Havighurst, 2017; Mantymaa et al., 2008; Colonnesi et al., 2012). NVC skills are integral components of the mother-infant relationship, enhancing their attachment (Schachner et al., 2005), while they contribute to maternal and infants' well-being (Colegrove & Havighurst, 2017). The present study focuses on the most salient NVC skills in infants – namely, facial affect, gaze, touch and vocalisations – and discusses in detail their significant role in the mother-infant interaction, as well as the effects of PND on the respective infants' developmental trajectories.

1.5.3 The Quality of Mother-Infant Interaction: maternal sensitivity, mother-infant reciprocity & general atmosphere

Departing from Bowlby's attachment theory (Bowlby, 1975; 1977), the scientific interest in the quality of mother-infant interaction has been significantly increased over the years. During the last decades, a great amount of research produced a variety of different constructs in order to portray the different aspects that influence and contribute to the quality of mother-infant relationship (for a review, see Provenzi et al., 2018). In the present study, all the variables under investigation, including maternal and infants' verbal and NVC behaviours, were taken into account in order to produce an overall picture of what emerges during the mother-infant play interaction that is inextricably linked to the quality of their interaction (Abney at al., 2017; Colegrove & Havighurst, 2017; Warlaumont et al., 2014; Weisleder & Fernald, 2013; Beebe & Steele, 2013). However, the quality of mother-infant interaction was also assessed separately through the prism of three specific variables; namely, maternal sensitivity, mother-infant reciprocity and general atmosphere. These variables are included into the reliable and valid assessment tools especially designed for evaluating the quality of mother-infant pattern of interaction that were used for the purpose of this study [i.e., the Infant CARE-index

(Crittenden, 2005) & the Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al, 1996b; Murray & Karpf, 2000)].

In the present field of research, maternal sensitivity is deemed one of the most fundamental dimensions in the quality of mother-infant interaction (for further relevant information, see Chapter 4, Section 4.3), and this renders maternal sensitivity one of the core variables in this context. The Infant CARE-index (Crittenden, 2005) was used to measure maternal sensitivity in a dyadic context for both groups and it is defined as follows: 'adult sensitivity in play is any pattern of behaviour that pleases the infant and increases the infant's comfort and attentiveness and reduces its stress and disengagement' (Crittenden, 2010; p. 4) (for further relevant information, see Chapter 3, Section 3.8.2).

In conjunction with maternal sensitivity, the present study evaluated two additional dimensions of the quality of the mother-infant interaction (i.e., mother-infant reciprocity and general atmosphere), using the Global Ratings Scales of Mother-Infant Interaction (GRS) (Murray et al, 1996b; Murray & Karpf, 2000). In the GRS, the reciprocity variable refers to 'the extent of mutual interchange between mother and infant. The infant's input is received and responded to by the mother and vice versa' (Murray & Karpf, 2000, p.8). In particular, the "reciprocity" variable rates the degree of joint orientation and co-ordination of the actions between the mother and the infant in achieving a task goal while the shared co-ordination and turn taking were also taken into account, making a very important contribution to this dimension (for further relevant information, see Chapter 3, Section 3.8.3.3).

Finally, the term "general atmosphere" of the interaction used in this research study refers to 'the extent of how harmonious or disharmonious (discordant and conflictual) the overall interaction between the mother and infant is', as defined by Murray and Karpf (2000, p.8). For the assessment of this dimension, the focus placed on the harmony between maternal and infants' feelings and the general emotional atmosphere created by them beyond their facial expressions during their play interaction. For example, if the infant, without expressing negative feelings, adopts a strategy of resisting, ignoring or avoiding the mother's initials, then the atmosphere in which this interaction takes place could be rated as discordant. Equivalently, if the mother and the infant are concentrated on the same task (e.g. play with blocks) without smiling while both enjoying the process of playing together, the atmosphere in which this interaction takes place could be rated as harmonious, agreeable and peaceful (for further relevant information, see Chapter 3, Section 3.8.3.3). This dimension was of pivotal importance for the current analysis, because it created a space where the researcher can reflect the feelings derived from each mother-infant interaction.

1.6 Organisation of This Thesis

This doctoral thesis opens with the present Chapter 1, which initially presents the rationale of this research, followed by its aims and the respective research questions that it attempts to address. This chapter also includes information about the research worldview, along with the theoretical background chosen for the purposes of this study. It closes with the presentation of the key terminology employed and the outline of its structure.

Chapter 2 contains the literature review on maternal PND, providing critical consideration of the risk factors that contribute to the development of this psychiatric disorder. Particularly, this chapter provides an overview of the history, definition, epidemiology and aetiology of PND. Information on treatment options and prognosis for mothers suffering from PND is also included. Subsequently, Chapter 3 discusses the methodology employed in the study. The overview of this study along with important considerations regarding study design – such as the participants' profile, the recruitment process and the data collection procedure – are presented. Moreover, ethical considerations that derived from focusing on vulnerable groups, such as infants and/or inpatient mothers with severe mental health problem, are discussed. Finally, Chapter 3 offers an overview of the measures and the data analysis process applied in the scope of this research.

In the context of this research project, four different studies were conducted, using the same sample to address the four main research questions and, thus, four different chapters emerged. Chapters 4 to 7 adopted an article-based format that consists of literature review, methodology and results sections, followed by a discussion of how the findings of each study are interwoven with and expand the existing literature on the respective topic. More specifically, Chapter 4 is devoted to Study 1, the aim of which was to provide a broad picture of the quality of interaction between mothers with and without PND and their infants, as well as to explore in depth what emerges from this kind of interaction.

Chapter 5 focuses on Study 2 which intended to explore the effect of PND on infants' verbal communication skills through the prism of maternal vocal behaviour, including maternal speech and singing. Chapter 6 is based on Study 3; the latter assessed the difference in mothers' and infants' NVC patterns between the two groups, by providing a detailed examination of the impact of PND on three different modalities of NVC (i.e., facial affect, touch and gaze) during a play interaction. Study 4 is integrated in Chapter 7 and considers the play-related behavioural patterns of infants and mothers with and without PND, as observed during their interaction. Together, the findings of these four studies create a comprehensive picture of the mothers' and infants' communication exchanges. These studies are also interconnected and captured how infants' verbal and NVC skills are shaped and influenced by the mother-infant interaction in the case of PND.

Finally, Chapter 8 presents the main findings of the four studies conducted within the framework of this research project and discusses them within the framework of Froebelian theory. It continues with the main strengths and limitations of this research project and concludes with manifold recommendations for future research. This thesis finally closes by discussing the implications of the research findings for policy and practice, which could inform professionals working with vulnerable populations, such as infants whose mothers suffer from severe mental health issues.

Chapter 2: Literature Review: Postnatal Depression

2.1 Introduction

Over the last decades, major strides have been made in the field of research dealing with maternal postnatal depression. The aim of this chapter is to provide a broader understanding of the nature of this disorder, including an overview of the history, definition, epidemiology and aetiology of postnatal depression (PND). Furthermore, information on treatment options and prognosis for mothers suffering from PND is included. Ultimately, the recognition and incorporation of maternal PND as one of the key variables in mother-infant interaction research has been the starting point for addressing the research questions of this study.

2.2 A Short History of Postnatal Depression

The first known reference to postnatal depression (PND) belongs to Hippocrates, in the fourth century B.C. (Sparks, 2013). Hippocrates referred to emotional difficulties in women during the postpartum period (Regus, 2007), as well as to the high risk that new mothers faced for an onset of ‘madness’ (Hamilton, 1962). Similarly, in the thirteenth century, Trotula, a female physician, in her attempt to describe and explain PND, wrote: ‘If the womb is too moist, the brain is filled with water, and the moisture running over the eyes, compels them to involuntarily shed tears' (Mason-Hohl, 1940, in Sparks, 2013, p. 3). The references to and medical interest in postnatal mental health difficulties continued over the centuries (O'Hara et al., 2014), with a major increase in the nineteenth century (Regus, 2007; O'Hara et al., 2014; Sparks, 2013).

In the mid-nineteenth century, the physician Jean-Etienne Esquirol reported in detail 92 clinical cases of postnatal melancholy and delirium (Makkar, 2018), while the psychiatrist MacDonald focused, for the first time, on the timing and acuteness of postnatal depressive symptoms (Sparks, 2012). However, one of the most important points in the medical history of PND occurred in 1858, when Marcé published 310 series of cases of women whom he had personally observed due to their perinatal mental health problems (O'Hara et al., 2014; Makkar, 2018). According to his findings, 9% of women suffered from depression during pregnancy, 58% in the postnatal period and 33% during the lactational period (Sparks, 2012). Marcé's remarkable work in the field of perinatal mental health is still remembered today, through the International Marcé Society for Perinatal Mental Health.

Throughout the twentieth century, the interest in PND among health professionals increased substantially, leading to numerous clinical and evidence-based research studies on the prevalence, aetiology and impact of PND on mothers, fetus, infants and their relationship. However, postnatal mental health disorders were finally incorporated in the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) only in 1994 (APA, 2000; Makkar, 2018). More specifically, while PND was first included as a distinct disease in the DSM-II in the 1960s, somewhat later, in 1980, it eliminated the category due to a lack of evidence of PND to warrant a separate diagnostic category in psychiatric diagnostic manuals (Kruckman & Smith, 2008). Interestingly, PND remains not distinguished as a unique diagnostic category; an onset specifier has been used, and PND is classified as 'Major

Depressive Disorder, with postpartum onset' and 'Major Depressive Disorder with peripartum onset' in the DSM-IV and DSM-V, respectively (Serge & Davis, 2013).

Over the past two decades, numerous government agencies in the European Union, Australia, America and Canada have produced guidelines specifically designed for the provision of care concerning mental health disorders that occur during the perinatal period – that is, pregnancy and the first year after birth (O'Hara et al., 2014). Perinatal mental health services have also been established, aiming at the prevention, detection and management of mental health problems in new mothers (Bate, 2017). Given that the effectiveness of perinatal mental health services and maternal services could have long-lasting and even trans-generational effect (Royal College of Psychiatrists, 2015), financial resources are warranted to improve this kind of services (Bate, 2017). Indeed, in 2016, David Cameron announced an investment of up to £290 million to enhance perinatal mental health services across the country, highlighting the profound importance of access to these services for all women (Bate, 2017).

2.3 Definition of Postnatal Depression

2.3.1 Three Common Forms of Postnatal Mood Illness

There exists a considerable amount of research supporting the notion that women are at greater risk of developing serious mood disorders during the postnatal period, more so than at any other time in their life (Kendell, 1987; Terp & Mortensen, 1998; Salmon et al., 2003). The three common forms of postnatal mood illness are as follows: (1) postpartum blues, also known as 'baby blues' or 'maternity blues', (2) postnatal or postpartum depression, and (3) postpartum or puerperal psychosis (Sharma & Burt, 2011; Norhayati et al., 2015; Roberson et al., 2003).

At one end of the spectrum stands the postpartum blues, which is characterised by emotional lability (Bass & Bauer, 2018). Postpartum blues is evident within the first week after delivery and usually resolves without intervention within 3 to 5 days (O'Hara & Segre, 2008;

Elliott, 2007; O'Hara, 2009; Bass & Bauer, 2018). At the other end of the spectrum lies postpartum psychosis, with an onset within the first month; its symptoms include disorganised thinking, psychotic thoughts, severely depressed mood and hallucination (Kendell et al., 1987; Munk-Olsen et al., 2006). Hospitalisation is usually included among the most appropriate treatment options for this disorder (O'Hara & Segre, 2008; Elliott, 2007; O'Hara, 2009). However, postpartum depression should be distinguished from postnatal psychosis and postpartum blues, since there are significant differences in their prevalence, onset, duration, treatment, classification and severity, as shown in Table 2.1 (adapted from Roberson et al., 2003). Because this chapter focuses on postnatal depression, only this mood disorder will be discussed in detail.

Table 2.1

Postpartum Mood Disorders

	Postpartum Blues	Postpartum Depression	Postpartum Psychosis
INCIDENCE	70-80%	10-20%	0.1-0.2%
ONSET	Within first week	Within first month	Within first month
DURATION	Mild depressive	2 weeks to 12 months	Variable
SYMPTOMS	2-3 days, resolves within 10 days	Severe depressive	Severe depressive with psychosis
SEVERITY	Mild dysfunction	Moderate to severe dysfunction	Severe dysfunction, considered psychiatric emergency
TREATMENT	No treatment necessary, reassurance	Antidepressant medication, psychotherapy	Antipsychotic medication,

			antidepressants, possibly inpatient hospitalisation
CLASSIFICATION	No considered psychiatric disorder	Considered psychiatric disorder	Considered psychiatric disorder

2.3.2 The DSM-V Definition

For more than three decades, a debate has been ongoing about whether puerperal mental health illnesses are separate, discrete nosological entities, or episodes of a mental health disorder that occur coincidentally in the perinatal period (Born et al., 2004; Rai et al., 2015). According to the medical model's classification, PND is not a discrete diagnosis, but the sub-category of a major depressive disorder with signs and symptoms generally similar to those in major depression occurring at any other time in life (Born et al., 2004; Howard et al., 2014; Roberson et al., 2003).

More specifically, the Diagnostic and Statistical Manual of Mental Disorders DSM-V (American Psychiatric Association [APA], 2013), describes the diagnostic criteria for major depressive disorder as presented in Table 2.2:

Table 2.2

Diagnostic Criteria for Major Depressive Disorder

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (l) depressed mood or (2) loss of interest or pleasure.
Note: Do not include symptoms that are clearly attribute to another medical condition.
1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful). (Note: In children and adolescents, can be irritable mood)
2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation)

3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. (Note: In children, consider failure to make expected weight gains)

4. Insomnia or hypersomnia nearly every day

5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)

6. Fatigue or loss of energy nearly every day

7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)

8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)

9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

C. The episode is not attribute to the physiological effects of a substance or a general medical condition.

Note: Criteria A-C represent a major depressive episode.

Note: Responses to a significant loss (e.g., bereavement, financial ruin, losses form a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss.

But what is the difference between major depressive disorder and PND? Both of the two internationally recognised classification systems for psychiatric illness, the DSM and the International Classification of Diseases (and Related Problems), or ICD, use an onset specifier and special code, respectively, that can be applied to all mood disorders, including major depressive disorder, in order to acknowledge the link between these disorders and childbearing.

2.3.3 Onset Specifier/Special Code in the Clinical Manuals for Mental Health Problems

In 1994, the postpartum onset specifier for major depressive disorder was introduced in the DSM-IV. In that edition, 'with postpartum onset' meant that the onset of the episode occurred within 4 weeks of delivery. In the DSM-IV-TR, the revised version of the DSM-IV, this course-specific designation – 'with postpartum onset' – did not change. Along the same line, the ICD-10 introduced the use of a special code (F53) for mental illnesses associated with puerperium; psychiatrists and clinical psychologists can use the special code – that is, F53 – only when the mood disorder occurs within 6 weeks postpartum.

One of the most important changes in the revised versions of the classification systems for psychiatric illness, the DSM-V and the ICD-11, is the inclusion of pregnancy as an onset specifier and special code, respectively. More specifically, the DSM-V onset specifier is now titled 'with peripartum onset', while the ICD-11 special code refers to 'mental or behavioural disorders associated with pregnancy, childbirth, and the puerperium, not elsewhere classified'. This change is in accordance with the recommendation made by mental health professionals in order to enhance the early detection of PND and, therefore, ensure the proper treatment and support for these women and their families. This has been a step forward, given that undiagnosed depression during pregnancy constitutes the main risk factor for PND (Leigh & Milgrom, 2008; Robertson et al., 2004)

It is worth mentioning, however, that the duration criterion (4 and 6 weeks postpartum, respectively) remains the same (Figure 2.1). This emerges as a limitation, since postpartum depressive symptoms may manifest weeks beyond the first month or persist for several months up to a year after delivery (Bass & Bauer, 2018; Sriraman et al., 2017). As result, in clinical practice and research, the specifier or special code is usually employed – beyond the restrictive time frame of 4 or 6 weeks and regardless of the classification systems criteria – for women with major depressive disorder onset within 12 months of childbirth (Winser et al., 2010; Woody et al., 2017; Gaynes et al., 2005). According to a recent review of the postpartum depression status published by O'Hara and McCabe (2013), the mood disorders workgroup of the DSM-V considered the extension of the time frame of the onset qualifier from 4 weeks to 6 months. However, such an extension cannot be supported due to the lack of available epidemiological evidence. Consequently, further research is needed in the field of postnatal mental health disorders in order to support the rationale for the extension of the postpartum-onset specifier/special code; this could result in better diagnosis, recognition and treatment, with significant positive impact on the mother, the infant and the entire family.

Figure 2.1

Comparison Between the Classificatory Systems for Perinatal Psychiatric Disorders (adapted from Parameshwaran & Chandra, 2018, p. 82)

ICD-10	DSM-IV	DSM-5	ICD-11
Mental and behavioral disorders	1. Mood disorders Major depressive disorder Bipolar I disorder Bipolar II disorder 2. Schizophrenia and other psychotic disorders 3. Brief psychotic disorder	1. Mood disorders Major depressive disorder Bipolar I disorder Bipolar II disorder 2. Schizophrenia and other psychotic disorders 3. Brief psychotic disorder	Mental behavioral and neurodevelopmental disorders (also, under complications predominantly related to puerperium) Mood disorders (depression, bipolar disorders; qualifier - current episode perinatal)
F53: Mental disorders associated with the puerperium, not elsewhere classified Not meeting criteria for other mental disorders because of a. Insufficient information b. Additional features making classification elsewhere inappropriate	Puerperal code - Postpartum-onset specifier: Can be applied to major depressive, manic, or mixed episode; or mixed episode in major depressive disorder, Bipolar I disorder, or Bipolar II disorder; or to brief psychotic disorder	Puerperal code - Peripartum-onset specifier: Can be applied to major depressive episode; manic episode; Bipolar I disorder; Bipolar II disorder; or to brief psychotic disorder	Mental or behavioral disorders associated with pregnancy, childbirth, and the puerperium, not elsewhere classified Syndromes associated with pregnancy or the puerperium (commencing within about 6 weeks after delivery)
Only when commencing within 6 weeks of delivery	Onset of episode within 4-week postpartum	Onset of the symptoms in pregnancy or 4-week postpartum	

ICD: International Classification of Diseases, DSM: Diagnostic and Statistical Manual of Mental Disorders

2.3.4 Additional Postnatal Depressive Symptoms

Having presented the postnatal depressive symptoms as they can be found in the classification systems for psychiatric illness (see Figure 2.1), it is important to add that in the literature the term PND also refers to a 'condition', implying a set of symptoms such as loss of appetite, sleep changes, negative thoughts, thoughts of harming the self or the baby, withdrawing for the partner and friends or family, loss of concentration, mood swings, overwhelming anger, intrusive and hostile behaviour towards the baby, feelings of inadequacy, feeling guilty, loss of self-esteem and inability to bond with the baby (Makkar, 2018; Westall & Liamputtong, 2011; Post and Antenatal Depression Association, 2010; Barnes, 2006; Dennis & McQueen, 2009; Halbreich & Karkun, 2006; Mancini et al., 2007; Patel et al., 2012; Schmidt, & Tolentino, 2018). These symptoms need to last for long periods of time and be diagnosed adequately by a mental health professional (Stoppard, 2014).

2.4 Prevalence of Postnatal Depression

Major depressive disorder is one of the most prevalent psychiatric disorders and affects 25% of women worldwide (Humphreys et al., 2018; Kessler et al., 2014). Along the same lines, PND is the most common complication observed in women following childbirth (Barsky & Silbersweig, 2017; Rai et al., 2015; Arifin et al., 2018; WHO, 2008; Makkar, 2018; Hahn-Holbrook et al., 2018; Rasmussen et al., 2017). In particular, Public Health England estimates that in the UK population, around 30 in every 1,000 women experience severe postanal depression and around 100 to 150 in every 1,000 women experience mild to moderate postanal depression while 2 in every 1,000 women experience postpartum psychosis or other chronic serious mental illness in the postanal period (House of Commons Library, 2021).

The widely cited prevalence rate of maternal PND is 13% (O'Hara & Swain, 1996); however, the accurate global or national prevalence rate of PND has yet to be established (Hahn-Holbrook et al., 2018). In particular, over the past three decades numerous studies have attempted to estimate a representative prevalence rate of maternal PND (Hahn-Holbrook et al., 2018; O'Hara, 2009). Yet, this rate varies dramatically across countries, and the global prevalence of PND is still unknown (Woody et al., 2017; Arifin et al., 2018). There is no clear explanation for the remarkable variation in PND prevalence estimates (Hahn-Holbrook et al., 2018), but several reasons render the prevalence of PND difficult to determine.

Firstly, the time onset criteria for PND varies; the DSM-V and ICD-10 use different time onset criteria when compared to the criteria used by health professionals and most epidemiological studies (see Chapter 2, Section 2.3.3) (Anokye et al., 2017; Brummette & Galea, 2016). Secondly, PND remains largely underdiagnosed and undertreated (Rasmussen et al., 2017; Rai et al., 2015; Marcus et al., 2003); one of the main reasons can be found in the fact that both mothers and health care providers underestimate the depressive symptoms, considering them as normal consequences of childbirth (Anokye et al., 2017; Banti et al., 2011). For instance, according to the study by Copper et al. (2003) almost 50% of mothers who independently had been diagnosed with PND were not identified as such by their health visitors. Thirdly, mothers themselves underreport PND, with only 20% of mothers who experience PND symptoms to report them to their care providers (Anokye et al., 2017). The mothers' reluctance to disclose their depressive feelings during this sensitive period of their life could be linked to the stigmatisation of a PND diagnosis, the fear of being a 'bad mother' (Anokye et al., 2017; Arifin et al., 2018; Chew-Graham et al., 2009) and the limited access to resources (Pereira et al., 2014b). Last, but not least, the methodology applied in epidemiological studies varies greatly; there exists significant variation in the definition, rating scales, screening instruments, timing of assessment, sampling methods and sociodemographic variances, which leads to inconsistent prevalence rates (Leathy-Warren & MacCathy, 2007; Woody et al., 2017; Banti et al., 2011; Gaynes et al., 2005; Gavin et al., 2005). For instance, most studies use self-report questionnaires – such as the Edinburgh Postnatal Depression Scale (EPDS) – to assess PND in mothers, rather than diagnostic instruments or clinical interviews; according to the literature, self-report measures tend to overestimate the PND prevalence rate (O'Hara & Swain, 1996; Shorey et al., 2018; Gavin et al., 2005; Woody et al., 2017).

2.4.1 Variation in PND Prevalence Rates

Numerous systematic reviews, meta-analysis and meta-regressions have been conducted to produce an accurate rate of PND prevalence. The largest research study was conducted first by O'Hara and Swain in 1996; this was a meta-analysis of 59 studies, with a total number of 12,810 participant mothers from different countries. It estimated that the overall prevalence rate of PND is between 10 and 15%. This appears to be the most widely cited prevalence rate of maternal PND (Hahn-Holbrook et al., 2018), despite the fact that it was overwhelmingly based on Western samples (Arifin et al., 2018; Hahn-Holbrook et al., 2018). O'Hara and Swain's (1996) findings are consistent with the findings of a recent review conducted by Underwood et al. (2016), which showed that the pooled prevalence of depression in the postnatal period is 13.1%. Similar findings were revealed by Woody et al. (2017); this study included 140 usable prevalence estimates from 96 different studies and suggested that 10-15% in every 100 women exhibit depressive symptoms following childbirth.

However, evidence shows that the prevalence of 10-15% underestimates the rates of PND in the word's population (Arifin et al., 2018; Hahn-Holbrook et al., 2018). Recent studies have indicated an increase in the rate of PND prevalence, which deserves further attention. The largest meta-analysis and meta-regression to date, of 291 studies from 56 countries, was conducted by Hahn-Holbrook et al. in 2018 to estimate the global PND prevalence.

Highlighting the profound heterogeneity between studies, this study found a pooled global PND prevalence of 17.7%. It is worth mentioning that all papers included in the review reporting PND prevalence were based on use of the EPDS. This emerges as a limitation of this study, given that, as mentioned above, it has been proven that the use of self-report questionnaires could overestimate the rate of PND prevalence (O'Hara & Swain, 1996; Shorey et al., 2018; Gavin et al., 2005; Woody et al., 2017). A similar rate was reported in another recent study (Sholey et al., 2018), which finds that the overall prevalence of PND amounts to 17%. The study by Sholey et al. (2018) is the first review that focuses solely on mothers without prior history of psychiatric disorder, who had given birth to healthy infants. On the contrary, a much lower rate was found in the study by Rasmussen et al. (2017) on postpartum affective disorders, including PND, in a nationwide cohort of mothers with no prior psychiatric history. The findings supported that an episode of postpartum affective disorder was observed for 0.6% of primiparous mothers.

2.4.1.1 Socio-Economic Factors. Depending on the inclusion criteria, there is great variation in the PND prevalence rate, ranging from 4.4% to 73.7% (Leahy-Warren & MacCathy, 2007). The use of socio-economic factors as part of inclusion criteria revealed that the prevalence of PND in low- and middle-income countries is significantly higher than that in high-income countries (Makkar, 2018). More specifically, the pooled prevalence reported in low- and lower-middle-income countries is approximately 19.7% (Fisher et al., 2012; Gelaye et al., 2016), while in high-income countries it ranges between 8.7% and 13% (Lanes et al., 2011; O'Hara and Swain, 1996). This finding is in line with the those of a recent study, according to which the pooled prevalence of PND was significant higher in low- and middle-income countries, with a rate of 18.7%, when compared to high-income countries where the rate lies at 9.5% (Woody et al. 2017). A systematic review conducted by Gavin et al. (2005), which included data from high-income countries only, found an even lower rate of prevalence of PND (5.7%). There exists significant variation in PND prevalence rates even within developing and developed countries, respectively; Narhayati et al. (2015), using 203 studies of which 191 employed self-reported questionnaires, showed that the prevalence of PND in developed countries varies form 1.9% in Germany to 82.2% reported in the USA, while in developing countries the prevalence ranges from 5.2% to 74%, with Pakistan and Turkey recording the lowest and highest rates, respectively.

Research has revealed large disparities in the rates of PND prevalence between different geographical regions, with the highest in Middle East (26%) (Shorey et al., 2018; Haque et al., 2015) and the lowest in Europe (8%), while the rate in the rest of Asia goes as high as 16% (Shorey et al., 2018); Australia reports 15% and Canada 8% (Haque et al., 2015). A similar variation of PND prevalence rates has been reported within continents; for example, based on the study by Arifin et al. (2018), which included 102 articles, the prevalence in Asia varies from 4 to 48.3%, in Europe from 7.2 to 50.3%, in America from 5 to 64% and in Africa from 7.2 to 50.3%. Moreover, the national estimates of PND prevalence varies widely: a review of 143 studies across 40 countries found that the prevalence changes between 0 and 60% globally (Halbreich & Karkun, 2006). Along the same lines, another study supported that the rate ranges from 3.1% in Singapore to 37.7% in Chile (Hahn-Holbrook et a., 2018), while Arifin et al. (2018) showed that Japan reported the lowest PND prevalence rate (4%) and America the highest (64%).

2.4.1.2 Assessment Time Point. An additional inclusion criterion that may contribute to the variation in PND prevalence rates is the assessment time point (Norhayati et al., 2015; Shorey et al., 2018; Gavin et al., 2015). The findings are once again inconclusive; in the study by Shorey et al. (2018), the prevalence estimates showed an increase after 6 months, while, according to Norhayati et al. (2015), the highest prevalence rates are evident from birth to 8 weeks for both developing and developed countries. Similarly, in the study by Banti et al. (2011), the point prevalence of minor and major postnatal depression decreased from 3.2% in the first month to 1.2% in the ninth month postpartum. These findings are inconsistent with the earlier findings of Gavin et al. (2005) who supported that the rate increases after the third month of the postpartum period. A cross-sectional study conducted by Mayberry et al. (2007), using the EPDS to screen for maternal depressive symptoms, found that the prevalence of PND was around 17-23% and that the differences in PND rates were not statistically significant over the first 2 years, across the four postpartum time cohorts (i.e., first postpartum cohort: 0-6 months, PND rate: 23.1%; second postpartum cohort: 7-12 months, PND rate: 16%; third postpartum cohort: 13-18 months, PND rate: 17.1%; fourth postpartum cohort: 19-24 months, PND rate: 20.4%). However, the findings of this study, which concur with those of other cross-sectional and longitudinal studies (i.e., Chang et al., 2014; Woolhouse et al., 2015), support the persistence in maternal depressive symptoms even 2 years after childbirth. Given this inconsistency, further research is needed to define the actual prevalence rate of PND in the postnatal period and to introduce an appropriate assessment time point.

2.4.2 Conclusion

Overall, the current literature suggests that the widely cited prevalence of PND of 10-15% is not representative for the majority of mothers in the word's population, as prevalence estimates are higher than in the past (17%). However, after three decades of interdisciplinary research, the global rate of PND prevalence remains unclear. There has been great variation in PND prevalence rates, mainly due to the heterogeneity in the methodology applied in the studies included: varying time periods, sample size, screening instruments and definition can affect the generalisability of the findings (Norhayati et al., 2015; Mayberry et al., 2007). Given these methodological issues, future research should use more appropriate and sound methodologies so that targeted interventions can be provided to all mothers worldwide.

Despite the lack of accurate national PND prevalence estimates, findings from the existing literature on PND prevalence may provide a great opportunity for enhanced research and further exploration. Indicatively, the methodological issue of the assessment time point and the findings that depressive symptoms in mothers persist after the first 6 weeks following childbirth (Mayberry et al., 2007; Chang et al., 2014; Woolhouse et al., 2015; Norhayati et al., 2015; Shorey et al., 2018; Gavin et al., 2015; Banti et al., 2011) highlight the need of reassessing the DSM-V's and the ICD-10's stringent criteria in terms of the episode's time onset and duration (Woody et al., 2017; Wisner et al., 2010). Expanding the time frame for studying mothers to the first 2 years postpartum will provide very useful data that can assist in the design of the most beneficial and supportive interventions for this population (Mayberry et al., 2007).

Another finding from the study by Shorey et al. (2018) is noteworthy: according to the literature, a past history of depression increases the risk of PND to 50% (Heshaw, 2003; Rai et al., 2015). Nevertheless, the review by Shorey et al. (2018) found similar prevalence rates of PND among mothers with and without history of depression. Consequently, equal emphasis should be placed on both groups so that routine screenings and follow-up examinations can be offered to all mothers postpartum. Finally, evidence suggests that the prevalence of maternal PND is higher in developing countries (Woody et al., 2017; Narhayati et al., 2015). However, the pooled PND prevalence varies dramatically both among and within countries (Shorey et al., 2018; Haque et al., 2015). It is worth noting that the above-mentioned national disparities in PND prevalence proved to be evident even between countries that fall within a similar socio-economic profile (Hah-Holbrook et al., 2018). Thus, improving quality and access to perinatal and postnatal mental health services is of pivotal importance for all countries worldwide, despite their socio-economic strata. Earlier diagnosis, better and tailor-made interventions along with necessary support for mothers is likely to ensure a reduction in the prevalence as well as in the impact of postpartum depression on mothers, babies and families (NHS Improving Quality, 2015).

2.5 Aetiology and Risk Factors

The aetiology of PND is multifactorial (Dennis et al., 2018; Pater et al., 2012). When interpreting studies of aetiological factors underlying PND, biological, genetic, psychosocial and environmental factors are consistently intertwined (O'Hara, 2009). A wide variety of research has addressed an extensive range of different risk factors linked to an increased incidence of PND.

According to biological studies, genetic determinants and hormonal changes play a major role in the causation of PND. A recent review of 214 scientific papers conducted by Yim et al. (2015) showed that the strongest biological risk factors for PND consist of the following: hypothalamic-pituitary-adrenal dysregulation, inflammatory processes and genetic vulnerabilities (for a review, see Yim et al., 2015). Moreover, a great deal of research has examined the psychosocial and environmental factors that play a primary role in the development of PND.

2.5.1 Two Main Categorisations of the Psychosocial Risk Factors Underlying PND

There exist two main categorisations of PND risk factors. The first is based on the level of risk, with the following categories: (a) strong to moderate effect sizes, (b) moderate effect size, and (c) low to small effect sizes (i.e., Robertson et al., 2004; Ryan et al., 2005; Martin, 2012; Milgrom et al., 2008; Oppo et al., 2009; O'Hara & Winser, 2014). Other studies have classified

PND risk factors into the following domains: physical/biological, psychosocial, obstetric and paediatric, sociodemographic and cultural (i.e., Beck, 2001; Klainin & Arthur, 2009; Norhayati et al., 2015; Makkar, 2018; Ghaedrahmati et al., 2017).

The second type of classification features the five sub-categories applied by Norhayati et al. (2015), who conducted one of the largest systematic reviews on risk factors for PND, including 203 studies from all over the world. The various PND risk factors that emerged from this review were also divided into two main groups based on geographic region: developed and developing countries. Although many differences in the PND risk factors have been identified between developed and developing countries, a great variety remain the same across countries; as result, developed and developing countries share many of them. Based on the above-mentioned systematic review (Norhayati et al., 2015), Makkar (2018) created a list of PND risk factors in developed countries that overlap with ones in developing countries.

The following table combines both categorisations and presents the PND risk factors as identified in studies of predictors. In particular, the table integrates the findings for PND risk factors grouped based on their level of risk, as they can be found in studies by Robertson et al. (2004) and O'Hara (2009), along with Makkar's (2018) list, as this derives from the categorisation of PND risk factors with five categories for both developing and developed countries (for a review, see Norhayati et al., 2015). Interestingly, the risk factors included in the categorisation based on level of risk all overlap with those in the categorisation with five categories. One additional category was introduced, under the title 'not specified' in terms of level of risk, in order to add the remaining risk factors that constituted part of the five categories.

Table 2.3

Risk Factors for Postnatal Depression Identified from Studies of Predictors ('Level of Risk': Robertson et al., 2004; O'Hara, 2009. 'Risk Factors': Norhayati et al., 2015; Makker, 2018)

Level of Risk / Risk Factors	Strong to moderate	Moderate	Low/small	No specified
Psychological	• History of earlier depression in mothers • Previous psychiatric illness • Antenatal depression and anxiety • Life stressful events (i.e., Childhood sexual abuse)	Marital conflict/difficult marital relationship during pregnancy		Family history of depression
Social	Lack of (or perceived lack of) social support		• Socio-economic status/financial difficulties • Low educational level • Gender of the child (birth of a female child)	• Maternal age less than 25 years • Domestic violence • Addiction in husband
Obstetric			• Unwanted or Unplanned pregnancy • High parity • Perinatal complications • Delivery by Caesarean-section	
Physical				• Poor physical health • History of premenstrual symptoms
Other/ Miscellaneous		Personalities and cognitive vulnerabilities/ neuroticism		Negative attitude toward pregnancy

2.5.2 Additional Risk Factors

There is considerable research about the risk factors of PND indicating multiple predictors. Some additional risk factors that are not included in the table but commonly cited in the literature comprise the following: maternal low self-esteem (O'Hara & Swain, 1996; Beck, 1996; 2001; Leigh & Milgrom, 2008; Underwood et al., 2017), history of miscarriage (Cryan et al., 2001; Patel et al., 2012; Leigh & Milgrom, 2008), physical, psychological and sexual abuse (Gelaye et al., 2016), preterm delivery (Wado et al., 2014; Rahman et al., 2007; Sanchez et al., 2013), current substance abuse (Patel et al., 2012), no breastfeeding or breastfeeding less than 6 months (Chojenta et al., 2016), being single (Underwood et al., 2016) and being immigrant – with the immigrant mother to be twice as likely to develop PND as the non-immigrant mother (Dennis et al., 2018).

2.5.3 Conclusions

Overall, the aetiology of PND remains unknown (Patel et al., 2012), while the biological and psychosocial factors that make women prone to PND appear to have a reciprocal relationship, with each contributing to the other, either directly or indirectly (Ghaedrahmati et al., 2017). Numerous risk factors have been identified over the past three decades of research; these refer to different domains, including biological/genetic, psychological and environmental factors, as well as to different effect sizes (i.e., strong, moderate, low, small). However, the findings from different studies have proven to be contradictory in terms of the risk factors and their effect size (for a review, see Norhayati et al., 2015). Methodological and interpretative limitations are due to the use of different screening tools for PND, different sample sizes and the fact that data collected at different points in time after delivery could affect the accuracy of the results (Underwood et al., 2016; Norhayati et al., 2015). Consequently, additional studies with sound methodology are of pivotal importance in order to identify reliably all possible vulnerability, risk and causal factors of PND. This knowledge could lay the foundation upon which to build effective prevention and intervention strategies for mothers at risk of PND, pointing to the necessity of appropriate, timely care and treatment (Broyce, 2003; Underwood et al., 2016). An enhanced understanding of the mechanisms that trigger depressive symptoms in women after childbirth, along with a clarification of these risk factors, will contribute to the development of the most effective PND monitoring interval guidelines so that all perinatal healthcare professionals will be aware and able to minimise the negative effect of these risk factors on women's lives and, subsequently, the mother-infant relationship.

2.6 Treatment

The presence of a great range of risk and causal factors of PND – including biological, genetic, psychological and social aspects – renders the origin of this condition multi-factorial. Given the complex nature of PND, treatment is usually holistic (Rai et al., 2015), involving both non-pharmacological and, in some cases, pharmacological interventions. There exists general agreement that PND is treatable; a body of reviews of treatment options for PND (i.e., Boath & Henshaw, 2001; Dennis, 2004b; Bledsoe & Grote, 2006; Freeman, 2006; Dennis & Hodnett, 2007; Daley et al., 2007; Daley et al., 2009; Stevenson et al., 2010; Ammerman et al., 2010; Alderdice et al., 2013; Stamou et al., 2018), along with respective meta-analyses (i.e., Cuijpers et al., 2008; Sockol, 2015; Stephens et al., 2016), have studied and evaluated the efficacy of both psychological and pharmacological treatments. Despite the inconsistencies among the findings, which appear to be a result of the variation in the methodological quality of the included and reviewed studies (Aderdice et al., 2013; Sockol, 2015), there is substantial evidence showing that both antidepressants and psychological support can effectively ameliorate depressive symptoms in women during the postpartum period.

2.6.1 Psychosocial Treatments

In light of the influence of psychosocial factors, there can be offered multiple psychotherapeutic techniques, such as social support, counselling (Milgrom et al., 2005; Cuijpers et al., 2008), psychodynamic therapy (Clark et al., 2003; Stephens et al., 2016), debriefing (Dennis & Hodnett, 2007), peer and partner support (Dennis, 2004), interventions focused on the mother-infant relationship (Brummelte, & Galea, 2016) (i.e., video feedback intervention [Bilszta et al., 2012]), relaxation/massage therapy (Field et al., 1996), maternal exercise (Gear & Trivedi, 2009) and listening visits (O'Hara, 2009). The most commonly employed treatment options for mothers suffering from PND, however, are interpersonal therapy (IPT) and cognitive behavioural therapy (CBT) (Patel et al., 2012; Meltzer-Brody, 2011; Hirst & Moutier, 2010).

2.6.1.1 Interpersonal Therapy. IPT is a time-limited treatment that focuses on interpersonal issues and current relationships (National Collaborating Centre for Mental Health, 2014; Fitelson et al., 2011). According to this approach, mood and interpersonal problems are inextricably linked (Klerman et al., 1984). For cases of PND, IPT has been specifically adapted to help mothers explore alternative ways of effectively handling interpersonal situations, such as their relationship with the baby or the partner, or the transition back to work, aiming at the consequent improvement of their mood (O'Hara et al., 2000; Spinelli & Endicott, 2003; Stuart & O'Hara, 1995). IPT has been proven beneficial for alleviating PND, and its efficacy has been established (O'Hara et al., 2000; Spinelli & Endicott, 2003; Swart et al., 2008; Grote et al., 2007). Indicatively, in the first large trial of IPT conducted by O'Hara et al. (2000), 120 mothers with PND were randomly assigned to 12 weekly 60-minute individual sessions, or to a waiting list. Findings showed that women who received IPT had significantly lower levels of depressive symptoms, fewer possibilities to meet diagnostic criteria for PND and important improvement in social adjustment, when compared to the wait-listed control group. Similarly, in a smaller randomised control trial (RCT) with PND women, Clark et al. (2003) found that IPT was superior to a wait-listed condition. These findings are consistent with those of additional studies that support the effectiveness of IPT as a psychological treatment for PND (i.e., Klier et al.2001; Ray et al., 2006; Cuijpers et al., 2008).

2.6.1.2 Cognitive Behavioural Therapy. Along the same lines, CBT – a discrete, well-studied and structured psychological treatment (NICE, 2014) – is highly pertinent to the needs of mothers with PND (Pearlstein et al., 2009). The main aim of CBT is to help the patient develop the skills to identify, evaluate and counteract dysfunctional beliefs, as well as alter problematic interpretations and behaviours, using a repertoire of coping skills (Cuijpers et al., 2008; Beck & Haigh, 2014; Sockol, 2015). The efficacy of CBT for treating PND is well established (O'Hara, 2009; Stamou et al., 2018). For instance, in a meta-analysis conducted by Sockol (2015), which included 40 randomised and quasi-randomised controlled trials, the efficacy of CBT during pregnancy and the first year postpartum was assessed. Findings confirmed that mothers with PND who attended CBT showed a significant reduction in their depressive symptoms when compared to any other control conditions. These results agree with the findings from a review of 15 studies in which CBT was used as the main treatment for PND (Stamou et al., 2018). The findings reported in this study showed that CBT had positive clinical results, as there was a significant reduction in the postnatal depressive symptoms of the participant mothers (Stamou et al., 2018).

2.6.1.3 Additional Psychological Interventions. There exists a series of studies that establish the effectiveness of psychological interventions in terms of higher rates of PND remission following treatment. For example, randomised controlled trials evaluating group-based CBT, group-based counselling, individual counselling and routine primary care (Milgrom et al., 2005); CBT, non-directive counselling, psychodynamic therapy and typical primary care (Cooper et al., 2003); listening visits, CBT and IPT (O'Hara, 2009); IPT and treatment as usual (Mulcahy et al., 2010); non-directive counselling, telephone-based peer support and CBT compared with usual care (Dennis, 2013); and CBT, a nondirective 'person-centred' approach compared with usual care (Morell et al., 2009) have all demonstrated similar results. In particular, the findings emerging from these studies exhibit great consistency, supporting that therapeutic outcomes did not differ significantly between different psychological therapies (Cuijpers et al., 2008). Furthermore, psychological interventions per se have always proven superior to routine care, leading to the clinical reduction of depressive symptoms in mothers during the postpartum period (Milgrom et al., 2005; Stamou et al., 2008).

2.6.2 Pharmacological Treatment

It is worth noting, however, that psychological interventions are particularly helpful in women with mild to moderate PND (Spinelli & Endicott, 2003; Dennis & Hodnett, 2007; Cuijper et al., 2008; Pearlstein et al., 2009; Yonkers et al., 2009). The existing literature clearly suggests that, as the severity of PND increases, pharmacological treatment could have a greater effect size than psychological interventions (Bledsoe et al., 2006; Cuijpers et al., 2008; Fournier et al., 2010; Meltzer-Brody, 2011; Molyneaux et al., 2014; 2017). A great variety of antidepressant medications is available, and these can be classified into different types (for a review, see Molyneaux et al., 2014). However, the most common class of antidepressant drugs used for the treatment of PND consists of selective serotonin re-uptake inhibitors (SSRIs), such as sertraline and fluoxetine (Wisner et al., 2006; Stephens et al., 2016).

The effectiveness of antidepressant medication, as a first agent, in the treatment plan for mothers with severe PND has been tested and confirmed by several RCT studies (i.e., Yonkers et al., 2008; Appleby et al., 1997; Wisner et al., 2006; Misri et al., 2004), along with some open trials (i.e., Abreu et al., 2005; Pearlstein et al., 2008). In a placebo-controlled RCT, Appleby et al. (1997) recruited 87 women with major or minor PND and assigned them randomly to one of the four following groups of treatment for 12 weeks: (1) fluoxetine daily and 6 counselling sessions, (2) fluoxetine daily and 1 counselling session, (3) placebo and 6 counselling sessions, or (4) placebo and 1 counselling session. Greater improvement was seen in the fluoxetine group in comparison to the one with placebo medication, as well as in the group receiving 6 counselling sessions when compared to the group receiving 1 session. Interestingly, mothers receiving both antidepressant drugs and counselling did not show a greater reduction in the severity of depression, when compared to mothers who only received fluoxetine. This finding underlines the effectiveness of antidepressants, but at the same time raises some doubts about the necessity of psychological treatments in the case of therapy with pharmacological treatment in severe PND. However, there is evidence that a treatment plan that combines psychotherapy and antidepressant medication may be the best treatment option for women suffering from severe PND (Meltzer-Brody, 2011). Therefore, further research and investigation is needed to illustrate this point (Cuijpers et al., 2008).

Although data on the effectiveness of antidepressant medication in comparison to other treatment modalities for PND are scarce (Fitelson et al., 2011), existing literature and meta-analyses on the pharmacological and hormonological treatment for PND conclude in the following findings: antidepressant drugs are significantly more effective than a placebo (Molyneaux et al., 2017) and have a larger effect size than psychological treatments for women with severe PND (Patel et al., 2012; Stephens et al., 2016), and no class of antidepressant drug is superior over others (Payne, 2007; Meltzer-Brody, 2011).

2.6.2.1 Antidepressants and Breastfeeding. Even though the effectiveness of pharmacological treatment in PND has been established, most mothers strongly prefer non-pharmacological treatment options (Boath et al., 2004; Oates et al., 2004; Chabrol et al., 2004; Whitton et al., 1996). More specifically, mothers are reluctant to take antidepressant medications (Shephens et al., 2016; Dennis & Chung-Lee, 2006; Boath et al., 2004; Whitton et al., 1996), due to concerns about transmission through breast milk that could adversely affect the infant (Adina et al., 2021; Shephens et al., 2016; Dennis & Chung-Lee, 2006; Pearlstein, 2008; Turner et al., 2008). Although there is limited evidence about the effects of exposure to antidepressant drugs through breastfeeding on infants (Freeman, 2009; Field, 2008), research suggests that some antidepressant drugs, such as sertraline and paroxetine, are less likely than others to be detectable in infants (di Scalea & Wisner, 2009; Fortinguerra et al., 2009; Weissman et al. 2004). Undoubtedly, the lack of strong evidence may reinforce the dilemma of mothers with PND regarding taking medication while breastfeeding. However, for mothers with clinical PND, antidepressant medication may be an important and effective treatment option, and the advantages of drug treatment could outweigh the disadvantages of untreated PND (Pearlstein et al., 2009). In particular, evidence shows that PND can have profound and pervasive effects on maternal and family well-being (Tsivos et al., 2015; Letourneau et al., 2017), mother-infant bonding (Moehler et al., 2006; Reck et al., 2011), as well as serious effects on the infant's holistic development, including cognitive, emotional and social development (Kingston et al., 2012; Murray et al., 2010; Murray et al., 1997). Consequently, PND treatment should constitute a priority in clinical settings, and a tailor-made treatment should be designed according to the mothers' needs and the severity of their symptoms in order to mitigate effectively the root cause of PND.

2.6.3 Mother-Baby Units

The majority of mothers who suffer from PND can be effectively treated in outpatient settings (Meltzer-Brody et al., 2014), but 4 in every 1,000 women require inpatient admission due to severe depressive symptoms during the postnatal period (NHS, 2013). There is considerable evidence that supports and stresses the need for hospitalisation-based treatment for mothers with severe PND and their babies (i.e., Vliegen et al., 2010; 2013; Nair et al., 2010; Buist et al., 2004; Vliegen & Luyten, 2008; 2009; Glangeaud-Freudenthal et al., 2004), while admission to an inpatient mother-baby unit (MBU) is now considered the best clinical practice for this population (Reilly et al., 2019; Austin et al. 2017; NICE, 2014).

MBUs allow for the joint admission of women and their infant up to 1 year after childbirth (Gillham & Wittkowski, 2015). The first joint mother-baby hospitalisation took place in the United Kingdom approximately six decades ago (Salmon et al., 2003; Pearlstein et al., 2009); since then, MBUs have been established in many developed countries worldwide, such as France, Belgium, Germany, New Zealand, Australia and the Netherlands (Meltzer-Brody et al., 2014). The philosophy behind the joint hospitalisation of mother and baby is to encourage the development of the mother-infant relationship, prevent the negative effects of a separation on maternal confidence and the infant's emotional well-being, enhance parenting skills, and, in parallel, stabilise maternal mental health (Wright & Wouldes; 2018; Gillham & Wittkowski, 2015; Christl et al., 2014; Vliegen et al., 2013). These specialist inpatient units, in order to achieve the above-mentioned goals, provide expert psychiatric care and management by applying a collaborative and multidisciplinary treatment approach (Kenny et al., 2013; Pearlstein et al., 2009). In these clinical settings, the treatment plan consists of the use of medication and psychiatric intervention, in conjunction with psychological therapies that aim at both the promotion of mother-infant bonding and the development of the maternal skills necessary for baby care (Kenny et al., 2013; Vliegen et al., 2013).

Video-feedback psychotherapeutic intervention constitutes a commonly used and effective method in these inpatient wards (Pawlby et al., 2010). Within the scope of this intervention, the mother-infant play interaction is video-recorded and then reviewed by the mother, with the assistance of an experienced mental health professional who provides feedback (Olhaberry et al., 2015; Bilszta et al., 2012). Through this process, the mother has the opportunity to recognise and understand her baby's cues and non-verbal language while discovering another image of themselves and their relationship (Bilszta et al., 2012; Noorlander et al., 2008; Vik & Hafting, 2006). In this way, positive parenting skills apparent on the video are reinforced, empathy is increased and overall sensitive care-giving is promoted (Koren-Karie et al. 2002; Klein-Velderman et al. 2006).

A growing body of research proves that MBUs offer supportive and safe clinical settings that provide effective psychiatric and psychological care for mothers with severe mental health issues and their babies. Inpatient mothers with severe PND show clinically highly significant improvements, with the symptom recovery rates ranging between 69 and 78% (Christl et al. 2015; Glangeaud-Freudenthal et al., 2011; Salmon et al., 2003). Along the same lines, another study indicates that, from the time of admission to discharge, maternal depressive symptoms rates dropped by over 10 points (Meltzer-Brody et al., 2014). Regarding the mother-infant interaction, parenting skills and infant well-being, the outcomes are once again encouraging; the findings from a systematic review of 23 scientific papers showed the beneficial effects on mother-infant attachment, increased confidence in parenting skills and an absence of adverse impacts on infant development, as result of the specialised, intensive and targeted interventions applied in MBUs (Gillham & Wittkowski, 2015). However, these conclusions are preliminary, due to the methodical heterogeneity of the studies included (Gillham & Wittkowski, 2015). Therefore, MBUs should form an integral part of the treatment plan for mothers with severe PND; at the same time, there is an imperative need for further research to generate a body of robust evidence to support this emerging research literature, as well as to inform and guide clinical practice.

2.6.4 Conclusion

To sum up, there exists a large body of research on the efficacy of a variety of psychological and pharmacological treatments for PND. Considerable evidence indicates the effectiveness of antidepressant medication in the treatment plan for severely depressed mothers during the postpartum period (Yonkers et al., 2008; Appleby et al., 1997; Wisner et al., 2006; Misri et al., 2004). Still, psychological interventions have been proven particularly beneficial for women with mild to moderate PND (Spinelli & Endicott, 2003; Dennis & Hodnett, 2007; Cuijper et al., 2008; Pearlstein et al., 2009; Yonkers et al., 2009), with IPT and CBT to be the best-studied and most commonly used among the psychological treatments (Patel et al., 2012; Meltzer-Brody, 2011; Hirst & Moutier, 2010). In comparison to antidepressant drugs, psychological therapies seem to be a preferential option for PND mothers (Dennis & Chung-Lee; 2006; Boath et al., 2004; Oates et al., 2004; Chabrol et al., 2004; Whitton et al., 1996). A plausible explanation for this preference is the risk of exposing the breastfeeding baby to antidepressant medication (Pearlstein et al., 2009; Stephens et al., 2016). Indeed, the use of antidepressants and medication in breastfeeding mothers is a controversial issue, and further research is needed to illustrate this point (Freeman, 2009; Field, 2008). However, mothers with clinical PND usually need to be jointly hospitalised with their baby in a MBU, and in this case, a multidisciplinary treatment plan may be best to maximise positive outcomes (Meltzer-Brody, 2011). The literature indicates the effectiveness of these clinical settings and renders them the most suitable and safest environment for clinically depressed mothers who require inpatient admission during the postnatal period (Christl et al. 2015; Glangeaud-Freudenthal et al., 2011; Salmon et al., 2003). Even if the effectiveness of all treatment modalities has been assessed and supported by the findings of existing research, the heterogeneity in study design creates a gap that restricts the generalisability of a definite conclusion (Fitelson et al., 2011; Cuijpers et al., 2008; Gillham & Wittkowski, 2015). Further research addressing the above-mentioned methodological issues is warranted.

2.7 Course and Prognosis of PND

The effectiveness of both psychological and pharmacological treatments for PND has been discussed above. Limited evidence is available concerning their sustained and long-term benefits to maternal mental health problems and, therefore, to mother-infant bonding and infant development (Murray et al., 2017). While the prognosis of PND is generally good, especially in the case of early detection and intervention (Rai et al., 2015), follow-up assessments have been proven imperative for PND mothers' effective treatment (Vliegen et al., 2014). Existing literature highlights the increased risk of PND to turn into a chronic disorder in mothers (Campbell et al., 2009; Vliegent et al., 2013). In particular, PND can be persistent, showing a delay in recovery rates (Zelkowitz & Milet, 2001; Campbell & Cohn, 1997; Glavin et al., 2010; Howell et al., 2009), which, in turn, leads to a risk of chronification (Torres et al., 2019). Between 25 and 50% of women suffering from PND may exhibit depressive episodes lasting at least 6 months (Beck, 2002), 1 year (Wang et al., 2005), or even 2 years following childbirth (Murray et al., 2017).

A prospective study conducted by Campbell and Cohn (1997) supported that 13% of mothers still met the diagnostic criteria of PND 2 years after childbirth. Accordingly, findings from the first longitudinal naturalistic 2-year follow-up study with a sample of 165 participant mothers with clinical PND found that only 66.3% of the mothers achieved full remission at 12 months during the postnatal period, while depressive symptoms proved to be persistent after the 2-year follow up for 9.7% of the participant mothers (Torres, et al., 2019). Furthermore, a recent review of 23 longitudinal studies on the course of PND revealed that, in 30% of PND mothers from community samples and 50% from clinical samples, depressive symptoms persisted during the first postnatal year or even beyond (Vliegen et al., 2014). Notably, the same study supported that, even if the rates of maternal depressive symptoms showed a decrease during the postpartum period, the time points of recovery varied significantly. Vliegen et al. (2014) concluded that, for a considerable proportion of mothers, PND constitutes a time-limited problem, as approximately at 4 months postpartum they could achieve a full remission lasting for a long follow-up period. For 38% of mothers, however, PND is just the starting point of a chronic depressive disorder. Still, it is worth mentioning that the methodological design applied across the 23 studies included in this review exhibits great heterogeneity, and this poses a limitation for the generalisation of the results.

With respect to the effectiveness of PND interventions, a meta-analysis of psychological treatments revealed that, indeed, there was a lack of evidence concerning their long-term effects, and the effectiveness of PND treatments could not be confirmed 6 months post-intervention (Cuijpers et al., 2008). This is mainly because of the insufficient number of longitudinal studies in this field (Cuijpers et al., 2008). The few long-term follow-ups also failed to find persistent benefits of PND interventions (e.g., Murray et al., 2003; Kersten-Alvarez et al., 2010). The research findings from the study by Cooper et al. (2003) are in complete agreement with this notion, showing that, although psychological treatments (i.e., CBT, non-directive counselling and psychodynamic therapy) for mothers with PND are beneficial in the short term, their therapeutic effects do not endure over time and start diminishing after the fifth month post-intervention.

Concerning the long-term follow-up data for inpatient PND mothers in MBUs, only a few studies investigate the course of PND for this population (Vliegen et al., 2013; Cornish et al., 2008; McMahon et al., 2005). A study conducted by Kumar and Robson (1984) indicated that 43% of inpatient PND mothers have psychological difficulties even 4 years later. Along the same lines, Milgrom and Beatrice (2003), as well as Horowitz and Goodman (2004), maintained that depressive symptoms could be evident in this population (25% and 31%, respectively) up to 2 years following childbirth (Vliegen et al., 2013). Overall, joint admission in an MBU is highly beneficial for mother-infant dyads in the short term, but follow-up research is needed to explore the real long-lasting benefits (Christl et al., 2015; Salmon et al., 2003).

Furthermore, mothers with PND appear to form a heterogeneous group with significant differences in their clinical profile, particularly in terms of the severity of depressive symptoms, chronicity and recovery rates. As result, three sub-groups were introduced in order to distinguish the mothers based on the course of their depressive symptoms: (1) mothers with chronic and severe depressive symptoms, (2) mothers with stable but high levels of mild symptoms, and (3) mothers who fully recover during follow-up (Vliegen et al., 2013; Campbell et al., 2009; Ashman et al., 2008). Moreover, maternal vulnerability to chronic depression may be attributable to a variety of risk factors. The main risks of PND chronicity are similar to risk factors with strong effect for PND; as defined in the study by Vliegen et al. (2014), these are as follows: poor social support, previous history of mental health illnesses, childhood sexual abuse, contextual risk factors and personality traits. An additional poor prognostic factor could consist of the onset of depression during pregnancy (Torres et al., 2019).

2.7.1 Conclusion

While existing PND treatment modalities have been proven effective in the short term (Stamou et al., 2018), maternal vulnerability in regard to the increased risk for relapse (re-emergence of depressive symptoms) or its slow pace of recovery could render PND a chronic disease (Torres, et al., 2019). These findings deserve proper attention, given that there is a great volume of research documenting the prolonged negative impact of maternal PND, not only on the mothers themselves, but also on infant development, particularly in the case of mothers who suffer from chronic depression (Murray et al., 2017; Vliegen et al., 2014; Ashman et al., 2008; Campbell et al., 1995; Moehler et al., 2007). Yet, it has been shown that it is not the diagnosis of PND per se, but its severity and chronicity that are strongly and directly associated with adverse outcomes in the children (Vliegen et al., 2014).

At present, a clear conclusion cannot be drawn about the course of PND due to the lack of well-designed longitudinal investigations (Vliegen et al., 2014). Yet, evidence has been established that mothers with PND are at increased risk to develop chronic depression, especially when certain risk factors are involved (Vliegen et al., 2013; 2014). Long-term follow-up with mothers after treatment termination has been highly recommended (Reay et al., 2012; Boath & Henshaw, 2001; Cuijpers et al., 2008; Dennis, 2004; Dennis & Hodnett, 2007). Overall, evidence documenting the effectiveness of PND treatment in the short term should serve as an impetus for the application of long-term interventions in PND mothers up to the second year after childbirth. In light of this recommendation, rigorous follow-up research needs to be conducted in order to provide evidence-based outcomes on the course, prognosis and different possible trajectories of PND. These outcomes can enhance the existing knowledge on the topic and present an asset for clinicians and mental health professionals working with PND mothers, who aim at the design of the most suitable, effective, person-centred PND treatment plan with sustained, long-lasting benefits for both mothers and their children.

2.8 Summary

Despite the myth of happy mothering, the postnatal period can be a challenging transition, during which mothers are particularly prone to experience mood disturbances. Maternal PND has been documented since Hippocrates' time, but officially incorporated in the psychiatric manuals only in 1994 (APA, 2000; Makkar, 2018). According to the two classification systems for psychiatric illness (i.e., the DSM-V and the ICD-11), PND is not a discrete diagnosis, but a sub-category of major depressive disorder; an onset specifier and special code, respectively, are applied in order to acknowledge the link between major depression and childbearing. In the revised versions of the DSM-V and ICD-11, the duration criterion for the use of the onset specifier/special code is from pregnancy up to 4 and 6 weeks postpartum, respectively. However, the use of this restrictive time frame has created a large debate in the field and raised many methodological issues in research, given that postnatal depressive symptoms may persist for several months up to 1 year after childbirth (Bass & Bauer, 2018; Sriraman et al., 2017).

PND is also the most common complication observed in women following delivery (Barsky & Silbersweig, 2017; Rai et al., 2015; Arifin et al., 2018; WHO, 2008; Makkar, 2018; Hahn-Holbrook et al., 2018; Rasmussen et al., 2017), affecting approximately 17% of mothers (Sholey et al., 2018). However, prevalence estimates vary significantly (from 4.4 to 73.7%), which can be attributed to heterogeneous study design (Leahy-Warren & MacCathy, 2007). Therefore, the accurate global or national prevalence rate of PND has yet to be established (Hahn-Holbrook et al., 2018). Furthermore, a considerable volume of research has attempted to determine the causal and risk factors of PND. Evidence supports that there exists a great range of interwoven risk factors, including psychological and biological ones, that play a major role in the development of PND (Dennis et al., 2018; Pater et al., 2012). The accurate identification and understanding of PND risk factors can serve as a stepping-stone for the establishment of more efficacious prevention and treatment interventions for this population.

Regarding PND treatment modalities, given the multidimensional nature of PND, which combines genetic and environmental factors, two basic treatment options are available: pharmacological and non-pharmacological (Patel et al., 2012). The treatment plan for PND, however, varies according to the severity of the depressive symptoms in mothers;

psychological interventions have been proven particularly beneficial for women with mild to moderate PND (Spinelli & Endicott, 2003; Dennis & Hodnett, 2007; Cuijper et al., 2008; Pearlstein et al., 2009;Yonkers et al., 2009), while, as the severity of depressive symptoms increases, pharmacological treatments appear to be the most effective treatment option (Bledsoe et al., 2006; Cuijpers et al., 2008; Fournier et al., 2010; Meltzer-Brody, 2011; Molyneaux et al., 2014; 2017).

Yet, mothers seem to be reluctant to take antidepressant medication due to their potential transmission through breast milk (Shephens et al., 2016; Dennis & Chung-Lee, 2006; Pearlstein, 2008; Turner et al., 2008). Potential adverse effects on the breastfeeding infant are a controversial issue, but of fundamental importance, and deserve further and robust investigation. Finally, for mothers with clinical depression who require inpatient admission, MBUs provide a unique service that not only stabilises maternal mental health, but also supports and reinforces mother-infant interaction, parenting skills and infant well-being (Gillham & Wittkowski, 2015). In these clinical settings, a collaborative and multidisciplinary treatment plan is used (Kenny et al., 2013; Pearlstein et al., 2009), combining psychiatric intervention along with psychological treatments (Kenny et al., 2013; Vliegen et al., 2013). Overall, the effectiveness of both psychological and pharmacological PND treatment has been well established in the short term (Stamou et al., 2018). By contrast, there is limited evidence that PND treatments confer long-lasting benefits on mothers and, in turn, on the mother-infant interaction and the infants (Vliegen et al., 2014; Torres et al., 2019).

As can be derived from the above, numerous studies have been conducted over the past three decades in an attempt to define PND, estimate its prevalence, explore the potential risk factors and contribute to the design of the best treatment plan for PND mothers. However, the outcomes remain inconclusive. A plausible explanation may lie in the complex nature of PND, which involves a constellation of predictors along with multiple clinical profiles, due to the significant differences in severity level, recovery pace and treatment plan. Taking this into account, it is imperative to address the considerable heterogeneity in studies focused on the conceptualisation of PND, using more rigorous methodological design. Well-designed investigations could compare different treatment modalities, explore potential risk factors based on individual components and provide useful data for designing the most effective, person-centred prevention and treatment plan for mothers with PND. Overall, further research is of pivotal importance in order to generate a body of robust evidence about how to best help mothers with PND even beyond postpartum, how to enhance mother-infant interaction in this population and promote infant well-being, so as to guide clinical practice and plan intervention accordingly.

Chapter 3: Research Methodology

3.1 Introduction

The current chapter discusses the methodology employed in this study. Initially, an overview of the research presents the aim, hypothesis and research questions. Then, the theoretical frameworks, along with the research methods, which are influenced by the former, will be discussed. Specifically, the chapter provides information about the participants' profile, the recruitment process and the data collection procedure. Ethical considerations also receive discussion in light of the issues arising from focusing on vulnerable groups, such as infants and/or inpatient mothers with severe mental health problems. Furthermore, Chapter 3 details the measures applied to assess the quality of mother-infant interaction and infants' verbal and non-verbal communication skills. Finally, it includes an overview over how the data were analysed.

3.2 Overview of the Research

The main aim of this research project is to examine the effect of maternal postnatal depression (PND) on both mother-infant interaction and infant development – with a focus on infants' verbal and non-verbal communication skills – through the lens of a particular sub-category: mothers with severe postnatal depression (PND) who have been hospitalised jointly with their infants in an MBU.

To address the core aim of this study, a total number of 52 videos that contain the footage of 104 participants (52 mother-infant pairs) were analysed and compared. In particular, videos of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months) were used for the clinical group. A comparison group of 30 mothers without PND interacting with their infants (aged 3-12 months) were video-recorded to illustrate the real differences – both strengths and challenges – in the interaction between mothers with PND and their infants.

The principal hypothesis posits that PND has a significant impact on the quality of mother-infant interaction and, consequently, on infant verbal and non-verbal communication skills.

Overall, this study aimed to address the following core research questions:

1) What are the differences between the two groups (mothers with and without PND and their babies) in the quality of mother-infant interaction?
2) What is the impact of PND on maternal vocal behaviour and, consequently, on infants' verbal communication skills?
3) Do infants of mothers with PND differ in their non-verbal communication skills when compared to infants of mothers without PND?
4) Do infants of mothers with PND differ in the way in which they use a toy during a play interaction with their mothers when compared to the infants of mothers without PND?

3.3 Theoretical Basis of the Research Methodology

3.3.1 Research Design

The present research adopted a cross-sectional study design, given that the aim was to examine the developmental outcomes of infants whose mothers suffer from PND, using a comparison group of mothers without PND and their infants. The approach of this study was a cross-sectional design at one single point in time, in that the researcher collected the data on the variables of interest at one point in time (Bryman, 2016; Creswell & Plano Crack, 2010). In addition, in a cross-sectional study, such as the current project, the participants are selected in terms of the inclusion and exclusion criteria set for the study (Setia, 2016) (for further relevant information, see Chapter 3, Section 3.4.3).

This study also used a mixed-method design. The combination of quantitative and qualitative approaches is highly recommended for exploring more complex aspects of human relationships (Malina et al., 2011). Combined quantitative and qualitative methods help the researchers conduct in-depth research while leading to more meaningful interpretation of the collected data (Hughes, 2016). This design, therefore, provides an opportunity for unexpected results to be revealed (Cohen et al., 2017). From among the mixed-method approaches, this study adopted an exploratory sequential design (Creswell & Plano Clark, 2010). The starting point was qualitative data collection and analysis, followed by quantitative data collection and an analysis that led to the interpretation of the data (Cohen et al., 2017; Plano Clark & Ivankova, 2016). Particularly, in the present study, video-recordings of mother-child interactions were used; these qualitative data were converted into quantitative data with the help of specific coding schemes. One of the main purposes of this design was to investigate in depth the phenomenon under study (Creswell & Plano Clark, 2010).

Lastly, a video-based observation research method was also employed, as it enables the generation of a large amount of data (Asan & Montagne, 2014) that is hard to capture by means of participant-observation (Paterson et al., 2003). As stated by Rustin (2006), 'the use of video-technology has made it possible to investigate the minute subtleties of mother-infant interaction from the earliest days of life' (Rustin, 2006, p. 4). Furthermore, the video-based observation research method enables revisiting the video-recorded material in order to produce more detailed, complete and accurate outcomes (Knoblauch et al., 2006). Consequently, this method enables researchers to capture complex interactions (Asan & Montagne, 2014; Suen & Ary, 2014), as well as to rigorously and systematically examine features of verbal (i.e., content of speech) and non-verbal communication (i.e., facial expression, gaze, touch) (Jewitt, 2012). In this research, mothers' and infants' interactional behaviours, which consist of the above-mentioned verbal and non-verbal communication features, have been analysed frame by frame. The following sub-section includes information about the sampling strategies and explores the theoretical underpinning of the decisions made concerning sample size.

3.3.2 Sampling Strategies

Probability and purposive sampling constitute the two main sampling strategies available in the social and behavioural sciences (Cohen et al., 2017; Teddlie and Yu, 2007). The former has also been referred to as a random method of sampling, while the purposive form of sampling is known as a non-probability or purposeful or qualitative or judgement sampling (Cohen et al., 2017; Guest et al., 2013). The present study relies on a purposive sampling strategy. The goal of this strategy is to deliberately select specific units or cases (i.e., organisations, documents, people and so on) to address the research questions (Bryman, 2016; Teddlie & Yu, 2007). The core research questions of this study concern the impact of maternal clinical PND on mother-infant interaction, as well as on the infants' verbal and non-verbal communication skills. Thus, both the clinical and the comparison group were deliberately selected from a clinical setting – an MBU and Children Centres, respectively – on the basis of the inclusion criteria of the study (see Chapter 3, Section 3.4.3).

The literature presents many varieties of the purposive sampling approach, in which several kinds of strategies are included (Cohen et al., 2017). Teddlie and Yu (2007) divide purposive sampling techniques into three main types: (a) sampling to achieve representativeness or comparability, (b) sampling special or unique cases, and (c) sequential sampling. A purposive sampling technique to achieve representativeness or comparability seems to be the most suitable strategy for this study. This technique is used when the researcher's aim is to select a typical sample that represents a broader group of cases as precisely as possible and to produce comparisons across different kinds of cases along a dimension of interest (Teddlie & Yu, 2007).

In addition, Hood (2007) offers another distinction between 'a priori' and contingent purposive sampling techniques. This distinction essentially concerns the timing of setting up criteria for the selection of sampling units for analysis (Bryman, 2016). As the participants' inclusion criteria was established at the outset of the study, the 'a priori' purposeful sampling technique was adopted.

3.3.2.1 Additional Sampling Strategy for the Clinical Group. For the clinical group of inpatient mothers with PND and their infants, a sampling of video clips was conducted. Goldman et al. (2007) described three approaches of sampling of video-recorded data: (a) inductive, (b) deductive, and (c) narrative-evolving. The most appropriate approach for this study consisted of a deductive approach to video data. This approach is appropriate for sampling when the following criteria are met: (1) there are clear research questions; (2) a suitable database has been identified; and (3) systematic sampling from this database takes place to address the specific research questions (Jewitt, 2012). Based on the characteristics of the deductive sampling of video tapes, this approach clearly falls under the umbrella term of the purposive sampling technique.

3.3.2.2 Additional Sampling Strategy for the Comparison group. The researcher attempted to expand the sample of the comparison group of mothers without PND and their infants. Hence, within the purposeful sampling technique, a snowball sampling technique proved fruitful. Based on this method, the existing study participants are able to invite other people among their acquaintances to take part in the study (Naderifar et al., 2017). Snowball sampling is an effective and popular technique to increase the sample size over the course of the research (Bryman, 2016).

Overall, the purposive sampling technique adopted for both groups in this research involves a trade-off: 'on the one hand, it provides greater depth to the study than probability sampling; on the other hand, it provides less breadth to the study than probability sampling' (Cohen et al., 2017, p. 219).

3.3.3 Sample Size

The present study aims at an in-depth understanding of the quality of mother-infant interaction while the mother suffers from PND and of the impact of this mental health disorder on infants' development; this guided the researcher's decisions concerning sample size. The number of participants had to be large enough to generate rich, fine-grained and contextually laden data, but also small enough to allow for in-depth exploration, thus providing a thorough picture of mother-infant interaction.

There is no general agreement on the specific number of participants that should be included in qualitative research (Cohen et al., 2017). However, if the data analysis includes statistical procedures, a sample size of 30 is considered the minimum number of cases for a qualitative study (Cohen et al., 2017; Teddlie & Yu, 2007): 'In general, sample sizes in qualitative research should not be so small as to make it difficult to achieve data saturation, theoretical saturation, or informational redundancy. At the same time, the sample should not be so large that it is difficult to undertake a deep, case-oriented analysis' (Onwuegbuzie and Collins, 2007, p. 289).

Adding to that a post-hoc statistical power analysis was performed for sample size estimation, based on data from this research study (N=52), comparing 22 participants from the clinical group to 30 participants from the comparison group. The effect size was also estimated for the statistical analyses for the four studies conducted in the scope of this research and reported to the 'Results' section of the Chapters 4,5,6,7 respectively. With an alpha = .05 and power = 0.80, the projected sample size needed with this effect size is approximately N = 14 for the simplest between group comparison. Thus, the proposed sample size of 52 pairs of participants (i.e., mothers -with/without PND- and their infants) has been proved to be more than adequate for the main objectives of this study.

3.4 Participants

A total of 104 participants (i.e., 52 mother-infant dyads) were included in the present study. Of the mothers, 22 represented a clinical sample of mothers with PND hospitalised jointly with their infants in an MBU. The remaining 30 mother-infant dyads represented a community sample of infants and mothers without PND from the same metropolitan area.

3.4.1 Sociodemographic Profile of the Clinical Group

The clinical group consisted of 22 mothers who had been hospitalised jointly with their infant in an MBU (40.9% boys, mean age in weeks: 28.6 [*SD* = 11.4, range = 35.6 weeks]). Each mother had been given the ICD-10 diagnosis of severe PND, and the majority in the sample suffered from severe PND without psychosis (40.9%). However, to increase the number of participants, mothers with PND as a primary diagnosis were included even when they also suffered from comorbid mental health problems, such as PND with psychosis (27.3%) or concurrent anxiety and/or post-traumatic stress disorder (31.8%).

Maternal age ranged from 18 to 40 years, with an average age of 30.2 (*SD* = 6). Most of the mothers were British (63.6%), while half of the sample was married (50%). The following table presents the sociodemographic profile of clinical participants in more detail.

Table 3.1

Sociodemographic Characteristics of Mother-Infant Dyads from the Clinical Group

Maternal sociodemographic characteristics (n=22)		
Age	Range	18-40
	Mean (SD)	30.2 (6)
Maternal Diagnosis	Pure severe PND (%)	9 (40.9 %)
	PND with psychosis (%)	6 (27.3%)
	PND with other concurrent diagnosis (%)	7 (31.8%)
Marital status	Single (%)	5 (22.7%)
	Married (%)	11 (50%)
	Divorced or separated (%)	1 (4.5%)
	Cohabiting (%)	5 (22.7%)
Ethnicity	British (%)	14 (63.6%)
	Asia (%)	1 (4.5%)
	Caribbean (%)	1 (4.5%)
	Indian/ British Indian (%)	1 (4.5%)
	Other Africa (%)	2 (9.1%)
	Other Black (%)	1 (4.5%)
	Pakistani (%)	1 (4.5%)
	Polish (%)	1 (4.5%)
Infants general information		
Gender	Female (%)	13 (59.1%)
	Male (%)	9 (40.9%)
Age	Range	46.4 weeks
	Mean (*SD*)	28.6 weeks (11.4 weeks)

3.4.2 Sociodemographic Profile of the Comparison Group

The sample consisted of 30 mothers without any personal history of depression or any other mental health problem, mean age 32.8 years (*SD* = 4.1, range = 24-43 years). Out of the 30 infants in the comparison group, 15 (50%) were boys and 15 (50%) girls, while their mean age was 32.9 weeks (*SD* = 10.67, range = 41.85 weeks). The majority of the sample were British or came from any other white background; 11 mothers (36.7 %) were British; equally, 11 mothers (36.7%) came from any other white background. In terms of marital status, most of the mothers were married (53.3 %). The sociodemographic characteristics of the comparison group are presented in Table 3.2. Additional information concerning the demographic profile of this group is presented in Appendix A.

Table 3.2

Sociodemographic Characteristics of Mother-Infant Dyads from the Comparison Group

Maternal sociodemographic characteristics (n=30)		
Age	Range	24-43
	Mean (SD)	32.8 (4.1)
Marital status	Single (%)	5 (16.7)
	Married (%)	16 (53.3%)
	Divorced or separated (%)	1 (3.3%)
	Partner (%)	8 (26.7%)
Ethnicity	British (%)	11 (36.7%)
	Any other white background (%)	11 (36.7%)
	White and black African (%)	1 (3.3%)
	Indian (%)	1 (3.3%)
	Any other Asian background	1 (3.3%)
	(%)	1 (3.3%)
	African (%)	1 (3.3%)
	Chinese (%)	2 (6.7%)
	Other ethnic category (%)	2 (6.7%)
Infants' general information		
Gender	Female (%)	15 (50%)
	Male (%)	15 (50%)
Age	Range	41.85 weeks
	Mean (SD)	32.9 weeks (10.67 weeks)

In the scope of this research, an attempt was made to recruit participants for both groups with similarities in their main demographic characteristics, namely maternal age, infants' age and gender, because '...creating pairs of similar people—one in each condition—it is possible to more clearly identify the effect of the manipulation on an outcome, or dependent variable, without confounding in the form of initial group differences.' (Zwarun, 2018, p.924). For further information, please refer to Table 3.3.

Table 3.3

Matching the Main Sociodemographic Characteristics of Mother-Infant Dyads from both Groups

Main Sociodemographic Characteristics of Mother-Infant Dyads from both Groups		
	Clinical group	*Comparison group*

		(N of participants= 22)	(N of participants=30)
Maternal age	18-24	2 (9%)	1 (3.3%)
	25-30	10 (45.4%)	8 (26.7)
	31-36	7 (32%)	17 (56.6%)
	37-40+	3 (13.6%)	4 (13.4%)
Infants' age	3-6 months	8 (36.3%)	9 (30%)
	6-9 months	9 (41%)	11 (36.7%)
	9-12 months	5 (22.7%)	10 (33.3%)
Infants' gender	Female	9 (41%)	15 (50%)
	Male	13 (59%)	15 (50%)

3.4.3 Criteria for Participant Selection

The clinical group was selected based on the following inclusion criteria:

1) Dyad of inpatient mother and her baby (aged 3-12 months) in an MBU;
2) Mother diagnosed with PND with or without psychosis; and
3) Video-recorded material of admission videos, where the maternal PND symptoms are still evident and untreated.

The comparison group was selected on the basis of the criteria below:

1) Mother without PND with her infant (aged 3-12 months);
2) Mother without personal history of depression or any other mental health problems; and
3) Mother with a score lower than 12 on the EPDS.

There is no exclusion on grounds of race, ethnicity, religion or belief in both groups.

3.5 Research Fieldwork and Video-Recorded Material

3.5.1 Mother-Baby Unit and Video-Recorded Material

For the clinical group, pre-existing video-taped material from the 13-bed Mother-Baby Unit (MBU), the largest in the UK, were used. Video-recordings that contain footage of mothers with PND and their infants interacting during play, face-to-face contact and/or maternal singing on their admission have been analysed.

MBUs provide psychiatric care for mothers with severe mental health problems and support them to form a relationship with their children in order to decrease disruption (Kenny et al., 2013; Gillham & Wittkowski, 2015). According to the National Offender Management Service, all MBUs should be available to accommodate infants up to 18 months (NOMS, 2015). Specifically, the MBU admits mothers with their babies (aged 0-52 weeks at the time of admission and no older than 18 months at discharge [Kenny et al., 2013]) for treatment, and mother-infant interaction is video-recorded for the purposes of video feedback intervention (Pawlby et al., 2010).

In the context of the video feedback intervention, the mothers are invited, during both admission and discharge, to have a 3-minute unstructured play session with their infant, which is then video-recorded. The recording takes place in a specially designed laboratory setting in the MBU; this quiet room contains a soft mat on the floor and some toys. The only instruction is to play and talk with their infant as they would normally. Then the inpatient mothers are invited to a therapeutic observation of this video tape (Bilszta et al., 2012), during which the psychologists help the mothers to interpret the infant's cues and reflect on their own behaviour (Kenny et al., 2013). Overall, the use of video feedback intervention in an inpatient perinatal psychiatric setting aims to improve maternal parenting, by enhancing behavioural sensitivity in mothers with severe mental health issues, including PND (Yagmur et al., 2014).

3.5.2 Children's Centres and Video-Recorded Material

For the comparison group (i.e., mothers without PND), videos of the mother-infant interaction were generated by the researcher. A group of mothers without PND and their infants were recruited from Children's Centres in London (see Section 3.7.2.). Children's Centres are institutions where local families with young children can receive support for various needs

(Douglas, 2019). The offered facilities and activities are designed especially for parents who have a child under the age of 5. Across the UK, approximately 85% of parents and their children regularly visit a Children's Centre (Department for Education, 2015). The participant dyads were video-recorded while interacting during a free-play session. This enabled direct comparison of the interaction between mothers with PND and without PND and their infants.

3.6 Ethical Considerations

3.6.1 Honorary Contract and Permission to Access Clinical Data

An honorary contract with the South London and Maudsley National Health System Foundation Trust (SLaM, NHS) was obtained in order to gain access to the video-recorded data of the clinical group (for the honorary contract along with its extension, see Appendix B). Consent was not sought for the use of archived video material of the clinical group (i.e., inpatient mothers with PND and their infants), since the inpatient mothers, through the consent forms they had signed, had already given their permission for their videos to be used for assessment, teaching or research purposes by professional staff or their trainees within SLaM, NHS or the Institute of Psychiatry, King's College London (see Appendix C).

Moreover, the researcher had no direct contact with the mothers or their infants in the clinical group; as an honorary researcher, the researcher had access only to patient data (i.e., the video-recorded material of mother-infant interaction), while through the NHS electronic system only specific sociodemographic characteristics of the patients were made accessible (i.e., age, ethnicity, religious affiliation, maternal diagnoses, length of hospitalisation and delivery routes).

3.6.2 Ethical Approval Obtained from the University of Roehampton

The application for this project's ethical approval confirmed that this research project abides by the British Psychological Society's (BPS, 2018) ethical guidelines for research with human participants, and the proposed study adheres to these guidelines. The research for this project was submitted for ethics consideration under the reference PSYC 18/321 in the Department of Psychology and approved by the University of Roehampton's Ethics Committee on 9 January 2019 (see Appendix D). Full ethical approval was granted for the project, while the risk assessment for this study was reviewed and approved by the Health and Safety Office. The revised version of the consent forms was used and completed by the comparison group (see Appendix E); the consent forms informed participants about the purposes of the study and their right to withdraw at any point without having to provide justification. Participants were also informed that there is neither compulsion or pressure to take part in the project, nor adverse consequences for withdrawing, as participation in the study was voluntary. All participants were reassured about the anonymity and confidentiality of the information provided. No images from the videos of either group will be reproduced in the thesis. All the information derived from the video tapes of both groups was treated confidentially, and videos were stored in password-protected folders. Data were collected and processed in accordance with the General Data Protection Regulation and Data Protection Act 2018, as well as Roehampton University's Data Protection Policy. Finally, the researcher obtained a clear DBS check, which she had always available in the setting where the research was carried out. The researcher also followed all the health and safety procedures required in the research venues.

3.7 Procedure

3.7.1 Clinical Data Collection Process

Following the researcher's initial contact with the MBU (see Appendix F), it was a prerequisite that the researcher would complete most of the data collection process for the comparison group in order to proceed with the acquisition of clinical data. The rationale for this decision was that the selection of clinical videos from the database should be informed by the demographic characteristics of that comparison group, so as to reduce any potential bias related to participants' demographic characteristics, thus creating two groups with a profile as similar as possible. Having received the ethical approval from the Research Ethics Committee (January 2019) and the Honorary contract with SLaM, as well as having completed the data collection for the comparison group, the data collection process for the clinical group lasted from February to April 2020.

It is worth mentioning that two significant changes took place before the completion of the clinical data collection process: Firstly, the initial inclusion criteria regarding the infants' age (i.e., 8-12 months) was changed and, consequently, another round of data collection for the comparison group was added. Specifically, after the main part of the data collection process for the comparison group had been completed, the researcher provided the clinical supervisor with the participants' demographic characteristics, including infants' gender and age. Subsequently, their first attempt to identify potential participants from the MBU database based on the comparison group's personal information revealed that, out of the 55 mothers who had a diagnosis of depression, including psychotic depression, only 7 had an infant who was admitted at 8 months (243 days) or over. This affected the inclusion criteria set regarding infant age, with the age range being expanded to include infants from 3 to 12 months old. This change in the infant age inclusion criteria generated the need for a second round of recruitment of participants with infants younger 8 months (for further information, see Section 3.7.2.1). Overall, the expansion of the infant age range increased the sample size from 7 to 29 admission videos selected, based on the final inclusion criteria from the MBU database. However, the final number of the clinical videos included in this study was reduced to 22, due to the global COVID-19 pandemic, which caused the second change in the data collection process. The pandemic effectively eliminated access to the MBU's strictly guarded clinical ward where the clinical data of 7 additional video tapes suitable for this study were stored. Hence, these videos were excluded from the final sample of this research project.

3.7.2 Recruitment Process for the Comparison Group: First Stage: Children Centres

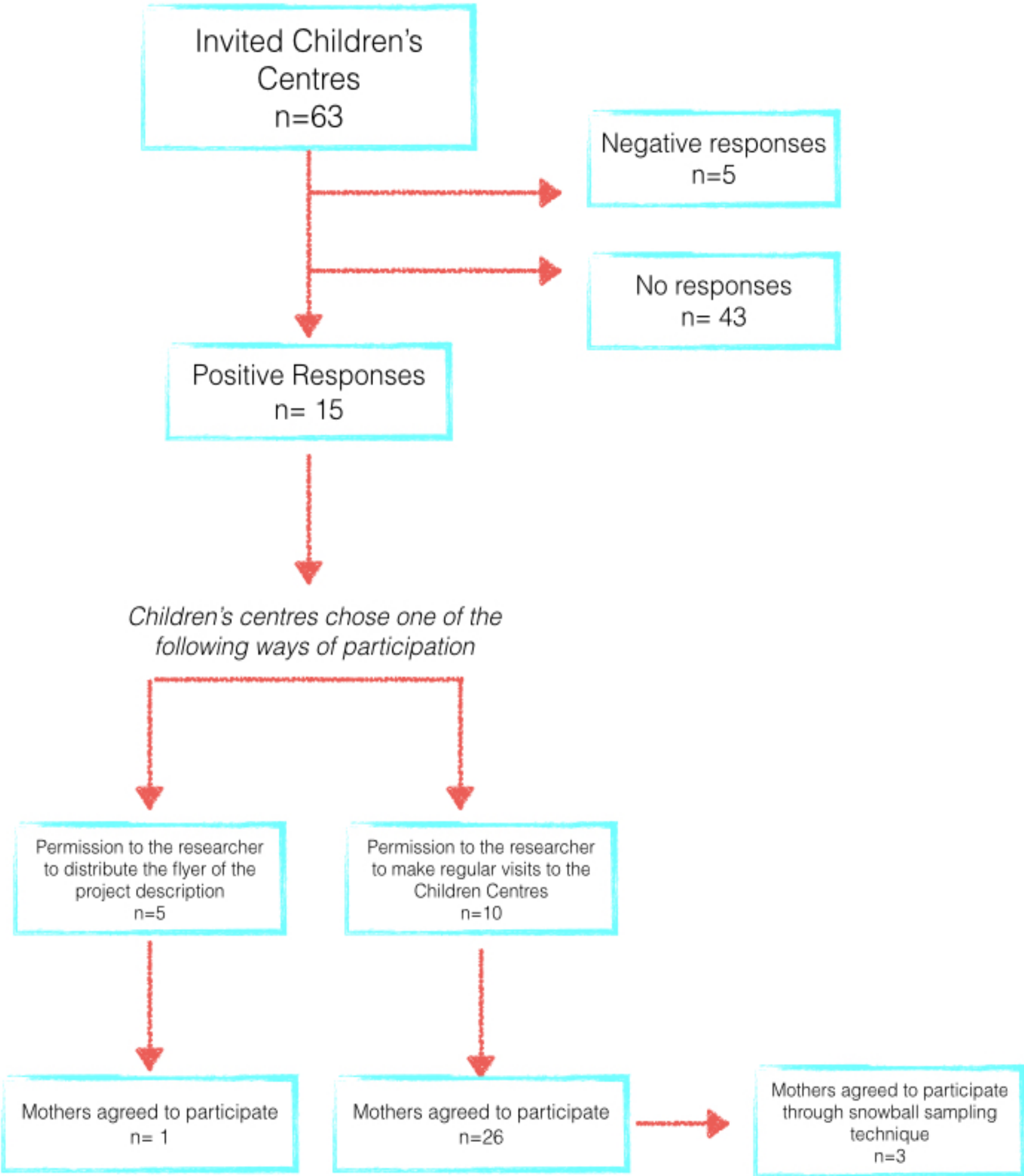
The recruitment process for the comparison group began upon project confirmation from the University of Roehampton's Research Degrees Board and ethical approval from the Research Ethics Committee (January 2019); it was completed in March 2020. The recruitment of participants and data collection for the comparison group took place in two different cycles: the first recruitment period occurred from February to April 2019, and, one year later, the researcher revisited the same Children Centres to recruit additional participants, in order to expand the sample in terms of the infants' age (for further information, see Section 3.7.1). The second recruitment cycle lasted from February to March 2020.

During the recruitment process, between January and February 2019, letters describing the project were sent out electronically, followed by phone calls to Children's Centres in London, addressed to the head of the centre, centre managers and/or centre coordinators (see Appendix G). Follow-up phone calls were made, and reminders sent via email to those addressees who did not reply within two weeks. Once organisations showed interest in the study, the researcher arranged an initial in-person meeting with the Children Centre coordinator or manager to present the study, explain the project in greater detail and discuss any questions raised. The average duration of these meetings was 45 minutes. During these meetings, the researcher clarified that the participation of the Children's Centre in this project did not require any additional work from the centre staff, nor made any additional demands on their time. The only involvement was to give the researcher the opportunity to approach the mothers who visited the place in order to inform them about the project. The main request included access to the premises for a few sessions with the mothers and their babies, if necessary. These sessions would be arranged at the time most convenient for the organisation and the participants.

A total number of 63 Children's Centres in four different Local Authorities (LAs) in London were invited to take part in this research. Out of the 63 Children's Centres invited to participate in this study, 15 Children's Centres (23.8%) agreed and 5 (8%) declined the invitation, while 43 Children's Centres (68.2%) never replied. Out of 15 Children's Centres participating in this research, 5 agreed to distribute on the premises the flyer of the project description specifically designed for the mothers (see Appendix H). The remaining 10 Children's Centres gave the researcher permission to visit on a regular basis in order to approach the mothers individually and invite them to participate in the study. In these settings, the researcher also obtained permission to use the premises for data collection purposes. The snowball sampling technique was also used, as an additional recruitment strategy (for further information, see Section 1.4.3).

Figure 3.1

Recruitment Process Flowchart: Comparison Group



3.7.2.1 Recruitment Process for Comparison Group: Second Stage: Mothers Without PND and Their Infants. The researcher on a daily basis attended the under-one Play and Stay sessions[1] taking place in the participating Children's Centres. During these sessions, the researcher identified mothers with infants aged 3-12 months, had individual meetings with them to present the project and invited them to take part. With those mothers who had been approached using a snowball sampling technique, the researcher arranged an initial phone meeting to discuss the project, followed by a home visit.

3.7.3 Procedure and Data Collection

All potential participants were screened for eligibility. The mothers were given an information sheet together with the consent form and a set of questionnaires, including closed-ended questions related to a personal history of depression, with indicative questions including whether they had ever been diagnosed with depression, and whether they had received treatment for PND (see Appendix I)The questionnaire took about 5-7 minutes to complete. Then, they were asked to complete the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987), which was used as a screening tool to ensure that these mothers were not suffering from PND (see Appendix J).

Participant mothers without PND and their infants who met the inclusion criteria were video-recorded under the same conditions as the clinical group (i.e., dyads of babies and mothers with PND), interacting during play, maternal singing and/or face-to-face contact. The clinical group was video-recorded in a quiet room at the MBU (see Section 3.5.1); this inpatient ward served not only as clinical setting, but also as temporary accommodation for the clinical group and this therefore increased the participants' familiarity with the setting. Given that a quiet room was needed to produce video footage of the dyads of mothers without PND and

[1] Stay and Play entails drop-in sessions especially designed for infants and their families. The aim of these sessions is to work together with the babies and their families in order to strengthen their bond while at the same time offering opportunities for social interaction for both mothers and babies, educational activities for babies under 1 year of age and tips for their mothers on how to support the child's learning and development. The duration of a session varies between 1.5 and 2 hours.

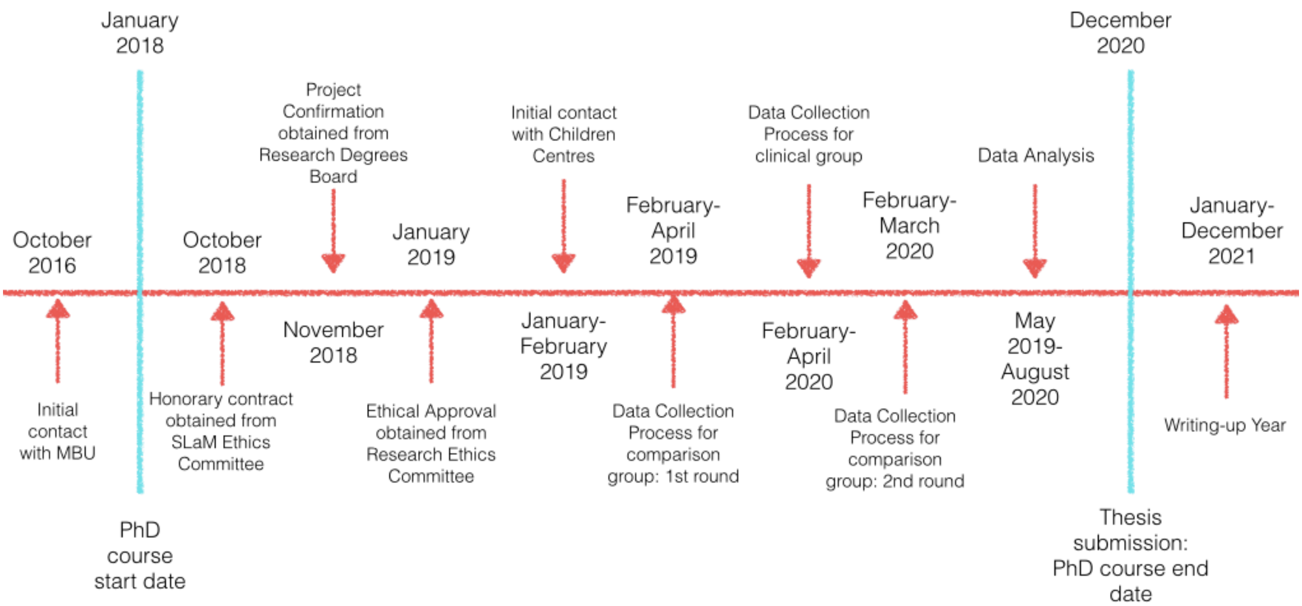
their infants, the video-recording process took place in each participant's preferred environment (i.e., in the Children's Centres or at home) to equally preserve familiarity with the context, at a time convenient for the participants. The room in which the video-recording process took place had to contain a small mattress on which mother and infant could sit and a variety of toys appropriate for the age of the infant. Out of the 30 participating mother-infant dyads, 3 were video-recorded in a home setting, while the video-production process for the remaining 27 dyads took place in a quiet room in the Children's Centre.

The mothers were asked to interact with their babies as they usually would. After a 'warm-up' period lasting a couple of minutes, the mother-infant play interaction was video-recorded for 3 minutes (i.e., the duration of the pre-existing videos of the case group) with one camera. Adopting Grugnola and colleagues's study set-up directions (Crugnola et al., 2014), the video camera was positioned inside the room in front of the dyad and framed the mother and infant sitting on the floor, sideways so as that behaviour and facial expressions of both members of the dyad to be visible and able to be coded. As with the clinical group, no specific instructions were provided to the mothers without PND in terms of how to interact with their babies. In addition, when infants cried for more than 40 seconds at any point, the video-recording process was interrupted, and mothers had the opportunity to soothe their babies. However, if an infant continued crying, the video-recording process was either postponed to another date following maternal consent or cancelled.

Before moving on to measures and data analysis, an overview of the research timeline is presented in Figure 3.2. This figure summarises the researcher's actions throughout the entire process in chronological order. It includes the stages described in the previous sections, highlighting the doctoral milestones, as well as introducing the research phases presented in detail in the following sections, in order to provide an overall picture of this doctoral research project.

Figure 3.2

Timeline of the Research Project



3.8 Measures

3.8.1 Measurement of Maternal Depressive Mood: Edinburgh Postnatal Depression Scale (Cox et al., 1987)

Despite the fact that mothers from the clinical group were given a clinical diagnosis of PND by a psychiatrist from the MBU, the budget constraints of this project restricted the option for the mothers from the comparison group to attend clinical interviews with a psychiatrist in order to assess their mental health status. Therefore, maternal depression in the comparison group was assessed with the help of the Edinburgh Postnatal Depression Scale (EPDS). The EPDS has been proven an efficient and effective way of identifying patients at risk for 'perinatal' depression (Cox et al., 1987). It also has adequate sensitivity and specificity to identify depressive symptoms in the larger population (Cox et al., 1996). As this scale has good discriminant validity (e.g., it can differentiate between mothers with and without depression), it has been widely used in studies focused on mothers with and without depression (e.g., Deave et al., 2008, Halligan et al., 2007; O'Connor et al., 2002; Glover et al., 2004; Koutra et al., 2012; Bilszta et al., 2012; Pawlby et al., 2008; Murrray et al., 1996a, 1996b; Hiscock et al., 2001; Amstrong et al., 1998).

In particular, the EPDS is a 10-question self-rating scale designed for women who are pregnant or have just had a baby. Originally, it was developed to assist in identifying possible symptoms of depression in the postnatal period. This self-report instrument assesses postnatal depressive symptomatology during the 7 days before the assessment date. The scale can be completed in about 5 minutes and is simple to score. Each item is rated on a 4-point Likert scale ranging from 0 (not at all) to 3 (most of the time), amounting to a total score ranging from 0-30. Regarding the cut-off score for clinical depression on this scale, a threshold of 12 has been recommended for community screening to identify potential cases of postpartum depression (Evans et al, 2001; Rubertsson et al., 2005; Pawlby et al., 2008). For the purpose of this research, only mothers scoring lower than 12 on the EPDS were invited/recruited to the second phase of this study (i.e., video-recording of mother-infant interaction).

3.8.2 Measurement of Maternal Sensitivity: Infant CARE-Index (Crittenden, 2005)

The Infant CARE-index (Crittenden, 2005) was used to measure maternal sensitivity in a dyadic context for both groups and has been derived from attachment theory to evaluate sensitivity in mother-infant interaction (Crittenden, 2010). It forms a valid and reliable screening tool to assess mother-infant interaction in a video-taped play interaction (Crittenden, 2005). This coding system includes three descriptors for the adult – sensitivity, control and unresponsiveness – and four for the infant – cooperativeness, difficultness, compulsiveness and passivity. Sensitivity is the central construct around which the coding system has been developed. It is defined as follows: ‘adult sensitivity in play is any pattern of behaviour that pleases the infant and increases the infant’s comfort and attentiveness and reduces its stress and disengagement’ (Crittenden, 2010; p. 4).

3.8.2.1 Infant CARE-Index Training. The researcher completed the Infant Care-Index course offered by Dr Steve Farnfield (course leader) and Ms Rebecca Carr-Hopkins at the University of Roehampton. This intensive course included 9 days of training and took place from October to December 2018. In February 2019, the researcher passed the reliability test. Since then, she has been attending the Infant Care-Index online course delivered by Ms Rebecca Carr-Hopkins.

3.8.3 Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al, 1996b; Murray & Karpf, 2000)

The Global Ratings Scales (GRS) of Mother-Infant Interaction were developed by Murray et al. (1996b) to assess the differences between groups of mothers with or without PND in a video-recorded mother-infant interaction. The GRS can be applied to mother-infant dyads from 2 to 6 months postpartum and has been widely used in research (e.g., Gunning et al., 2004; Mäntymaa et al., 2006; Puura et al., 2007; Bozicevic et al., 2016; Koch et al., 2019). The Coding Scheme for Structured Mother-Infant Play Interaction at 12 months (Murray & Karpf, 2000), an adaptation of the Global Rating Scales (Murray et al., 1996a), was used for the purpose of this study. This assessment tool was deemed appropriate because it is designed to assess infants', mothers' and their interactional behaviours, covering a wide range of behavioural aspects. Relatively speaking, it is not particularly time-consuming to rate, while still maintaining clinical sensitivity (Gunning et al., 2004). It has also been proven sensitive to impaired interaction between mother and infant, even in low-risk samples (Gunning et al., 2004). In a meeting with the researcher, Dr Murray confirmed the suitability of this scoring scheme for the aims of the present research.

Here, the following measures of maternal vocal behaviour were applied: maternal verbal control behaviour, positive expressed emotion, negative expressed emotion and maternal verbal elaboration. In parallel, the measures used for the infants' behaviour were the following: vocalisation, emotional tone and self-regulation. In particular, existing literature on vocal behaviour in mothers shows that there exist differences between mothers with depression and mothers without depression (Field, 2010); infant-directed speech in mothers with depression is characterised by longer utterances, fewer explanations, suggestions and questions, less use of repetition, more negative affect and fewer references to their babies' behaviour (Herrera et al., 2004; Kaplan, Bachorowski & Zarlengo-Strouse, 1999). These deficits in mother-child interactions are strongly linked to poorer language outcomes and cognitive capacities (Zauche et al., 2016), as well as to emotional difficulties (Paulson et al, 2009) (for further relevant information, see Chapter 5). To illustrate this point, infants' verbal and non-verbal communication skills (i.e., measures of vocalisations, emotional tone and self-regulation, respectively) in conjunction with the content of maternal speech during the mother-infant play interaction were analysed and assessed, using the GRS instrument. The following two sections present the maternal and infant GRS measures used in this study in greater detail.

3.8.3.1 Global Ratings Scales-Infant Measures: Infant Vocalisations, Emotional Tone and Self-Regulation. The core measures used for infants' behaviour are vocalisations, emotional tone and self-regulation. Specifically, the measure of infant vocalisations refers to non-crying utterances or recognisable utterances embedded in crying, without also considering physiological sounds such as burps, sneezes or hiccups. The actual number of vocalisations that the infant elicits was also calculated. Infant emotional tone refers to verbal and non-verbal signs that indicate how happy or unhappy and fussy the infant is during the interaction. Finally, the infant self-regulation measure refers to the overall impression of how emotionally and physically well-regulated the infant expresses him- or herself, taking into account the number of state-changes through which the infant may cycle, as well as self-soothing and self-distracting strategies used by the infant.

Each dimension was coded on a 5-point scale, running from 5 (good) to 1 (poor). Only for the vocalisation category, in conjunction with the rating scale score, the total number of the infant's vocalisations were added up, to give a score from 0 to the actual count of events. For instance, at least 10 vocalisations correspond to a score of 5 on the rating scale, which means that the infant vocalises for most of the interaction.

3.8.3.2 Global Ratings Scales-Maternal Measures: Verbal Control, Positive and Negative Expressed Emotion, Maternal Verbal Elaboration and Maternal Emotional Tone. The maternal verbal control behaviour measure rates the number of maternal utterances of strong and mild verbal control. The sub-categories of strong verbal control include commands, strong requests, inhibition, forbids, cautioning and correcting, while mild control refers to suggests, prompts, gentle requests, joint suggestions and guides used by the mothers when addressing their infants in the play session (see Table 3.4).

Table 3.4

Summary of the Categorisation Scheme for Maternal Verbal Control Behaviour (Murray & Karpf, 2000, p. 3)

Strong Control ***Commands, which are often imperatives***	**Mild control** ***Some attempt to influence***
Commands ('Come here!', 'Bring the…!')	Suggests ('How about doing…')
Strong Request ('Look here!')	Prompts ('The circle goes in here…', 'What is it?', 'Where does it go?')
Inhibition ('That won't work')	Gentle requests ('Would you like to…', 'Do you want…', 'Can you give….')
Forbids ('No, don't do…!')	Joint suggestions ('Shall we do…', 'How about if we…')
Cautioning ('I will take it away…')	Guides (Information accompanied by practical help)
Correcting ('No, you have to do…')	

The content of maternal speech was also assessed in the light of the maternal positive expressed emotions, which is defined as any positive, affectionate or complimentary comment directed at the infant, along with maternal negative expressed emotions, perceived as any critical, negative or denigratory expressions directed at the infant. Furthermore, the dimension of maternal verbal elaboration was used to assess the maternal verbal expansion of use of the toy or information about the toy, which adds to the infant's experience. Verbal elaborations could be: (1) simple comments on form, shape, function, colour and sound of the toy or count (e.g., 'three balls', 'red', 'rattle'); (2) more sophisticated instructional, educational and explanatory comments (e.g., by using a higher quality of counting such as 'one, two, three balls', or by comparing the toy or its function to another familiar object or concept, for example 'this is green and red, like the traffic lights'); and (3) other flexible/imaginative uses of the toy (e.g., the use of the shape sorter as a drum). For the first three measures, the actual count of events was added up to give a total score, while for the last item a 5-point rating scale was used, including the labels 'no verbal elaboration', 'little verbal elaboration', 'moderate verbal elaboration', 'good verbal elaboration' and 'very good verbal elaboration'.

Lastly, parallel to the evaluation of the content of the maternal speech, this study assessed the maternal emotional tone; this dimension refers to how happy or unhappy and fussy the mother is during the play. This item was coded on a 5-point scale; a score of 1 was 'very unhappy' and a score of 5 'very happy'.

3.8.3.3 Global Ratings Scales-Joint Measures: General Atmosphere and Reciprocity. Two elements of this instrument – namely, general atmosphere and reciprocity – fall under the dimension joint measures and refer to the assessment of the mother-infant interaction's quality. General atmosphere of the interaction refers to the extent of how harmonious or disharmonious the overall interaction between the mother and infant is. This item was rated on a 5-point Likert-type scale, with a value of 1 for 'very much discord' and 5 for 'very harmonious, agreeable and peaceful, no conflict or negative feelings expressed'.

Lastly, the quality of the mother-infant interaction was also evaluated through the prism of the dimension of dyadic reciprocity, which refers the 'dance-like' fluency occurring in mother-infant interaction (Provenzi et al., 2018). Reciprocal interactions between a mother and her infant reinforce child holistic development (van Huisstede et al., 2019). This kind of interactions is also related to the child's self-regulation, empathy and better attachment in adolescence (Feldman, 2007, 2010; van Huisstede et al., 2019). PND is associated with reduced reciprocity in mother-infant interaction (Kaplan et al., 2009). This leads the infants of mothers with PND to be at increased risk to exhibit problems in their social, emotional and cognitive development (Kaplan et al., 2009), as well as psychopathology later in life (Pawlby et al., 2008). In the GRS, the reciprocity variable rates the degree of joint orientation and co-ordination of the actions between the mother and the infant in achieving a task goal. In other words, this evaluates the extent of mutual exchange between mother and infant; the infant's input is received and responded to by the mother and vice versa. Ratings were made on a 5-point scale, with 1 standing for 'no reciprocity' and 5 for 'very much reciprocity'.

3.8.3.4. Global Ratings Scales of Mother-Infant Interaction Training. The researcher attended a 3-day training course run by Mrs Laura Bozicevic from the University of Liverpool, UK. This course took place from February to March 2020. Upon completion of the training, 10 videos were scored by the researcher and returned to the trainer for reliability rating. The researcher passed the reliability test in April 2020.

3.9 Data Analysis

3.9.1 Mother-Infant Interaction: A Micro-Analytic Approach

The aim of this study was to compute a fine-grain micro-analysis in order to gain an in-depth understanding of both mother and infant behaviours. Hence, the type, frequency, quality and duration of the interactive behaviour of 52 mother-infant dyads were examined based on video-recorded material. Because mother-infant interaction involves a wide range of behaviours and communicative exchanges, it was essential to employ a methodology that assures a detailed examination of these complex and extremely rapid behaviours that occur in mother-infant interaction.

The micro-analytic approach is a widely used method to study mother-infant interaction (e.g., Bigelow, 1998; Field et al., 1988; Murray et al., 1993; Stack & Muir, 1990; Stern, 1971; Brazelton et al., 1974; Trevarthen, 1977, 1979; Tronick, 1989; Tronick & Cohn, 1989; Cohn et al., 1990), especially concerning maternal PND (e.g., Friedman et al., 2010; Reissland & Shepherd, 2006; Reissland et al., 2002b; Reissland et al., 2005; Stack & Muir, 1990; Murray & Cooper, 1997a, 1997b, 1997c; Murray et al., 1993; Cohn et al., 1990; Field et al., 1988). This approach allows for the behavioural coding and analysis of filmed behaviours in slow motion and frame by frame (i.e., 1 frame= 1/25th second). As such, it allows an objective, sequential, detailed examination of mother-infant interaction that includes the observation and assessment of gaze orientation, facial expression, vocalisation, physical contact and body posture (Beebe, 2006; Herrera, 2010). Overall, even if it makes for a very laborious coding procedure (Herrera, 2010), it was chosen for the present study because 'microanalysis operates like a "social microscope", identifying "subterranean" rapid communications, which are often not quite perceptible in real time' (Beebe & Steele, 2013, p. 583).

Due to the complexity of the micro-analytic coding scheme, the Noldus Observer XT 16.0 software package (a computer-aided coding system, Noldus, Wageningen, the Netherlands) was used for the management, analysis and presentation of the time-structured data from the video-recorded material. The Observer XT is a software system for data review, behaviour coding and analysis (Ducharme et al., 2009). It is specifically designed for the collection, management and analysis of observational data, as well as for developing coding schemes and generating quantitative data. In addition, it is widely used in studies of mother-infant interaction due to its level of precision (e.g., Reyna et al., 2012; Reale et al., 2011; Crugnola et al., 2014, 2016; Logsdon et al., 2014; Crucianelli et al., 2019; McFarland et al., 2020). While using Observer XT, structured coding schemes were created for each video, which comprise labels for infants' and/or mothers' signifier behaviours (or alternatively, target behaviours) based on predetermined events. The target behaviours were divided in two types; (1) 'point events' when the focus was only on the frequency of occurrence, and (2) 'state events' when, besides the frequency of occurrence, the duration was also recorded. Each video was coded separately, using mutually exclusive codes. The researcher attended an Observer XT training in March 2020.

3.9.1.1. Coding Scheme Used for the Observer XT Micro-Analysis. This coding scheme was developed to evaluate indices of self- and interactive behaviours within a small time-unit during a mother-infant free-play interaction. Its aim was to examine the impact of PND on infants' verbal and non-verbal communication skills, as well as on the quality of mother-infant play interaction. In order to provide an overall picture of both infants' developmental skills and mother-infant interaction, a wide range of variables strongly linked to infant development and mother-infant relationship have been used. These behavioural variables are organised into different sub-categories, derived from a merging of reliable coding schemes pre-existing in other relevant studies in the field (i.e., Tronick et al., 1980; Adamson & Bakeman, 1985; Polan and Ward, 1994; Neale et al., 2018; Zuccarrini et al., 2018; Moszkowski & Stack, 2007; Reece et al., 2016; Crucianelli et al., 2019; Murray & Karpf, 2000; Crugnola et al., 2013; Crittenden, 2010; Tronick et al., 2005; Aureli et al., 2015; Serra et al., 2020). Tables 3.5 and 3.6 present the infants' and maternal variables used in the coding scheme, along with their sub-categories, while Section 3.6 provides further information about the description of these behavioural codes.

Table 3.5

Coding Scheme: Behavioural Categories and Variables in Terms of Infants' Verbal and Non-Verbal Communication Skills

Infant Behavioural Categories	Variables
Affect	Positive Negative Neutral
Gaze	Towards the mother Towards the object Towards the toy or hand the mother is using Eye-contact Elsewhere
Touch	Affectionate Object-mediated Play-related Static Rough Due to the position No Touch
	Vocalization

Vocal behaviour	no-vocalization Strange vocalization
Use of Toy	Holding without interest Non-object related use of toy Object related use of toy Grasping Explorational use of toy No physical contact with the toy

Regarding the infants' skills, each infant was evaluated separately in terms of each of the following behavioural codes: infant affect, physical contact, direction of gaze, vocalisation and use of the toy, which fall under five different infant developmental domains – that is, socio-emotional, sensorimotor, cognitive, social/interactive and language. Table 3.5a provides further information about the correspondence between the behavioural variables and infant developmental dimensions.

Table 3.5a

Categorisation of Infant Behavioural Codes into Different Dimensions of Infant Development

Dimensions of Infant Development / Infant Behavioral Codes	Socioemotional	Sensorimotor	Cognitive	Social/interactive	Language
Affect	x		x	x	
Direction of Gaze	x		x	x	
Physical Contact	x	x		x	
Vocalization			x	x	x
Use of Toy		x	x	x	

Having presented the behavioural categories and variables in terms of infants' verbal and non-verbal communication skills, Table 3.6 contains the respective behavioural categories and variables in terms of maternal verbal and non-verbal communication behaviours used for the purpose of this study.

Table 3.6

Coding Scheme: Behavioural Categories and Variables in Terms of Maternal Verbal and Non-Verbal Communication Behaviours

Maternal Behavioural Categories	Variables
Affect	Positive Negative Neutral

Gaze	Towards the mother Towards the object Following partner's gaze Eye-contact Elsewhere
Touch	Affectionate Object-mediated Instrumental Play-related Attention-Seeking Static Due to the position No Touch Rough
Vocal behaviour	Talk Singing Sounds No talk
Use of Toy	Play without the use of toy Non-object related use of toy Object related use of toy Holding the toy Taking the toy Offering the toy No toy manipulation

As mentioned above, in addition to describing and assessing infants' developmental trajectories, another intention of the present coding scheme was to reliably capture specific communication modalities that commonly emerge during mother-infant interaction. Therefore, it was essential to assess during play maternal communication patterns that are interrelated to infants' communication abilities. More specifically, maternal behavioural codes assess maternal communication behaviours (i.e., facial affect, touch, gaze, verbal behaviour), while one variable was related to the use of a toy/object, given that in the present study the mother-infant interaction is organised around a free-play situation. Again, the coding was carried out separately for each mother. However, it is worth mentioning that infant behavioural codes were inextricably interwoven with maternal behavioural codes and vice versa.

3.9.1.2 Description of Behavioural Codes. Table 3.7 contains all the descriptions and/or operational definitions that correspond to the behavioural codes included in the proposed coding scheme for the two subjects, the infant and the mother. The table also includes examples to better explain some of the sub-categories of behavioural aspects.

Table 3.7

Descriptions of Behavioural Codes Included in the Coding Scheme

Behavioural Category	Behavioural Code	Description
Affect	Positive	For infants: wide-eyed, smiling/laughing, happy facial expression, energetic movements, raised eyebrow (Neale et al., 2018) For mothers: smiling/laughing, happy facial expression
	Negative	For infants: frowning, sad, fussing, crying, evidence of overt or subtle distress signals (Neale et al., 2018) For mothers: Unhappy, angry, frowning, grimaces of disapproval or dissatisfaction (Crittenden, 2010; Murray & Karpf, 2000)
	Neutral	Normal facial expression (Crittenden, 2010)
Gaze	Towards the partner	Direction of gaze is towards the partner
	Towards the object	Direction of gaze is towards the object
	Following infant's gaze	Mother follows infant's gaze and is looking where the infant looks
	Eye-contact	Eye contact was defined as situations in which one individual gazes at the other and vice versa simultaneously (i.e., two-way) (Jongerius et al., 2020)
	Elsewhere	Direction of gaze is neither towards the partner nor towards the object

	Affectionate	Affectionate touch that gives a sense of closeness between the child and the mother (Reece et al., 2016)
	Object-mediated	Object-mediated touch that creates a physical contact indirectly, through the use of an object (Serra et al., 2020)
Touch	Instrumental	Instrumental intentional touch that serves the child (Reece et al., 2016) Vestibular stimulation (e.g., adjust the position with change in balance) Caregiving (e.g., reposition infant; wipe infant's mouth; adjust infant's clothing; etc.) (Serra et al., 2020)
	Play-related	Play-related touch that occurs as forceful guidance to make the infant achieve the task (Murray et al., 2000) Play-related touch towards the meaning of the story (not affective, e.g., touching the infant's foot when a picture of shoe appears)
	Attention-seeking	Physical contact to elicit attention
	Static	Passive contact such as resting the hand in contact with the infant (Polan and Ward, 1994) or provide hand or finger for infant to hold (Serra et al., 2020)
	Due to the position	Physical contact due to mother-infant position
	Rough	Rough Touch: scratch; pull; push; pinch; poke (Serra et al., 2020) Vestibular stimulation (e.g., rough or restrictive handling) Proprioceptive stimulation (awkward holding) (Crucianelli et al., 2019)
	Maternal Sounds	Imitation of baby's sounds; imitation of animal sounds; imitation of toy sounds
Vocal behaviour	Infants' strange vocalisation	Strange vocalisations include vocal growling and strained positive voice and are index of stress (Crittenden et al., 2010)
	Infant vocalisation	Cooing, babbling, constant sounds or words (Murray & Karpf, 2000)
	Play without the use of a toy	Engagement in playful activity without the use of a toy
	Non-object-related use of the toy	Any kind of activity with the object that does not involve appreciation of the object's particular properties, i.e., the action could be done with almost any object (Neale et al., 2018)
	Object-related use of the toy	Mother demonstrates or presents an object to infant in a way that involves appreciation of the object's particular properties (Neale et al., 2018) (i.e., the mother shows the baby how to play with a telephone by pressing the buttons)

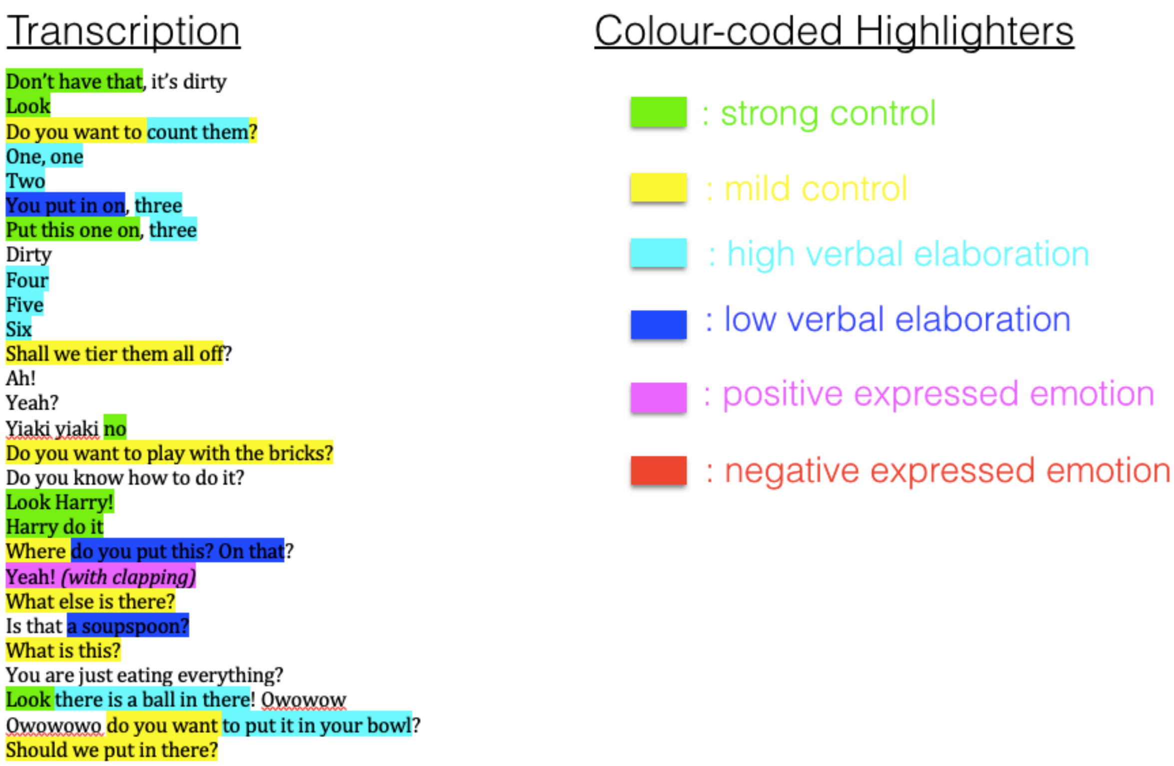
Maternal use of the toy	Holding the toy	Physical contact with object and no actions (e.g., holding) (Neale et al., 2018)
	Taking the toy	The action or process of taking the object from the infant that is followed by the infants' extension of the arm with the object in hand and directed toward the hand of the mother
	Offering the toy	Extension of the arm with the object in hand and directed toward the hand of the infant (Zuccarrini et al., 2018)
	No toy manipulation	No physical contact with the toy
Infants' use of the toy	Holding without interest	Physical contact with object and no actions (e.g., holding) (Neale et al., 2018)
	Non-object-related use of the toy	Physical contact with object and non-object-specific exploration of object, using circular/repetitive action/motion with object (e.g., banging, shaking, mouthing) (Neale et al., 2018)
	Object-related use of the toy	Physical contact with object with rule-based behaviour related to object (Neale et al., 2018)
	Grasping	Curling of fingers around a new stimulus (Moszkowski & Stack, 2007) offered by mother or chosen by infant
	Explorational use of the toy	Physical contact with object and object-specific exploration of object (Neale et al., 2018) (i.e., through palpation)
	Joint manipulation	Mother actively helping the infant manipulate an object, entailing mother and infant touching the same object at the same time
	No physical contact with the toy	No toy manipulation

3.9.2 Maternal Vocal Behaviour

Maternal speech directed at the babies in each video-recorded interaction was transcribed verbatim, coded and analysed based on the GRS measures in conjunction with the footage (see Section 3.8.3.2). A colour-coding technique was applied to organise and analyse data related to maternal vocal behaviour, by segmenting transcripts in various user-assigned colours (Creswell, 2012). This technique provides a visual classification of the content of maternal speech when addressing her infant, based on colour-coded highlighters for labelling the following variables: strong or mild control, high or low verbal elaboration, positive or negative expressed emotion. Figure 3.3 presents an example of transcription analysed while using the colour-coding technique.

Figure 3.3

Example of Transcription Analysed Using the Colour Coding Technique



3.10 Summary

To summarise, this cross-sectional study used mixed methods in order to investigate the impact of PND on the quality of mother-infant interaction as well as on infant development. Video-recordings of a clinical group of 22 inpatient PND mothers with their infants (3 to 12 months of age) interacting during a free-play session were analysed and compared with similar video-recorded material of 30 mothers without PND interacting with their infants (3 to 12 months of age). Having an honorary contract with the SLaM, NHS and the ethical approval in place, the researcher conducted the data collection process for the control group and the comparison group in an MBU and Children's Centres, respectively. For the data analysis, valid and reliable assessment tools were used (i.e., Infant CARE-Index [Crittenden, 2005], Global Rating Scale [Murray & Karpf, 2000]). Moreover, a micro-analytic approach served to evaluate infants' communication skills, as well as to ensure the detailed examination of complex and extremely rapid behaviours that occur during mother-infant interaction.

Chapter 4: Mother-Infant Interaction

4.1 Introduction

The current chapter begins by reviewing the literature concerning the quality of mother-infant interaction in the context of postnatal depression (PND). The review focuses on key concepts relevant to the mother-infant relationship – that is, mother-infant attachment and reciprocity, maternal sensitivity, and infant self-regulation. The chapter discusses the significance of each concept in child development, while also exploring their strong interrelationship and their effects on child well-being, through the prism of the presence of PND. Furthermore, Chapter 4 continues to discuss the methodology chosen for the present study, which aims to produce an overall picture of the mother-infant interaction in case of PND. In addition, the main findings emerging from the current study will be presented, together with a discussion on how these findings integrate with and expand the existing literature.

4.2 Mother-Infant Interaction

4.2.1 Attachment

The most influential model for producing a coherent understanding of how early mother-infant interactive patterns may predict child development outcomes consists of attachment theory (Bowlby, 1977). According to attachment theory, the quality of maternal postpartum behavioural repertoire (i.e., gaze, smile, sensitivity, affectionate touch, vocalisation-motherese) is inextricably linked to the child's development and well-being (Gillibrand et al., 2011). Secure attachment between mother and child is attributed to maternal sensitivity, availability and responsiveness (Music, 2011); through these, the mother provides a 'secure base' upon which the child can develop and flourish so that s/he becomes autonomous later in life (Stern, 2009). Infants whose mothers respond to them appropriately and without stress learn to see the world as a safe and reliable place (Bilszta et al., 2012; Music, 2011). Previous research has also indicated that securely attached children tend to have much better outcomes across all developmental domains, including socio-emotional and cognitive ones (Deave et al., 2008; Evans et al., 2012; Olhaberry et al., 2015), as well as lower rates of mental health problems, than insecurely attached children (De Wolff & van Ijzendoorn, 1997).

Despite maternal postpartum behaviours being 'genetically programmed' (Feldman & Eidelman, 2007, p. 290), there are some factors, such as PND, that can have detrimental effects on the relationship between the mother and the infant. Mothers with PND are less likely to be attuned to their infants' pace and wishes and, consequently, less likely to have securely attached children (Hayes et al., 2013). A substantial body of research shows that maternal PND is linked to the development of insecure attachment between a mother and her infant (i.e., Murray et al., 1996; Murray & Copper, 1997; Hipwell et al., 2000; Moehler et al., 2006; Wilkinson & Mulcahy, 2010; Margaret et al., 2018). For example, Meredith and Noller (2003) investigated the relationship between attachment style and PND in 68 participant mothers (45 mothers without PND and 23 with PND). The findings indicated that the group of mothers with PND was significantly more insecure in attachment style than the group of mothers without PND. Likewise, in Australian samples of clinically depressed mothers (n=47) and mothers without PND (n=68), Wilkinson and Mulcahy (2010) found that the clinical group reported less security of attachment, as well as more preoccupied and fearful attachment.

Moreover, longitudinal studies of attachment indicate that early attachment patterns have long-term effects and can be transmitted across generations (Sroufe, 2005; Verhage et al., 2016; Deans et al., 2020). For instance, PND was found to be associated with insecure attachment at 12 months (Lyons-Ruth et al., 1986; Hipwell et al., 2000), at 18 months (Tomlinson et al., 2005; Murray, 1992) and in the second year of life (Teti et al., 1995).

Insecurely attached children of depressed mothers are at a high risk of poor developmental outcomes as they move into adulthood (Alhusen et al., 2013). These children tend to have lower self-esteem and confidence, less empathy, lower self-regulatory capacities, poorer academic performance, as well as lacking ability to express their feelings and form trusting relationships (Music, 2011; King et al., 2015; Bates et al., 2020). Insecure attachment in infants also serves as a predictor of mental health issues later in life, including internalising and externalising problems, self-harming behaviours, and borderline personality symptoms (Carlson et al., 2009; O'Connor et al., 2011).

4.1.2.1 Dyadic Reciprocity. After more than five decades, attachment theory remains the cornerstone of research on mother-infant interaction. Although mother-infant attachment often is considered a coherent global construct in its own right, under the umbrella-term of 'attachment' there exist additional constructs integral to the quality of mother-infant attachment. A recent comprehensive review by Provenzi and colleagues (2018) attempted to combine the different constructs that have been used in research in order to depict the different aspects of the mother-infant 'dyadic dance'. Reciprocity and mutuality emerged as the two broad meta-theoretical concepts, while attunement, contingency, coordination, matching, mirroring, reparation and synchrony as specific processes contribute to the development of a secure attachment between a mother and her infant (for the theoretical definitions of these concepts, see Appendix K).

For the purposes of this study, the quality of mother-infant interaction was assessed through the prism of reciprocity as defined by Murray and Kraft (2000): Reciprocity 'refers to the extent of mutual interchange between mother and infant. The infant's input is received and responded to by the mother and vice versa' (Murray & Kraft, 2000, p. 8). Thus, dyadic reciprocity refers to the 'dyadic dance' that occurs when infants begin to undertake a more active role in the interaction with their mothers (van Huisstede et al., 2019). As a corollary, there is a substantial increase in dyadic reciprocity between 3 and 24 months of age (Feldman, 2010). There also exists evidence that maternal sensitivity may be a prerequisite for dyadic reciprocity (Skuban et al., 2006). Indicatively, in a recent longitudinal study on the developmental trajectories of maternal sensitivity across the first year of life and their relations to dyadic reciprocity, van Huisstede and colleagues (2019) observed a sample of 322 mothers and their infants interacting during a free play task at 3, 4.5, 6 and 12 months. The findings revealed that higher levels of maternal sensitivity at 3 months were linked to greater dyadic reciprocity at 12 months. It is also worth mentioning that reciprocity is a core component of early mother-infant interaction, which could be compromised by PND (Feldman, 2003; Feldman & Eidelman, 2004, 2005; Campbell et al., 1995). This poses an increased risk for infants of PND mothers, given that dyadic reciprocity during the first year of life can serve as predictor of an infant's optimal developmental skills, including cognitive, social-emotional, linguistic and self-regulatory skills (Feldman & Eidelman, 2004; Feldman & Greenbaum, 1997; Feldman et al., 1999).

Overall, reciprocity as a broad meta-theoretical concept was chosen for this study because it includes all the above-mentioned specific concepts (such as attunement, contingency and synchrony) and because it is directly linked to the quality of mother-infant interaction. In addition to mother-infant reciprocity, this study also focused on another fundamental component of mother-infant attachment and dyadic reciprocity – namely, maternal sensitivity. As reported in several studies, maternal sensitivity is a strong predictor of secure attachment between the mother and the infant (Bernard et al., 2018; Verhage et al., 2016), as well as a prerequisite for dyadic reciprocity (Skuban et al., 2006). The following section is devoted to maternal sensitivity and its central role in shaping the reciprocal mother-infant interaction, forming secure attachment and, therefore, positively influencing child developmental trajectories. The impact of PND on maternal sensitivity, as well as the subsequent consequences on mother-infant interaction and child well-being, will also receive discussion.

4.3 Maternal Sensitivity

Framed in the context of attachment theory, maternal sensitivity has been defined by Ainsworth and colleagues (1978) as a mother's ability and alertness to perceive and interpret accurately the infant's signals, as well as to respond to these signals promptly and adequately. Winnicott (1953) coined the term 'good-enough mother' to describe a sensitive mother who is neither too sensitive nor inadequately sensitive to her infants' cues, allowing her infant the space to communicate her/his needs and then meeting these needs by adapting her behaviour accordingly. Stressing the dyadic nature of the sensitivity construct, Crittenden (2010) defines sensitivity as 'any pattern of behaviour that pleases the infant, increases the infant's comfort and attentiveness, and reduces its distress and disengagement' (Crittenden, 2010, p. 10).

Robust empirical evidence across the existing literature indicates the predictive significance of maternal sensitivity during infancy for secure mother-infant attachment and the child's optimal development (Vaever et al., 2020; Verhage et al., 2016; Bernard et al., 2018). Specifically, in a systematic review of all articles published from 1978 to 2007, Shin and colleagues (2008) found that infant comfort, mother-infant attachment and infant development were the three consistently reported consequences of maternal sensitivity. In line with this finding, another recent comprehensive review of 687 articles published until December 2016 supported that there exists a strong association between maternal sensitivity, mother-infant attachment and child developmental outcomes (Deans, 2020). Moreover, Bakerman-Kranenburg and colleagues (2003) conducted a meta-analysis of 70 studies on sensitivity and attachment interventions in early childhood. The findings showed that effective interventions intended to increase maternal sensitivity were also effective for promoting secure attachment between the mother and the infant; this highlights the causal effect of maternal sensitivity on attachment.

Maternal sensitivity, as ‘a global proxy for different aspects of responsive parenting’ (Frick et al., 2019, p. 97), has been found to be interconnected with scaffolding (Bernier et al., 2010), cognitive and emotional stimulation (Valloton et al., 2017; Spinrad & Stifter, 2002) and linguistic input (Tamis-LeMonda et al., 2014). Consequently, maternal sensitivity influences a variety of child developmental factors (for a review, see Deans, 2020). In particular, maternal sensitivity has been proven to have a positive impact on child physical health (Anderson et al., 2011; Wu et al., 2011; Bernier et al., 2014), as well as on the child’s socio-emotional well-being (Groh et al., 2017), including social competence (Blandon & Scrimgeour, 2015; Howes & Hong, 2008), emotionality (Enlow et al., 2014; Mount et al., 2010) and temperament (Trommsdorff & Friedmeier, 2010). Additionally, maternal sensitivity contributes to infant cognitive development (Bernier et al., 2010; Worobey et al., 2009), language acquisition (Leigh et al., 2011; Cantero et al., 2016) and academic achievement later in life (Raby et al., 2015).

More specifically, there is evidence that maternal sensitivity has long-lasting effects on child development (Bernard et al., 2018). A study conducted by Raby and colleagues (2015) showed the enduring role of maternal sensitivity in child development through mid-adolescence and adulthood. Specifically, replicating the previous findings of Fraley et al. (2013), the study by Raby et al. (2015) found that early maternal sensitivity is a strong predictor of social skills and academic competence in adolescence, as well as of effective romantic engagement and educational attainment through 32 years of age. Given the fundamental role of maternal sensitivity in child development across different domains and throughout the lifespan, it is essential to consider factors that may impede mothers from being sensitive to their infants’ needs.

4.3.1 Maternal Sensitivity in PND

A substantial body of research has documented that maternal PND can negatively affect and, consequently, reduce maternal sensitivity (e.g., Binda et al., 2019; Bernard et al., 2018; Campbell et al., 2004; Leerkes et al., 2015). Indicatively, in a longitudinal study of 45 mother-infant dyads, Ann-Easterbrooks and colleagues (2000) found that PND in infancy was linked to reduced maternal sensitivity at age 7. Another study of 188 mother-infant pairs revealed that mothers with PND in remission exhibit less sensitivity towards their infants when compared to mothers who had never suffered from PND (Klucziok et al., 2016). Along the same lines, a study conducted by Binda at al. (2019) demonstrated that mothers with PND had lower maternal sensitivity than those without PND, regardless of the presence of antenatal depressive symptoms.

However, there exists extensive research indicating a variety of factors that contribute to the association between PND and maternal sensitivity. For instance, evidence shows that poverty combined with PND can have a negative impact on maternal sensitivity (Hwa-Froelich et al., 2008; Moszkowski et al., 2009; Norcross et al., 2020). Another risk factor for reduced maternal sensitivity has been proven to be the severity of maternal PND (Bernard et al., 2018). For instance, Mills-Koonce and colleagues (2008) found that, even though there was an increase in maternal sensitivity from 6 to 36 months when the children classified as securely attached at 36 months, more severe depressive symptoms were linked to a decrease in sensitivity from 6 to 36 months for mothers of insecurely attached children at 36 months of age. Furthermore, a study by Campbell et al. (2004) investigated whether the course of maternal depressive symptoms and maternal sensitivity could predict secure mother-infant attachment at 36 months. The results showed that the course and timing of PND and maternal sensitivity could serve as predictor of insecure attachment. Specifically, mothers who displayed late, intermittent or chronic depressive symptoms in conjunction with low levels of maternal sensitivity were more likely to have insecure children at the age of 36 months, when compared to symptomatic mothers with higher sensitivity.

As described above, the combination of PND and decreased maternal sensitivity can negatively affect mother-infant attachment. Despite PND being a risk factor for reduced maternal sensitivity and, in turn, insecure mother-infant attachment, PND per se does not automatically prevent a mother from being sensitive with her infant (Campbell et al., 2004; Deans, 2020). Numerous studies failed to find differences in maternal sensitivity between groups of mothers with and without PND, creating a controversy concerning the findings about PND's negative effect on maternal sensitivity (e.g., Alvarenga et al., 2013; Fonseca et al., 2010; Sidor et al., 2011). For example, Sidor and colleagues (2011), using a non-clinical group of 106 mother-infant dyads, found that there was no association between maternal depressive symptoms and sensitivity. Furthermore, maternal sensitivity could also act as a buffer in the case of mothers with PND, serving as a mediator or moderator of the impact of PND on attachment between the mother and her infant (Campbell et al., 2004). For instance, both the National Institute of Child Health and Human Development (NICHD) and the Early Child Care Research Network (1999), following a large sample of mothers and infants up to 36 months, as well as Feldman and colleagues (2009), using a sample of 971 mothers, found that maternal sensitivity had a moderating effect on the impact of PND on child development, including social, cognitive and language development. Overall, the differences reported regarding the sensitivity level in mothers with PND generate different maternal interactive patterns with their infants, which constitute the main interest of the present study. The following section will look more closely at the mother-infant interactive patterns in the case of PND and discuss their long-term consequences on infant development.

4.3.1.1 Mother-Infant Interactive Patterns in PND. As evident from the above discussion, mothers with PND exhibit different levels of sensitivity and thus show highly heterogeneous interactive patterns with their infants, oscillating from optimally sensitive to either controlling or passive (Flykt et al., 2010). More specifically, a substantial body of research suggests that low maternal sensitivity in PND generates mainly two interactive styles varying from intrusive, coercive and hostile at one extreme, to withdrawn, disengaged and passive at the other (Murray et al., 1996, 2015, 2018; Kemppinen et al., 2006; Field, 2010; Crugnola et al., 2016). Both these interaction patterns lead to a clear disengagement in infants from the interaction with their mothers, as well as cascading effects on infant well-being (Field, 2010).

More specifically, the infants of mothers with PND tend to mimic maternal interactive behaviours (King et al., 2015; Flykt et al., 2010; Field, 1995). Tronick and Reck (2009) found that, in the case of PND, infants whose mothers exhibited a disengaged or withdrawn pattern persistently displayed sadness and withdrawal after a failure to engage with their mothers. Yet, infants whose mothers exhibited hostility and intrusiveness displayed an angry coping style. A plausible explanation of this infants' mimic reaction could derive from the notion of the 'contagion effect' suggested by Field (1995) in an attempt to elucidate the negative shared affect repeatedly reported in PND mother-infant interactions. According to Field (1995), infants of PND mothers exhibit sad affect, either by modelling their mothers' sad affect, or by being directly affected by their mothers' depressed behaviour. Stern (1994) similarly suggested that infants, in their attempt to cope with a maternal depressive interactive style, identify themselves with the depressed mother and then imitate her depressive expressions and sadness. Overall, such evidence suggests that a vicious circle of mutual rejection can be formed between PND mothers and their infants, which can deteriorate not only the quality of mother-infant interaction, but also mothers' and infants' well-being (Murray et al., 1996, 2018).

These two salient interactive patterns in PND are implicated in a developmental cascade leading to a range of long-term outcomes in infants (Bilda et al., 2019; Murray et al., 1996, 2018). Infants of withdrawn mothers are more prone to develop long-term internalising and cognitive problems (Murray et al., 1996; Wanger et al., 2016), while the infants of intrusive mothers have been found to be prone to externalising and behavioural problems, such as conduct problems and attention deficit hyperactivity disorder (ADHD) (Mantymaa et al., 2004; Morrel & Murray, 2003). Maternal hostility as early interactive style can also predict negative self-cognitions at 5 years of age (Murray et al., 2001; Maughan et al., 2007). Finally, both interactive styles occurring between mothers with PND and their infants have been found to equally affect infants' well-being, by provoking infant distress and behavioural dysregulation (Field, 2010). This is of pivotal importance, given that there exists general agreement among researchers that the development of children's self-regulatory abilities is a critical component of the child's holistic development (Brandes-Aitken et al., 2019; Blair & Raver, 2016; Ursache et al., 2012). The following section will discuss the significant role of self-regulation in child development and explore how infants' self-regulatory mechanisms can be hampered by maternal PND.

4.4 Infant Self-Regulation

Self-regulation refers to processes that enhance goal-directed behaviours, encompassing cognitive, behavioural and affective aspects (Frick et al., 2018; Hofmann et al., 2012; Karoly, 1993; Nigg, 2017; Rothbart et al., 2006; Frick et al., 2019, Bridgett et al., 2015). Self-regulation evolves over development (Bates et al., 2020; Sun et al., 2020), with an overall rapid increase in self-regulatory abilities between 3 to 13.5 months of age (Rothbart et al., 1992). In its early emergence, genetic and environmental factors are inextricably interrelated (Morawska et al., 2019, Bridgett et al., 2015; Morris et al., 2007; Bronson & Bronson, 2001). Twin studies have indicated a substantial contribution of genetics to the development of self-regulation (Friedman & Miyake, 2017), while there also exists profound evidence for the plasticity of self-regulation to environmental inputs (Sun et al., 2020; Brandes-Aitken et al., 2019).

From birth, the infant is equipped with self-regulatory systems that are primarily immature and reactive, as well as malleable (Bronson & Bronson, 2001). As a corollary, the infant's self-regulation skills are particularly sensitive to and influenced by nurturing environmental stimuli and the quality of early parenting (Blair, 2010; Raver, 2004; Zeytinoglu, Calkins, Swingler, & Leerkes, 2017; Murray et al. 2016b; Shonkoff 2012). In the aggregate, self-regulation is an outgrowth of co-regulation of empathic socio-emotional interactions that take place between the mother and her child (Housman, 2017; Murray et al. 2014, 2016b). The transition from co-regulation to self-regulation is fostered by maternal sensitive responses to infants' needs, with the intention of reducing the intensity of their emotion (Frick et al., 2019; Granat et al., 2017; Housman, 2017; Noe et al., 2015). In particular, during the first year of life, the role of the primary caregiver is of pivotal importance for organising, modifying and regulating an infant's self-regulatory responses (Bronson & Bronson, 2001). Through sensitive parenting, the mother is able to strengthen and reinforce the development of the child's self-regulation by using ongoing support, instruction and coaching (Murray et al., 2016b).

A substantial body of research has consistently found responsive parenting as an established predictor of child self-regulation (e.g., Morawska et al., 2019; Fay-Stammbach et al., 2014; Frick et al., 2019, 2018; Bernier et al., 2010; Pauli-Pott et al., 2017; Wade et al., 2018). Indicatively, two recent meta-analyses supported that positive parenting strategies, such as guidance, are linked to better child self-regulation, while weak self-regulation abilities in children are associated with negative parenting strategies (Karreman et al. 2006; Valcan et al., 2018). Furthermore, a longitudinal study conducted by Frick and colleagues (2019) assessed the interrelationship among maternal sensitivity, child verbal ability and later self-regulation.

The results indicated the important role of responsive parenting and the child's verbal ability in the development of self-regulation. According to the findings of the same study, maternal sensitivity at 10 months served as predictor of infant emotion regulation at 18 months (Frick et al., 2019).

Commensurately, a research-study conducted by Leerkes and Crocknberg (2002), based on 92 primiparous mothers with their 6-month-old infants, revealed a strong association between maternal self-efficacy, caregiving behaviours and self-regulation in infants. Additional longitudinal evidence demonstrated the positive effects of sensitive parenting during infancy on the development of self-regulatory capacities in children (e.g., Williams & Berthelsen, 2017; Bernier et al., 2010; Roskam et al., 2014). A comprehensive and multidisciplinary review by Bridgett and colleagues (2015) accumulated evidence of the last 75 years of research in the intergenerational transmission of self-regulation. The findings strengthened the importance of parenting as a fundamental social mechanism in the intergenerational transmission of self-regulation, while a positive association between mother and child regulatory capacity was found (Bridgett et al., 2015). Overall, the role of the mother in the development of child self-regulation has been proven catalytic (Vaever et al., 2020); this should be of special scientific interest, considering the importance of self-regulation in the quality of children's lives.

Over the past decades, self-regulation has been found to constitute a key predictor of children's lifelong functioning across a wide range of developmental domains (Sun et al., 2020; Murray et al., 2014), including the physical, social and emotional domains (Housman, 2017; Sun et al., 2020; Murray et al., 2014). For instance, empirical research suggests that higher levels of self-regulatory capacities in young children are linked to a greater likelihood of academic success, better interpersonal relationships and lower risk for physical and mental health issues (for a review, see Rothbart et al., 2006). Along the same lines, recent studies supported that the growth of self-regulatory capacities early in life is clearly associated with learning and academic achievements, as well as with personal and social success (Sun et al., 2020; Leerkes et al., 2008; Housman, 2017; Francis & Susman, 2009; McClelland et al., 2010; Murray et al., 2014, 2015).

4.4.1 Infant Self-Regulation in PND

Deficits in the development of self-regulation may initiate cascades of dysfunctions in multiple domains of child well-being, which may be sustained across adulthood (Bates et al., 2020). In particular, 'child dysregulation, which consists of the ineffective modulation of the emotional response to relevant external stimuli through behavioral, cognitive and physiological processes, is a well-known risk factor for adult adverse outcomes including depression' (Marino et al., 2019, p. 1-2). In a systematic review of 25 studies, Kostyrka-Allchorne and colleagues (2020) also found that negative emotionality and self-regulation could be transdiagnostic risk markers for the development of mental health issues later in life. Specifically, the lack of an adequate development of self-regulation was found to be linked to the following mental health problems: internalising disorders, autistic spectrum disorder and attention deficit hyperactivity disorder (ADHD) (Kostyrka-Allchorne et al., 2020). Indeed, as has been shown in several studies, poor self-regulatory capacities serve as a precursor of psychopathology (Asmussen et al., 2021; Granat et al., 2017; Noe et al., 2015), including anxiety (Rubin et al., 1995), aggression, violence and substance use (Marsee & Frick, 2007), behaviour problems (Cole et al., 2003) and eating disorders (Murray et al., 2014). In parallel, low levels of self-regulation in children result in great difficulties in school life, such as struggling with school transition, peer rejection, dropping out of school and exhibiting fewer academic achievements (Housman, 2017; Denham, 2006; McClelland et al., 2006).

One of the best-stablished risk factors for poor self-regulation in offspring is maternal PND (Bates et al., 2020; Vaever et al., 2020; Sun et al., 2020; for a review, see Goodman, 2015; Goodman et al., 2011). For instance, Conroy et al. (2012) supported that maternal PND at 2 months postpartum could significantly predict infants' dysregulation at 18 months. Equally, a study conducted by Asmussen and colleagues (2021) supported that persistent neurodiversity in emotional, behavioural and attention regulation in children aged between 2.5 and 5 years were attributed to maternal PND in infancy. Finally, the results of a study by Brake et al. (2020) contribute to elucidate further the interrelationship between PND and self-regulation. According to the findings of this research, mothers admitted to an MBU rated themselves as having a high level of emotion dysregulation, which was found to be a key predictor of PND symptoms that in turn compromised mother-infant attachment. Taking into account the intergenerational transmission of self-regulation, as described above, the findings underline an ensuing vicious circle that should be broken by including both maternal and infant self-regulation in PND interventions.

Despite abundant evidence that PND may compromise the infant's self-regulation, some mothers with PND are still able to reinforce and scaffold the development of self-regulatory abilities in their infants (Granat et al., 2017; Sun et al., 2020; Bates et al., 2020). A range of maternal sensitive parenting qualities has been proven to buffer against the negative effect of PND on the infant's self-regulatory development. Indicatively, Granat and colleagues (2017) used a micro-analytic approach to assess the interrelationship among maternal depression and anxiety, social synchrony and 9-month-old infants' emotion regulation. They found that, in the group of mothers with depression, touch synchrony moderated the impact of PND on infant self-regulation. Likewise, a mediation model suggested by Bates and colleagues (2017) indicated that, in the case of PND, maternal self-efficacy could predict better outcomes in the infant's self-regulation. Similar findings in the study of Sun et al. (2020) supported that positive maternal behaviours significantly moderate the effects of PND associated with deficits in infant self-regulatory behaviour. The role of positive maternal behaviour in buffering against the negative impact of internalising disorders, such as PND, on child self-regulation outcomes has also been proven by several studies (e.g., Kalpan et al., 2008; Thomas et al., 2017; Luthar et al., 2015). To summarise, all the above-mentioned findings present maternal sensitive and positive parenting as a core component necessary for the optimal development of self-regulatory skills in children, which can also overcome the negative effects of PND on this process. These results are encouraging and can further inform interventions more effectively enhancing children's self-regulatory skills, by focusing on and embedding a variety of early parenting skills (Morawska et al., 2019).

4.5 Conclusion

The maternal role is fundamental in the child's life, and the quality of mother-infant attachment is strongly linked to child well-being (Gillibrand et al., 2011). The mother, through her sensitive responses to the infant's needs, provides a safe, reliable and stimulating environment (Olhaberry, 2015) in which the child forms trusting and intellectually engaged relationships (Tovey, 2016). This fertile environment created by a sensitive mother cultivates a secure mother-infant attachment that, in turn, sets a keystone for the child's optimal development. Over the past decades, a significant amount of research has revealed a strong association between maternal sensitivity, mother-infant attachment and infants' developmental outcomes; high maternal sensitivity is inextricably linked to secure attachment, which both contributes to and enhances the child's cognitive, socio-emotional and behavioural development (for a review, see Deans, 2020). Also, the significance of shaping a secure attachment between mother and infant during these formative years is underscored by the intergenerational transmission of attachment patterns (Brake et al., 2020).

However, numerous empirical studies offer profound evidence that PND can have detrimental effects on the quality of mother-infant attachment, maternal sensitivity and, consequently, on the child's holistic development (Bernard et al., 2018; Raby et al., 2015). Mothers with PND show limited sensitivity and, thus, experience difficulties with effectively engaging in fulfilling and mutually enjoyable interactions with their children (Music, 2011). As a corollary, PND is associated with reduced reciprocity during mother-infant interaction (Kaplan et al., 2008), and mothers with PND are more likely to have insecurely attached infants (Murray et al., 1996; Murray & Copper, 1997; Hipwell et al., 2000; Moehler et al., 2006; Wilkinson & Mulcahy, 2010; Margaret et al., 2018). Insecure attachment, in conjunction with a lack of maternal sensitivity in the case of PND mothers, put infants at an increased risk for problems in their socio-emotional and cognitive development (Kaplan et al., 2008; Campbell et al., 2004), as well as psychopathology later in life (Pawlby et al., 2008). Furthermore, there is evidence that PND also negatively affects infants' self-regulatory capacities (Sun et al., 2020; Goodman, 2015; Goodman et al., 2011); this is of pivotal importance, considering that children's self-regulatory skills serve as the foundation for long-term physical, social and emotional well-being (Housman, 2017; Sun et al., 2020; Murray et al., 2014).

4.6 The Present Study

Recognising the importance of the quality of mother-infant relationship in child development and well-being, the main aim of Study 1 is to provide an overall picture of the quality of interaction between mothers with and without PND and their infants, as well as to explore in depth what emerges from this kind of interaction. Given that there exists a variety of constructs integral to the quality of mother-infant relationship, it was essential to explore how different components relate to each other and are interwoven in mother-infant interaction. The following variables of the mother-infant interaction were categorised into three groups and investigated:

(1) maternal measures: (a) *maternal emotional tone*, (b) *maternal sensitivity*, (c) *maternal coercions*; (2) infant measures*:* (a) *infant emotional tone*, (b) *infant self-regulation*; and (3) joint measures: (a) *reciprocity* and (b) *general atmosphere.*

Based on previously published research, one may expect to find differences between groups of mothers with and without PND and their infants (Sun et al., 2020; Binda et al., 2019; Murray et al., 2018; Pawlby et al., 2008). To the author's knowledge, this is the first study aiming to assess the interrelationship of these variables in a particular sub-category – namely, mothers with severe PND who have been hospitalised jointly with their infants in an MBU. More specifically, by looking more closely at the mother-infant interaction in a clinical setting, this study aims to address the core research question: *What are the differences between the two groups (mothers with and without PND and their infants) in the quality of mother-infant interaction during a play session?* The principal hypothesis posits that PND negatively affects the quality of mother-infant interaction. To address the main research question and test the hypothesis, the following additional research questions emerged:

1) Are there any differences between the two groups in terms of the GRS and CARE-index measures (i.e., infants' measures of emotional tone and self-regulation; maternal measures of emotional tone, coercions and sensitivity; joint measures of reciprocity and general atmosphere)?
2) Do infants' age and gender affect the infant, maternal and joint measures?
3) Can the infant and maternal measures predict the outcomes of joint measures?
4) Can the infant, maternal and joint measures predict the classification of membership in one of the two groups (i.e., infants and mothers with PND as the clinical group / infants and mothers without PND as the comparison group)?

4.7 Material and Methods

4.7.1 Participants

A total of 52 videos containing footage of 104 participants (52 mother-infant pairs) were analysed and compared. In particular, the clinical group consists of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months); their interaction was video-recorded for intervention purposes in the clinical context of an MBU. A comparison group of 30 mothers without PND was recruited from several Children's Centres in London, and their play interaction with their infants (aged 3-12 months) was equally video-recorded. Video-recordings of both groups (n= 52) were analysed and compared to illustrate the real differences – both strengths and challenges – in the interaction between mothers with PND and their infants.

4.7.1.1 Inclusion Criteria. The clinical group was selected based on the following inclusion criteria:

1) Dyad of inpatient mother and her baby (aged 3-12 months) hospitalised in an MBU*;
2) Mother diagnosed with PND with or without psychosis; and
3) Video-recorded material of admission videos, where the maternal postnatal depressive symptoms are still evident and untreated, is available.

The comparison group was selected on the basis of the criteria below:

1) Mother without PND with her infant (aged 3-12 months)*;
2) Mother was without any personal history of depression or any other mental health problems; and
3) Mother had a score lower than 12 on the EPDS

There was no exclusion on grounds of race, ethnicity, religion, or belief for both groups.

*The infants' age range was selected based the fact that, around the third month, there is a transition in infant social behaviour, which increases the opportunities for dyadic exchanges between mother and infant (Henning et al., 2005).

4.7.1.2 Participant Characteristics. Mothers in both groups were ethnically, culturally, and socio-economically diverse, reflecting the population of London, which the MBU and the Children's Centres served. Table 4.1 outlines the main sociodemographic variables of participant dyads of mothers and infants in both the clinical and comparison groups.

First, the possible effects of basic sociodemographic characteristics on the study groups were investigated. These variables included maternal age, infant age, marital status, ethnicity and diagnosis for the clinical group specifically. There was no significant effect of age in either of the groups. Study participants did not differ in mean age $t(50) = -1.73$, $p = .092$. Neither was there any difference in the mean age of the babies $t(50) = -1.37$, $p = .177$.

Regarding marital status, participants were asked to report whether they were single, married or had a civil partner, whether they were cohabiting, divorced/separated, or in any other, specified status. All the responses for other status seemed to fall under one of the pre-existing categories and were therefore added to the respective category. There were no differences between the MBU and comparison groups for marital status χ^2 (3) = .562, $p = .905$.

Concerning ethnicity, data was provided by the self-report questionnaire. Preliminary tests for the possible effects of ethnicity on our data were conducted by using national groups. Due to the small occurrence of most categories, participants were grouped as either British or Other. There was no statistically significant difference of reported ethnic group membership, neither for the clinical group χ^2 (1) = 1.636, p = .201, nor for the comparison group χ^2 (1) = 2.133, $p = .144$.

Table 4.1

Participant Characteristics for Both Clinical and Comparison Groups

Participant Characteristics			
		Clinical (n=22)	Comparison (n=30)
Maternal age	Range	18-40	24-43
	Mean (SD)	30.2 (6)	32.8 (4.1)
Ethnicity (% British)		63.6%	36.7%
Marital status (% married)		50%	53.3%
Infant gender (% female)		59.1%	50%
Infant's age	Range	46.4 weeks	41.85 weeks
	Mean (SD)	28.6 weeks (11.4 weeks)	32.9 weeks (10.67 weeks)

4.7.1.3 Maternal Depression: Comparison Group. Mothers in the comparison group were screened for postnatal depression (PND) using the Edinburgh Postnatal Depression scale (Cox et al., 1987). The vast majority of the comparison sample (90%) did not have any PND symptoms.

Table 4.2

Comparison Group: Maternal EPDS Scores and Levels of Depressive Mood

Maternal EPDS* total score		
Total score	Frequency (n = 30)	Percent
No evidence of symptoms of PND (score: 0-8)	27	90%
Mild symptoms of PND (score: 9-12)	3	10%

*Note. *EPDS= Edinburgh Postnatal Depression Scale*

4.7.2 Procedure

Pre-existing video-taped material from an MBU was used. Video recordings that contain footage of mothers with PND and their infants interacting during play, face-to-face contact and/or maternal singing on their admission was analysed. The mother-infant interaction was video-recorded for the purposes of video feedback intervention (Pawlby et al., 2010). In the context of this intervention, the mothers were invited, on both their admission and discharge, to have a 3-minute unstructured play session with their infant, which was then video-recorded. The video-recording process takes place in a specially designed laboratory setting in the MBU; this quiet room contains a soft mat on the floor and some toys. The only instruction is to play and talk with their infant, as they would normally.

For the comparison group (i.e., mothers without PND), videos of the mother-infant interaction were generated by the researcher. All potential participant mothers were screened for eligibility based on the Edinburgh Postnatal Depression Scale (Cox et al., 1987) to ensure that they were not suffering from undiagnosed PND. Participant mothers and their infants who met the inclusion criteria were video-recorded under the same conditions as the clinical group (for further details about the procedure and data collection process for both groups, see Chapter 3, Section 3.7).

4.7.3 Measures

The assessment tools employed in this study have been presented in detail in Chapter 3, Section 3.8. The following reliable tools were applied:

1) Measurement of Maternal Depressive Mood: Edinburgh Postnatal Depression Scale (Cox et al., 1987);
2) Measurement of Maternal Sensitivity: Infant CARE-index (Crittenden, 2005);

3) Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al., 1996b; Murray & Karpf, 2000). In this study, the following maternal, infant and joint measures were applied: (a) maternal measures: maternal emotional tone and maternal coercions, (b) infant measures: infant emotional tone and self-regulation, (c) joint measures: reciprocity and general atmosphere.

4.8 Results of Study 1

4.8.1 Reliability Analysis

4.8.1.1 Reliability in GRS measures. To test the reliability of GRS measures, a second rater was designated to score 10 sessions on the scale and then compare the results with the primary rater. Inter-rater agreement was calculated by Cohen's Kappa coefficient (Cohen, 1960) and the reliability scores for the maternal and infant measures were as follows; maternal emotional tone: .70 and maternal coercions: .97; infant emotional tone: .81 and infant self-regulation: .67. For the joint measure of atmosphere and reciprocity were .85 and .87 respectively. The second coder was blind to the maternal mental health status.

4.8.1.2 Inter-Rater Reliability in CARE-Index Scores. The 'maternal sensitivity' scores for the clinical group were provided by the MBU clinical database. In order to preserve reliability in the comparison group's CARE-Index scores, all the video-taped recordings were coded by two independent trained raters, who were completely unaware of the study's hypotheses and of the fact that none of the mothers had a diagnosed mental illness. Differences in the scores of the 'maternal sensitivity' scale were discussed, and consensus scoring reached.

In case of disagreement, a third trained assessor became involved, thus reaching 95% agreement on the scale.

4.8.2 Descriptive Statistics and Preliminary Results on the GRS and CARE-Index measures

Table 4.3 shows mean scores and standard deviations for the clinical and comparison groups on the GRS and CARE-Index measures. First, possible differences across the clinical and comparison groups for maternal age, infants' age and gender were examined. No significant means difference was found, neither for maternal age $t(50) = -1,836$, $p = .072$, nor for infant age $t(50) = -1,386$, $p = .172$. Moreover, no effects of the infants' gender were observed, $x^2(1) = .422$, $p = .516$.

Infants' age exhibited moderate to high positive correlations with GRS and CARE-Index measures. For the infants' emotional tone, $r(52) = .52$. $p < .001$, maternal sensitivity, $r(52) = .60$, $p < .001$ and maternal emotional tone $r(52) = .40$. $p = .003$, general atmosphere of interactions, $r(52) = .53$, $p < .001$, and reciprocity, $r(52) = .61$, $p < .001$ correlations were moderate, whereas for self-regulation, $r(52) = .74$, $p < .001$ correlation was high. Therefore, age was handled as a covariate in subsequent group comparisons.

A preliminary examination of the amount of maternal coercive behaviours showed that there was no significant difference across the clinical group (M=.67, SD=0) and the comparison group (M=.77, SD= 0), with $\chi^2(3) = 1.760$, $p = .624$. Therefore, it was not included in further analyses.

Table 4.3

Means and Standard Deviations for the GRS and CARE-Index Measures

	Clinical Group		Comparison Group	
	M	*SD*	*M*	*SD*
Infant Emotional Tone (R.S.)	2.86	0.47	3.20	0.71
Infant Self-regulation (R.S.)	2.50	1.01	3.50	1.25
Maternal Emotional Tone (R.S.)	3.05	0.65	3.83	0.75
Maternal Sensitivity (R.S.)	5.05	2.04	7.57	2.84
General Atmosphere (R.S.)	3.41	0.73	3.83	0.91
Reciprocity (R.S.)	2.41	0.96	3.30	1.15

Note. R.S.= Rating Scale

Table 4.4 displays correlations between the GRS and CARE-Index measures, disaggregated by groups. As shown here, patterns of correlation are comparable between groups, in terms of both magnitude and positive direction. The only exceptions were correlations between maternal emotional tone and infant self-regulation in the clinical group, which were markedly lower and statistically non-significant.

Table 4.4

Intercorrelations among GRS and CARE-Index Measures Aggregated by Study Group

Variable	1	2	3	4	5	6
Infant Emotional Tone (R.S.)	-	.68**	.51**	.75**	.61**	.66**
Infant Self-regulation (R.S.)	.62**	-	.35	.86**	.54**	.79**
Maternal Emotional Tone (R.S.)	.51**	.50**	-	.67**	.53**	.69**
Maternal Sensitivity (R.S.)	.66**	.66**	.48*	-	.69**	.95**
General Atmosphere (R.S.)	.67**	.80**	.49*	.82**	-	.76**
Reciprocity (R.S.)	.69**	.67**	.50**	.93**	.89**	-

Note. The results for the comparison group (*n*=30) are shown below the diagonal. The results for the clinical group (*n*=22) are shown above the diagonal. R.S.= Rating Scale.
*$p < .05$, **$p < .01$

4.8.3 Effects of PND on Infants' Emotional Tone and Self-Regulation

First, differences across clinical and comparison groups in terms of infant emotional tone and self-regulation were investigated. As mentioned above, infant age was found to be moderately to highly correlated to emotional tone and self-regulation, implying developmental effects on those measures. To test for group differences, controlling in the same instance for developmental effects, one-way univariate analyses of covariance (ANCOVAs) through IBM SPSS 23 © were performed.

The assessment of assumptions revealed satisfactory results for linearity, homogeneity of variance, homogeneity of regression and reliability of covariates, for both analyses.

Independence between infant measures and the covariate was observed. No univariate or multivariate outliers were identified.

For infant emotional tone, a One-Way ANCOVA was performed. The independent factor was the two groups, and the covariate was the infants' age. No significant main effects of groups were found F (1, 49) = 1.913, p = . 173, partial η^2= .038. The infant age's effect was found significant F (1, 49) = 16.123, p <0.001, partial η^2= .248, as expected. No effects of interaction were observed between independent and covariate variables.

For infant self-regulation, there existed a significant effect of infant age F (1, 49) = 59.642, p<0.001, partial η^2= .549, r= .743. The main effect of the groups remained significant after controlling for the covariate, with F (1, 49) = 8.803, p= .005, partial η^2= .152. No effects of interaction were observed. Estimated marginal means indicate that the infants from the clinical group appear to be less self-regulated (M= 2.69, SD= 0.17) than the infants from the comparison group (M= 3.36, SD= 0.15).

4.8.4 Effects of PND on Maternal Emotional Tone and Sensitivity

Next, the same set of analyses was run on maternal measures. Differences between groups concerning maternal emotional tone and sensitivity to infants' cues, while simultaneously controlling for effects of infant age, were investigated.

Linearity, homogeneity of variance, homogeneity of regression and reliability of covariates were observed for both analyses, as was independence between groups and infant age. No univariate or multivariate outliers were identified. Maternal sensitivity distributions exhibited normality, whereas for maternal emotional tone, moderate departures from normality were exhibited.

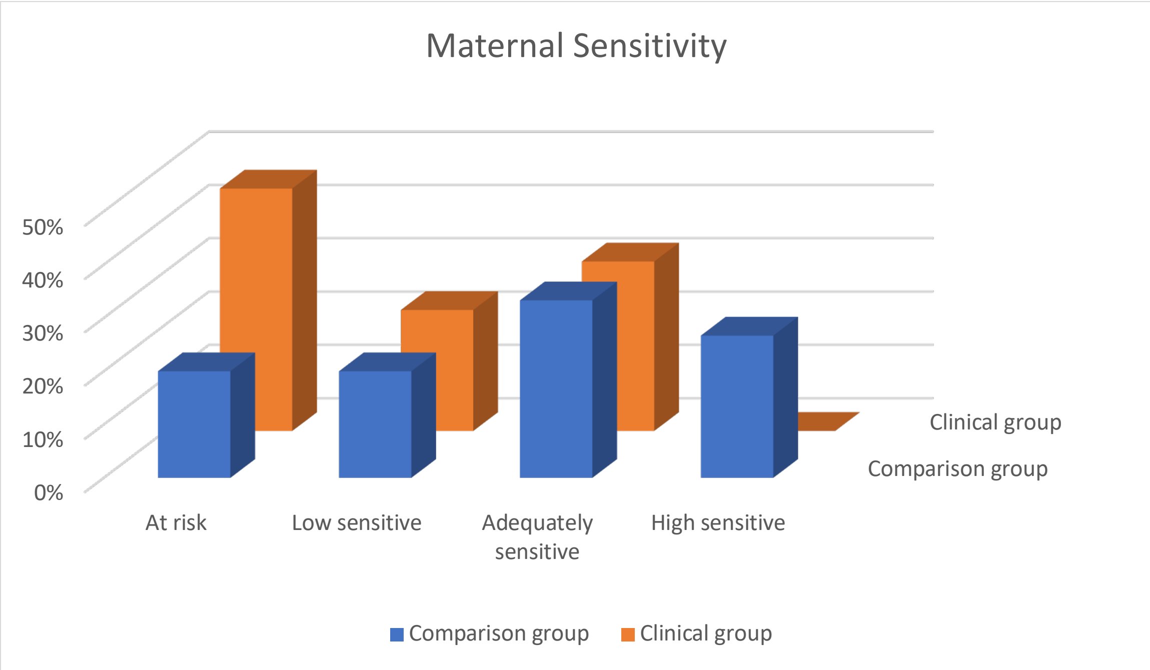
For maternal emotional tone, the effect of infant age was significant F (1, 49) = 7.333 p = .009, partial η^2= .130. The main effects of the groups remained significant after controlling for infant age, with F (1, 49) = 12.990, p =.001, partial η^2= .210. No effects of interaction were observed. Estimated marginal means indicate that the mothers in the clinical group exhibited a worse emotional tone (*M*= 3.10*, SD*= .14) than those from the comparison group (*M*= 3.80*, SD*= 0.12).

For maternal sensitivity to infant cues, the effect of the infants' age was significant, with F (1, 49) = 25.280, p< .001, partial η^2 = .340. The main effects of the groups remained significant after controlling for infant age, with F (1, 49) = 10.744, p =.002, partial η^2 = .180. Interactions were non-significant. Estimated marginal means show that mothers in the clinical group appear to be less sensitive to infant cues (*M*= 5.38*, SD*= .45) than the comparison group mothers (*M*= 7.32*, SD*= .38).

Figure 4.1 presents the percentages of each category of maternal sensitivity levels in the two groups, as derived from the CARE-Index scores. CARE-Index scores range from 0 to 14 on the 'maternal sensitivity' scale. For the purposes of this study, based on the 'dyadic synchrony scale' of the CARE-Index, the following four different categories were created to describe the level of maternal sensitivity: (a) sensitive (score: 10-14), (b) adequately sensitive (score: 7-10), (c) low sensitive (score: 5-6), and (d) at risk (score: 0-4). As displayed in Figure 1, mothers with PND showed reduced sensitivity when interacting with their infants, with the majority (n=10) scoring at the lowest end of the scale and none of them achieving the highest level. The sensitivity level in mothers without PND ranged from low sensitivity (i.e., at risk) to high sensitivity, with most of them (n=10) adequately sensitive when interacting with their infants.

Figure 4.1

Percentages of Maternal Sensitivity Level: A Comparison Between Groups



4.8.5 Effects of PND on Mother-Infant Interactions

The effects of PND on measures that assess the quality of interaction between the mother-infant dyad were investigated. As infant age was found to be correlated with joint GRS measures, too, once again the author of this study opted for an analysis of covariance. Again, clinical groups and infant age were independent. Linearity of correlations, homogeneity of variance, homogeneity of regression and reliability of covariates were observed. No outliers were identified.

The general atmosphere of interactions exhibited a significant effect of the infants' age, with F (1, 49)= 17.390, p<.001, partial η^2= .262. No main effects of groups were observed, with F (1, 49)= 1.505, p=.002, partial η^2= .030, while controlling for the infants' age.

For reciprocity, infant age had a significant effect, with *F* (1, 49)= 25.739, $p< .001$, partial η^2= .344. The main effects of the groups remained significant after controlling for infant age, with *F* (1, 49)= 6,615, p=.013, partial η^2= .119. Interactions were non-significant. Estimated marginal means show that mother-infant dyads in the clinical group exhibit less mutual interchange (*M*= 2.55*, SD*= .19) than those in the comparison group (*M*= 3.20*, SD*= 0.16).

4.8.6 Predictions of Joint Measures: General Atmosphere and Reciprocity

For the last step, the comparative effects of infant and maternal affective tone and behaviour on their interactions were examined to illustrate whether infant and maternal measures could predict the outcomes of joint measures. Given that general atmosphere and reciprocity may be thought of as outcome variables of affective and behavioural functions, an outline of effects on those outcomes was sought. For this reason, multiple linear regression models were run on IBM SPSS Statistics Version 23 (method: ENTER), using general atmosphere and reciprocity as dependent variables, as well as infant emotional tone, self-regulation, maternal emotional tone and sensitivity as predictors. Predictor variables were entered in two blocks to assess possible changes of explanatory power.

For the general atmosphere of interactions, predictors were inserted in two blocks, each one consisting of infant and maternal measures, respectively. While in the first phase infant measures coefficients were found statistically significant, the insertion of maternal measures – specifically, maternal sensitivity to infant cues – seemed to accumulate predictive effects. This finding implies that maternal sensitivity may exert a significant effect on other variables in statistically predicting the general atmosphere, considering the high correlations among variables. The effect size was rather large (Cohen, 1988). Results are displayed in Table 4.5.

Table 4.5

Regression Coefficients for Infant and Maternal Measures on the General Atmosphere of Interactions

Variables	*Model 1*			*Model 2*		
	B	*SE B*	*Β*	*B*	*SE B*	*β*
Constant	-2.90	.45		-1.25	.65	
Infant Emotional Tone (R.S.)	.55	.20	.35*	.24	.21	.15
Infant Self-regulation (R.S.)	.40	.10	.50**	.17	.12	.22
Maternal Emotional Tone (R.S.)				.08	.11	.08
Maternal Sensitivity (R.S.)				.46	.17	.46**
R^2	.63	.		.69		
ΔR^2	.61			.67		

Note. N=52. The effects of infant and maternal measures were examined on a rating of interaction (general atmosphere). In the first model, infant measures were used to predict the general atmosphere. In the second, maternal measures were employed.
$^{*}p < 0.01$, $^{**}p < 0.001$

For reciprocity, the same way of inserting variables in the model was applied. The analysis gave similar results concerning the significance of coefficients. Only maternal sensitivity was found to have an effect on predicting the outcome variable, implying patterns of relationship similar to those described above. However, in this case, effect size was excessively large. This finding may be due to the small sample size, implying a lack of variability between measures, or it may be the result of high correlations among variables, thus collinearity. In the second case, a proper outline of comparative effects of predictors cannot be suggested, as discrimination between them is not possible, and further analysis must be deemed redundant. A highly predictive ability seems to be the case, but a final conclusion should not be drawn (Tabachnick & Fidell, 2014).

Table 4.6

Regression Coefficients for Infant and Maternal Measures on Reciprocity of Interactions

Variables	*Model 1*			*Model 2*		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Constant	-3.02	.40		-.126	.33	
Infant Emotional Tone (R.S.)	.54	.18	.35*	.01	.10	.01
Infant Self-regulation (R.S.)	.44	.09	.55**	.03	.06	.04
Maternal Emotional Tone (R.S.)				.08	.06	.08
Maternal Sensitivity (R.S.)				.87	.09	.87**
R^2	.708			.93		
ΔR^2	.69			.92		

Note. N=52. The effects of infant and maternal measures were examined on a rating of interaction (reciprocity). In the first model, infant measures were used to predict the general atmosphere. In the second, maternal measures were employed.
$^{*}p$ <0.01, $^{**}p$ <0.001

4.8.7 Effects of GRS and CARE-Index Measures on Group Membership Prediction

The final stage of our analysis was to examine which of the measures could be used to offer better discrimination among groups and thus delineate patterns of effects of PND on mother-infant interactions. A direct discriminant analysis was performed with the help of IBM © SPSS

23. The five GRS measures, along with the CARE-index measure (i.e., maternal sensitivity), were used as predictors for the comparison and clinical groups (coded as 0 and 1).

One discriminant function was calculated, with *Wilks' Λ*= .624, χ^2 (6)= 22.144, *p*=0.001 and eigenvalue =.602 and canonical correlation =.613, meaning that the discriminant function accounted for about 61% of the total relationship between predictors and group. Overall, the effect size, partial η^2= .15 was satisfactory.

The structure matrix, as displayed in Table 4.8, revealed that among the five GRS measures, together with the CARE-Index measure, only the general atmosphere of interactions did not load adequately on the discriminant function, using a cut-off point of .33 (Tabachnick & Fidell, 2014). Both maternal emotional tone and sensitivity exhibit high loadings, followed by infant self-regulation and reciprocity. Infant emotional tone offers the lowest loading on the discriminant function. Patterns of differences of means and standard deviations across groups are displayed in Table 4.3 (means of GRS and CARE-Index measures). The clinical group exhibited systematically lower means than the comparison group on all measures. Overall, the discriminant function offered satisfactory results of classification. Approximately 73.1% of cases were classified correctly, with 21 (70%) in the comparison group and 17 (77.3%) in the clinical group.

Table 4.7

Results of Discriminant Analysis of GRS and CARE-Index Measures on Group Membership

Predictors	Function Loadings	Univariate $F(1, 50)$	Pooled Within Group Correlations Among Predictors				
	1		2	3	4	5	6
Infant Emotional Tone	.35	3.703	.71	.55	.76	.69	.73
Infant Self-regulation	.56	9.472^{*}		.44	.79	.74	.77
Maternal Emotional Tone	.72	15.682^{**}			.57	.56	.61
Maternal Sensitivity	.65	12.593^{*}				.81	.95
General Atmosphere	.32	3.219					.86
Reciprocity	.54	8.742^{*}					
Canonical *R*	.61						
Eigenvalue	.60						

Note. N=52. The GRS & CARE-Index measures were entered as predictors for discriminating between clinical and comparison groups.
$^{*}p< .01$, $^{**}p< .001$

4.9 Discussion

The main objective of the present study was to explore the quality of interaction between inpatient mothers with PND and their infants. A comparison group of mothers without PND and their infants served to illustrate the real effect of PND on the quality of mother-infant interaction. The contribution of this study consists of the simultaneous assessment of multiple factors associated with the quality of mother-infant relationship, aiming to produce a broad picture of this interaction – namely, maternal emotional tone, sensitivity and coercions, infant emotional tone and self-regulation, as well as reciprocity and general atmosphere. The findings revealed that the quality of mother-infant interaction is negatively affected by the presence of PND. In particular, in this study mothers with PND showed less maternal sensitivity to their infants' cues during their interaction, while maternal and infants' emotional tone was less positive in the clinical group when compared to the dyads from the comparison group. The following sections will discuss the results in detail, in light of the existing literature.

4.9.1 Maternal and Infant Emotional Tone

There exists general agreement that mothers with PND exhibit overall less positive emotional tone when compared to mothers without PND; they also display more negative than positive expressions and a loss of animation when interacting with their infants (e.g., Stern, 1994; Murray et al., 1996; Frizzo & Piccinini, 2005; Schwengber & Piccinini, 2003). Findings in the current investigation are in line with the existing literature examining maternal emotional tone in the case of PND; the results suggest that mothers with PND showed less positive emotional tone in comparison to mothers without PND. Furthermore, this study revealed that maternal emotional tone could also serve as strong predictor of group membership (i.e., clinical and comparison groups). This finding may be explained by the nature of PND, with one of the salient symptoms to be sadness (DSM V-APA, 2013), and highlights the importance of assessing emotional tone for the early identification of women at risk of PND.

Concerning infant emotional tone, numerous lines of research have shown that infants of PND mothers are influenced by their mothers' emotional tone and present similar profiles by sharing negative affect (Mantymaa et al., 2008). A plethora of evidence demonstrates that infants of mothers with PND display higher levels of negative affect and lower emotional tone (mood), while they are characterised as fussier, less relaxed and less content when compared to infants of mothers without PND (Goodman & Brand, 2009; Stein et al., 2010; Prenoveau et al., 2017). The infants' lowered emotional tone could be attributed either to the infant's tension to resonate emotionally with maternal negative affect displays (Stein et al., 2010; Flykt et al., 2010), or to the direct impact of a negative maternal emotional tone to the infant's emotional well-being (Field, 1995). Consequently, in a recent comprehensive review of 122 studies, Slomian and colleagues (2019) found that PND has a profound effect on the emotional development of infants.

In contrast to previous research, the present study did not find a significant difference in infant emotional tone when comparing infants of mothers with and without PND (for further information, see Chapter 6, Section 6.7.1). However, a conclusion cannot be drawn regarding the infants' emotional well-being in the sample of the present study, without taking into account infants' self-regulatory abilities. Despite similar profiles of infant emotional tone between the two groups, the participant infants differed significantly in their self-regulatory skills. These findings are complementary; the lack of difference in infant emotional tone between groups and the presence of deficits in infant self-regulation in the clinical group may highlight the possibility of compulsive behaviour, presenting evidence of the somatisation of negative emotions in infants belonging to the clinical group. The following section discusses in detail the findings of both the existing literature and the current study regarding infants' self-regulatory abilities and explores their impact on infant well-being.

4.9.2 Infant Self-Regulation

According to Perry and colleagues, 'self-regulatory functioning has been conceptualized as a system in which adaptive self-control can be observed across physiological, attentional, emotional, behavioral, and cognitive domains' (Perry et al., 2018, p. 3). As a corollary, children's self-regulatory abilities are linked to physical, social and emotional developmental domains and serve as the foundation for the child's long-term well-being (Housman, 2017; Sun et al., 2020; Murray et al., 2014). Self-regulation evolves with development (Bates et al., 2020; Sun et al., 2020), with a rapid increase in self-regulatory abilities taking place between 3 to 13.5 months of age (Rothbart et al., 1992). This provides an explanation for the findings of the present study, according to which the infants' age, ranging from 3 to 12 months in the current sample, exhibited a high positive correlation with self-regulation. This finding was expected, considering the infants' age range and in light of known developmental effects on infants' self-regulatory abilities. Thus, for the purposes of this research, infant age was handled as a covariate in the comparison of infants' self-regulatory capacities between the two groups.

There exists a large body of research demonstrating that maternal PND is a well-established risk factor for deficits in infant self-regulation (for a review, see Goodman, 2015; Goodman et al., 2011). In accordance with the existing literature, the findings of the current study suggest that PND adversely affects infant self-regulation. In particular, the results indicate that infants of mothers with PND are less effectively self-regulated and more distressed when compared to infants of mothers without PND during a play interaction with their mothers. These results concur with those reported in a recent study by Vaever et al. (2020), in which the authors assessed a sample of 28 infants of PND mothers and 52 infants of non-depressed mothers. The findings demonstrated that there was a disturbance in self-regulatory capacities in infants whose mothers suffered from PND. Along the same lines, Bates and colleagues (2020), using a cohort of 142 mother-infant dyads, indicated that greater maternal depressive symptomatology predicted poorer infant self-regulation. Indicatively, this association between the presence of maternal PND and impairments in infant self-regulatory abilities was also similarly identified in studies conducted by Conroy et al. (2012) and Asmussen et al. (2021).

However, the deficits in infant self-regulation in the clinical group of this study may also be attributed to another factor – that is, maternal sensitivity. Robust empirical evidence across the literature demonstrates the significance of maternal behaviour in the development of infant self-regulatory skills (e.g., Morawska et al., 2019; Fay-Stammbach et al., 2014; Frick et al., 2018, 2019; Bernier et al., 2010; Wade et al., 2018), with maternal sensitivity serving as a buffer against the negative effects of PND on infant self-regulation (Granat et al., 2017; Sun et al., 2020; Bates et al., 2020; Kalpan et al., 2008; Thomas et al., 2017; Luthar et al., 2015). For instance, an overview of the role of parenting in the development of child self-regulation was also conducted by Morawska and colleagues (2019); the authors concluded that there was a clear link between the quality of parenting and self-regulation. In fact, infants of sensitive mothers are more likely to adapt effective self-regulation strategies when compared to infants of less sensitive mothers (Ghazban et al., 2013; Gable & Isabella, 1992; Tronick et al. 1982). In the present research, compared to the comparison group, mothers with PND exhibited lower levels of maternal sensitivity, which in turn can negatively affect infants' self-regulatory abilities. The findings of this study strengthen the assertion that maternal sensitivity enhances infant self-regulation, which is consistent with assertions made in previous studies (e.g., Granat et al., 2017; Sun et al., 2020; Bates et al., 2020; Kalpan et al., 2008; Thomas et al., 2017; Luthar et al., 2015).

Generally, children who are capable of using their self-regulatory skills effectively from early on tend to show greater self-confidence and empathy and to establish trusting relationships; they are intellectually inquisitive and more able to communicate and relate with others successfully (Housman, 2017; Cohen et al. 2005). Given the significant role of self-regulation in child development and well-being, the findings of this study – that is, infants of mothers with PND show deficits in their self-regulatory capacities – are concerning. There is evidence to suggest that interventions focused on enhancing children's self-regulation are effective (Morawska et al., 2019). However, a recent meta-analysis of universal interventions designed for enhancing self-regulation in children, from infancy to adolescence, found that there is no universal intervention for children younger than 2 years of age (Pandey et al., 2018). This is quite surprising, given that the growth of self-regulation takes place during the formative years of infancy (Housman, 2017). The findings of this study highlight the need for early interventions that enhance self-regulation in infants whose mothers suffer from mental health issues, such as PND, in order to preserve infants' optimal development.

4.9.3 Maternal Sensitivity

Recognising the important role of maternal sensitivity in mother-infant bonding and child development, an extensive body of research focuses on the effect of PND on maternal sensitivity, with studies producing equivocal results. On the one hand, there is strong evidence that maternal PND can negatively affect and reduce maternal sensitivity (e.g., Binda et al., 2019; Bernard et al., 2018; Campbell et al., 2004; Leerkes et al., 2015; Ann-Easterbrooks et al., 2000; Klucziok et al., 2018). On the other hand, another line of research has failed to find differences in maternal sensitivity between groups of mothers with and without PND (e.g., Alvarenga et al., 2013; Fonseca et al, 2010; Sidor et al., 2011). The results of the present study provide support for the former; in this sample, mothers with PND were significantly less sensitive to their infants' signals than mothers without PND.

However, at this point it is essential to mention that the clinical group of the current study consists of inpatient mothers with severe PND. There exists evidence that the severity of PND is a risk factor of reduced maternal sensitivity (Bernard et al., 2018; Mills-Koonce et al., 2008; Campbell et al., 2004). For instance, in a meta-analysis of 48 studies of a total of 4,934 mother-infant pairs, Bernard and colleagues (2018) found that the severity of PND plays a central role in the quality of maternal sensitivity. The findings revealed that mothers with a higher level of depressive symptoms were less sensitive than mothers with lower levels of depression. As a consequence, the reduced level of maternal sensitivity found in the clinical group of this study could also be attributed to the severity of PND in participant mothers.

Furthermore, the current study also assessed the predictive role of maternal sensitivity; the findings resonate with the previously published literature, which supports that maternal sensitivity is a key predictor in mother-infant reciprocal interaction (Vaever et al., 2020; Verhage et al., 2016; Bernard et al., 2018). What the present study adds is a novel finding according to which maternal sensitivity can also predict the quality of the general atmosphere occurring when a mother interacts with her child during a play session. In other words, the findings regarding the general atmosphere revealed that the level of maternal sensitivity may be a predictor for how harmonious or disharmonious (discordant and conflictual) the overall mother-infant interaction is. Given that it is of pivotal importance for infant well-being to secure an atmosphere of happiness, love and understanding in which the child can grow up and flourish (Cuthbert et al., 2011), these findings revealed an additional reason why maternal sensitivity in mothers with PND constitutes a meaningful target for intervention.

Finally, the findings of this study confirmed that severe PND is linked to reduced maternal sensitivity, with the level of maternal sensitivity also serving as predictor for the allocation of mothers to either the clinical or the comparison group; this highlights the strong association between PND and maternal sensitivity found in this research. Taking into account the significant role of maternal sensitivity in mother-infant attachment and, consequently, infant development (Deans, 2020), these findings provide an explicit recognition of the vulnerability of infants with PND mothers to poor developmental outcomes. Therefore, the findings of the current research call for scientific attention in order to further investigate how best to promote maternal sensitivity in mothers with severe mental health issues so as that to ensure mothers' and infants' well-being.

4.9.4 Maternal Coercive Behaviour

Mothers with PND do not form a homogeneous population (Hatzinikolaou & Murray, 2010; Flykt et al., 2010), since their interactive patterns with their infants range from optimally sensitive to either coercive or passive (Flykt et al., 2010). The present study found no evidence of maternal coercive behaviour in either the clinical or the comparison group; therefore, this variable was excluded from further analysis. This null finding contradicts some previous literature that has observed evidence of such maternal behaviours in the case of PND (Murray et al., 1996, 2015, 2018; Kemppinen et al., 2006; Field, 2010; Crugnola et al., 2016).

According to the literature, one of the two dominant interactive patterns occurring between mothers with PND and their infants is an intrusive, coercive and hostile style (Murray et al., 1996, 2015, 2018; Kemppinen et al., 2006; Field, 2010; Crugnola et al., 2016). There has been a proliferation of knowledge about how maternal interactive style is linked to infant development (e.g., Deans, 2020; Bernard et al., 2018). Specifically, there exists evidence that maternal coercive behaviour contributes to the infant adapting an angry coping style (Tronick & Reck, 2009). Furthermore, infants of intrusive mothers have been found to be at increased risk for exhibiting externalising and behavioural problems, such as conduct problems and ADHD later in life (Mantymaa et al., 2004; Morrel & Murray, 2003).

Overall, this null finding raises the important question as to whether the brief video-recorded mother-infant interaction in a clinical context may be a plausible explanation for the lack of any coercive behaviour on the part of mothers with PND. Further research is needed to investigate the interactive patterns between infants and mothers with severe mental health issues, such as PND, in the context of an MBU, given that these patterns are directly linked to child emotional and social well-being (Mantymaa et al., 2004; Morrel & Murray, 2003).

4.9.5 Mother-Infant Reciprocity

Reciprocity refers to the mutual interchange between the mother and the infant; a reciprocal interaction is characterised by finely tuned, co-ordinated and smooth exchanges (Murray & Karpf, 2000). In a reciprocal interaction, the mother should be able to receive the infant's input and respond appropriately, and vice versa; this leads to the assertion that maternal sensitivity is a prerequisite for dyadic reciprocity (Skuban et al., 2006). There exists general agreement that the mother and infant reciprocal interaction during the first year of life is of pivotal importance for infant development, enhancing infants' cognitive, social-emotional, linguistic and self-regulatory skills (Feldman & Eidelman, 2004; Feldman & Greenbaum, 1997; Feldman et al., 1999).

However, dyadic reciprocity between mother and infant can be significantly hampered by PND (Feldman, 2003; Feldman & Eidelman, 2004, 2005; Campbell et al., 1995). In accordance with the existing literature, the findings of this study showed that PND has a negative impact on the quality of mother-infant interaction. Particularly, the dyads of the clinical group displayed considerably less reciprocal interaction during a play session in comparison with mothers without PND and their infants. At this point, it is worth mentioning that there exists an additional factor that should be taken into account for the interpretation of these findings. Given that reciprocal interaction is attributed to maternal sensitivity (van Huisstede et al., 2019), the low level of maternal sensitivity exhibited by mothers with PND in the present study could also compromise the reciprocal interaction with their infants.

In the present chapter, the profound importance of the quality of mother-infant interaction in human life has been discussed in detail. Even if the results of this study – that is, the presence of deficits in the interaction between mothers with PND and their infants – were expected, their significance should not be underestimated. These results give even greater importance to the above-mentioned suggestions concerning the need for carefully planned interventions that target mothers with PND and their infants, who are at risk of adverse developmental outcomes. Further research to suggest how mother-infant interaction could be enhanced in the case of PND is needed in order to support infants to achieve their greater long-term health and developmental potentials.

4.9.6 General Atmosphere: '50 Seconds Left'

Fogel (1993) introduced the concept of framing, which refers to 'the adult's capacity to create an atmosphere, in which the interaction can continue, and hints at their efforts to draw the infant into positive states' (Noe et al., 2015, p. 179). Evidence shows that infants of PND mothers live in an atypical emotional environment where negative sentiment prevails due to the exposure to maternal sadness, lack of energy and neutral expressions (Szekely et al., 2014; Dawson et al., 2003; Field, 1995). Nevertheless, the present study did not find significant differences in the quality of the general atmosphere occurring when mothers with and without PND interacted with their infants. More specifically, despite the fact that the general atmosphere was more harmonious in the case of mothers without PND and their infants, the differences between the two groups were not statistically significant.

These findings are quite encouraging since they show that, even in a clinical context, the majority of mothers with PND attempted to secure a friendly and positive environment when interacting with their babies. However, these results should be interpreted with caution due to the short duration of video-recorded interactions. In support of this argument, Wan and colleagues (2008) suggested that, in a hospital context, the lack of negativity in mothers with severe mental health issues during brief interactions with their infants may also be attributed to their fear of being questioned about their parenting abilities, given that the risk of having their infant removed to care is apparent and threatening.

Apart from the presence of this threat for mothers with PND, this study provides another possible interpretation; to illustrate this, it is essential to refer to the characteristic example of a mother-infant pair from the clinical group. This specific dyad scored comparatively high for all measures, including the joint measures of reciprocity and general atmosphere. In this case, a harmonious play interaction was taking place between the mother and the infant, with the mother smiling and positive, as well as effectively playing with and talking to her baby throughout the session. The baby was relatively engaged in the play interaction and seemed to enjoy the process. During a 3-minute session, while the mother was actively playing with her infant, she looked at the wall clock after the first 2 minutes and said to the baby '50 seconds left' before returning to their joint activity. This phrase contains all the efforts made by mothers with PND to overcome their depressive symptoms and stay positive in a play interaction with the infant; however, even a 3-minute play session can be exhausting for this population. As illustrated by this example, mothers with PND may have good intentions to positively engage with their infants in a play session, but their depressive symptoms constitute an obstacle. Still, maternal good intentions can serve as a strong base upon which maternal sensitivity and parenting skills may be further enhanced by a tailor-made treatment, aiming at improving the quality of mother-infant interaction and, consequently, the mother's and child's well-being.

4.10 Conclusion

The present study makes important contributions to the research on mother-infant interaction in the case of severe maternal PND. In the scope of this research, a constellation of maternal and infants' qualities that are interrelated in shaping the quality of mother-infant bonding were assessed through the prism of PND. Overall, the findings of the present study, which stand in agreement with previous research, supported that the quality of mother-infant interaction significantly differs between mothers with and without PND and their infants (Murray et al., 1996; Murray & Copper, 1997; Hipwell et al., 2000; Moehler et al., 2006; Wilkinson & Mulcahy, 2010; Margaret et al., 2018).

In particular, the findings revealed that the clinical group exhibited deficits in their reciprocal interaction, with mothers with PND showing less maternal sensitivity to their infants' cues and worse emotional tone when compared to mothers without PND. Likewise, infants whose mothers suffered from PND displayed deficits in their self-regulatory capacities. No statistically significant differences were found in the measures of general atmosphere and infant emotional tone between the groups, while there was no evidence of maternal hostile behaviour in either the clinical or the comparison group. Overall, this study responds to the need for more in-depth understanding of mother-infant interaction in the case of inpatient mothers suffering from PND. Moreover, this research highlights the imperative need for the development of multidimensional early interventions for this population. These early interventions should simultaneously aim to ameliorate maternal postnatal depressive symptoms and to enhance maternal sensitivity so as to preserve the quality of mother-infant interaction which in turn promotes the infant's holistic development.

Chapter 5: Mother-Infant Vocal Interaction

5.1 Introduction

This chapter compares the vocal behaviour of infants and mothers with and without PND. It begins by reviewing the relevant literature before presenting Study 2 of this doctoral research project. Study 2 examined the effect of PND on infants' verbal communication skills through the prism of maternal vocal behaviour – that is, maternal speech and singing. The last section of this chapter includes a discussion of how the findings of the present study not only fit into the body of literature on mother-infant vocal interaction in the presence of PND, but also expands that literature by providing new evidence.

5.2 Infant Vocal Development

Research of the past few decades has enhanced our knowledge on infants' capacities, with the first milestones of infant development being achieved already inside the womb (Oller et al., 2012). This refutes the traditional view of the infant as being a passive and helpless organism at birth (Beebe, 1982); in contrast, the infant, as a social human being, is equipped biologically to be an active and stimulus-seeking partner in mother-infant interaction (Beebe, 1982; Chess & Thomas, 1987). At birth, the infant has a large repertoire of prelinguistic behaviours – such as eye gaze, gestures and vocalisations – that are related to subsequent language development (Wu & Gros-Louis, 2014; see also Laakso et al., 1999). The emergence of a rich prelinguistic communication system has been proven to constitute an infant's universal capacity (Oller et al., 2012; Kuhl & Meltzoff, 1996) that develops by following a predictable and continuous process (Oller et al., 2012, Pretzer et al., 2019; Buder et al., 2013; Oller, 1980, 2000; Stoel-Gammon, 1989).

From birth, neonates begin vocalising by using primitive, reflexive vocalisations (Pretzer et al., 2019; Buder et al., 2013; Roug et al., 1989). By the third month, normally developing infants have gained enough control of their vocal tracts to be able to make interactive sounds by using a wide range of protophones (i.e., vowel-like sounds, raspberries, yells, squeals, growls) (Oller, 2000; Yoo et al., 2018; Pretzer et al., 2019; Slater & Lewis, 2007). Between 4 and 6 months, infants engage in vocal play characterised by experimentation with articulators and nonsegmental features, such as pitch, loudness, rhythm and vocal register (Slater & Lewis, 2007). By about the sixth month, infants can be typically cajoled into babbling, which signals the production of canonical syllables in repetitive sequences that reflect the acoustic patterns of adult-like speech (Oller, 2000; Gros-Louis et al., 2006; Oller et al., 2012; Buder et al., 2013). Typically, a receptive vocabulary has also been developed by this stage (Bergelson & Swingley, 2012). Following this stage, between 10 and 15 months, infants gradually develop the necessary oral-motor skills to enter the complex babbling period (Slater & Lewis, 2007). This period marks the transition from the use of single consonant-vowel syllables to multisyllabicity (i.e., the use of either disyllables or strings of syllables) (Lang et al., 2019; Koopmans-van Beinum & van der Stelt, 1986; Fagan, 2009). These vocal milestones set a foundation for lexical development (Oller, 2000), while during this period infants will have gradually created associations between caregivers' words and the external world (Buckley, 2003). At around 12 months and onwards, infants start using speech-related vocalisations, producing their first words to refer to things (Warlaumont & Ramsdell-Hudock, 2016; Chericoni et al., 2016; Sung et al., 2013). This progression to speech-related vocalisations is a significant component of language acquisition (Abney et al., 2017). All these preverbal abilities are inextricably linked to later language development and academic achievement (Hirsh et al., 2014; see also Pelaez et al., 2011).

Table 5.1

Developmental Milestones of Speech-Sound Production in Infancy

Stage	Main features	Approximate age range
Reflexive vocalisation	Crying, burping, coughing, sneezing	0-6/8 weeks
Interactive sound making	Cooing, laughing They begin by producing vowel-like sounds, such as ‘ooooo’ and ‘ahhhh’	6-19 weeks
Vocal play	Deliberate exploration of sounds	16 weeks-6 months
Babbling	The extended repetition of certain single syllables, such as ‘ma-ma-ma, da-da-da, ba-ba-ba’	6-10 months
Complex babbling	Interactive use of babbling; exploration of stress; intonation	10-15 months
Referential words	First words used to refer to things	12-15 months

5.3 Mother-Infant Vocal Interaction

Language learning during the first year of life is a social affair (Sung et al., 2013). Infants acquire and advance their vocal communication abilities mainly through interaction with their caregivers (Pretzer et al., 2019). Any of the infant’s above-mentioned developmental achievements are influenced by mother-infant vocal interaction (Abney at al., 2017; Goldstein et al., 2003; Goldstein & Schwade, 2008; Gros-Louis et al., 2006; Jaffe et al., 2001; Kokkinaki & Kugiumutzakis, 2000; Northrup & Iverson, 2015; Papousek, 1989; Ramírez-Esparza et al., 2014; Warlaumont et al., 2014; Weisleder & Fernald, 2013). This vocal interaction between mother and baby in early infancy not only fosters infant language development but is also thought to be the cornerstone for child's subsequent cognitive, socio-emotional and affective-organisational development (Roe & Drivas, 1997; Brazelton et al., 1974). Having presented above the trajectories of infant vocal development during the crucial developmental stages from birth to the first year of life, the following section will discuss the crucial role of mothers in infant language development and how mothers build the necessary foundations through their vocal behaviour during the postnatal period.

5.4 Maternal Speech

5.4.1 Maternal Vocal Behaviour in the Postnatal Period

Caregivers across cultures commonly use a particular way of speaking during the interaction with their baby, which allows them to capture the baby's attention as well as to promote reciprocity (Edwards, 2011). This special communication mode is called 'motherese' – a term coined by Bateson (1971) – or alternatively 'infant-directed speech' (IDS) (Music, 2011). IDS includes features such as exaggeration, high pitch, decreased tempo, long hyper-articulated vowels, very simplified syntax, receptiveness and simplified pitch counters (Milligan et al., 2003; Stern, 2009; Edwards, 2011; Music, 2011; Fancourt & Perkins, 2017; Van Puyvelde et al. 2013; Lam-Cassettari & Kohlhoff, 2020). In IDS, the patterns of vocalisation, pacing and content are also modified (Allely et al., 2013), while there is a high frequency of interrogatives (Bulter et al., 2003), which creates a conversational pattern between mother and infant (Snow, 1977). These simplified speech patterns form the basic scaffolding for infant language development (Butler et al., 2003). The main function of these specific features of IDS is to establish ties of proximity and warmth by communicating affect, to enhance social interaction, as well as to engage and sustain infant attention (Lam-Cassettari & Kohlhoff, 2020; Golinkoff et al., 2015; Spinelli et al., 2017; Kitamura & Lam, 2009).

The important role of IDS in infant development has been well documented in research (Lam-Cassettari & Kohlhoff, 2020). More specifically, there exists evidence that an effective use of IDS results in eliciting greater responsiveness from the infant (Werker & McLeod, 1989); this cultivates a positive interactive cycle in mother-infant social interaction (Saint-Georges et al., 2013), which consequently enhances infant vocal communication skills (Goldstein et al., 2003, 2008). Indicatively, a study conducted by Ramirez-Esparza and colleagues (2014) examined the association between language input and infant language development, comparing IDS to standard speech. The results revealed a positive correlation between the use of IDS and infants' concurrent speech and later word production. Deficits in IDS input, however, are linked to the infant's decreased engagement in sustained social interaction and poorer language development by the age of 2 (Ramirez-Esparza et al., 2017).

The effective use of IDS is also associated with the quality and quantity of maternal vocal stimulation. Empirical evidence shows that the quantity of maternal speech has an impact on infant emotional, cognitive and language development (Brookman et al., 2020; Hart & Risley, 1995; Zimmerman et al., 2009), including lexical processing and vocabulary size (Ramírez-Esparza et al., 2014; Weisleder & Fernald, 2013). In other words, children of talkative mothers tend to speak more and develop more advanced language abilities later on (e.g., Gilkerson et al., 2018; Romeo et al., 2018). Roe and Drivas (1997), using a sample of 147 mother-infant dyads, found that mothers in the mid-level talking range showed great reciprocity, given that they allowed their infants to initiate vocal conversations. In contrast, the most talkative mothers did not give their infants the opportunity to initiate vocal conversations, and the least talkative mothers ignored their infants' attempt to communicate through vocalisations (Roe & Drivas, 1997).

A study conducted by Merz and colleagues (2015) supported that there is no association between the quantity of maternal language input and the child's developmental outcome. However, the same study found that the quality of maternal linguistic input contributed to infants' language ability and reinforced the development of high-level reasoning skills. Wade et al. (2018) demonstrated that the quality of maternal linguistic input was positively linked to the child's pre-academic outcomes, including cognitive and literacy abilities. It is worth mentioning that the amount and complexity of maternal speech do not remain stable over time; the quality and quantity of maternal vocal stimulation changes so as to meet the infant's needs across different developmental stages and respond to the infant's increased social behaviour over time (Henning et al., 2005). Thus, additional research is needed to assess the impact of both the quantity and quality of maternal linguistic input on infant language development during the different developmental stages in infancy.

Furthermore, the effective changes that the mother makes in the quality and quantity of her vocal behaviour so as to meet her infant's needs have been attributed to the construct of maternal responsiveness (Brookman et al., 2020). When mothers produce contingent vocal responses to their infants' vocalisations, both the quality and quantity of the infant's vocalisations increases (Brookman et al., 2020). As reported by Nicely et al. (1999), maternal contingent responses to 9-month-old infants predicted the achievement of several language milestones at 21 months (Nicely et al., 1999). Additionally, Dunst and colleagues (2010) reviewed 22 studies conducted between 1959 and 2008; their findings indicated that changes in infant vocalisations were linked to maternal vocal contingent responses. In a recent study (Brookman et al., 2020), infants' 18-month vocabulary size was linked to maternal sensitive responses, which become more conversational in the vocal interaction with the infant.

The association between maternal responsiveness and infant language development has also been documented in another body of research in the field. Wu et al. (2014) observed the interaction between mothers and their 10- to 13-month-old infants and examined the extent to which this interaction influences infants' language outcomes at 15 months of age. They found that maternal contingent responses improved infants' comprehension skills and word production at 15 months (for similar findings, see McGillion et al., 2013; Tamis-LeMonda et al., 2001). Along the same lines, Goldstein and Schwade (2008) found that 9-month-old infants produced more developmentally advanced vocalisation when their mothers provided contingent social feedback to their prelinguistic vocalisations, compared to when they responded with a delay. Other studies have provided support for the crucial role of maternal responsiveness in infant language development (i.e., see Gros-Louis et al., 2006, 2014; Goldstein et al., 2003, 2010; Miller & Lossia, 2013).

Overall, the studies reviewed above have shown the importance of maternal contingent and sensitive responses to infants' vocalisations, underlining the social nature of infant language acquisition; the sensitive responses on behalf of the mother encourage the infant's attempt to communicate, influence the quality and quantity of this communication and give social importance to the infant's vocalisations (McFarland et al., 2020). Yet, this is not to underestimate the importance of infants' behaviour in this vocal interaction. As infant language acquisition takes place in a social context, the active role of infants as learners is well documented (Tamis-LeMonda et al., 2001; Hirsh et al., 2014): 'Infants are not merely passive "listeners" of IDS but can act as agents in their interactions and language learning' (Brookman et al., 2020, p. 1224). Two main social functions of infants' vocalisation have been highlighted in the relevant literature: one to attract the mother's attention, and the other to signal an emotional reaction (Delgado et al., 2002; Goldstein et al., 2009). In both cases, the infant, through vocalisations, actively contributes to the promotion and improvement of mother-infant communication (Bouvris et al., 2018).

There is also evidence that infant responsiveness to maternal vocal behaviour constitutes a predictor of infant language milestones (Masur & Olson, 2008). Indicatively, Fagan & Doveikis (2019) supported that, in a mother-infant vocal interaction, maternal responses are highly correlated with infants' vocalisation, suggesting that the more infants used vocalisations, the more maternal responses they received. This creates a circle of communication in which both partners influence the trajectory of their vocal behaviours. However, this important circle of communication, which consists of emotional and information exchanges between the mother and the infant, can break in the case of maternal PND (Kaplan et al., 2014; Smith-Nielsen et al., 2016). In comparison to mothers without PND, mothers with PND exhibit differences in their vocal behaviour when interacting with their infants, and these differences can be a root cause for neurodiversity in infant development (Kaplan et al., 2014; Murray et al., 1993). The following section will focus on the impact of PND on maternal vocal behaviour. The subsequent effects on infant development and mother-infant bonding will also be presented and discussed.

5.4.1.1 Maternal Vocal Behaviour and Postnatal Depression. The existing literature on vocal behaviour in mothers argues that there are differences between mothers with and without PND (Field, 2010). Mothers with PND have been found to vocalise less (Buckley, 2003), as well as to use IDS less effectively than non-depressed mothers (Sohr-Preston & Scaramella, 2006). In particular, IDS in mothers with PND is characterised by longer utterances, smaller pitch rate, less use of repetition, less vocal energy and more negative affect (Lam-Cassettari & Kohlhoff, 2020; O'Leary et al., 2019; Butler et al., 2003; Herrera et al., 2004; Buckley, 2003; Kaplan et al., 2014; Zajicek-Farber, 2010). Evidence also shows that mothers with PND speak with a significantly higher voice when addressing their babies, in comparison to mothers without PND (Reissland et al., 2003). These findings suggested that, even when mothers with PND use attuned and appropriate mind-related comments for their infants, the quality of the interaction might not be improved due to the mothers' irritated tone of voice (Pawlby et al., 2010). Consequently, the infant of a depressed mother may be forced to adapt to self-regulatory patterns that will eventually compromise their development (Reissland et al., 2003). These deficits in mother-child interactions are strongly linked to poorer language outcomes and cognitive capacities (Brookman et al., 2020; Zauche et al., 2016), as well as emotional difficulties (Paulson et al., 2009).

In terms of the quality of maternal vocal behaviour, the content of speech in mothers with PND differs from the content of speech in mothers without PND. In this comparison, mothers with PND use less infant-focused speech when interacting with their infants than mothers without PND (Lam-Cassettari & Kohlhoff, 2020; Buckley, 2003; Murray, 1993; Butler et al., 2003). The use of infant-focused speech by mothers seems to have an important impact on children's cognitive development (Murray et al., 1993). As shown by Murray et al. (1993), when mothers used more infant-focused speech at 2 months, rather than using mother-focused speech or directing the baby's actions, their infants exhibited better cognitive outcomes at 9 months. Furthermore, in a study conducted by Herrera et al. (2004), the content of infant-directed speech was assessed and analysed for 72 dyads of mothers with and without PND while playing with their infants at two different points in time – when the babies were 6 and 10 months old, respectively. The results revealed that mothers with a depressed mood of 6-month-old infants displayed fewer affective and informative features in their speech than mothers without PND (the control group). Also, depressed mothers of 6- and 10-month-old babies showed little change in the use of affect-salient speech over time when compared to the control group, indicating that they were not able to adapt their speech to the infants' new developmental needs. To illustrate this point, it is essential to present the findings of the study conducted by Kitamura & Burnham (2003). In this study, the affective quality of IDS in 12 healthy mothers while interacting with their infants was assessed by naive raters at different points in time: at birth, 3, 6, 9 and 12 months. Results revealed that maternal vocal behaviour reflects the infant's developmental needs and that the mother adjusts her vocal behaviour accordingly; the most conspicuous quality in maternal IDS at birth was 'comforting and soothing' while 'approving' and 'directive' predominated at 6 and 9 months, respectively. These findings provide support for the view that maternal IDS is attuned to different infants' developmental stages while, as derived from the above, this function of IDS is not evident in the case of mothers who suffer from PND.

Regarding the vocal timing of mothers' responses to their infants' vocalisations, the results differed again for mothers with and without PND. In comparison to mothers without PND, mothers with PND proved to respond more slowly and indiscriminately to their infants (Zajicek-Farber, 2010; Buckley, 2003). They also use longer switching pauses that varied more and were less predictable when compared to those of non-depressed mothers (Zlochower & Cohen, 1996). For example, Bettes (1988) assessed the effect of maternal PND on IDS to 3- to 4-month-old infants, and the findings showed that, in comparison to mothers without PND, mothers with PND used fewer verbal responses to their infants' vocalisations, with greater variability in response latency and pauses. This has a negative impact on mother-infant coordination in terms of their vocal behaviours (Zlochower & Cohen, 1996), while these deficits in the vocal timing of maternal responses can affect the vocalisation quantity of infants (Brookman et al., 2020; Field, 2002).

The severity of maternal depression can also affect the use of IDS in mothers (Milligan et al., 2003). In line with the findings presented above, mothers with mild depression reported to use IDS less frequently and to respond slower to their babies' vocalisation than mothers without depression (Bettes, 1988; Milligan et al., 2003). However, mothers with major depressive symptoms showed a less frequent modulation of IDS (Kaplan et al., 2001). Along the same lines, most recently, Porritt et al. (2014), using a sample of 281 mothers of 3- to 14-month-old infants, found that mothers with clinical PND produced a smaller pitch range when compared to mothers with PND in partial remission. Overall, PND can negatively affect the maternal vocal behaviour towards their infants in multiple ways, with the severity of this psychiatric disorder playing a crucial role in the degree of this effect. It is quite surprising, then, to find a gap in the respective literature on PND mothers who have been hospitalised in a clinical setting with their infants (Pawlby et al., 2010); the present study aims to fill this gap.

5.4.2 The Impact of Maternal PND on Infant Language Development

The findings of studies examining the impact of maternal PND on infant language development have been inconsistent (Kaplan et al., 2014; O'Leary et al., 2019; Slomian et al., 2019; Aoyagi et al., 2019; Smith-Nielsen et al., 2016), highlighting the need for further research in the field. In a recent systematic review, Slomian and colleagues (2019) examined studies published between 2005 and 2016 to investigate the consequences of PND on infants' developmental outcomes. Out of the 122 studies included in the review, 13 studies had focused on the association between maternal PND and infant language development; their findings were inconsistent. Six of these studies indicated a significant impact of PND on infant language development (Kaplan et al., 2012; Zajicek-Farber, 2009; Kaplan et al., 2014; Paulson et al., 2009). Four studies demonstrated that PND indirectly affected infant language development, following a mediated path model (Ali et al., 2013; Stein et al., 2008). According to evidence from three studies, there is no association between PND and the development of language in infants (Koutra et al., 2013; Piteo et al., 2012).

More specifically, a wealth of evidence indicates that maternal PND could delay infant language development. In particular, Quevedo et al. (2012) found that 1- to 3-month-old infants of mothers with PND showed delays in their language development. A study by Koutra and colleagues (2013), using a sample of 502 mother-infant pairs, reported that children whose mothers had PND at 2 months postpartum exhibited decreased cognitive development at 18 months. Results from a study by Smith-Nielsen et al. (2016) similarly indicated that infants of PND mothers showed poorer cognitive development at 4 months, in comparison to infants of mothers without PND. Another longitudinal study by Valla et al. (2016) used a cohort of 1,555 mother and infant pairs to investigate the association between PND and infants' communication skills. They reported that maternal PND at 4 months is highly associated with lower infant communicative skills at 12 and 24 months of age, when compared to infants of mothers without PND.

This is in line with recent findings indicating that there exists an association between PND and poor expressive language skills during childhood (Aoyagi et al., 2019). Importantly, in the study by Aoyagi et al. (2019), follow-up evaluations were carried out on a total of 969 neonates and their mother; infants' expressive language development was measured using the Mullen Scales of Early Learning and monitored at six points over time (10, 14, 18, 24, 32 and 40 months postpartum). The findings revealed that there was no association between PND and infants' expressive language abilities at 10-14 months. These findings are consistent with previous studies that found no significant reduction in infants' expressive language skills at 6 and 12 months (Murray, 1992) and at 4 and 12 months (Cornish et al., 2005). However, Aoyagi et al. (2019) repeated a study using the measures of expressive language skills beyond the age of 12 months and found that PND was significantly and consistently linked to decreased expressive language abilities in infants aged 18 months and older. A plausible explanation for these differences in infant expressive language skills across different assessment points is due to the fact that expressive language skills develop dramatically at about 1 year of age or after this age (Reilly et al., 2006).

Numerous studies have examined the indirect ramifications of PND's effects on infant language development. Decreased maternal responsiveness (Aoyagi et al., 2019; Keim et al., 2011; Kingston et al., 2012; Milgrom et al., 2004), poor quality of parenting (Zajicek-Farber, 2009; Stein et al., 2008), deficits in maternal communication (Murray et al., 1993, 1996) and specific maternal sociodemographic characteristics, such as low socio-economic status and low educational level (Kurstjens & Wolke, 2001; Zajicek-Farber, 2009; Santos et al., 2020), have been proven to count among the main factors that may indirectly affect the association between PND and infant language development. For instance, Zajicek-Farber (2009) investigated the impact of parenting and PND on the emergent language competencies of 198 babies in low-income Latino and African-American families. The findings showed that children's involvement in stimulation activities was influenced by the effects of parenting and maternal psychopathology and directly predicted the competence in children's language and their emergent vocabulary. Along the same lines, Milgrom and colleagues (2004) followed mothers with PND and their infants and reported that infant cognitive-linguistic abilities at 42 months of age were mediated by the quality of maternal responsiveness assessed at 6 months postpartum.

Factors related to the nature of PND that could also affect the trajectories of infant language development include the timing of PND onset (Aoyagi et al., 2019; Ahun et al., 2017), the severity of PND (O'Leary et al. 2019; Cornish et al., 2005), and its chronicity or recurrence (O'Leary et al., 2019; Ahun et al., 2017; Smith-Nielsen et al., 2016; Feldman & Eidelman,2009; Cornish et al., 2005; Kurstjens & Wolke, 2001; Murray et al., 1993; NICHD, 1999; Petterson & Albers, 2001; Sohr-Preston & Scaramella, 2006; Sutter-Dallay et al., 2011). For example, the NICHD Early Child Care Research Network (1999) recruited a large cohort of mother-infant dyads and followed up at 6, 15, 24 and 36 months to assess infant cognitive and language development at the age of 36 months. The findings revealed that infants whose mothers suffered from chronic PND exhibited lower scores in expressive language than infants of mothers with occasional depressive symptoms. Similar findings were reported in a recent study by Ahun and colleagues (2017) who recruited 1,073 mother-infant dyads in order to assess the effect of maternal depressive symptoms on infants' verbal abilities. Using the Peabody Picture Vocabulary Test-Revised (PPVT-R), infants' verbal abilities were assessed at ages 5 months and 1.5, 3.5 and 5 years of age: Children whose mother suffered from chronic depression had lower levels of verbal abilities in middle childhood.

In some studies, no association between PND and infant language development was found. Indicatively, two different studies evaluated the effect of PND and infant cognitive, motor and language development at 6 and 18 months, respectively (Husain et al., 2012; Piteo et al., 2012). Both reported no association between PND and infant cognitive, motor and language development at the two different assessment points (Piteo et al., 2012). In a study by Wang and associates (2005), infants of 29 mothers with PND and 32 mothers without PND were assessed one year after childbirth across eight developmental domains (gross motor, fine motor, expressive language, comprehension, conceptual, situation comprehension, self-help, personal social and general development). Maternal PND was found to have no significant influence on these eight developmental areas of infant development. However, the number of mothers with PND in these studies (e.g., Husain et al., 2012; Piteo et al., 2012) were small, which limits the generalisability of their findings.

Overall, research on the association between PND and early language development remains inconclusive. However, given the catalytic role of maternal vocal behaviour in infant language and communication skills, further research is needed to examine in depth the potential direct or indirect effects of PND on mother-infant vocal interaction, so as to avoid putting the infant's long-term development at risk. This study attempts to provide a broad picture of maternal vocal behaviour and infant development in the case of PND. At this point, it is essential to clarify that maternal vocal behaviour consists of two elements: maternal speech (as discussed in this section) and maternal singing. Therefore, the following section will shed light on the interrelationship between PND, maternal singing and infant development.

5.5 Maternal Singing

5.5.1 Maternal Singing in the Postnatal Period

Compared to maternal speaking, maternal singing is characterised by a remarkable stability in pitch and tempo (Fillipa et al., 2018; 2020; Falk & Tsang, 2020; Bergeson & Trehub, 2002) and by shorter length of pauses and longer length of vocalizations (Carvalho et al., 2019). Consistency in absolute pitch and tempo in maternal singing makes mothers' songs more suitable for soothing the baby, directing the baby's attention to specific words and, consequently, enhancing social bonds (Trehub, 2021; Cirelli et al., 2020; Bergeson & Trehub, 2002). Yet, variability in vocal characteristics in maternal speech has different function in the early mother-infant communication (Fillipa et al., 2022) and may be more suitable for getting the baby's attention (Nakata & Trehub, 2004; Bergeson & Trehub, 2002).

Both IDS and ID singing convey emotional intentions, regulate arousal, and elicit and sustain infants' attention (Falk et al., 2021; Palazzi et al., 2021; Soderstrom, 2019; Trehub, 2017; Filippa et al., 2013; 2020; 2021; Nakata & Trehub, 2004; de l'Etoile, 2006). However, despite differences between IDS and ID singing, infants were reported to be considerably more engaged when the mother was singing rather than speaking to them (Tsang et al., 2017; Corbeil et al., 2016; Nakata & Trehub, 2004). In other words, the effectiveness of maternal speech is focused on recruiting infants' attention and the effectiveness of maternal singing on sustaining infant attention (Nakata & Trehub, 2004). In support of this observation, Nakata and Trehub' s study (2004) found that the participant infants looked at audio-visual displays of singing for

78.6% of the time, while they looked at audiovisual displays of speaking for 67.3% of the time. Adding to that, a series of studies conducted by Palazzi and colleagues (2019; 2020; 2021) to investigate the impact of maternal singing on premature infants' signs of engagement. The findings indicated that compared to a non-singing interaction, the infants displayed greater eye opening [i.e., important marker of engagement in infancy (Filippa et al., 2018; 2020)] while they touched, smiled and looked at the mother more during singing. These findings are in accordance with the results from the study by Fillipa and colleagues (2020) which showed that maternal singing can increase infants' eye opening, self-touch behaviours and smiling.

Moreover, maternal speech leads to a less sustained reduction of infant arousal than does maternal singing (Cirelli et al., 2020; Shienfield et al., 2003; Milligan et al., 2003). To further support this notion, Nakata & Trehub (2004) showed that, in response to maternal singing, infants exhibit greater visual attention, which leads to less body movement, when compared to infants' reactions during maternal speaking. These findings are in line with the results of one of the first research-studies that aimed to explore the differences between maternal speaking and singing, based on a sample of preterm infants (Coleman et al., 1997). The findings demonstrated that the effect of maternal singing is greater on preterm infants' heart rate, oxygen saturation and behaviour state than that of maternal speaking. Since then, the positive effects of maternal singing on infants' physiological responses have been well-documented (i.e., Epstein et al., 2021; Meder et al., 2021; Bielenink et al., 2016; Arnon et al., 2014; Filippa et al., 2013). For instance, a recent multi-centre randomised clinical trial conducted by Filippa and colleagues (2022) demonstrated that maternal singing, but not maternal speech, enhances premature infants' vagal activity and therefore improves infants' autonomous nervous system stability. In the same line, another study conducted by Cirelli and Trehub (2020) assessed the effectiveness of parents' speech and singing (using both familiar and unfamiliar songs) in alleviating the distress in infants aged 8- and 10-month-old (n = 68 per age group). The findings supported that regardless the infants' familiarity with the songs, parental singing was more effective in reducing infant distress when compared to speaking.

However, the role of maternal speaking and singing is equally important for infant development and mother-infant attachment (Nakata & Trehub, 2004), as long as both ways of communication include a positive emotional tone (Tsang et al., 2017). To illustrate this point, it is essential to present the findings of a study conducted by Singh et al. (2002). The researchers revealed that, as long as its emotional tone is positive, infants show greater preference for adult-directed speech than for IDS when its emotional tone is neutral. Thus, infants are more attracted to ID singing mainly because of its positive emotive qualities (Flank & Tsang, 2020; Tsang et al., 2017; Shienfield et al., 2003). Nevertheless, the infants' preference for maternal signing, a dominant feature of which is high pitch, may have multiple additional explanations: (1) There exists general agreement about a biologically based tendency to link specific sounds to certain emotions, across species (Trainor & Zacharias, 1998). In particular, evidence shows that specific acoustic features, such as tempo and pitch, are associated with specific emotional states (i.e., sadness, happiness) (Kamiloğlu et al., 2020; Millgram et al., 2003). Higher-pitched singing is considered to be linked to positive emotional expressiveness and feelings, such as happiness, affection, nonaggression and tenderness (Flank et al., 2021; Flank & Tsang, 2020; Bergeson & Trehub, 2002; Juslin, 1997; de l'Etoile, 2006; Trainor & Zacharias, 1998). Indeed, in a study conducted by Singh and colleagues (2002), the findings supported that infants greatly preferred utterances that express positive affect, rather than those with neutral affect. (2) There is similarity between infants' natural pitch level when vocalising and the high pitch level used in maternal singing, making it more appealing and familiar to babies (Bainbridge et al., 2021; Trehub & Trainor, 1990). Adding to the earlier findings, Wermke & Mende (2009) found that the musicality of infants' cries is similar to the musicality of motherese. (3) Lastly, infants' auditory system matures to perceive high frequencies first, which makes infants better listeners to higher voices (Trainor & Zacharias, 1998).

Overall, there is a general agreement amongst studies regarding the beneficial role of maternal singing during the postnatal period not only for the infants -as presented above- but also for the mothers and the quality of mother-infant interaction (i.e, Filippa et al., 2022; Falk et al., 2021; Palazzi et al., 2021; Brisola et al., 2018; Perkins et al., 2018). A recent review study conducted by Brisola and colleagues (2021) pointing to maternal singing as a tool, which helps the mothers express their emotions towards their infants. This emotional expression can enhance positive affect and the sense of joy in their everyday life with the baby. Adding to that, the review also supported that maternal singing could contribute to increase maternal self-esteem. Indeed, there is a line of research indicating the contribution of maternal singing to maternal empowerment (Palazzi et al., 2021) as well as increased self-efficacy and confidence (Wulff et al., 2021; Perkins et al., 2018; Brisola et al., 2018). More specifically, the use of singing and its effectiveness to sooth the baby makes the mothers feel competent and confident to deal with challenging infant behaviours (Perkins et al., 2018). Maternal singing also generates an interactional circle; as mentioned above, this activity promotes infants' signs of engagement that enhance maternal interactional abilities and feelings of connection which in turn positively reinforces mother-infant co-regulation and emotional bonding (Palazzi et al., 2021). Finally, the positive effects of maternal singing on mothers' mental health and well-being is well documented and discussed in detail in the following section (for further information, see section 5.5.1.3 in this Chapter).

In terms of the beneficial role of singing in the quality of mother-infant interaction, evidence suggests that maternal singing contributes to the establishment of an emotional bond between the mother and the infant that in turn enhances the quality of their interaction (Palazzi et al., 2021; Flank & Tsang, 2020; Brisola et al., 2018; Perkins et al., 2018). In particular, Fancourt and Perkins (2018) conducted the first quantitative experimental study to examine the impact of mother-infant singing on perceived mother-infant closeness. The researchers used a sample of 43 mothers and compared the effects of maternal singing on maternal perceptions of emotional closeness with other care-giving activities (i.e., talking and playing with the baby). The results demonstrated that, in comparison to other activities, maternal singing could significantly increase the perceived mother-infant closeness. Furthermore, the three different conditions of this study (i.e., maternal singing, talking, playing) were compared in terms of affect. All conditions were linked to a decrease in negative affect and an increase in positive affect. However, it is worth mentioning that maternal singing contributed to the greatest level of decrease in negative affect and increase in positive affect, when compared to the other two conditions. This echoes the findings from a study conducted by Mualem and Klein (2013), which supported that the duration of communication between mother and infant was higher in the musical condition than in play, while the mother-infant musical interaction was characterised by positive emotions and both physical and eye contact. According to the findings of another study in which participant mothers completed self-report questionnaires, maternal singing was reported as a relaxing activity for both mothers and infants that enhances their emotional closeness as well as supports their relationship by creating sensitive early interaction moments (Kostilainen et al., 2021).

5.5.1.1 Characteristics of Maternal Singing in the Presence of PND. Regarding the characteristics of maternal singing in the presence of depression, there is evidence that its acoustic parameters changes when the mother suffers from depression (Riise et al., 2020; de l'Etoile & Leider, 2011). In particular, de l'Etoile & Leider (2011) recruited 80 mothers with their infants in order to explore the relationship between the acoustic parameters of ID singing and maternal depressive symptoms. Findings showed that mothers with PND tended to use a faster tempo of ID singing. At this point, it is important to mention that the slow tempo of ID singing used by mothers without depression has been proven to convey a more loving tone of voice that is linked to maternal sensitivity (Trehub et al., 1993). Consequently, this leads to a synchronised mother-infant interaction with social partners, as needed for infants' self-regulation (de l'Etoile, 2012; Trehub et al., 1993).

Another important finding of the study conducted by de l'Etoile & Leider (2011) consisted of the observation that mothers with depression sang to their male babies with great tonal key clarity, but not to female infants. Shifts in tonality are an effective way for mothers to attract infant attention and modify their emotional state (de l'Etoile & Leider, 2011). The author concluded that 'as mothers experience more depressive symptoms, their ID singing may lack the sensitivity and emotional expressivity as needed for infant self-regulation' (de l'Etoile & Leider, 2011, p. 254).

5.5.1.2 Infants' Responses to Infant-Directed Singing in the Presence of PND. Regarding infants' responses to ID singing when their mothers suffer from PND, de l'Etoile (2012) conducted a study to explore this phenomenon further. It involved 32 mother-infant dyads who were divided into two groups: 16 infants and their mothers with depressive symptoms, and 16 infants and their mothers without depressive symptoms. Infants' gaze responses were observed under two conditions: the mother sings to the infant, and a stranger sings to the infant. The infant's gaze is an important social cue associated with their attempts at self-regulation (Crown et al., 2002; Carvajal & Iglesias, 2002; de l'Etoile, 2012). The maternal depression had no significant effect on the infant gaze type during ID singing from both the mother and the stranger. In particular, a mainly neutral gaze was reported in babies from both groups during maternal ID singing. On the contrary, a sustained gaze was reported mainly in babies from both groups during ID singing by the stranger. In responding to mothers' and strangers' ID singing, infants showed more of a roaming gaze to their mothers, but a more averted gaze to the stranger. It is, therefore, well-established that infants from both groups were able to discriminate their mother from the stranger. Overall, the findings of this study suggested that ID singing can promote face-to-face interaction; consequently, through this, the infant can experience self-regulation.

However, there exists disagreement between the findings of de l'Etoile's study (2012) and previous research. There is evidence that infants of mothers with depression face great difficulty learning their mothers' voice, and it is possible that they may be unable to discriminate their mother from a stranger (Hernandez-Reif et al., 2002). A plausible explanation for this disagreement may lie in the fact that de l'Etoile's study (2012) took place in a laboratory setting where mothers were asked to sing to their babies, and this setting could have an impact on the findings. Hence, more research is needed to further explore the issue. Having presented and discussed the main characteristics of maternal singing in mothers with and without PND and their infants and explored the infant's preference, the following section will focus on the beneficial role of maternal singing in child development, maternal well-being and mother-infant bonding.

5.5.1.3 Benefits of Maternal Singing for Mother and Infant in the Presence of PND. Mothers with PND experience great difficulties in providing their children with adequate stimulation and engaging with their baby through maternal singing (Shannon, 2006), probably because the pitch and tone of their voice lack a sense of attentional focusing, urgency and affection (Sohr-Preston& Scaramella, 2006). However, there is no doubt about the beneficial role of singing for mothers with PND, as singing is associated with decreased depressive symptoms and increased psychological well-being (Brisola et al., 2021; Estevao et al., 2021; Perkins et al., 2018; 2021; Wulff et al., 2021; Fancourt & Perkins, 2017; Van Puyvelde et al., 2014). Indicatively, in a study of Arnon et al. (2014), maternal mental health symptoms were reduced when mothers participated in individual mother-infant singing sessions. Another study found that maternal intersubjectivity and self-efficacy increased in mothers who attended a 5-week singing programme specifically designed for mothers with PND (Van Puyvelde et al., 2014). A longitudinal study by Persico et al. (2017) demonstrated that mothers who sing to their infants in the first 3 months of their life reported lower levels of perceived maternal stress and that they had a significantly increased self-reported mother-infant bond. These results perfectly match the findings from a recent correlation study (Fancourt & Perkins, 2017).

Particularly, Fancourt and Perkins (2017), using a sample of 391 new mothers, showed that maternal singing was linked to a stronger self-reported mother-infant bond. These researchers also found that mothers who sang daily were more than twice as likely to report greater perceived mother-infant bonding (Fancourt & Perkins, 2017). Likewise, a study conducted by Reilly and colleagues (2019) assessed how the use of singing affected dyads of mothers and infants hospitalised in an MBU clinical setting. The findings indicated that 56% of the mothers reported feelings of closeness to their infant and 48% that the singing activity increased their awareness of their infants' feelings. Finally, Perkins and colleagues (2018) conducetd a three-arm randomised control trial to evaluate how singing, creative play and usual care facilitate recovery from PND symptoms. As compared to creative play and usual care, the use of maternal singing during mother-infant interaction was found to lead to faster recovery from moderate/severe PND symptoms, promoting mother-infant bond.

5.6 General Conclusion

Maternal vocal behaviour, including maternal speech and singing, plays a significant role for scaffolding early speech and promoting infants' social and emotional well-being. However, mothers with PND are less involved in vocal interactions with their infants (Lam-Cassettari & Kohlhoff, 2020), spending less time in vocal interactions with their baby (Lucci & Otta, 2013);

even when they vocally interact, there seem to occur deficits in their vocal behaviour (O'Leary et al., 2019; Butler et al., 2003; Herrera et al., 2004; Kaplan et al., 2014). These deficits in mother-infant vocal interactions negatively affect child development (Sohr-Preston & Scaramella, 2006). In particular, children of mothers with PND are at increased risk of poor developmental outcomes (i.e., emotional difficulties and poor cognitive capacities, language outcomes and academic attainment) (Alhusen et al., 2013; Music, 2011; Sohr-Preston & Scaramella, 2006; Kawai et al., 2017). Despite the important role of maternal speech and singing in both the quality of mother-infant interaction and child development, research that focuses on the impact of PND on maternal and infant vocal behaviours and, commensurately, on infant development is sparse (Aoyagi et al., 2019). There is also relatively limited evidence available for the maternal and infant vocal behaviours of mothers who due to mental health issues are residents in a clinical setting together with their infants. It is this gap that the present study aims to address.

5.7 The Present Study

The main aim of Study 2 was to investigate the effect of PND on infants' verbal communication skills and maternal vocal behaviour (i.e., maternal speech and singing) by comparing the vocal behavioural patterns between dyads of healthy and clinically depressed mothers and their infants. To the author's knowledge, this is the first study to provide a detailed examination of the frequency, quality and duration of different aspects of maternal vocal behaviour, including maternal speaking and spontaneous singing, as well as of the emergent use of infants' communication skills during a play interaction in the setting of an MBU. The goal here is to answer the main research question: What is the impact of PND on maternal vocal behaviour and, consequently, on infants' verbal communication skills? In the quest to address this main research question, the following secondary questions emerged:

1) Are there any differences in terms of maternal and infants' vocal behaviour between the two groups? (This will be answered with the help of comparisons between groups regarding different kinds of maternal vocal behaviour – i.e., speaking, making sounds and singing – as well as the quality, type, frequency and duration of maternal and infant vocal behaviour.)
2) Do infants' age and gender affect their vocalisation?
3) Do the six variables of Study 1 (namely, infant emotional tone and self-regulation, maternal emotional tone and sensitivity to infant cues, general atmosphere and reciprocity) affect maternal and infant vocal behaviour in the two groups?
4) What are the maternal and infants' behavioural patterns that occur together when mothers with and without PND are singing to their infants? (This will be answered with the help of comparisons between clinical and control groups.)

5.8 Material and Methods

5.8.1 Participants and Procedure

A total number of 52 videos containing footage of 104 participants (52 mother-infant pairs) were analysed and compared between two groups of mothers. Specifically, the clinical group consisted of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months); their interaction was video-recorded for intervention purposes in the clinical context of an MBU. The comparison group consisted of 30 mothers without PND who were recruited from several Children's Centres in London; their play interaction with their infants (aged 3-12 months) was video-recorded specifically for this study. Video-recordings of both groups (n= 52) were analysed and compared in terms of the vocal interaction between mothers with PND and their infants (for detailed information on the participants' characteristics and study design, see Chapter 3, Sections 3.4 and 3.7.)

5.8.2 Measures

The assessment tools applied in this study have been presented in detail in Chapter 3, Section 3.8. The following measurements were used:

1) Measurement of Maternal Depressive Mood: Edinburgh Postnatal Depression Scale (Cox et al., 1987);
2) Measurement of Maternal Sensitivity: Infant CARE-index (Crittenden, 2005); and
3) Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al, 1996b; Murray & Karpf, 2000).

As for the latter (3), the following measures of maternal vocal behaviour were applied: *verbal control behaviour*, *positive expressed emotion*, *negative expressed emotion* and *maternal verbal elaboration*. Maternal speech directed at the babies in each video-recorded interaction was transcribed verbatim, coded and analysed based on the GRS measures in conjunction with the films. Parallel, the *vocalisations* measure was used to assess infants' vocal behaviour. Specifically, the measure of 'infant vocalisations' refers to non-crying utterances or to recognisable utterances embedded in crying, without also considering physiological sounds such as burps, sneezes or hiccups. The actual number of vocalisations that the infant produced has also been calculated.

5.8.3 Data Analysis

5.8.3.1 Mother-Infant Vocal Interaction: A Micro-Analytic Approach. To gain an in-depth understanding of both mother and infant behaviours, the type, frequency, quality and duration of interactive behaviours of 52 mother-infant dyads on video-recorded footage were examined while using a micro-analytic approach. This approach allows for behavioural coding and analysis of filmed behaviours in slow motion and frame by frame (i.e., 0.5 seconds at a time). As such, it allows an objective, sequential, detailed examination of mother-infant interaction. Due to the complexity of the micro-analytic coding scheme, the Noldus Observer XT 16.0 software package (a computer-aided coding system; Noldus, Wageningen, the Netherlands) was used for the management, analysis and presentation of the time-structured data excerpted from the video-recorded material (for further information on the micro analytic approach, the coding scheme and the Noldus Observer XT 16.0 software, see Chapter 3, Section 3.9.1).

5.8.3.2 Coding of Vocal Behaviour. Infants' vocalisations were coded second by second in terms of relative frequency and duration of occurrence. Infants' behavioural states were coded as *vocalisation*, *no-vocalisation* and *strange vocalisation* (i.e., strange vocalisations include vocal growling and strained positive voice and are index of stress [Crittenden et al., 2010]). The frequency and duration of each maternal vocal behaviour during the mother-infant interaction was coded frame by frame and classified as: (a) *talk*, (b) *singing*, (c) *sounds* (imitation of baby's sounds, imitation of animal sounds, imitation of toy sounds), and (d) *no talk.* All these above-mentioned categories of maternal and infants' vocal behaviour are mutually exclusive and thus cannot occur simultaneously.

5.8.3.3 Data Analysis and Statistics. Statistical analysis using parametric tests employed to examine the data of this study. Descriptive analysis, Univariate Analyses of Variance (ANOVAs) analysis and a series of Pearson's correlations were computed on IBM© SPSS 23. P-values less than 0.05 were considered statistically significant.

5.9 Results of Study 2

5.9.1 Reliability Analysis

To test the reliability of the GRS measures, a second independent rater was designated to score 10 video-recorded sessions on the GRS scale and then compare the results with those of the primary rater (i.e., the researcher). The second coder was blind to the maternal mental health status. Inter-rater agreement was calculated by Cohen's Kappa coefficient (Cohen, 1960) and the reliability scores ranged from .76 to .97 for maternal scales and from .73 to .81 for infant scales. The maternal negative expressed emotion event count could not be tested for its reliability, because both raters were unable to see the occurrence of such behaviours in all of the 10 sessions.

5.9.2 The Effect of Maternal Diagnosis on the Results of GRS Measures

To determine whether the type of diagnosis in the clinical group affected the data derived from the GRS measures, the mothers were allocated to one of three groups: severe PND without psychosis, PND with psychosis and PND with another concurrent diagnosis. There was no group over-represented in this study, χ^2 (2) = .636, p= .727. Also, parametrical testing of multiple groups offered no statistically significant results on the GRS measures.

5.9.2.1 The Effect of PND on Maternal Vocal Behaviour and the Total Number of Infant Vocalisations: Comparisons Between Clinical and Comparison Groups. Significant group differences were found in terms of maternal verbal elaborations and the total number of infant vocalisations. These results suggest that mothers in the clinical group exhibited significantly fewer verbal elaborations during play interactions, in comparison to mothers without PND. Infants of mothers in the clinical group displayed a higher count of vocalisation during the interaction with their mothers (*M* = 12.73, *SD* = 10.94) than did infants of mothers in the comparison group (*M* = 7.03, *SD* = 7.97), $F(1,47) = 4.72$, $p < .05$, partial $\eta^2 = .09$. Results are summarised in Table 5.2.

Table 5.2

Means, Standard Deviation and One-Way Analyses of Variance for 7 of the GRS Measures

	Clinical group (=22)		Comparison group (n=30)		*F*(1, 47)	η^2
	M	SD	M	SD		
Maternal Verbal Control Behaviour Strong Control (E.C.)	2.90	2.27	3.31	3.12	0.25	0.01
Maternal Verbal Control Behaviour Mild Control (E.C.)	6.80	8.11	7.48	2.98	0.17	0.01
Maternal Verbal Elaboration (R.S.)	2.29	0.90	3.28	1.25	9.54**	0.17
Maternal Positive Expressed Emotion (E.C.)	1.30	1.95	1.55	2.50	0.14	0.00
Maternal Negative Expressed Emotion (E.C.)	0.05	0.22	0.03	0.19	0.07	0.00
Infant Vocalisations (R.S.)	3.64	1.50	2.83	1.64	3.27	0.06
Infant Vocalisations (E.C.)	12.73	10.94	7.03	7.97	4.72*	0.09

Note. E.C.= Event Count, R.S.= Rating Scale
$^{*}p < .05$, $^{**}p < .01$

5.9.2.2 The Effect of PND on the Sub-types of Maternal Strong and Mild Verbal Control: Comparisons Between Clinical and Comparison Groups. Mean scores for the sub-types of maternal strong and mild verbal control were compared (see Table 5.3). Firstly, for maternal strong verbal control a significant group effect was found only for requests, indicating that mothers in the clinical group (M = .80, SD = 1.20) exhibited significantly fewer strong verbal requests than mothers in the comparison group (M = 2.03, SD = 1.78), $F(1,47)$= 7.30, p< .05, partial η^2 = .13.

Table 5.3

Means, Standard Deviation and One-Way Analyses of Variance for the 6 Types of Strong Maternal Verbal Control

	Clinical group (=22)		Comparison group (n=30)		$F(1, 47)$	η^2
	M	SD	M	SD		
Commands (E.C.)	1.80	2.04	0.90	1.29	3.61	.07
Requests (E.C.)	0.80	1.20	2.03	1.78	7.30*	.13
Inhibition (E.C.)	0.00	0.00	0.03	0.19	0.69	.01
Forbids (E.C.)	0.30	0.92	0.27	0.83	0.02	.00
Cautioning (E.C.)	0.05	0.22	0.00	0.00	1.46	.03

Correcting (E.C.)	0.00	0.00	0.04	0.20	1.42	.03

Note. E.C.= Event Count
*p < .05

For mild verbal control (see Table 5.4), significant group differences were found in three types of interactions. Specifically, mothers in the clinical group displayed significantly fewer suggests (M = .30, SD = .92) and requests (M = .10, SD = .31) than mothers in the comparison group [(M = 1.38, SD = 1.74), F(1,47)= 6.41, p< .05, partial η^2 = .12 & (M = .48, SD = .79), F(1,47)= 4.28, p< .05, partial η^2 = .08, respectively]. Similarly, mothers with PND used fewer joint suggestions when interacting with their infants (M = .50, SD = 1.15), when compared to mothers without PND (M = 1.24, SD = 1.35), F(1,47)= 4.01, partial η^2 = .08, although the result is borderline, p= .051.

Table 5.4

Group Differences in the 5 Types of Mild Maternal Verbal Control

	Clinical group (=22)		Comparison group (n=30)		F(1, 47)	η^2
	M	SD	M	SD		
Suggests (E.C.)	0.30	.92	1.38	1.74	6.41*	.12
Prompts (E.C.)	5.15	7.55	3.93	3.06	0.63	.01
Requests (E.C.)	0.10	.31	0.48	0.79	4.28*	.08

Joint Suggestions (E.C.)	0.50	1.15	1.24	1.35	4.01†	.08
Guide (E.C.)	0.70	1.46	0.38	0.86	0.94	.02

Note. E.C.= Event Count
$^{*}p < .05$, $^{\dagger}p = .051$

5.9.3 Correlations Between Measures of Study 1 and Study 2

A series of correlation analyses was run between the 6 variables of Study 1 (infant emotional tone and self-regulation, maternal emotional tone and sensitivity to infant cues, general atmosphere and reciprocity) and measures of infant and mother behaviour: (1) maternal verbal control behaviour strong, maternal verbal control behaviour mild, maternal verbal elaboration, maternal positive expressed emotion, maternal coercion, maternal negative expressed emotion, infant vocalisations (R.S.), infant vocalisations (E.C.); (2) measures of maternal strong verbal control: commands, requests, inhibition, forbids, cautioning, correcting; (3) measures of maternal mild verbal control: suggests, prompts, requests, joint suggestions and guide. For purposes of legibility, Tables 5.5, 5.6 and 5.7 were limited to those variables for which significant and meaningful correlations were found. Complete tables are presented in the Appendix L.

Table 5.5

Correlations Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Verbal Behaviour

	1	2	3	4	5	6	7	8
Infant Emotional Tone	1							
Self-Regulation	$.73^{**}$	1						
Maternal Emotional Tone	$.59^{**}$	$.55^{**}$	1					
Maternal Sensitivity	$.77^{**}$	$.83^{**}$	$.66^{**}$	1				
Atmosphere	$.71^{**}$	$.75^{**}$	$.60^{**}$	$.81^{**}$	1			
Reciprocity	$.75^{**}$	$.81^{**}$	$.68^{**}$	$.96^{**}$	$.86^{**}$	1		
Maternal Verbal Elaboration (R.S.)	$.45^{**}$	$.48^{**}$	$.61^{**}$	$.43^{**}$	$.42^{**}$	$.43^{**}$	1	
Maternal Coercion (E.C.)	$-.48^{**}$	$-.29^{*}$	$-.29^{*}$	$-.43^{**}$	$-.46^{**}$	$-.47^{**}$	-.25	1

Note. E.C.= Event Count, R.S.= Rating Scale
$^{*}p < .05$, $^{**}p < .01$

For the first series of correlations (Table 5.6), significant results were exhibited only with measures of maternal verbal elaborations and maternal coercions. These findings suggested that a higher rating in verbal elaborations was moderately to highly positively correlated with the infant's emotional tone, $r(52)= .45$, $p=.001$, infant self-regulation, $r(52)= .47$, $p=.000$, maternal emotional tone, $r(52)= .61$, $p=.000$ and sensitivity $r(52)= .43$, $p=.002$, as well as joint measures [i.e., reciprocity, *r*(52)= .43, *p*=.002 and general atmosphere, *r*(52)= .42, *p*=.003]. These results complement previous findings that suggested systematic differences between clinical and comparison groups on the scale, in favour of the comparison group. In terms of maternal coercions, weak negative correlations were exhibited with the infant's self-regulation and maternal emotional tone [*r*(52)= -29, *p*=.04 for both variables] and moderate negative correlations with the infant's emotional tone, *r*(52)= -.48, *p*=.000, maternal sensitivity, *r*(52)= -.43, *p*=.001, reciprocity, *r*(52)= -.47, *p*=.000 and general atmosphere, *r*(52)= -.46, *p*=.001. No significant correlation was found for infant verbal behaviour measures.

Furthermore, correlations with maternal strong verbal controls were examined. As exhibited in Table 5.7, only maternal correcting controls were found to exhibit weak positive correlations with emotional quality, functioning and joint measures. Specifically, a positive association was found between maternal correcting verbal behaviour and the following variables: infant emotional tone, *r*(52)= .30, *p*=.04, infant self-regulation, *r*(52)= .31, *p*=.03, maternal sensitivity, *r*(52)= .32, *p*=.02, reciprocity, *r*(52)= .36, *p*=.01 and general atmosphere, *r*(52)= .32, *p*=.02. There was no significant correlation between maternal emotional tone and maternal correcting verbal behaviour, *r*(52)= .25, *p*=.08.

Table 5.6

Correlations Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Strong Verbal Control

	1	2	3	4	5	6	7
Infant Emotional Tone	1						
Infant Self-Regulation	.73**	1					

Maternal Emotional Tone	.59**	.55**	1				
Maternal Sensitivity	.77**	.83**	.66**	1			
Atmosphere	.71**	.75**	.59**	.81**	1		
Reciprocity	.75**	.81**	.68**	.96**	.86**	1	*
Maternal Correcting	.30*	.31*	.25	.32*	.32*	.36*	1

*p < .05, **p < .01

Lastly, correlations with maternal mild verbal controls were investigated. Following previous analyses concerning the group differences for these measures, mild suggestions, gentle requests and joint suggestions exhibited associations with other measures. More specifically, mild suggestions were moderately positively correlated with the infant's emotional tone, $r(52)= .43$, $p=.002$ and maternal sensitivity, $r(52)= .41$, $p=.004$, and weakly correlated with infant self-regulation, $r(52)= .32$, $p=.02$ and reciprocity of interactions, $r(52)= .32$, $p=.02$. These patterns suggest positive effects of mild verbal controls on the infant's emotional functioning, association with the mother's capacity to follow infant cues, as well as reciprocity of mother-infant interactions. Gentle requests were significantly correlated with infant and maternal emotional tone [$r(52)= .34$, $p=.02$ & $r(52)= .33$, $p=.02$, respectively] and general atmosphere of interactions, $r(52)= .31$, $p=.03$. Lastly, joint suggestions were found to be moderately associated with the infant's self-regulation $r(52)= .30$, $p=.03$, maternal emotional tone and sensitivity, [$r(52)= .46$, $p=.001$ & $r(52)= .37$, $p=.01$, respectively, and joint measures [i.e., reciprocity, $r(52)= .33$, $p=.02$ and general atmosphere, $r(52)= .29$, $p=.04$].

Table 5.7

Correlations Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Mild Verbal Control

	1	2	3	4	5	6	7	8	9
Infant Emotional Tone	1								
Infant Self Regulation	.73**	1							
Maternal Emotional Tone	.59**	.55**	1						
Maternal Sensitivity	.77**	.83**	.66**	1					
Atmosphere	.71**	.75**	.59**	.81**	1				
Reciprocity	.75**	.81**	.68**	.96**	.86**	1			
Mild suggest	.43**	.32*	.21	.41**	.21	.32*	1		
Gentle request	.34*	.22	.33*	.25	.31*	.24	.10	1	
Joint suggest	.17	.30*	.46**	.37**	.29*	.33*	-.06	.22	1

$^{*}p < .05$, $^{**}p < .01$

5.9.4 Results of the Micro-Analysis in Mother and Infant Vocal Behaviour

An independent samples t-test was conducted to examine the differences between the clinical and comparison groups in terms of the duration of different types of maternal and infants' vocal behaviour that appeared in a mother-infant play interaction.

5.9.4.1 Maternal Vocal Behaviour. In terms of maternal vocal behaviour, between the clinical and the comparison group there existed a statistically significant difference in the mean duration of maternal speaking, with the effect sizes ranging from small to large, represented as *Pearson's r*, with .1 meaning small, .3 medium, and .5 large (Cohen, 1988). In terms of the differences of statistical significance in the current analysis, the effect sizes ranged from $r = .3$ to .4. Mothers with PND ($M = 52.41$, $SD = 32.7$) were found to talk less to their infants during a free-play session than did mothers without PND ($M = 77.74$, $SD = 36$), $t(50) = 2.60$, $p= .012$, $r= 0.3$. Even though mothers without PND ($M = 6.55$, $SD = 15.21$) seemed to use more spontaneous singing than mothers with PND ($M = 1.95$, $SD = 5.27$), this difference between the groups was not statistically significant. In addition, mothers from the clinical group remained silent for longer periods of time ($M =79.99$, $SD = 37.04$) than did mothers from the comparison group ($M = 108.3$, $SD = 34.3$) $t(50)= -2.8$, $p = .007$, $r= 0.4$, and this difference between the groups was significant.

Figure 5.1

Percentage of Different Types of Maternal Vocal Behaviour: A Comparison Between Groups

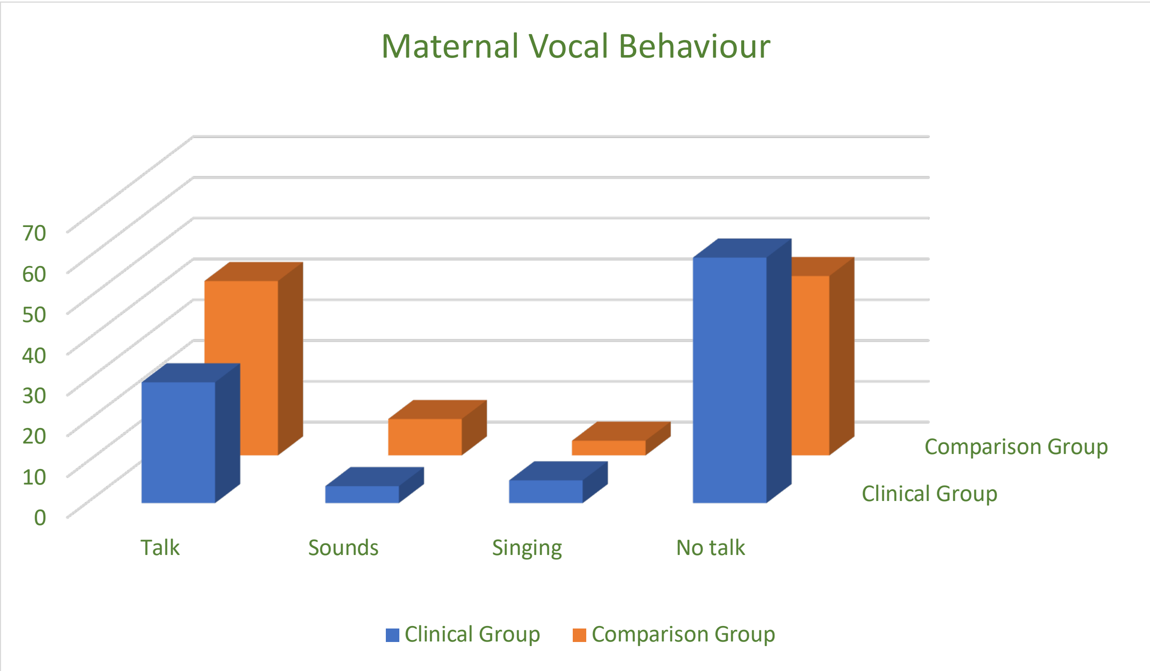


Table 5.8

Maternal Verbal Behaviour: Clinical Versus Control Group

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Talk	52.41	32.73	77.74	36.01	2.60	.01	0.3
Singing	1.95	5.27	6.55	15.21	1.35	.13	0.2
Use of sounds	7.74	9.75	16.22	15.95	2.20	.03	0.3
No talk	108.32	34.58	79.99	37.04	-2.80	.00	0.4

A statistically significant difference was also found in the frequency of play-related sounds, with mothers from the comparison group (M = 16.22, SD = 15.95) using more sounds when interacting with their infants than did mothers from the clinical group (M = 7.74, SD = 9.75), $t(50)$ = 2.20, p = .03. Specifically, 63.6% of mothers with PND did not use play-sounds (i.e., imitation of baby's sound, animal and/or toy sound) when interacting with their infant. To further explain this finding, in the clinical group, none of the mothers imitated any animal sounds, only 13.6% used a toy sound, while 27% imitated their baby's sounds as part of their vocal interaction. By contrast, in the comparison group, only 13.3% of the mothers did not use sounds in the play interaction with their babies. In particular, 26.6% of mothers from the comparison group imitated the baby's sounds, while 56.7% and 23.3% produced imitations of toy and animal sounds, respectively.

Table 5.9

Percentage of the Production of Different Types of Sounds as Part of Maternal Vocal Behaviour

Types of sounds in maternal vocal behaviour	Clinical Group	Comparison Group
Imitation of baby's sounds	27%	26.6%
Imitation of animals' sounds	0%	23.3%
Imitation of toy's sounds	13.6%	56.7%
No use at all of these types of sounds	63.6%	13.3%

5.9.4.2 Infant Vocal Behaviour. No statistically significant differences were found between the two groups in terms of the infants' vocalisations, strange vocalisations and no vocalisations. Indicatively, although infants from the clinical group (M = 9.25, SD = 15.71) used more vocalisations when compared to infants from the comparison group (M = 6.50, SD = 9.31), this difference did not reach any significant level.

Figure 5.2

Percentage of Infant Vocal Behaviour: A Comparison Between Groups

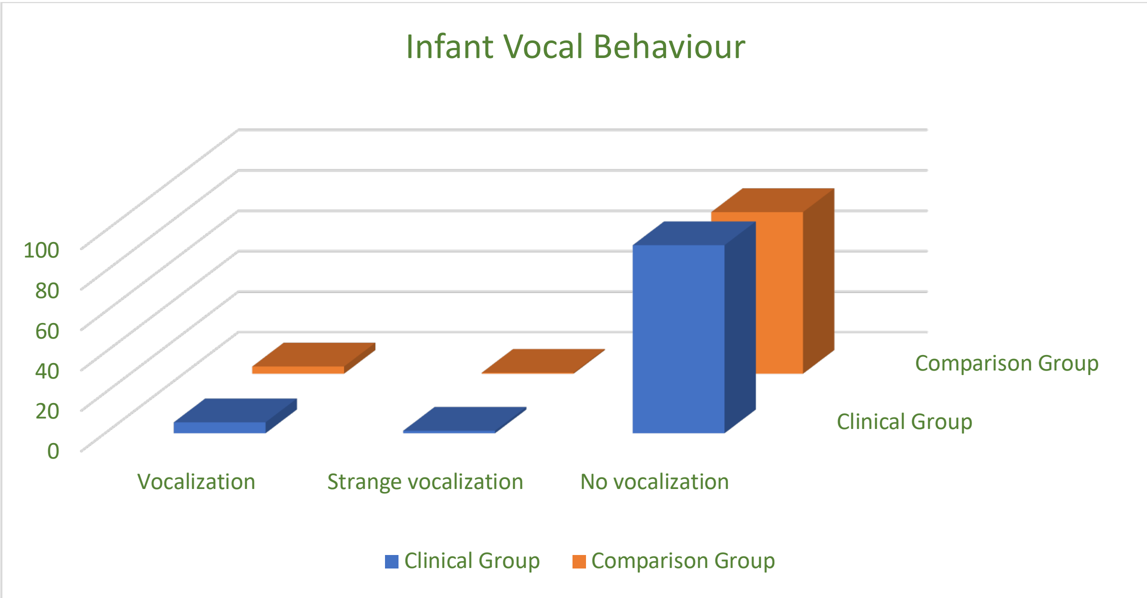


Table 5.10

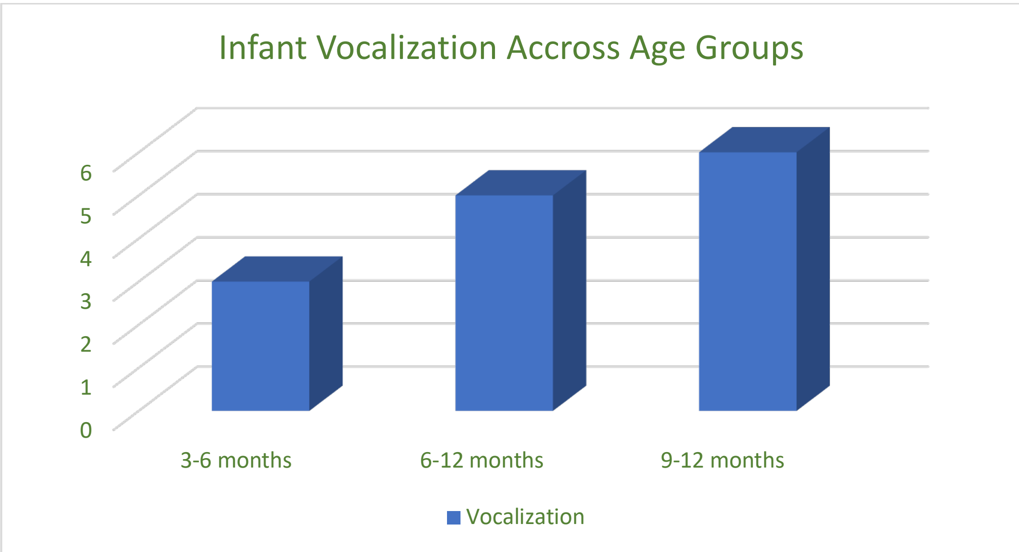
Three Types of Infant Verbal Behaviour in the Clinical and Comparison Groups

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Vocalisation	9.25	15.71	6.50	9.31	-.78	.43	0.1
Strange Vocalisation	2.12	4.59	.88	3.06	-1.16	.25	0.1
No Vocalisation	159.16	22.3	145.25	57.22	-1.21	.23	0.1

A general linear model was used to compare the mean duration of the vocal behaviours of infants from the clinical and comparison group, with the infant's age and gender added as covariates. Controlling for infants' gender and age, no statistically significant difference was found between groups in terms of their vocal behaviours. However, as infants are growing older, an increase in their use of vocalisations was found across different developmental stages (Figure 5.3).

Figure 5.3

Percentage of Infant Vocalisation Across Age Groups



5.9.4.3 What Happens When Mothers Sing to Their Infants? This analysis has aimed to produce an overall picture of what happens during maternal singing. To achieve this, the focus was on both infants' and mothers' behaviours during maternal singing; the combination of these details depicts the quality of the dyad's experience during this interaction.

The findings of this study indicate that mothers without PND use more ID singing (26.6%) as an interactive activity when playing with their babies than do mothers with PND (13.6%).

5.9.4.4 Infant Behaviour During Maternal Singing: Comparison Between Groups. Compared to infants of mothers without PND, the infants of mothers with PND were less active and engaged in the interaction when their mothers were singing to them. Notably, infants with PND mothers displayed only neutral affect (100%) during maternal singing. Infants of mothers without PND were also mostly neutral (87.3%); however, they showed both positive (7.5%) and negative (5.3%) affect when their mothers were singing. It is important to clarify that, whenever the infant's negative affect and maternal singing co-existed, the infants were already upset and their mothers used singing to soothe them.

In terms of the infants' gaze during maternal singing, infants from both groups were mainly looking elsewhere (58.4% and 42.8% of the duration for the clinical group and the comparison group, respectively). Even though the infants from the clinical group were looking more towards their mothers when compared to infants of mothers without PND (28.7% and 11.2% of the duration, respectively), none of them made eye contact with the mother, while eye-contact was observed for 2.3% of the duration in the comparison group. In addition, infants from the comparison group were looking towards the toy for 43.6% of the duration of maternal singing, either towards the toy that they used (25.9%), or towards the toy that the mothers displayed (17.7%). In contrast, infants of mothers with PND looked only at the toy that they used (16.5%).

Regarding the use of a toy as part of the interaction, for most of the singing time, infants from both groups did not use any toy (89.7% for the clinical and 56.5% for the comparison group). However, in those cases when the mothers decided to use a toy as part of the singing activity, infants from the clinical group displayed no explorational behaviour related to the object, while infants from the comparison group showed explorational behaviour related the toy (for 24% of the duration) while their mothers were singing. This finding also supports the above assumption about the playful experience of infants with mothers without PND during maternal singing.

Table 5.11

Co-Occurrence of Maternal and Infants' Behaviours During Maternal Singing

Behaviours		Clinical Group		Healthy Group	
		Mothers	**Infants**	**Mothers**	**Infants**
AFFECT	Positive	100%	0%	75.5%	7.5%
	Negative	0%	0%	-	5.3%
	Neutral	0%	100%	24.2%	87.2%
GAZE	Towards the partner	94.7%	28.7%	80%	11.2%
	Towards the object	5.3%	12.8%	16.5%	25.9%
	Elsewhere	0%	58.4%	1.2%	42.8%
	Eye contact	0%	0%	2.3%	2.3%
	Towards the mother's hands	-	0%	-	17.7%
TOUCH	Touch due to the position	80.3%	80.3%	67.7%	75.9%
	Other types of touch	0%	0%	22.3%	0%
	No touch	19.7%	19.7%	10%	23.5%
USE OF A TOY	No use of a toy	100%	89.7%	57.8%	56.4%
	Use of a toy	0%	10.3%	42.2%	43.6%

5.8.4.5 Co-Existing Maternal Behaviours During Singing: Comparison Between Groups. None of the mothers with PND used a toy when singing to their baby. In contrast, mothers without PND made both object-related (36%) and non-object related (3.6%) use of a toy. Concerning physical contact during maternal singing, the majority of mothers from both groups had almost constant physical contact with their baby; only for 19.7% and 10.2 % of the duration, mothers from the clinical and comparison group, respectively, did not touch their babies. However, mothers with PND had physical contact with their infants only due to their position (80.2%), while for mothers without PND the respective percentage was 67.7%. More specifically, mothers without PND exhibited different types of physical contact with their babies while singing (i.e., object-mediated, play-related and affectionate touch), with these mothers being physically affectionate with their babies for 15% of the duration of singing.

Regarding maternal affect and gaze, mothers without PND showed only positive affect and were mainly looking towards their infants (94.7%). Mothers without PND were looking slightly less towards their babies (80.5%), when compared to the clinical group. This is because they also used a toy in their interaction, with the mothers focusing on the object for 16.6% of the duration. Other than exhibiting positive affect (75.8%), some mothers without PND were neutral while singing to their babies (24.2%).

5.10 Discussion

The present study has aimed to provide a comprehensive and integrative picture of the effect of PND on maternal and infant vocal behaviours, which influence the quality of their interaction and bonding. To our knowledge, this is the first study to provide a detailed examination of mother-infant vocal interaction in the context of an MBU. Our findings showed that, in a comparison between mothers with and without PND and their infants, there exists a clear difference in the quality and quantity of maternal and infant vocal behaviours. The results revealed deficits in the mother-infant vocal interaction in the case of PND. Given the evidence that these impairments in mother-infant vocal behaviours can lead to poorer language outcomes and cognitive capacities, as well as to emotional difficulties in children (Alhusen et al., 2013; Music, 2011; Sohr-Preston & Scaramella, 2006; Kawai et al., 2017; Kaplan et al., 2012, 2014; Zajicek-Farber, 2009; Paulson et al., 2009), the findings of the present study are of pivotal importance, as they indicate that the infants of mothers with severe PND are a population at risk for adverse developmental outcomes.

5.10.1 Maternal Vocal Behaviour

5.10.1.1 Quantity of Maternal Vocal Behaviour. In line with several studies, the present study found that mothers with PND were talking significantly less to their infants during a free-play session. Several studies have yielded similar conclusions (i.e., Lam-Cassettari & Kohlhoff, 2020; Lucci & Otta, 2013; O'Leary et al., 2019; Defelipe et al., 2019). For instance, a summary of the reviewed studies by Frizzo and Piccinini (2005) and Schwengber and Piccinini (2003) supported that mothers with PND spend significantly less time talking with their infants when compared to mothers without PND. Defelipe and colleagues (2019) similarly found that mothers with PND at 4-5 months postpartum vocalised less to their infants; this, in turn, reduced maternal investment during early mother-infant interaction.

The findings of the present study regarding the association between PND and reduced maternal vocalisations during mother-infant interaction are of interest because of the following reasons: first, there is evidence that under-stimulation in terms of the quantity of maternal vocal behaviour could have detrimental effects on the infant's optimal development (Wade et al., 2018; Merz et al., 2015; Roe & Drivas, 1997; Roe et al., 1990); this may result in infants' insecure attachment (Belsky et al., 1984), deficits in their cognitive processing (Roe et al., 1990) and a decrease in both infant attentiveness and positive affect (Field, 1987). Second, a body of studies supports that deficits in maternal vocal behaviour could be a predictor of the development of child psychopathology (Allely et al., 2013; Marwick et al., 2013; Santos et al., 2020). Indicatively, Allely and colleagues (2013), using a cohort of 180 1-year-old infants, found that low frequencies of maternal vocalisations are linked to later psychopathology, such as disruptive behaviour disorders, oppositional-conduct disorders and emotional disorders. Interestingly, the same study revealed an association between a higher infant vocalisation frequency and later disruptive behaviour disorder. Likewise, Marwick and colleagues (2013) supported that discrepancies in maternal speech strongly predict a psychiatric diagnosis at 7 years of age.

5.10.1.2 Quality of Maternal Vocal Behaviour Through the Dimension of 'Maternal Verbal Elaboration'. In the present study, the quality of maternal vocal behaviour was approached through different dimensions, including assessments of maternal verbal elaboration (i.e., instructional and explanatory comments on infants' surroundings and experiences), maternal verbal control (i.e., [a] strong verbal control: commands, strong request, inhibition, forbids, cautioning and correcting, and [b] mild verbal control: suggests, prompts, gentle request, joint suggestions and guides), as well as different types of maternal verbal behaviour (i.e., speech, sounds and signing) in order to provide a broad picture of maternal vocal behaviour.

In terms of maternal verbal elaboration, the findings of the present study showed that mothers with PND have significantly lower scores in maternal verbal elaboration than mothers without PND. In other words, mothers from the clinical group were found to use less sophisticated ways to liken the toy to more familiar aspects of the infant's world and to use less verbal elaboration on the qualities of the toy (i.e., form, shape, function, colour or count) than the comparison group. These findings are in line with the existing literature supporting the differences in the content of speech in mothers with and without PND (Lam-Cassettari & Kohlhoff, 2020; Buckley, 2003; Murray, 1993; Butler et al., 2003). Indicatively, Herrera and colleagues (2004) found that mothers with depressed mood of 6-month-old infants displayed fewer informative features in their speech when interacting with their infants than did mothers without PND. Overall, the findings of the current research are important because the deficits found in verbal elaboration in the case of PND could restrict the significant role of mothers in scaffolding infants' emergent language and cognitive skills as well as in promoting their social and emotional well-being (Lam-Cassettari & Kohlhoff, 2020; Butler et al., 2003).

5.10.1.3 Quality of Maternal Vocal Behaviour Through the Dimension of 'Maternal Verbal Control'. In agreement with the literature, this study found that the content of speech in mothers with PND differed from that of mothers without PND. More specifically, findings revealed that mothers with PND used significantly less mild verbal control (especially suggests, requests and joint suggestions), as well as less strong requests when addressing their infants, in comparison with mothers without PND. These findings add to the prior research supporting that mothers with PND use fewer explanations and questions, more negative utterances and less sensitively attuned comments in their interaction with their infants (Lam-Cassettari & Kohlhoff, 2020; Buckley, 2003; Murray, 1993; Butler et al., 2003).

In this study, the lower level of the use of mild verbal control and strong requests in mothers with PND renders the play interaction with their infants less interactive and playful, and it underlines the lack of opportunities offered by the mother to the baby to participate actively in this situation. It is worth mentioning that maternal strong requests refer to the use of imperatives (such as 'Look here!') that aim to engage the baby in the interaction. According to the literature, some of the main functions of maternal verbal behaviour are to enhance social interaction with the baby, as well as to engage and sustain infant attention (Lam-Cassettari & Kohlhoff, 2020; Golinkoff et al., 2015; Spinelli et al., 2017; Kitamura & Lam, 2009; Fernald & Simon, 1984). These functions are inextricably linked to infant communicative development, including language, cognitive and socio-emotional development (Kaplan et al., 2014). As a corollary, the limited use of mild verbal control and strong requests during play interaction in the case of PND could restrict infants' social interaction and engagement, which in turn can negatively influence infants' communicative, cognitive, socio-emotional and behavioural development.

5.10.1.4 Relationship Between Maternal Vocal Behaviour and Maternal Sensitivity and Mother-Infant Reciprocity. Having examined the maternal vocal behaviour towards their babies in both groups, it was essential to include the variables of maternal sensitivity and mother-infant interaction in this analysis, due to their fundamental role in mother-infant vocal interaction and, consequently, infant development. In particular, there exists a considerable amount of research that places maternal responsiveness at the core of the maternal qualities that contribute to infant language and communicative development (Goldstein & Schwade, 2008; Goldstein et al., 2003; Gros-Louis et al., 2006; Hirsh et al., 2014; Smith-Nielsen et al., 2016; Dunst et al., 2010; Tamis-LeMonda et al., 2001, 2014; Paavola et al., 2006; Renzi et al., 2017; Aoyagi et al., 2019; Pretzer et al., 2019;Wu et al., 2014; McFarland et al., 2020; Abney et al. 2017).

The findings of the present study revealed that high ratings in maternal verbal elaboration were positively correlated with maternal emotional tone, maternal sensitivity and mother-infant reciprocity. The above-mentioned findings are in line with the existing literature which indicates that the quality of maternal vocal behaviour follows a mediated path passing through maternal responsiveness (Aoyagi et al., 2019). Specifically, there is evidence that decreased maternal responsiveness (Aoyagi et al., 2019; Keim et al., 2011; Kingston et al., 2012; Milgrom et al., 2004) and poor quality of parenting associated with decreased mother-infant reciprocity (Zajicek-Farber, 2009; Stein et al., 2008) count among the main factors that indirectly affect the association between PND and infant language development.

For instance, a set of studies was conducted by Tamis-LeMonda and colleagues (1996, 1998, 2001, 2014) to explore the importance of maternal responsiveness in infant language development. In these studies, maternal responsiveness proved to be a predictor of infants' greater receptive and expressive language skills, vocabulary growth, the timing of infants' achieving language milestones (i.e., first words, combinational speech) and for infants' growing pragmatic understanding of the social nature of language. Similarly, Stein and colleagues (2008) investigated the effect of PND on infant language development by assessing the quality of parenting that is directly linked to mother-infant reciprocity. In this research, they followed up on 1,201 mothers until their infants were 3 years of age. The language skills of 999 children were assessed at the age of 36 months, and the researchers found that the negative impact of PND on the quality of parenting indirectly affected infant language development. Likewise, in the present study, PND is significantly associated with decreased maternal sensitivity; this could negatively affect the use of maternal verbal elaboration, which then could put infants of mothers with PND at a heightened risk for poor language development.

5.10.1.5 Relationship Between Maternal Vocal Behaviour and Infant Emotional Tone. One of the most important findings of the current study consists of the positive correlation between maternal mild verbal control and infants' emotional tone. These findings provide further support for findings from prior studies that maternal vocal behaviour also conveys emotional meaning to babies (Kaplan et al., 2014; Smith-Nielsen et al., 2016). Infants, when listening to their mothers, do not try 'to understand her words, but to understand her' (Locke, 2001, p. 301). The accumulated findings from the present study show that, on one hand, an association exists between the quality of maternal verbal behaviour and the infant's emotional well-being, while, on the other hand, the participant mothers with PND showed deficits in the use of mild verbal control; these findings deserve further scientific attention.

Given that deficits in maternal vocal behaviour have been found to be linked to long-term effects on infant development, resulting in child emotional disorders later in life (Allely et al., 2013), the present findings point to the need for early intervention for this at-risk population.

5.10.2 Maternal Vocal Behaviour: The Use of Sounds

This study provides new evidence regarding the use of sounds in mother-infant vocal interaction when mothers experience PND, which constitutes an understudied topic (Pelaez et al., 2011). More specifically, despite the fact that, immediately after birth, the mother is involved in the infant learning process by producing words and sounds (such as the imitation of infants' sounds, animal sounds or toy sounds) in order to impose meaning on the infant's actions and surroundings (Athari et al., 2021), the use of maternal vocal sounds has rarely been studied (Pelaez et al., 2011). The results of the current study showed that mothers from both groups equally imitate infants' vocalisation. These findings are encouraging, given that maternal vocal imitation of infant vocalisations can reinforce infant vocalisation and, therefore, is associated with later verbal development in the child (Pelaez et al., 2011). There also exists evidence that imitation of infants' sounds in mother-infant vocal interaction contributes to the infant's socio-emotional well-being (Field et al., 1985; Masur & Oslon, 2008).

Contrary to the use of imitation of infants' sounds, however, the participant mothers with PND showed significantly less use of other types of sounds (i.e., animal and toy sounds). The production of these symbolic sounds by the mothers during a play interaction is linked to the infants' learning process, as these help the child to connect sounds to the external world, as well as pave the way for the child to copy these sounds, an essential stage in language learning (Ozturk et al., 2013; Stark, 1980). The deficits in the use of animal and toy sounds found among mothers of the clinical group, in conjunction with the beneficial role of the use of sounds in infant development reported in the literature, lends further support to the idea that infants whose mothers suffer from PND may be vulnerable to poor linguistic outcomes.

5.10.3 Maternal Vocal Behaviour: The Use of Maternal Singing

Compared to other studies where maternal ID singing served as condition in research design, the present study examined the spontaneous use of singing as a means of communication between mother and infant during a free-play situation. More specifically, mothers were asked to play with their babies as they usually do, without any specific instruction in relation to the use of singing. This was to assess whether mothers with or without PND include the activity of singing in their play interaction with their infants. The findings of this study indicated that mothers without PND use more ID singing (26.6%) as an interactive activity when playing with their babies than do mothers with PND (13.6%); however, the difference between groups was not statistically significant. The findings that mothers with PND spontaneously use less ID singing are quite important, considering the beneficial role of maternal singing for mothers' well-being, infants' development and self-regulation, as well as mother-infant attachment (Palazzi et al., 2021; Fancourt & Perkins, 2018; Vlismas et al., 2013; Mello et al., 2009; Carolan et al., 2012), especially in the case of PND (Estevao et al., 2021; Fancourt & Perkins, 2018; Van Puyvelde et al., 2014; Arnon et al., 2014; Baker et al., 2005).

Indicatively, Palazzi et al. (2021) examined the effect of maternal singing, as part of a 6-session therapy program. The findings revealed that ID singing could promote mother-infant bonding, enhance their communication, co-regulation and emotional connection. As for the case of PND, one study (Fancourt & Perkins, 2017) exclusively assessed associations between maternal singing and symptoms of PND. A significant association was found between maternal singing and a decrease in depressive symptoms in mothers. According to the findings of this study, maternal singing can causally improve mental health in mothers with depression and enhance postnatal psychological well-being. These findings are in line with other studies that supported the causal beneficial link between maternal singing and PND symptoms (i.e., Perkins, 2021; Estevao et al., 2021; Fancourt & Perkins, 2018; Van Puyvelde et al., 2014; Arnon et al., 2014; Baker et al., 2005).

The accumulation of the above-mentioned findings, in conjunction with the findings of the current study, about the reduced use of maternal singing in the clinical group indicate the imperative need for the inclusion of a singing programme into intervention plans for mothers with PND. Such a programme may restore and enhance the positive and emotionally synchronised interaction between mother and infant, which normally occurs during maternal singing, as it may have been disturbed in case of maternal depression (Perkins, 2021; de l'Etoile, 2012).

5.10.3.1 Micro-Analysis of the Infant's Interactive Profile During Maternal Singing. In the present study, when compared to infants of mothers with PND, infants of mothers without PND were more active and engaged in the interaction while their mothers were singing to them. In terms of infant affect during singing, infants from the clinical group remained neutral, while infants from the comparison group displayed all types of affect – that is, positive, negative and neutral. At this point, it is noteworthy that, in those cases where infants' negative affect and maternal singing occurred together, it was the infant's negative mood that provoked maternal singing, as a way to soothe the baby, and not the other way around. This is in line with the existing literature, which argues that one of the main functions of maternal singing is to soothe the baby (Filippa et al., 2022; Bergeson & Trehub, 2002; Trehub et al., 1997; Creighton et al., 2013; Milligan et al., 2003; de l'Etoile, 2006) and to regulate its mood and arousal (Cirelli et al., 2020).

A research-study conducted by de l'Etoile (2012) explored the infant's gaze during maternal singing, by observing one group of mothers with PND and one without. The findings revealed that a neutral gaze was mainly reported in babies from both groups during ID singing (de l'Etoile, 2012). However, findings from the present study indicate that infants of mothers without PND have a more active gaze when their mothers sing than do infants from the clinical group. Notably, some infants in the comparison group also made eye-contact with their mothers during ID singing, and this is consistent with a previous study supporting that mother-infant musical interaction is characterised by eye contact (Mualem & Klein, 2013) which, in turn, fosters the feeling of togetherness (Kostilainen et al., 2021; Creighton et al., 2013).

Generally, mothers without PND characterised the experience of singing to their infants as enjoyable and affectionate (Oldfield & Bruce, 2001; Oldfield et al., 2003; Edwards, 2011; Creighton et al., 2013; Ettenberger & Ardila, 2018; Brisola et al., 2018). The fact that the infants of mothers without PND in the present study had a more active gaze (i.e., looking at the mother, at their toy, elsewhere, towards the toy that the mother displayed and making eye contact) and spent more time using a toy while their mothers were singing leads to the assumption that this group was more active, more engaged in the interaction and that it experienced the interaction as a more playful and affectionate situation than did the clinical group.

Overall, the present findings regarding the infants' interactive profile during maternal singing deserve attention. According to the literature, infants' responses to maternal singing produce feelings of loving intimacy for the mother, and this is vital for the developing bonding between the mother and the infant (Palazzi et al., 2021; Brisola et al., 2018; Gerhardt, 2004; Edwards, 2011). Furthermore, a reciprocal communication and more intense engagement between mother and infant are created, as infants direct and sustain their attention to their mothers during ID singing (Palazzi et al., 2021; Filippa et al., 2018; Fancourt & Perkins, 2017;

de l'Etoile, 2006a). The present results suggested that infants of mothers with PND were mainly passive, with neutral affect and aversion in their gaze, when mothers sang to them, and this fact may affect the quality of the dyadic encounter and result in a negative communication circle. The path of this circle may be the following: PND negatively affects the quality of maternal singing (de l'Etoile, 2012; Trehub et al., 1993), and due to the deficits in maternal singing the infant exhibits more passive or avoidant behaviour, which in turn negatively influences mother-infant interaction and increases maternal stress (Quevedo et al., 2012).

5.10.3.2 Micro-Analysis of the Maternal Interactive Profile During Maternal Singing. Compared to mothers with PND, mothers without PND were more focused on stimulating their babies through maternal singing, as revealed by the fact that they combined singing with the use of a toy. Remarkably, none of the mothers with PND used a toy when singing to their baby. In contrast, for almost half of the duration of singing, mothers without PND made use of a toy; this was likely to transform the singing situation into a more playful and interesting activity for the baby. In terms of physical contact during maternal singing, the majority of mothers from both groups had almost constant physical contact with their baby. This observation agrees with the existing literature, which supports that the mother-infant interaction during singing is characterised by physical contact (Mualem & Klein, 2013).

In this study, mothers from the clinical group were continuously looking at their babies and smiled while singing, whereas mothers from the comparison group were mainly looking at the baby and smiled, but, as part of this interaction, they were also looking at the toy that they used and sometimes showed neutral affect. These findings are consistent with earlier research suggesting that mothers smile considerably more while singing than while speaking to their infants (Cirelli et al., 2020; Trehub et al., 2016). The combination of smiling and singing conveys maternal feelings to infants both vocally and visually (Trehub et al., 2016), transforming the singing activity into a vehicle for conveying emotion (Nakata & Trehub, 2004).

However, considering that the babies in the clinical group were only neutral and mostly looking elsewhere, this stability in maternal affect and gaze may underline an effort on the part of the mothers to create a positive atmosphere and attract the babies' attention, rather than to produce a sensitive response to the infants' state. To provide further support for this assumption, it is important to look more closely at the cumulation of all the co-existent behaviours during maternal singing. In the clinical group, mothers were mainly holding their infants in their hands while singing, without using any toy, which made the interaction quite intense. The fact that the babies were looking mainly elsewhere could be translated as possible cognitive and social incidence of avoidance. Existing literature supports this argument, as PND has been found to be associated with infant avoidance (Goodman & Brand, 2009). However, even though infants from the comparison group were also looking elsewhere sometimes, this could be explained by the fact that their singing interaction with their mothers proved to be more playful and less intensive and that this created space for the infant to explore.

5.10.4 Infant Vocalisation

For the purposes of this study, infant vocalisations were approached in four different ways. The researcher assessed the duration and types of infant vocalisations with a micro-analytic approach, while the quality (rating scale) and quantity (event counts) of infant vocalisations were assessed with the help of the GRS. The findings of all the measurements demonstrated that the infants of mothers with PND vocalise more often than do infants of mothers without PND. In terms of the quantity and quality of infant vocalisations, there was a significant difference between the groups, with the infants in the clinical group vocalising more than those in the comparison group. However, in terms of the duration and types of vocalisations, even though the infants in the clinical group were found to exhibit a longer duration of vocalisations than those of mothers without PND, the difference was not statistically significant. Likewise, there was no statistically significant difference in the types of vocalisations between the groups.

These findings reflect the inconsistency existing in the relevant literature. In particular, there is a general agreement that infant vocalisations differ in cases of presence versus absence of PND (Friedman et al., 2010). Yet, some studies suggested that infants of PND mothers vocalise less in mother-infant interaction, when compared to infants of mothers without PND (Lucci & Otta, 2013; Frizzo & Piccinini, 2005; Lam-Cassettari & Kohlhoff, 2020), while other studies revealed a vocal variability in infants of mothers with PND – that is, infants being vocally more active in both positive and negative qualities, in comparison to infants of mothers without PND (Friedman et al., 2010).

As a plausible explanation for the increased vocalisations, which were also observed in the infants of the clinical group in the present study, Stern (1994) postulated that 'the infant of the depressed mother becomes a charmer in relation to her, actively trying to bring the mother back to life. The infant serves as a kind of antidepressant for the mother' (Friedman et al., 2010, p. 13). These findings lend further support to the idea that infants of PND mothers attempt to elicit maternal responses through being vocally active. Furthermore, more recent studies also showed that infant vocalisations during the Still Face Paradigm serve two main social functions: (1) to revive the dialogue with their mothers, and (2) to signal an emotional reaction (Delgado et al., 2002; Goldstein et al., 2009). As a consequence, infant vocalisations can function as an interactional regulatory tool (Bouvris et al., 2018) that enhances the quality of mother-infant communication. However, the current study's findings regarding the high level of vocalisations in infants of mothers with PND is of pivotal importance, given that the extant literature has indicated an association between higher infant vocalisation frequency and later child psychopathology (Allely et al., 2013).

5.11 Conclusion

To the best of our knowledge, this research is the first attempt to provide a comprehensive and multi-dimensional picture of mothers' and infants' vocal behaviours, based on a micro-analytic approach and assessment tools, of a sample of mothers with PND who have been hospitalised jointly with their infants in an MBU. A comparison group of mothers without PND served to illustrate the real effect of PND. The findings of the present study, in consonance with the existing literature, supported that PND significantly affects the quality and quantity of maternal speech addressed to the infants. Particularly, mothers with PND were found to talk less to their infants, while the quality of the content of their speech showed deficits when compared to mothers without PND. Taking into account the significant role of maternal speech in infant holistic development – including language, cognitive and socio-emotional development – these findings deserve scientific attention and further exploration.

This study also revealed that PND significantly affects both quality and quantity of infants' vocal behaviour, which is associated with subsequent language development. Infants of mothers with PND showed a significantly higher level of vocalisations. A plausible explanation for the infants' use of vocalisations in the case of PND may lie in the notion that infants, through their vocal behaviour, attempt to elicit their mothers' attention. In the literature, another favoured explanation posits that infant vocalisation reflects the infants' distressed emotional state due to maternal 'absence' while being present. A high level of infant vocalisations has been proven to constitute an indicator for later mental health issues in children; therefore, further research is essential to identify how to best support this at-risk population.

Furthermore, there exists general agreement that maternal singing serves as a tool for mothers to communicate with their children, a medium to engage with them and meet their needs, as well as a way to improve their own self-perception. It is, thus, quite surprising that the literature on this topic presents a major gap. Even though the findings of the present study regarding the effect of PND on maternal singing are not statistically significant, the fine-grain micro-analysis of this interaction suggested that the mother-infant interaction during maternal singing seemed to be less playful and enjoyable for the clinical group, and infants of mothers with PND exhibited signs of passivity and avoidance. Additional research is needed to explore in depth how both maternal vocal behaviour and singing can be integrated into therapeutic programmes and existing interventions especially designed for mothers with PND, in order to enhance mother-infant interaction as well as mothers' and infants' well-being.

Chapter 6: Mother-Infant Non-verbal Communication

6.1 Introduction

The present chapter reviews the literature on non-verbal communication (NVC) between the mother and her infant during the postnatal period, focusing on facial affect, gaze and touch. The impact of maternal postnatal depression (PND) on this form of communication also receives discussion. The second section of this chapter presents Study 3, which aims to investigate the effects of PND on infants' non-verbal communication skills, taking into account maternal NVC behaviour. Then, the methodology underlying this study, along with the results concerning NVC in mother-infant interaction and the role of PND in the quality of infants' NVC skills are presented. This is followed by a discussion of the present study's findings in relation to the relevant literature in this field and its contributions to this existing literature.

6.2 The Importance of NVC

The coordination of main expressive modalities – such as gaze, touch, facial affect and vocal tone – emerges toward the second month of life and marks the beginning of socio-emotional communication in infancy (Colegrove & Havighurst, 2017; Mantymaa et al., 2008; Colonnesi et al., 2012; Messinger & Fogel, 2007). These NVC skills create a critical channel through which infants communicate their positive or negative emotions to their mothers, signal their need for support, express relational distress and elicit caregiving behaviours (Schachner et al., 2005). Infants also use NVC strategies to regulate the flow of interaction (Cohn & Tronick, 1989) and, thereby, facilitate their self-regulation; for instance, self-touch behaviours are central means of self-comfort (Koulomzin et al., 2002; Murray & Trevarthen, 1985; Weinberg & Tronick, 1994; Weinberg et al., 1998), while gaze aversion is an important means of regulating attention and proximity (Beebe & Steele, 2013; Koulomzin et al., 2002). Overall, the accumulation of these NVC skills form an emotion regulation constellation in infants (Beebe et al., 2010). Indicatively, Beebe and colleagues (2008b) found that infant touch and vocal affect are interlinked, in that a higher level of infant touch behaviours was related to less negative vocal affect.

However, the development of NVC skills in infants is a dyadic process that involves both the mother and the infant; it is achieved through maternal sensitivity and responsiveness to her infant's cues (Trevarthen & Aitken, 2001; Tronick, 1989; Tronick & Weinberg, 1997). Infants depend on their mothers' ability to accurately understand their NVC signals and thus interpret their emotions in order to meet their needs (Colegrove & Havighurst, 2017; Stein et al., 2010). Maternal empathic understanding of her infant's nonverbal cues and affective state may be a prerequisite for the development of emotional regulation in infants (Trevarthen & Aitken, 2001; Tronick, 1989). On the contrary, maternal unavailability and/or incapacity to interpret and respond appropriately to her infants' nonverbal cues may lead to an escalating cycle of dysfunctional behaviours in both mother and infant (Milgrom & Holt, 2014), which can have detrimental effects, not only on their relationship but also on infant development (for further information, see Chapter 4, Section 4.3).

Maternal responses also build the basis upon which the infants – through observational learning, modelling and mirroring (Eisenberg et al., 1998; Morris et al., 2007; Coan et al., 2007) – shape and develop their own NVC skills. Specifically, in a mother-infant interaction, 'through the repeated co-occurrence of social gaze, matching of affective states, co-vocalisation, coordination of body tone and movements, and matching of arousal level, infants begin the process of learning how to regulate their own affect and arousal' (MacLean et al., 2014, p. 513). Consistent and sensitive maternal responses to infant's NVC signals are associated with infants' self-regulatory abilities (Koulomzin et al., 2002; Murray & Trevarthen, 1985; Weinberg & Tronick, 1994; Weinberg et al., 1998; Beebe & Steele, 2013), resilience

(Savage-McGlynn et al., 2015), empathy (Field et al., 2009), as well as socio-emotional development and, thus, the infants' ability to effectively form and maintain relationships (Colonnesi et al., 2012; Nowicki & Duke, 2013). It is also worth mentioning that contingent maternal responses to infants' nonverbal cues are linked to a high quality of mother-infant interaction, while they also improve maternal self-esteem (Tronick & Weinberg, 1997). Overall, NVC skills are of pivotal importance for a reciprocal, bidirectional infant-caregiver interaction, effective and responsive parenting, as well as for mothers' well-being and infant development (Colegrove & Havighurst, 2017).

6.2.1 Non-Verbal Communication in PND

PND has consistently been reported to interfere with the emotional and behavioural exchanges through NVC between the mother and her infant (e.g., Kawai et al., 2017; Colegrove & Havighurst, 2017; Milgrom & Holt, 2014; Field et al., 2006; MacLean et al., 2014; Reck et al., 2004). There exists evidence that mothers with PND usually provide their infants with minimal or ambiguous NVC cues (Crittenden, 2013). Compared to mothers without PND, the NVC behaviour of mothers with PND is characterised by less positive and more negative affect, a decreased ability to perceive and interpret accurately the infants' signals, lack of emotional availability, less expressive mimetic behaviour, disengagement and passivity or intrusiveness, as well as reduced vocal, gaze and tactile behaviours towards their infants (Asselmann et al., 2018; Cohn et al., 1990; Field et al., 2006, 2009; Mäntymaa et al., 2008; Milgrom & Holt, 2014).

As maternal communicative qualities play a significant role in the development of infants' NVC skills (Colegrove & Havighurst, 2017), deficits in the quality of maternal NVC towards her infant among mothers with PND may have a direct effect on infants' NVC skills. Although depression in infants remains a controversial issue (Mantymaa et al., 2008), infants of mothers with PND exhibit a similar depressive profile of communication as do their mothers (Aktar et al., 2017), which they seem to generalise to their interaction with non-depressed adults as early as 3 months of age (Field et al., 1985; Milgrom & Holt, 2014). Specifically, in contrast to infants of mothers without PND, infants of mothers with PND have been found to exhibit more gaze avoidance, fewer vocalisations and positive facial expressions (Cohn et al., 1990, 1986; Field, 2014; Landesman, 2011; Nadel et al., 2005; Reck et al., 2004), employ more active self-touch (Herrera et al., 2004; Moszkowski et al., 2009) and be less responsive to faces and voices (Field et al., 2009, Field, 2011). PND has also been reported to negatively impact infants' ability to detect and expect social contingency (Nadel et al., 2005; Field et al., 2005).

Furthermore, the presence of PND in early infancy tends to predict delays in infants' NVC skills during the second year of life; a study conducted by Kawai and colleagues (2017) assessed the link between PND and infants' NVC skills at 14 months in a sample of 951 infants. The findings indicated that infants of mothers with PND are at increased risk of exhibiting delays in the development of their NVC skills (Kawai et al., 2017); these delays were strongly associated with poor language development (Brignell et al., 2016). Deficits in NVC skills in infancy can have long-term effects on children's lives, as these are linked to psychopathology (Colegrove & Havighurst, 2017), such as aggressivity (Russell et al., 1993), depression (Van Beek & Dubas, 2008), social anxiety (McClure & Nowicki, 2001) and emotion dysregulation (Puura et al., 2019). Furthermore, children with impairments in their NVC skills usually have difficulties in understanding people's nonverbal cues, which in turn generates conflicts, leading to negative relationships with others (Colegrove & Havighurst, 2017). Overall, NVC skills are integral components of the mother-infant relationship, enhancing their attachment (Schachner et al., 2005), while contributing to maternal and infants' well-being (Colegrove & Havighurst, 2017). The following section will look more closely at the most salient NVC skills in infants, on which the present study focuses – that is, facial affect, gaze and touch – and discuss in detail their significant role in the mother-infant interaction, as well as the effects of PND on the respective infants' developmental trajectories.

6.2.2 Facial Affect

The perception and expression of facial affect are remarkably sophisticated in infants (Beebe et al., 2010) and constitute central elements of infants' early social interactions, especially with their mothers (Stern, 1985; Cohn & Tronick, 1988). Even at birth, the morphology of infants' and adults' emotional expressions is similar for the same discrete emotion (Shutter & Camras, 2010), while the complete range of infant facial expressions emerges by the fourth month of life (Beebe et al., 2010; Stern, 1985; Weinberg & Tronick, 1994). Neonates tend to orient themselves towards faces, reflecting a specific form of attention and preference (Haist & Anzures, 2017) that seems to reinforce their responsiveness to adult faces and voices from the very first period of their life (Field et al., 2009). As infants develop over the first few months, they also become able to distinguish different facial expressions – such as happy, sad and angry expressions – of an unfamiliar person (Beebe et al., 2010); therefore, they can differentiate the respective affective states (Reck et al., 2004). In parallel, emotional expressions in 2-month-old infants are coordinated with visual attention, and the interactions with their mothers include sequences of shared smiles (Feldman, 2007).

An infant's positive affect and smile constitutes a landmark in the reciprocal mother-infant interaction; through smiling, infants establish closeness and engage the mother in their interaction (Bowlby, 1975), while infants' smile also has a rewarding effect on the mother (Bouvis et al., 2018). There is evidence that infants' facial affect in the first 6 months can predict the quality of the mother-infant relationship (Cohn & Campbell, 1992), as well as their attachment at the age of 12 months (Colonnesi et al., 2012; Braungart-Rieker et al., 2001). However, face-to face mother-infant interaction is a dyadic dance in which both partners' behaviours are interconnected and interdependent (Stern, 1974, 2009). In a study conducted by MacLean and colleagues (2014), the sequential relationship between the synchrony of 84 mother-infant dyads and infant affect was investigated. The findings indicated that the experience of synchronicity contributes to observable shifts in affect; at a micro-analytic level, the mutual gaze between mother and infant was followed by an immediate change in the infant's affect, which became more positive. As a corollary, the infants' experience of a synchronous and contingent maternal response elicits positive changes in their emotion regulation, and this highlights the crucial role of maternal behaviours in infants' affect.

6.2.2.1 Still-Face Paradigm. To evaluate the important role of maternal affect in infants' emotional well-being, as well as the infants' sensitivity to social contingency and their respective expectations of maternal positive behaviours during their interaction, Tronick and colleagues (1978) developed the face-to-face still-face (SF) paradigm. Since then, the SF paradigm has been adopted for a body of micro-analytic studies that generated a large series of modified SF experiments in research concerning early mother-infant interactions (e.g., Mantis et al., 2019; Feldman et al., 2010; Field et al., 2005; Nadel et al., 2005; Skotheim et al., 2013; Pelaez-Nogueras et al., 1996). The SF experiment (Tronick et al., 1978) entails three phases of interaction. The first phase includes a free-play mother-infant interaction. During the second phase, the mother is requested to interrupt the ongoing interaction by displaying a blank face while she keeps looking at the infant. The third phase, also known as the reunion/reinstatement phase, contains the return to the free-play situation and to the accustomed contact between the mother and her infant.

Accumulating evidence suggests that, during this experimental perturbation procedure, infants are typically highly sensitive to their mothers' momentary unavailability; in such situation, infants show distress by increasing gaze aversion, using more negative facial expressions and changes in their vocalisations and displaying less positive affect and fewer smiles (e.g., Tronick et al., 1978; Mesman et al., 2009; Delgado et al., 2002; Bouvris et al., 2018). The fact that the SF effect provokes a distressed infant's reaction depicts the infant's expectations of maternal contingent responses and positive affect during their interaction (Skotheim et al., 2013). In parallel, infants' distress during the SF procedure may also serve as an active attempt to revive and resume normal communication with their mothers (Bouvris et al., 2018).

However, there exists evidence that infants of mothers with PND experience the SF effect differently from infants of mothers without PND (e.g., Field et al., 2005a, 2005b, 2007; Cohn et al., 1991; Weinberg & Tronick, 1996; Pelaez-Nogueras et al., 1996; Rosenblum et al., 2002). For example, Field and colleagues (2007) showed that 4-month-old infants of mothers with PND exhibited less distress during the SF procedure than infants of mothers without PND. In addition, infants of mothers with PND made noticeably less effort during the SF phase to re-engage their mothers in their interaction. These findings suggested that infants of mothers with PND are more accustomed to a less expressive maternal face and maternal non-contingent behaviours; consequently, they expect much less affect from their mothers and experience less rejection during this perturbation procedure (Field et al., 2007, 2009).

The study by Cohn and colleagues (1991) indicated that the affective interaction between the mother and the infant during the SF experiment revealed useful information about the quality and history of the mother-infant relationship. Furthermore, findings from SF experiments underscored the significant role of maternal facial affect as a means of emotional communication with the infant. Thus, the passive reaction to the SF effect of infants whose mothers suffer from PND allows for a better understanding of the difficulties that mothers with PND may face in sustaining a positive and affective interaction with their infants, which is essential for the infants' emotional well-being.

6.2.2.2 Facial Affect in Mother-Infant Interaction. Maternal facial expressions in a mother-infant early interaction are predominantly positive and serve as 'frame' for infants' regulation of affect (Cohn & Tronick, 1987). It has been suggested that maternal expressed positive emotions elicit more responses from her infant, thus facilitating a stronger engagement (Olino et al., 2011). However, an optimal mother-infant interaction is a flexible process (Cohn & Tronick, 1987) that contains both a high proportion of maternal positive affect and shifts between 'matches' and 'mismatches' in mother-infant affect (Reck et al., 2004; Beebe & Lachmann, 2003), aiming at synchronicity and reciprocity of maternal and infant affective states (Reck et al., 2004). The shared positive affect in mother-infant interaction influences the quality of their relationship, which is linked to infants' socio-emotional, cognitive and psychological functioning throughout their life-span (Puura et al., 2019; Fredrickson, 2004; Ramsey & Gentzler, 2015; Aktar et al. 2017; Feldman, 2007; Lecleere et al., 2014). Indicatively, a study conducted by Legerstee and Varghese (2001) showed that infants of mothers who display a high level of affect mirroring ranked high on prosocial behaviours and social expectancy.

The mother-infant interaction in the case of PND is characterised by the expression of fewer positive emotions, while the negative state predominates in terms of the duration of occurrence (Field et al., 2006). For instance, in a study with 113 mother-infant dyads, Puura and colleagues (2019) indicated that higher maternal depressive symptoms were associated with a shorter duration of shared pleasure between mother and infant. Considering the above-mentioned role of shared pleasure, this deficit may have detrimental effects on child development. Infants of mothers with PND not only have less positive facial affect than do infants of mothers without PND (Mantymaa et al., 2008; Field et al., 2009, 2014), but they also have difficulties in discriminating various facial expressions (Bornstein et al., 2011).

Overall, the impact of maternal PND on infant facial affect can negatively influence an infant's holistic development (Puura et al., 2019). More specifically, as mentioned above, infants' NVC skills constitute a constellation of modalities of communication that are inextricably linked. The existing literature highlights the importance of coordination between facial expression and gaze (Colonnessi et al., 2012); in a mother-infant interaction, facial affect is combined with the respective gaze behaviour as an index of the quality of interaction. The following section will explore and discuss the role of the gaze in this interaction, in the context of mothers with and without PND and their infants.

6.2.3 Gaze

The gaze is one of the central channels of communication in infants (Væver et al., 2015) and considered 'a cardinal social and bonding behavior' (Stern, 2009, p. 50). Infants' gaze towards the mother has been found to promote the establishment of a secure attachment within the dyad (Vekovischeva & Lyakso, 2017). As early as in the neonatal period, infants are responsive to faces (Field et al., 2009), displaying a clear preference for face-like visual arrays – especially their mothers' face – over non-face-like stimuli (e.g., Hayes & Watson, 1981; Johnson et al., 1991). However, between 3 and 11 months of age (Gredeback et al., 2010), there occurs a decrease in infants' attention towards the maternal face, followed by an increase in curiosity about the surroundings (Nomikou et al., 2016) and, therefore, in attention towards objects (Fogel et al., 1999; Cohn & Tronick, 1987). This attraction to objects from the third month onwards can be attributed to the developmental trajectories of the infant's gaze. The process of the visual system's maturation takes place during the first 4 months of infancy (Stern, 2009) and is central to infants' interaction, not only with the mother, but also with the external world (Landesman, 2011).

During the third month of life, maturation of the visual motor system is achieved, insofar as infants gain complete control over their gaze direction and attain gaze coordination (Lotzin et al., 2015; Fogel, 2006; Stern, 2009). Thus, infants' gaze behaviour acquires functional significance (De Pascalis et al., 2017). For instance, infants' gaze aversion is an important regulatory behaviour (Egmose et al., 2021; Field, 1981), used in case of distressing events or information overload (Field, 1981) in order to modulate arousal, process information (Field, 1981; Væver et al., 2015; Landesman, 2011) and/or regulate maternal behaviour by signalling disengagement (Gianino & Tronick, 1988). Likewise, gaze coordination (i.e., shared attention) and mutual gaze, which are inherently bidirectional processes occurring between mother and infant (Northrup et al., 2020), serve several functions that contribute to infants' social and emotional well-being.

In particular, both gaze coordination and mutual gaze help infants feel and understand maternal emotional states and intentions (Jaffe et al., 2001; Tomasello, 1992; Baron-Cohen, 1997), which, in turn, enhance their ability to infer others' mental states (Wellman et al., 2008). Specifically, gaze coordination is an integral component of mother-infant interaction, which provides infants with learning opportunities (Lotzin et al., 2015). The mutual gaze serves as a predictor of the quality of the mother-infant interaction (Britton et al., 2001), promotes infants' positive affect (Hains & Muir, 1996) and reinforces their attention control (Niedzwiecka et al., 2018). For example, a recent study, using 55 mother-infant dyads, found that 5-month-old infants who spent more time engaged in a mutual gaze with their mothers exhibited better attention control at 11 months (Niedzwiecka et al., 2018). Overall, infants' optimal gaze behaviour contributes to their subsequent socio-emotional, physiological, cognitive and language development (Væver et al., 2015; Astor et al., 2020; Zukow-Goldring & Arbib, 2007; Field, 1981).

As derived from the above discussion, maternal gaze behaviour, which contributes to shared attention and mutual gaze in mother-infant interaction, plays a central role in early infant development (De Pascalis et al., 2017). The maternal gaze towards the infant creates an interactive environment rich in opportunities for a mutual gaze and interpersonal attention, which constitute meaningful parts of infants' social and emotional experiences (Northrup et al., 2020; Johnson et al., 2015). Throughout the mother-infant interaction, the maternal gaze towards the infants' faces remains predominant (Stern, 2009), with mothers looking away from the infants less than 10% of the time (Murray et al., 2008). Several studies reported that mothers spent a significantly greater proportion of time looking at the infant's face than vice versa (Lotzin et al., 2015; Colonnesi et al., 2012; Rivas-Vazquez et al., 2004; Stern, 1974). However, the maternal gaze changes according to the infant's age in order to meet the infant's curiosity about the surroundings and, therefore, increases the infant's exploration opportunities (Gredeback et al., 2010). Thus, both the mothers' and infants' attention shift to objects, while the role of maternal visual input remains essential (Stern, 2009).

Generally, the maternal gaze towards the infants' face serves a variety of purposes for effective interaction (Northrup et al., 2020). Through their gaze, mothers can assess their infants' affective states (Northrup et al., 2020), set the basis for the organisation of infants' gaze behaviour (Nomikou et al., 2013) and build a foundation for the infants' communicative and linguistic skills (Nomikou et al., 2016; Brooks & Meltzoff, 2008). Specifically, maternal responsiveness to the infant's gaze elicits the infant's feedback and engagement, which provides fertile ground for proto-conversations (Filipi, 2009; Bateson, 1979; Bruner, 1983). Moreover, the maternal gaze can provide the infant with information about word meaning, given that mothers usually label the objects at which they are gazing during the mother-infant interaction (Brooks & Meltzoff, 2008). Overall, maternal gaze behaviour provides a scaffolding for infants' learning and language development, as well as for the refinement of infants' social interactions and emotional well-being (Wu & Gros-Louis, 2014). Research into the mother-infant gaze patterns in the presence of PND, however, has revealed that PND has unfavourable effects on mother-infant gaze interaction (e.g., Væver et al., 2015; Lotzin et al., 2015; Beebe & Steele, 2013; Beebe et al., 2008; Field et al., 2009), to be discussed in detail in the following section.

6.2.3.1 Gaze in PND. While mothers without PND engage in moderate gaze active interactions that ensure less gaze aversion in the infants (Field, 1981), thus enhancing mother-infant bonding, mothers with PND exhibit dysregulated gaze patterns that depict disorganised parenting styles, characterised as passive or intrusive (Lotzin et al., 2015; Beebe & Steele, 2013). Mothers with PND are less likely to establish eye-contact with their infants (Smith-Nielsen et al., 2016). In addition, mothers with PND are more likely to produce less predictable self-contingency gaze patterns to their infants, which prevent infants from being able to expect and depend on maternal visual attention (Beebe & Steele, 2013). Overall, they are more likely to exhibit either heightened or lowered rather than moderate mother-infant gaze synchrony (Lotzin et al., 2015). This disturbance in maternal gaze patterns, which is linked to decreased maternal sensitivity (Egmose et al., 2021), can have detrimental effects on infant development, as well as a direct impact on infants' gaze behaviour in the case of PND (Lotzin et al., 2015).

Although PND is associated with deficits in mother-infant interaction, findings on infants' gaze behaviours in the presence of maternal PND have been equivocal (Væver et al., 2015). Some studies suggested that, in comparison to infants of mothers without PND, infants of mothers with PND looked more at their mothers' faces (Beebe et al., 2008) and showed less gaze aversion (Field, 1981). Other studies reported that infants of mothers with PND looked less at their mothers and exhibited more gaze aversion when interacting with their mothers than did infants of mothers without PND (e.g., Egmose et al., 2021; Cohn et al., 1990; Field et al., 2009; 1988; Reissland et al., 2005). Other studies showed no difference at all in gaze behaviour between infants of mothers with and without PND (e.g, Væver et al., 2015; Chabrol et al., 1996; Striano et al, 2002). The inconsistency of these findings may be attributed to methodological differences, such as the use of different assessment instruments, research design and infant age (Væver et al., 2015). This underscores the need for further investigation.

In a recent study by Egmose and colleagues (2021), infants of mothers with PND displayed fewer shifts between gaze towards and away from their mothers' faces than did infants of mothers without PND. These findings were interpreted as indicating a deficit in self-regulatory abilities in infants of mothers with PND; the infants did not employ attentional regulatory strategies, but instead exhibited self-directed regulatory strategies, such as self-touch. The importance of touch in the mother-infant interaction and as self-regulatory strategy in infants' well-being will be discussed in the following section.

6.2.4 Touch

The skin is the earliest sense organ to develop (Field, 2010). Unlike other fine motor skills and modalities of interaction (e.g., gaze), the sense of touch is already well-developed in new-borns (Crucianelli et al., 2019; Gallace & Spence, 2016). Young infants use this primary modality to discover their world; specifically, through touch, they explore themselves and their surroundings, as well as engage and interact with others (Mammen et al., 2016; Field, 2014; Stack, 2010). Another unique feature of touch is that it necessarily entails proximity and mutual physical contact (Ciaunica & Fotopoulou, 2017). Thus, touch constitutes a powerful communicative channel, serving as a vehicle of emotional communication and affection in the mother-infant interaction (Botero et al., 2020; Stack et al., 2010). This, in turn, renders touch an essential element of mother-infant bonding (Jean et al., 2014; Stack & Jean, 2011; Stack, 2010; Feldman et al., 2004). The importance of touch is also reflected in its frequent occurrence during mother-infant interactions (Mantis et al., 2019), which ranges between 55% and 99% of the time (Field, 1984; Jean et al., 2009).

The significant role of touch in infant development has been well established (Serra et al., 2020; Gallace & Spence, 2016; Field, 2010, 2014; Feldman & Eidelman, 2003). As reported in numerous studies, maternal touch can regulate the infant's arousal level (Kida & Shinohara, 2013) and affect (Egmose et al., 2018; Herrera et al., 2004), thereby reducing infant distress (Feldman et al., 2010; Jean et al., 2014) and promoting the infant's self-regulatory abilities (Jean & Stack, 2009; Bystrova et al., 2009; Feldman et al., 1999a). In addition, touch can facilitate and enhance parent-infant bonding and the development of secure attachment (Botero et al., 2020; Lieberman & Van Horn, 2008; Anisfeld & Lipper, 1983; Greenberg & Morris, 1974; Cascio et al., 2019; Duhn, 2010). Tactile contact is also an integral component of the homoestatic regulation that mothers provide to their infants (Fotopoulou and Tsakiris, 2017). Evidence shows that touch can regulate new-borns' temperature and breathing (Acosta, 2016; Winberg, 2005), reduce the infant's cortisol levels (Feldman et al., 2010) and support the maturation of the prefrontal cortex (Feldman et al., 2014; Kida & Shinohara, 2013). As a corollary, physical contact between mothers and their infants is one of the most important aspects of infant development, contributing to infants' social, emotional, communicative, physical and neurological growth (Barnett, 2005; Underdown et al., 2010; Stack, 2010; Stack & Jean, 2011; Feldman et al., 2014; Kida & Shinohara, 2013).

To investigate the significant role of maternal touch in infants' well-being, even when other communicative channels are blocked, several studies used a modification of the SF paradigm (Tronick et al., 1978). This modification includes maternal touch as an additional episode [Still Face + Touch (SF+T)] and aims to assess the impact of maternal touch on infants' affect during the mother's momentary affective unavailability. As derived from the experiments using the SF+T condition, maternal touch in itself can reduce the infant's distress, as infants showed more positive and regulatory behaviours, as well as less fussing and crying, negative affect, gaze aversion and self-soothing behaviours when compared to the standard SF (Gusella et al., 1988; Jean & Stack, 2009; Jean et al., 2014; Stack & LePage, 1996; Stack & Muir, 1990, 1992). As already mentioned above, these findings indicate that maternal touching behaviours are associated with the functioning of infants' stress-management systems (Feldman et al., 2010) and contribute to infants' affect regulation (Hertenstein, 2002).

However, research shows that it is not the presence of touch per se, but the quality and the types of touch that contribute to the mothers' and infants' well-being (Mantis et al., 2019; Mercuri, 2017; Beebe et al., 2010). Touch is a complex and multidimensional phenomenon (Hertenstein, 2002) that includes a range of different sub-types of touch patterns (Serra et al., 2020; Egmose et al., 2018) with diverse functions (Cascio et al., 2019), which are connected to distinct outcomes in mothers and their infants (Serra et al., 2020; Beebe et al., 2010; Keren et al., 2003; Stack & Muir, 1992). Indicatively, there are three main types of maternal positive touch: affectionate, playful/stimulating and instrumental touch (Jean et al., 2009). Affectionate touch – such as kissing, stroking, caring, tickling, or massaging (Serra et al., 2020; Botero et al., 2020) – promotes relaxation and reduces negative affect in infants (Lowe et al., 2016; Egmose et al., 2018; Arnold, 2002; Moreno et al., 2006; Peláez-Nogueras et al., 1997). Affectionate touch has been reported to form a link with infants' communication skills (Field, 2014). Playful touch, or alternatively stimulating, jiggle/bounce touch, tends to promote infants' social skills, by reinforcing eye-contact, positive affect and activity level (Lowe et al., 2016; Egmose et al., 2018; Moreno et al., 2006; Peláez-Nogueras et al., 1997). For instance, a study conducted by Jean and colleagues (2014) demonstrated that maternal playful touch co-existed with infant smiling. Finally, caregiving touch (or utilitarian/instrumental touch) was associated with a decrease in the infant's discomfort (Moreno et al., 2006; Jean et al., 2014) and distress (Jean & Stack, 2009).

Different types of positive maternal touch are inherent components of the global mother-infant interaction system, while these are also linked to maternal sensitivity and, consequently, the level of reciprocity and synchrony in the mother-infant interaction (Botero et al., 2020; Ferber et al., 2008). There also exists evidence that mother-infant physical contact can increase maternal responsiveness to the infants' cues; through physical contact, the mother can become emotionally aware of the infant's emotional state and communicative intentions (Little et al., 2018). To illustrate this point, a study by Little and colleagues (2018) showed that mother-infant physical contact could predict feeding in response to infants' early hunger cues, whereas mother-infant proximity that did not include physical contact failed in this prediction. These findings highlight that physical contact reinforces the exchange of emotions between the mother and the infant, while facilitating maternal awareness of her infant's signals.

Overall, early mother-infant physical contact increases maternal satisfaction with the infant, maternal gaze towards the infant's face, as well as time spent in their interaction (Field, 2014); thus, it serves as foundation for a closer and more sensitive mother-infant relationship. However, given that the use of positive touch patterns reflects the mother's well-being (Ferber et al., 2008) and sensitivity (Jean & Stack, 2009), it is plausible that there are mothers who face difficulties in sustaining physical contact with their infants and in producing positive touch patterns in their interaction. Several studies have demonstrated that maternal touching behaviours may be negatively affected by the presence of psychopathology, including PND (Mantis et al., 2020; Cascio et al., 2019; Egmose et al., 2018; Beebe & Steele, 2013; Herrera et al., 2004). The following section will explore in depth the effects of PND on the mother-infant tactile exchanges.

6.2.4.1 Touch in PND. Maternal depression is associated with less affectionate maternal touch (Beebe et al., 2010; 2008; Feldman & Eidelman, 2003), while negative patterns of maternal touch are usually met in this population (Ferber et al., 2008; Field, 2010). For example, Reissland and colleagues (2005) used a sample of 15 mothers with PND and 15 mothers without PND interacting with their 8-month-old infants during a face-to-face play session with a soft toy. The results showed that mothers with PND used the toy in a more intrusive way to touch their infants (poking instead of nestling), and this, in turn, elicited more negative emotional reactions in their infants when compared to mothers without PND and their infants. In the literature, negative touching behaviours commonly reported in mothers with PND include intrusive, over-stimulating touch (e.g., rough poking, tickling, shaking, rough pulling) and withdrawn, under-stimulating touch (Field, 2010; Jung et al., 2007; Lovejoy et al., 2000; Malphurs et al., 1996). These touching behaviours are directly linked to the two main interactional styles observed between mothers with PND and their infant – namely, withdrawn and intrusive (Cohn et al., 1986; Field et al., 1990; Field, 2010) (for further information, see Chapter 3, Section 3.2).

A handful of studies have provided ambivalent results regarding the effect of PND on mother-infant touching behaviours, however. A study by Lundy and colleagues (1996) observed no differences in maternal touching behaviours between mothers with and without PND while interacting with their infants (Lundy et al., 1996). In contrast, Ferber (2004) argued that mothers with postnatal blues exhibited passive or withdrawn touch patterns, as they touched their new-borns less frequently than mothers without postnatal blues. Peláez-Nogueras and colleagues (1996) used 48 mothers with and without PND and their 3-month-old infants who were randomly assigned to the following control and experimental conditions: (a) normal play, (b) SF-no-touch, (c) SF-with-touch (SF+T), and (d) no play. It is worth mentioning that all participant mothers were instructed and shown how to touch their infants during the SF+T condition. The findings indicated that mothers with PND can successfully increase positive affect and attention in their infants by providing rhythmic stroking and rubbing, with maternal touch thereby serving as a compensatory for the negative effects of the lack of facial affectivity and flat vocal expression normally associated with PND (Peláez-Nogueras et al., 1996). Overall, these inconsistent results may be attributed to the fact that different disciplines and research groups focus on a great variety of types of touch, using different methods, measures, clinical and/or healthy cohorts, without an integrated perspective (Field, 2019).

6.2.4.2 Infant Touch. Given the important role of touch in the development of the emotional connection between the mother and the infant and, hence, in the infant's holistic development, it is surprising that research on infant touch has been sparse (Crucianelli et al., 2019; Mercuri, 2017). A handful of studies have focused on infant self-touch and its self-soothing effect in the absence of maternal tactile engagement (Herrera et al., 2004; Weinberg & Tronick, 1996; Moszkowski et al., 2009). Indicatively, Herrera (2010), using a clinical group of 18 infants and mothers with PND and a control group of 18 infants and mothers without PND, found that 6-month-old-infants in the clinical group showed more self-touch than those in the control group. In interpreting these findings, the authors argued that infants used self-touch to compensate for reduced positive touch received from their mothers (Herrera et al., 2004; Field, 2014). In another study, infants of mothers with PND exhibited more active patterns of touching during stressful situations than did those in the control group, such as grabbing and pulling, as a self-regulatory reaction to calm themselves (Field et al., 1999).

However, touching behaviours have been predominantly explored from a unidirectional perspective, with most research investigating either maternal or infant touch only (Mantis et al., 2014). According to the Mutual Regulatory Model (Tronick, 1989), however, mother and infant are active social partners and constitute a dyadic system in which both are interdependent and mutually affect each other, moment-to-moment (Tronick, 1989; Beebe & Steele, 2013). Thus, it is of pivotal importance to investigate changes in maternal and infant touch patterns simultaneously and during the same interaction (Cohn & Tronick, 1988; Beebe et al., 2016; Petit & Arsiwalla, 2008; Fogel, 1992, 1993; Menashe & Atzaba-Poria, 2016). In the light of the equivocal results reported above and the lack of research on touch patterns between mothers with severe PND and their infants, the present study aims to contribute to the existing literature by investigating a range of different tactile behaviours in both inpatient mothers with PND and their infants.

6.3 Conclusion

Overall, facial affect, gaze and touch patterns lie at the core of the mother-infant relationship, facilitating attachment (Schachner et al., 2005), while constituting central integrating elements in child development and maternal well-being (Koulomzin et al., 2002; Field et al., 2009; Tronick & Weinberg, 1997; Colegrove & Havighurst, 2017). Research on early face-to-face exchanges of NVC cues between the mother and her infant contributes to our knowledge and understanding of socio-emotional and relationship development later in life (Colonnesi et al., 2012). Given the unique importance of each modality of NVC – namely, facial affect, gaze and touch – in the mother-infant relationship and infant development, as well as the inconsistent findings regarding the impact of PND on these, the need for further research is apparent.

6.4 The Present Study

The main aim of Study 3 was to conduct a fine-grain micro-analysis in order to gain an in-depth understanding of infants' NVC skills linked to mother-infant interactive behaviours during a play situation, as well as to assess the respective effects of PND on these behaviours. In the optimal development of infants' NVC skills, different modalities – such as facial affect, gaze and touch – are inextricably interwoven (Beebe et al., 2010), while the role of maternal NVC behaviours are of fundamental importance for their development (Trevarthen & Aitken, 2001; Tronick, 1989, Tronick & Weinberg, 1997). However, many micro-analytic studies focus on identifying one or two NVC modalities (Beebe & Steele, 2013) within single channels (Halberstadt et al., 2013). In the present study three NVC modalities (i.e., facial affect, gaze and touch) were examined simultaneously in both mothers and infants, who were then coded independently.

To the author's knowledge, this is the first study to provide a detailed examination of the impact of PND on three different modalities of NVC (i.e., facial affect, touch and gaze) during a play interaction in a sample of infants and mothers with PND (n= 22 dyads) who have been hospitalised in an MBU. A group of mothers without PND and their infants (n=30 dyads) was used as a comparison group. The duration and different patterns of the three NVC modalities were investigated in order to address the main research question: Do the infants of mothers with PND differ in their non-verbal communication skills when compared to the infants of mothers without PND? The principal hypothesis posits that PND will be associated with disturbances in the quality of NVC between the mother and her infant. In the attempt to answer the main research question and test the hypothesis, the following additional research questions emerged:

1) Are there any differences between the quality, type and duration of the three NVC modalities (i.e., affect, gaze and touch) in both mothers and infants? (The answer requires comparison between clinical and control groups.)
2) Is there any association between the following aspects below?
    a) The three variables of Study 1 (i.e., mother-infant reciprocity, maternal sensitivity and infant self-regulation) and maternal and infant NVC modalities (i.e., affect, gaze and touch). (The answer requires comparison between clinical and control groups.)

b) Maternal and infant affect modality (i.e., positive, negative, neutral). (The answer requires comparison between clinical and control groups.)

c) Specific infant NVC cues (i.e., positive affect, gaze towards the mother and no touch behaviour) and specific maternal NVC cues (i.e., maternal no touch behaviour and maternal gaze towards the infant). (The answer requires comparison between clinical and control groups.)

3) What kind of maternal and infant NVC cues are apparent when infants display positive and negative affect during the interaction with their mothers?

6.5 Material and Methods

6.5.1 Participants and Procedure

A total of 52 videos containing footage of 104 participants (52 mother-infant pairs) were analysed and compared. The clinical group consisted of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months); their interaction was video-recorded for intervention purposes in the clinical context of an MBU. A comparison group of 30 mothers without PND was recruited from several Children's Centres in London, and their play interaction with their infants (aged 3-12 months) was equally video-recorded. Video-recordings of both groups (n= 52) were analysed and compared (for detailed information about the participants' characteristics and study design, see Chapter 3, Sections 3.4 and 3.7).

6.5.2 Measures

The assessment tools used in this study have been presented in detail in Chapter 3, Section 3.8. The following reliable assessment tools were employed:

1) Measurement of Maternal Depressive Mood: Edinburgh Postnatal Depression Scale (Cox et al., 1987)
2) Measurement of Maternal Sensitivity: Infant CARE-index (Crittenden, 2005)
3) Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al, 1996b; Murray & Karpf, 2000). In this study, the infant self-regulation and mother-infant reciprocity measures were applied.

6.5.3 Data Analysis

6.5.3.1 Mother-Infant Non-Verbal Communication: A Micro-Analytic Approach. The micro-analytic approach is a widely used method to study mother-infant interaction and infants' behaviours, especially in the case of maternal PND (e.g., Friedman et al., 2010; Reissland & Shepherd, 2006; Reissland et al., 2002b; Reissland et al., 2005; Stack & Muir, 1990; Murray & Cooper, 1997a, 1997b, 1997c; Murray et al., 1993; Cohn et al., 1990; Field et al., 1988). Due to the complexity of the micro-analytic approach, the Noldus Observer XT 16.0 software package (a computer aided coding system; Noldus, Wageningen, the Netherlands) was used for the management, analysis and presentation of the time-structured data from the video-recorded material (for further information about the data analysis process, see Chapter 3, Section 3.9.1).

6.5.3.2 Infants' Non-Verbal Communication Skills: Coding Scheme. In applying the micro-analytic approach, a coding scheme was developed to record the onsets, offsets and the types of behaviours linked to infants' non-verbal communication skills. This coding scheme was derived from merging reliable pre-existing coding schemes employed in other relevant studies (i.e., Tronick et al., 1980; Adamson & Bakeman, 1985; Polan and Ward, 1994; Neale et al., 2018; Zuccarrini et al., 2018; Moszkowski & Stack, 2007; Reece et al., 2016; Crucianelli et al., 2019; Murray & Karpf, 2000; Crugnola et al., 2013; Crittenden, 2010; Tronick et al., 2005; Aureli et al., 2015; Serra et al., 2020). The infant behavioural codes included into this coding scheme consist of the following: *infant affect*, *direction of gaze* and *touch behaviour*. The frequency and duration of each non-verbal modality during the mother-infant interaction was coded frame by frame and classified, as presented in Table 6.1.

Table 6.1

Coding Scheme: Behavioural Categories and Variables in Infants' Non-Verbal Communication Skills

Infant Behavioural Categories	Variables
Affect	Positive Negative Neutral
Gaze	Towards the mother Towards the object Towards the toy or hand the mother is using Eye-contact Elsewhere
Touch	Affectionate Object-mediated Play-related Static Due to the position No Touch

6.5.3.3 Maternal Non-Verbal Behaviours: Coding Scheme. The type, frequency and duration of NVC behaviours of 52 mother-infant dyads were examined. In addition to the infant behavioural codes presented above, maternal behavioural codes – namely, *maternal affect*, *direction of gaze* and *touch behaviour* – were included in the coding scheme and classified, as presented in Table 6.2.

Table 6.2

Coding Scheme: Behavioural Categories and Variables in Maternal Non-Verbal Communication Behaviours

Maternal Behavioural Categories	Variables
Affect	Positive Negative Neutral
Gaze	Towards the mother Towards the object Following partner's gaze Eye-contact Elsewhere
Touch	Affectionate Object-mediated Instrumental Play-related Attention-Seeking Rough Static Due to position No touch

All the above-mentioned categories, for both maternal and infants' NVC behaviours, are mutually exclusive and thus cannot co-occur. Only for the 'touch' behaviour, the following variable operationalisation was applied: (1) no touch, (2) due to position, (3) static, (4) attention-seeking, (5) instrumental, (6) object-mediated, (7) play-related, (8) affectionate, and (9) rough. For instance, if the mother was holding the baby, the code 'due to position' was applied, but if the mother kissed the baby while holding it, the code 'affectionate' was applied for the moment of the kiss.

6.6 Results

6.6.1 Reliability Test

Inter-rater agreement in the second-by-second coding calculated by Cohen's Kappa coefficient (Cohen, 1960) ranged from .69 to .93 for the observation of maternal behaviours and from .67 to .90 for the observation of infant behaviours. The second coder was blind to the mothers' mental health status.

6.6.2 Means and Standard Deviation for the Variable of Infants' and Maternal Affect

6.6.2.1 Infant Affect. No significant difference was found in the mean duration of infant affect between the two study groups. Although the infants from the comparison group (M =22.6, SD = 30.5) displayed more positive affect when compared to infants from the clinical group (M = 9.35, SD = 13.3), this difference did not amount to any significance.

Figure 6.1

Percentage of Different Types of Infants' Affect: A Comparison Between Groups

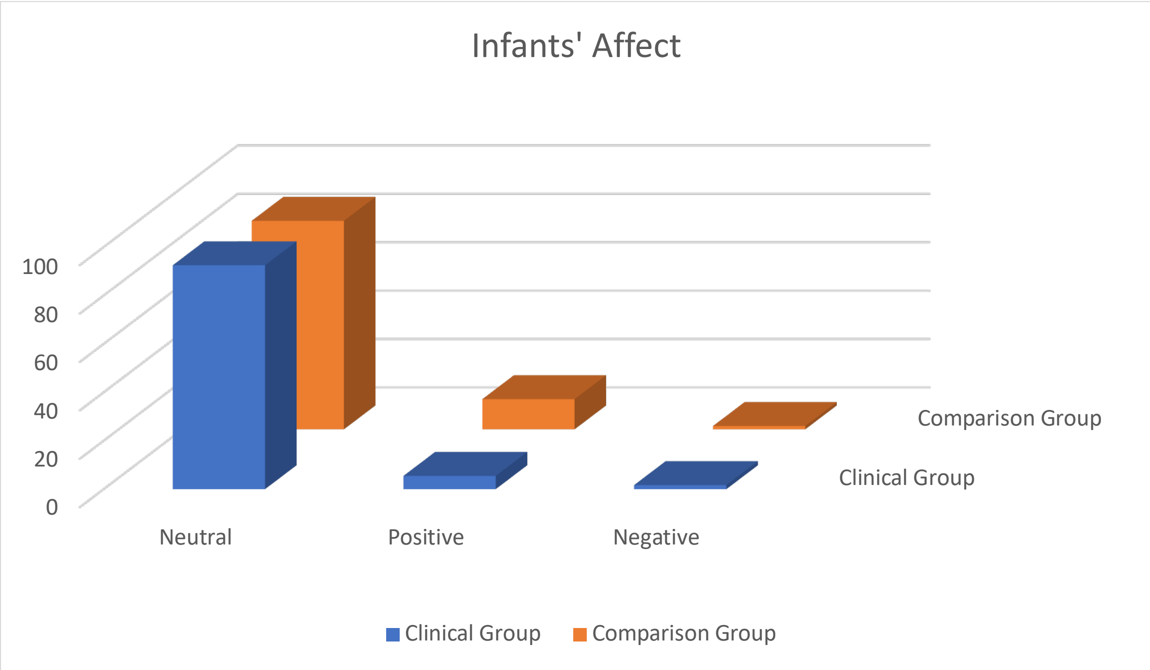


Table 6.3

Infants' Neutral, Positive and Negative Affect: Clinical Versus Comparison Group

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Neutral	158.3	28.3	156.2	29.6	-.21	.82	0.03
Positive	9.35	13.3	22.6	30.5	1.91	.06	0.2
Negative	2.87	8.83	2.48	6.22	-.18	.85	0.02

$^{*}p < .05$, $^{**}p < .01$

6.6.2.2 Maternal Affect. There existed a statistically significant difference in the mean duration of maternal positive and neutral affect between the two study groups, with the effect sizes being large, represented as Pearson's r, with .1 meaning small, .3 medium, and .5 large (Cohen, 1988). Specifically, mothers with PND (*M* = 113.2, *SD* = 57.7) were found to display statistically significant more neutral affect during a free-play session with their infants than did mothers without PND (*M* = 61.3, *SD* = 49.9), *t*(50) = -3.46, *p*= .001, *r*= 0.4. In addition, mothers in the comparison group were more positive in their affect *(M* =119.5*, SD* = 49.3) when interacting with their infants than were mothers in the control group (*M* = 47.7*, SD* = 45.2), *t*(50)= 5.36, *p* = .000, *r*= 0.6. In terms of negative affect, mothers without PND (*M* = 6.55, *SD* = 15.21) were never negative, while only few mothers with PND (*M* = 1.95, *SD* = 5.27) exhibited negative affect; yet, this difference between the groups was not statistically significant.

Figure 6.2

Percentage of Different Types of Maternal Affect: A Comparison Between Groups

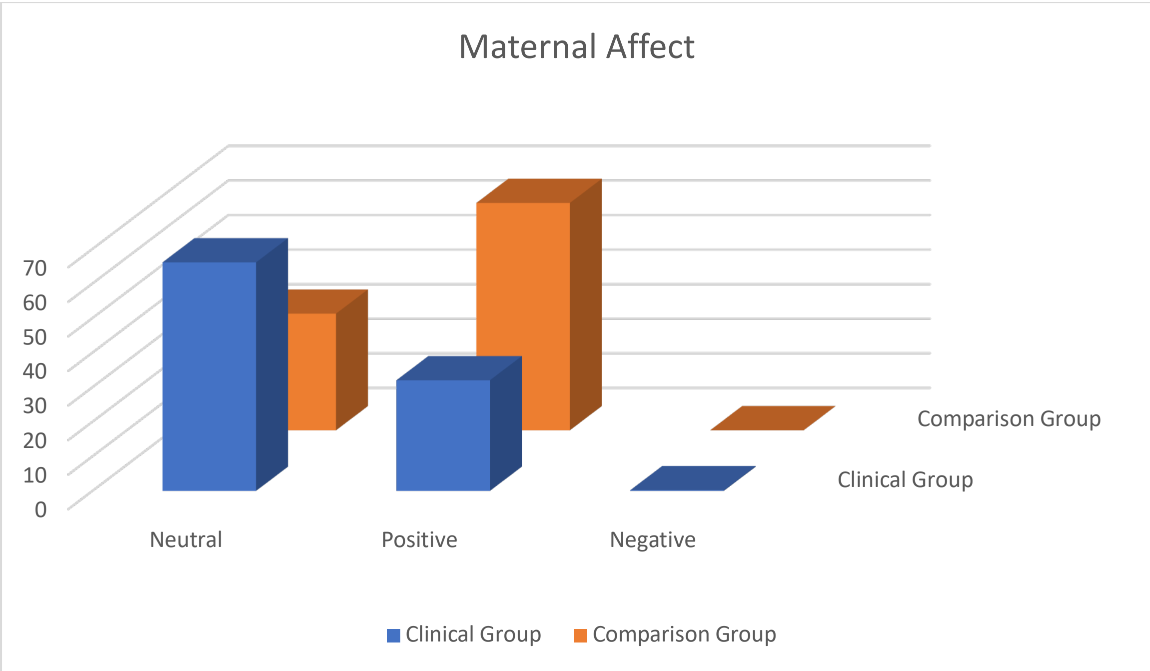


Table 6.4

Maternal Neutral, Positive and Negative Affect

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Neutral	113.2	57.7	61.3	49.9	-3.46	.001	0.4
Positive	47.7	45.2	119.5	49.3	5.36	.000	0.6
Negative	.33	.92	.00	.00	-.1.67	.109	0.2

$^{*}p < .05$, $^{**}p < .01$

6.6.3 Means and Standard Deviation for the Variable of Infants' and Mothers' Direction of Gaze

6.6.3.1 Infants' Direction of Gaze. No statistically significant difference was observed between the two study groups in the mean duration of different directions of the infants' gaze during the interaction with their mothers. In particular, infants in the clinical group (*M* =19.5, *SD* = 26.4) looked more towards their mothers when compared to infants from the comparison group (*M* = 9.01, *SD* = 9.27), *t*(50)= -1.78, *p* = .08, although this difference is only of marginal statistical significance. Infants in the comparison group (*M* = 70.1, *SD* = 30.9) were found to direct their gaze more towards the toy or the hand that the mother was using as part of the interaction, in comparison to infants of mothers with PND (*M* = 52.9, *SD* = 40.2), *t*(50)= . 32,

p = .06, with the difference being marginally significant. Lastly, despite the fact that infants in the clinical group (M = 1.96, SD = 5.58) exhibited less eye-contact with their mothers during the play interaction, when compared to infants from the comparison group (M = 5.15, SD = 7.12), the difference once again was of only marginal statistical significance (p=.08).

Figure 6.3

Percentage of Different Types of Infants' Direction of Gaze: A Comparison Between Groups

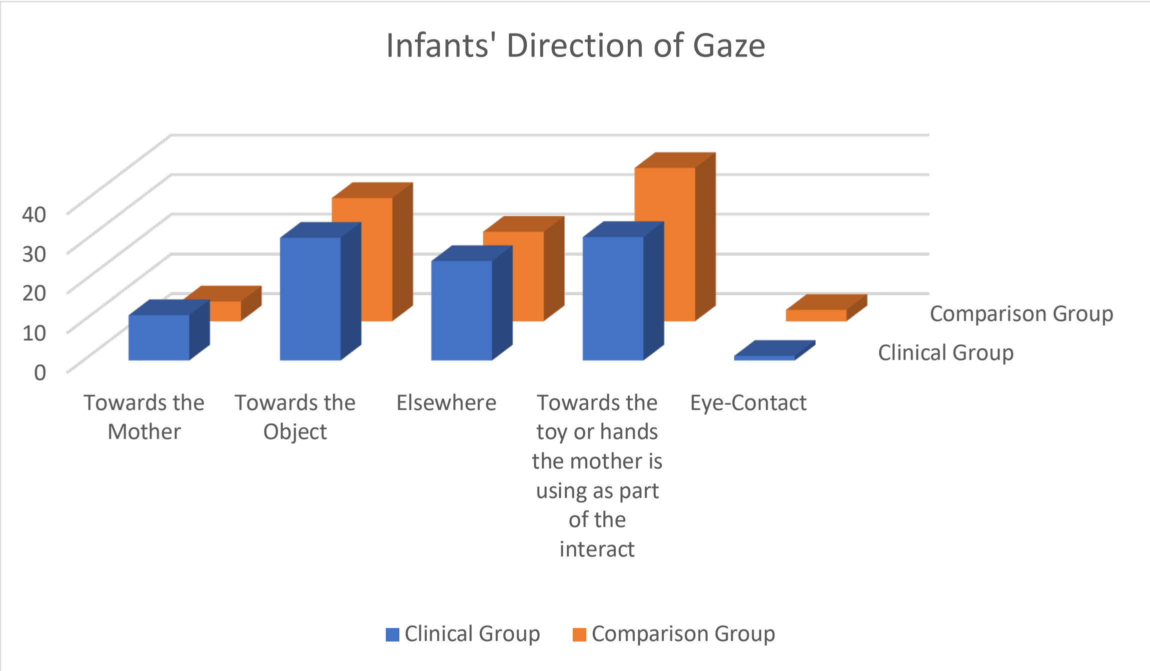


Table 6.5

Infants' Direction of Gaze: Clinical Versus Comparison Group

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Towards the partner	19.5	26.4	9.01	9.27	-1.78	.08	0.2
Towards the object	52.9	40.2	56.3	35.6	.32	.74	0.04
Towards the toy or hand that the mother is using as part of the interaction	53.2	32.6	70.1	30.9	1.90	.06	0.2
Elsewhere	42.8	31.4	40.9	26	-.24	.81	0.03
Eye-contact	1.96	5.58	5.15	7.12	1.74	.08	0.2

$^{*}p < .05$, $^{**}p < .01$

6.6.3.2 Maternal Direction of Gaze. In the majority of the cases, the maternal direction of gaze did not differ significantly between mothers with and without PND. A statistically significant difference was found in the mean duration of the maternal gaze towards the object, with mothers from the comparison group (M = 63.8, SD = 29.6) looking more towards the object that they used when interacting with their infants than did mothers of the clinical group (M = 39.7, SD = 25.8), $t(50) = 3.05$, $p = .004$, r= 0.4. Also, mothers with PND (M = 9.48, SD = 12.0) significantly looked elsewhere, more so than mothers without PND (M = 4.65, SD = 4.09), $t(50)$= -2.04, $p = .046$, r=0.2, when interacting with their babies.

Figure 6.4

Percentage of Different Types of Maternal Direction of Gaze: A Comparison Between Groups

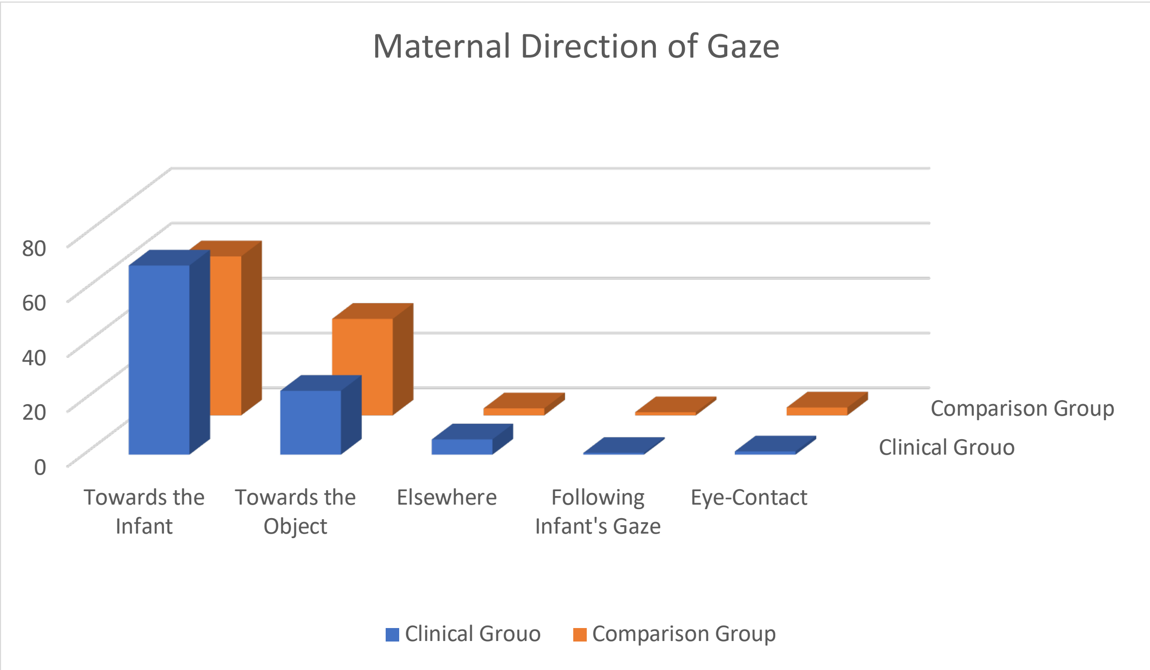


Table 6.6

Means and Standard Deviation for the 5 Types of Maternal Direction of Gaze

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Towards the infant	117.9	29	105.2	28	-1.58	.119	0.2
Towards the object	39.7	25.8	63.8	29.6	3.05	.004	0.4
Following infant's gaze	1.07	1.96	2.09	4.27	1.03	..304	0.1
Elsewhere	9.48	12.0	4.65	4.09	-2.04	.046	0.2
Eye-contact	2.01	5.59	5.20	8.29	1.56	.125	0.2

$^{*}p < .05$, $^{**}p < .01$

6.6.4 Means and Standard Deviation for the Variable of Infants' and Maternal Touch Behaviour

6.6.4.1 Infants' Touch Behaviour. Regarding the infants' touch behaviour, despite the fact that infants in the comparison group seemed to touch their mothers more during the play session (Figure 6.5), in comparison to the infants of mothers with PND, there was no statistically significant difference in the mean duration of different types of infants' touch behaviour between the two study groups.

Figure 6.5

Percentage of Infants' Touch Behaviour: A Comparison Between Groups

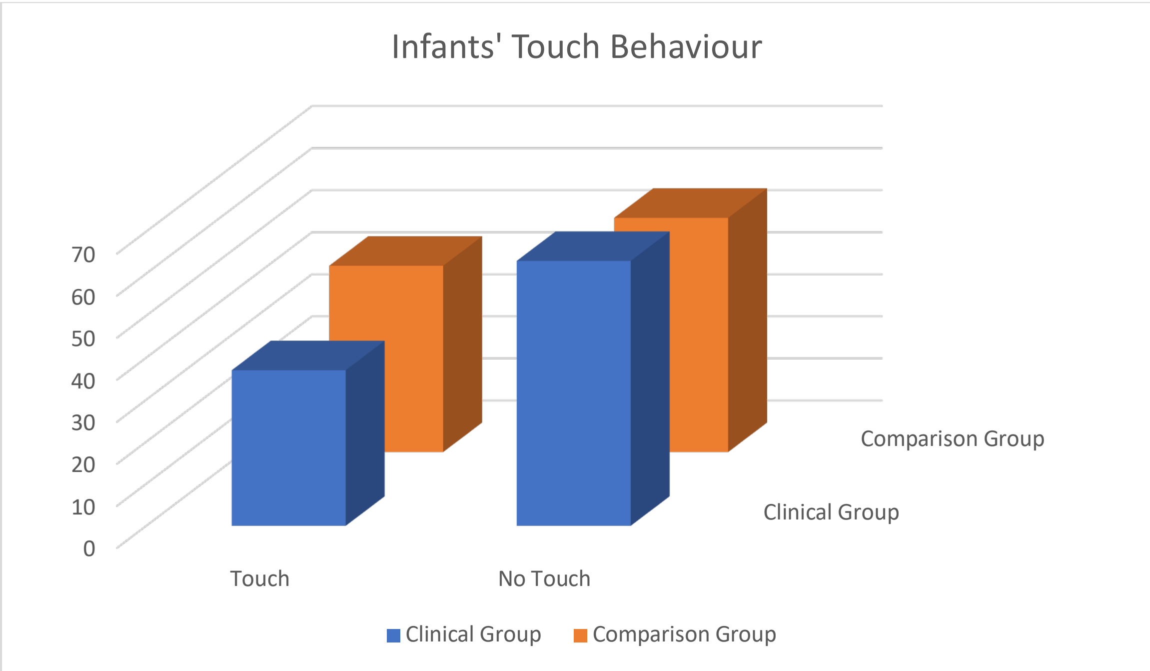


Figure 6.6

Percentage of Different Types of Infants' Touch Behaviour: A Comparison Between Groups

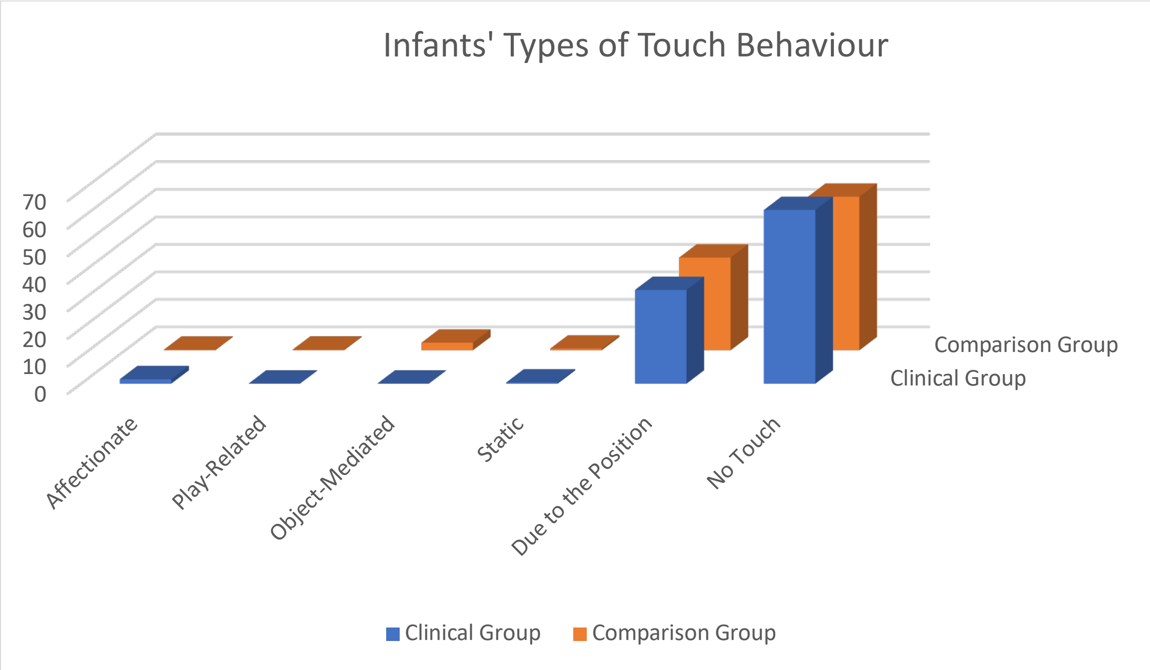


Table 6.7

Means and Standard Deviation for the 6 Types of Infants' Touch

	Clinical group (=22)		Comparison group (n=30)		*t*	*p-value*	*R*
	M	SD	M	SD			
Affectionate	2.75	7.87	.40	2.18	-1.36	.18	0.2
Object-mediated	.04	.20	5.01	21.2	1.28	.21	0.1
Play-related	.04	.16	.42	2.03	.88	.38	0.06
Static	.72	2.67	1.11	6.09	.28	.77	0.04
Due to position	58.2	69.7	61.1	71.6	.14	.88	0.02
No Touch	107.8	73.0	101.3	81.2	-.30	.76	0.04

$^{*}p < .05$, $^{**}p < .01$

6.6.4.2 Maternal Touch Behaviour. In the comparison between the clinical and comparison groups, this study found that mothers without PND touched their infants more than mothers with PND (Figure 6.7). However, when assessing the eight different types of maternal touch behaviour – affectionate, object-mediated, play-related, instrumental, attention-seeking, static touch, touch due to position and no touch – a statistically significant group difference emerged only in play-related touch. Specifically, mothers from the comparison group (M = 2.78, SD = 5.56) exhibited more play-related touch towards their infants when compared to mothers of the clinical group (M = .49, SD = 1.22), $t(50)$= 2.18, p = .03. No incidence of rough touch behaviour was observed in either group; therefore, this category was excluded from the analysis.

Figure 6.7

Percentage of Maternal Touch Behaviour: A Comparison Between Groups

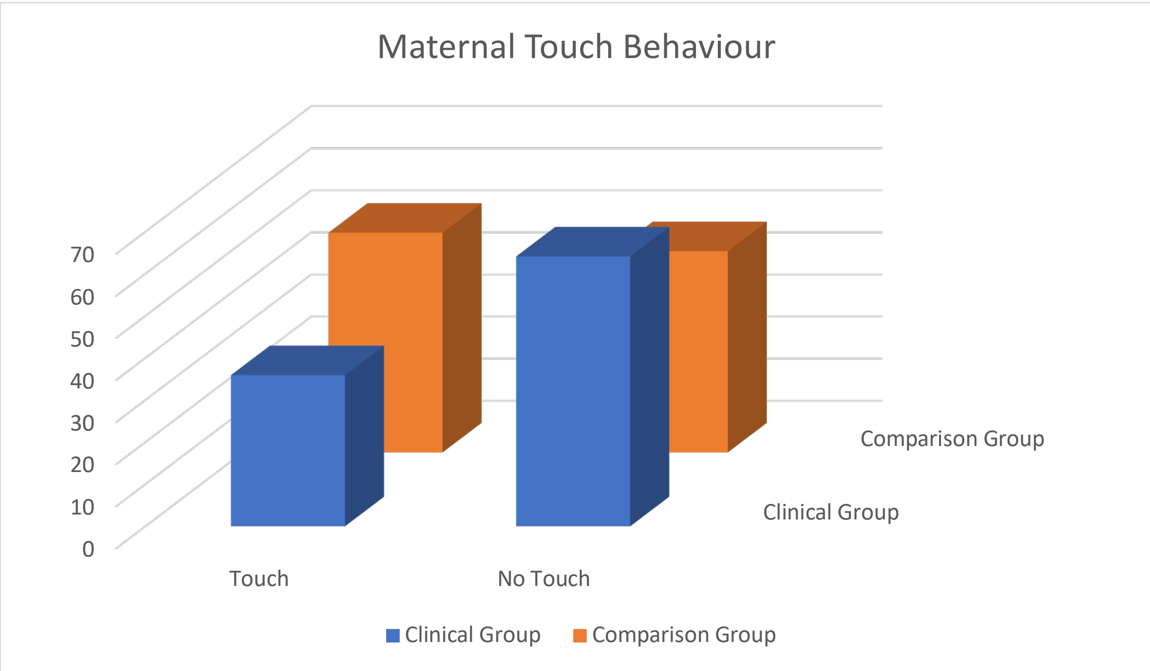


Figure 6.8

Percentage of Different Types of Maternal Touch Behaviour: A Comparison Between Groups

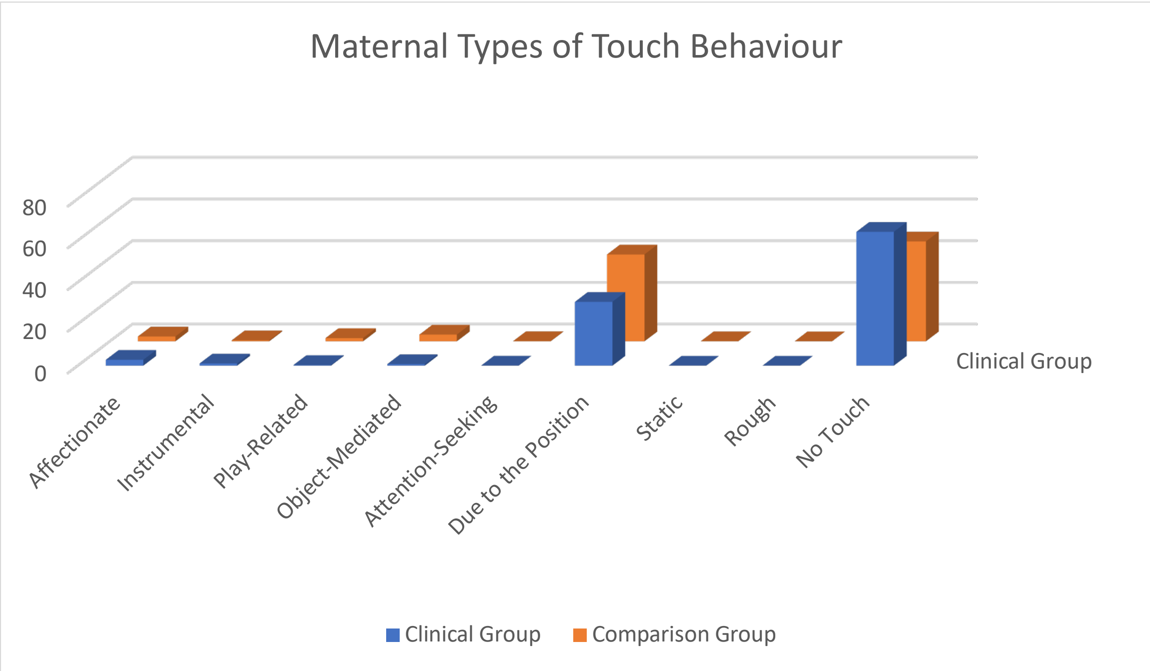


Table 6.8

Means and Standard Deviation for the 8 Types of Maternal Touch

	Clinical group (=22)		Comparison group (n=30)		*T*	*p-value*	*r*
	M	SD	M	SD			
Affectionate	4.79	9.50	4.19	7.12	-.25	.79	0.03
Object-mediated	1.25	3.60	5.82	14.5	1.64	.10	0.2
Play-related	.49	1.22	2.78	5.56	2.18	.03	0.3
Instrumental	1.78	5.45	.83	1.75	-.90	.37	0.1
Static	.00	.000	.07	.40	.85	.39	0.1
Due to position	52.3	68.9	75.6	66.3	1.22	.22	0.2
Attention-seeking	.02	.11	.17	.73	.92	.36	0.1
No touch	109.8	72	87	74.4	-1.10	.27	0.2

$^{*}p < .05$, $^{**}p < .01$

6.6.5 Correlations Between Measures of Study 1 and Study 3

A series of partial correlation analyses was run between the clinical and comparison groups among the three variables of Study 1 (i.e., infant self-regulation, maternal sensitivity to infant cues and reciprocity) and the variables of maternal and infant NVC (i.e., affect, gaze and touch). The aim of this analysis was to investigate the associations among the respective variables in the case of PND. Control for infant age was applied to all the correlation analyses run in the present study.

6.6.5.1 Touch Modality.

6.6.5.1.1 Partial Correlations Among Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Different Maternal Touch Patterns. Partial correlation analysis was run between the variables of Study 1 and maternal touch behaviour: (1) affectionate, (2) object-mediated, (3) play-related, (4) static, (5) attention-seeking, (6) due to position, and (7) no touch. After controlling for infant age, for the first series of correlations (Table 6.9) significant results emerged only concerning the measures of infant self-regulation and maternal affectionate touch. Particularly, in the comparison group a higher rating in infant self-regulation is negatively correlated with maternal affectionate touch, $r(52) = -.53$, $p = .003$.

Table 6.9

Correlations Among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Maternal Touch Behaviours Between Groups

Maternal codes for touch behaviour	Clinical Group			Comparison group		
	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Affectionate	.23	.21	.16	-.30	-.32	**-.53***
Object-mediated	.004	.12	.30	.13	.24	-.07
Instrumental	.09	.06	.29	-.003	.11	-.001
Play-related	-.16	-.03	.007	-.26	-.29	-.18
Static	-	-	-	-.28	-.20	-.30
No touch	.20	.24	.31	.11	.12	.31
Attention-seeking	-.14	.21	.13	-.06	-.15	.09
Due to position	-.16	-.18	-.38	-.15	-.15	-.18

$^{*}p < .05$, $^{**}p < .01$

6.6.5.1.2 Partial Correlations Among Reciprocity, Maternal Sensitivity, Maternal Reciprocity, and Different Infant Touch Patterns. To examine the relationship among the variables of Study 1 and infant touch behaviour, a partial correlation analysis was applied to each of the study groups. After controlling for infant age, an association among variables was found only for the clinical group. More specifically, affectionate touch pattern in infants of mothers with PND seemed to be highly correlated to reciprocity and maternal sensitivity [$r(52) = .53$, $p = .01$ and $r(52) = .48$, $p = .02$, respectively], as well as marginally associated with infant self-regulation, $r(52) = 41$, $p = .06$. A weak association was also found between infants' 'no touch' behaviour and self-regulation in the clinical group, $r(52) = .41$, $p = .06$. In addition, a significant negative correlation was found between infant touch due to position and infant self-regulation in the clinical group, $r(52) = -.45$, $p = .04$.

Table 6.10

Correlations Among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Infant Touch Behaviours Between Groups

Infant codes for touch behaviour	Clinical Group			Comparison group		
	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Affectionate	.53**	**.48***	.41	-.03	-.04	-.08
Object-mediated	.14	.10	-.32	.28	.23	.21
Play-related	-.10	-.002	.13	-.03	-.10	-.07
Static	-.05	-.17	-.41	-.06	-.12	-.10
No touch	.17	.21	.41	.29	.17	.13
Due to position	-.17	-.17	**-.45***	.51	-.12	.00

$^{*}p < .05$, $^{**}p < .01$

6.6.3.2 Facial Affect Modality.

6.6.3.2.1 Partial Correlations Among Reciprocity, Maternal Sensitivity, Reciprocity and Different Maternal Facial Affect Patterns. Partial correlations among the three variables of Study 1 (i.e., infant self-regulation, maternal sensitivity to infant cues and reciprocity) and the maternal positive, negative and neutral facial affect were examined for both groups, after controlling for infant age. As displayed in Table 6.11, correlations among variables were found only for the clinical group. More specifically, low levels in mother-infant reciprocity was significantly associated with maternal negative affect, $r(52) = -.43$, $p =$

.04, while maternal positive affect was highly correlated with infant self-regulation, $r(52) = .43$, $p= .04$.

Table 6.11

Correlations Among Measures of Reciprocity, Maternal Sensitivity and Infant Self-Regulation and Maternal Patterns of Facial Affect Between Groups

Maternal codes for facial affect	Clinical Group			Comparison group		
	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Positive	.09	.28	**.43***	-.10	-.07	-.18
Negative	**-.43***	-.28	-.22	-	-	-
Neutral	.003	-.06	-.14	.11	.10	.21

$^{*}p < .05$, $^{**}p < .01$

6.6.3.2.2 Partial Correlations Among Reciprocity, Maternal Sensitivity, Reciprocity and Different Infant Facial Affect Patterns. Partial correlations among the three variables of Study 1 (i.e., infant self-regulation, maternal sensitivity to infant cues and reciprocity) and the infant's positive, negative and neutral facial affect were also examined in the two groups, after controlling for infant age. As exhibited in Table 6.12, infants' positive facial affect is associated with reciprocity and maternal sensitivity, regardless of the study group. In addition, neutral affect in infants of the comparison group is negatively associated with reciprocity and maternal sensitivity, $r(52) = .-.50$, $p= .006$ and , $r(52) = -.46$, $p= .012$, respectively. Lastly, positive affect in infants of the clinical group was also found to be particularly weakly associated with infant self-regulation, $r(52) = .39$, $p= .07$.

Table 6.12

Correlations Among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Infant Patterns of Facial Affect Between Groups

	Clinical Group			Comparison group		
Infant codes for facial affect	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Positive	**.46***	**.55***	.39	**.54***	**.53***	.29
Negative	.02	.11	-.18	-.17	-.28	-.29
Neutral	-.05	-.10	-.08	**-.50****	**-.46****	-.18

*p < .05, **p < .01

Moreover, partial correlations between maternal and infants' different patterns of affect were run in the two groups, after controlling for infant age. The findings revealed that correlations among variables were found only for the clinical group, with maternal positive affect being significantly correlated with infant positive affect, $r(52) = .60$, $p = .004$. Furthermore, infant neutral affect was found to be negatively correlated with maternal positive affect and positively associated with maternal neutral affect, $r(52) = -.50$, $p = .02$ and $r(52) = .50$, $p = .02$, respectively (Table 6.13).

Table 6.13

Correlations Among Different Patterns of Maternal and Infant Facial Affect Between Groups

Infant codes for facial affect	Clinical Group			Comparison group		
	Maternal Positive Affect	Maternal Negative Affect	Maternal Neutral Affect	Maternal Positive Affect	Maternal Negative Affect	Maternal Neutral Affect
Positive	**.60****	-.20	-.36	.25	-	-.23
Negative	.12	.13	-.10	.16	-	-.21
Neutral	**-.50***	-.004	**.50***	-.30	-	.30

$^{*}p < .05$, $^{**}p < .01$

6.6.3.3 Gaze Modality.

6.6.3.3.1 Partial Correlations Among Reciprocity, Maternal Sensitivity, Reciprocity and Different Infant Gaze Patterns. After controlling for infant age, no significant correlations were found between different types of infant gaze and reciprocity, maternal sensitivity or infant self-regulation in the clinical group. Only maternal sensitivity was marginally associated with the infants' gaze towards their mothers for this group, $r(52) = .40$, $p = .07$. By contrast, in the comparison group (Table 6.14), infants' self-regulation was negatively correlated with gazing 'elsewhere', $r(52) = -.41$, $p = .025$. In addition, eye-contact between infants and mothers without PND was significantly associated with reciprocity, $r(52) = .36$, $p = .05$.

Table 6.14

Partial Correlations Among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Infant Patterns of Gaze Between Groups

Infant codes for gaze behaviour	Clinical Group			Comparison group		
	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Towards the mother	.30	.40	.15	.10	.16	-.07
Towards the object	.03	-.09	.09	.17	.01	.03
Towards the toy or hand the mother is using	-.19	-.19	-.39	-.04	.09	-.04
Elsewhere	.03	.12	.22	-.31	-.26	**-.41***
Eye-contact	.13	.21	-.12	**.36***	.07	.29

$^{*}p < .05$, $^{**}p < .01$

6.6.3.3.2 Partial Correlations Among Reciprocity, Maternal Sensitivity, Reciprocity and Different Infant Gaze Patterns. Partial correlation was applied to investigate the relationship between reciprocity, maternal sensitivity and infant self-regulation (i.e., variables of Study1) and maternal gaze behaviour during a play interaction with their infants in mothers with and without PND. Having controlled for infant age (Table 6.14), the findings showed that, for the clinical group, there is no significant associations between the variables of Study 1 and maternal gaze behaviour. Only a marginally significant association was found between infant self-regulation and the following types of maternal gaze: 'Following infant's gaze' and 'elsewhere', $r(52) = 39$, $p = .08$ and $r(52) = 41$, $p = .06$, respectively. For the comparison group, a significant positive association was found between mother-infant eye-contact and maternal sensitivity and reciprocity, $r(52) = 49$, $p= .007$ and $r(52) = .45$, $p= .01$, while a weaker relationship was found between 'eye-contact' gaze pattern and infant self-regulation, $r(52) = .32$, $p= .09$.

Table 6.14

Correlations Among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Maternal Patterns of Gaze Between Groups

	Clinical Group			Comparison group		
Maternal codes for gaze behaviour	Reciprocity	Maternal Sensitivity	Infant Self-regulation	Reciprocity	Maternal Sensitivity	Infant Self-regulation
Towards the infant	.009	.06	-.12	.02	.001	.02
Towards the object	-.05	-.09	-.006	-.18	-.18	-.11
Following infant's gaze	.28	.25	.39	.21	.29	.29
Elsewhere	.37	.37	.41	.11	.16	.04
Eye-contact	.12	.19	-.14	**.45****	**.49****	.32

$^{*}p < .05$, $^{**}p < .01$

6.6.4 Mother and Infant NVC Modalities

Finally, partial correlation analysis was run for both the clinical and the comparison group after controlling for infant age among the following variables: *infant positive affect*, *infant's gaze towards the mother*, *maternal no touch behaviour*, *maternal gaze towards the infant* and *infant no touch behaviour*. In both groups, a high association was found between maternal and infant no touch behaviour: $r(52) = .75$, $p= .000$ for the comparison group and $r(52) = .91$, $p= .000$ for the clinical group. No other association among the variables was found in the dyads of the comparison group. On the contrary, additional associations were apparent between maternal and infant NVC behaviours in the clinical group. In particular, infant gaze towards the mother was found to be significantly correlated with infant positive affect, $r(52) = .57$, $p = .006$, while maternal gaze towards the baby was positively associated with infant gaze towards the mother, $r(52) = .42$, $p = .05$ (for further information see Tables 6.15a and 6.15b).

Table 6.15a

Correlations Between Infant Variables (Positive Affect, Gaze Towards the Mother, No Touch Behaviour) and Maternal Variables (Gaze Towards the Infant, No Touch Behaviour) for the Comparison Group

	1	2	3	4	5
Infant Positive Affect	1				
Infant's Gaze towards the Mother	.19	1			
Maternal No Touch	-.08	-.16	1		
Maternal Gaze towards the Infant	-.06	.02	.21	1	
Infant No Touch	.03	.12	**.75****	.11	1

$^{*}p < .05$, $^{**}p < .01$

Table 6.15b

Correlations Between Infant Variables (Positive Affect, Gaze Towards the Mother, No Touch Behaviour) and Maternal Variables (Gaze Towards the Infant, No Touch Behaviour) for the Clinical Group

	1	2	3	4	5
Infant Positive Affect	1				
Infant's Gaze towards the Mother	**.57****	1			
Maternal No Touch	-.85	.02	1		
Maternal Gaze towards the Infant	.20	**.42***	.33	1	
Infant No Touch	.26	-.07	**.91****	.26	1

$^{*}p < .05$, $^{**}p < .01$

6.6.5 Descriptive Analysis of Co-Existing Maternal and Infant NVC Behaviours during Infant Positive Affect

What kind of maternal and infants NVC cues are apparent when infants display positive affect during the interaction with their mothers? To determine the co-occurrence of maternal and infants' NVC cues during a play interaction, an analysis of various NVC qualities that co-exist with infant positive affect was conducted. The aim of this analysis was to illustrate what happens in terms of all the other NVC modalities in both mothers and infants when the infant is happy (Table 6.16). The findings revealed that infants of mothers without PND display more positive affect (12.5% of the time) than infants of mothers with PND (5.3% of the time) in a play session with their mothers.

6.6.5.1 Infant Behaviour during Positive Affect: Comparison Between Groups. In a comparison between infants of mothers with and without PND, infants of mothers without PND showed a more active gaze when they were happy during the interaction with their mothers. In contrast, the infants in the clinical group were looking mainly towards their mothers (56% of the time) when they exhibited positive facial affect. In terms of the infants' touch behaviour in the positive state, infants in the comparison group were more likely to have physical contact with their mothers (67% of the time) when they were happy, than did infants from the clinical group (40% of the time). Finally, in the comparison group, infants' positive affect co-existed with use of a toy for 65% of the time while, in the clinical group, positive affect and use of a toy co-occurred for 37% of the time.

6.6.5.2 Maternal Co-existing Behaviours during Infant Positive Affect: Comparison Between Groups. When the infants were happy, mothers without PND exhibited a positive facial affect 91% of the time, establishing shared pleasure in the interaction with their infants. In contrast, mothers with PND displayed both positive and neutral facial affect when their infants were happy (65% and 35 % of the time, respectively). As happened in infants of mothers without PND, mothers from the comparison group had a more active gaze (i.e., towards the infant 58.2% of the time, towards the object 24.5% of the time and eye-contact 13.5% of the time) than did mothers with PND, who were predominantly looking towards the infant (85% of the time). Regarding the use of a toy and physical contact with the infants, when the infants were happy, mothers from both groups displayed a similar behavioural profile.

Table 6.16

Co-Occurrence of Maternal and Infants' Behaviours during Infants' Positive Facial Affect

	Behaviours	Clinical Group		Healthy Group	
		Mothers	Infants	Mothers	Infants
AFFECT	Positive	65%	100%	91%	100%
	Negative	0%	-	0%	-
	Neutral	35%	-	9 %	-
GAZE	Towards the partner	81%	56%	58.2%	10%
	Towards the object	3.5%	4.5%	24.5%	23%
	Elsewhere	3.5%	16.5%	2.8%	26%
	Eye-contact	9.7%	9.7%	13%	13%
	Towards the mothers' hands	-	13.3%	-	28%
	Following infants' gaze	2.3%	-	1.5%	-
TOUCH	Touch due to position	29%	45%	28%	20%
	Other types of touch	17%	15%	19.5%	13%
	No touch	54%	40%	52.5%	67%
USE OF TOY	No use of toy	20%	63%	21%	35%
	Use of toy	80%	37%	79%	65%

6.6.6 Descriptive Analysis of Co-Existing Maternal and Infants' NVC Behaviours during Infant Negative Affect

What kind of maternal and infants NVC cues are apparent when infants display negative affect during the interaction with their mothers? Having presented the constellation of nonverbal behavioural cues that co-occurred when the infant was happy during a mother-infant interaction for both groups, it was essential to also investigate the infants' and maternal behaviours when the infant displayed negative affect. However, it is worth noting that in both groups negative affect in infants was present only for approximately 2% of the total interval duration. Despite the fact that infant negative affect was mostly absent in the mother-infant interaction for both groups, an analysis was conducted to examine which maternal and infant non-verbal reactions entailed the infant's negative state, as these behaviours can reflect the quality of the mother-infant relationship.

6.6.6.1 Infant Behaviour during Negative Affect: Comparison Between Groups. The infants of mothers with PND were looking mainly towards their mothers' hands when they were upset (66%), while the infants in the comparison group did not have a prevalent visual target during distress. One of the main differences between the two groups consisted of the following observation: when the infants of mothers without PND were upset, they had physical contact with their mothers (92.6% of the time), while the infants of mothers with PND had only limited physical contact with their mothers under this condition (21.5% of the time). Infants from the two groups also differed in their use of a toy when feeling distress: in the comparison group, the use of a toy and infant negative facial affect occurred together for 45.5% of the time, but for infants in the clinical group it was 14.5.% of the time.

6.6.6.2 Maternal Co-Existing Behaviours during Infant Negative Affect: Comparison Between Groups. Regarding maternal non-verbal reactions when their infants were distressed, there were no significant differences in the patterns of maternal gaze and use of a toy between mothers from both groups. However, mothers without PND spent a large portion of the time having physical contact with their babies in a negative state (66.5% of the time), in comparison to mothers from the clinical group, who spent 24% of the time in physical contact with their distressed infants. Noteworthy is that only mothers from the clinical group shared the negative affect state with their infants (5.6% of the time).

Table 6.17

Co-Occurrence of Maternal and Infant Behaviours during Infants' Negative Facial Affect

Behaviours		Clinical Group Mothers	Clinical Group Infants	Healthy Group Mothers	Healthy Group Infants
AFFECT	Positive	82%	-	72.5%	-
	Negative	5.6%	100%	0%	100%
	Neutral	12.4%	-	27.5 %	-
GAZE	Towards the partner	80%	.02%	81%	27%
	Towards the object	17.8%	11%	7.5%	20%
	Elsewhere	2.2%	22.8%	5.7%	20%
	Eye-contact	0%	0%	4.3%	4.3%
	Towards the mothers' hands	-	66%	-	28.3%
	Following infants' gaze	0%	-	1.5%	-
TOUCH	Touch due to position	12%	21.5%	43.5%	73%
	Other types of touch	22%	0%	23%	19.6%
	No touch	76%	78.5%	33.5%	7.4%
USE OF A TOY	No use of a toy	65%	85.5%	56.6%	54.4%
	Use of a toy	35%	14.5%	43.4%	45.5%

6.7 Discussion

The aim of the present study was to explore NVC exchanges during mother-infant play interaction and to assess the impact of PND on the quality of infants' NVC skills. To achieve this goal, a clinical group of mothers with PND and their infants were compared with a comparison group of mothers without PND and their infants. The novel aspect of this study lies in the fact that it focused on a negligible population (Pawlby et al., 2010) – that is, infants and their mothers who suffered from PND severely enough to warrant hospitalisation. To our knowledge, this is the first study focusing on inpatient mothers with PND and their infants in order to provide a detailed examination of the three main modalities (i.e., affect, gaze and touch), which represent three domains of emotional communication – the facial, the attentional and the tactile (Colonnesi et al., 2012) – through the prism of mother-infant reciprocity, maternal sensitivity and infant self-regulation. The findings of this study revealed differences in the non-verbal interactional profiles between dyads of mothers with and without PND and their infants, as well as among infants' NVC skills in the two groups. However, the lack of relevant research on maternal NVC behaviours and NVC skills in infants from 3 to 12 months of age in an inpatient population hinders our ability to draw direct comparisons with findings from previous studies. Still, it will be beneficial to place the present study's findings within the current literature and to highlight its contribution – that is, results emerging from a fine-grain micro-analysis of bidirectional NVC between inpatient mothers with PND and their infants

6.7.1 Facial Affect

Our findings about maternal facial affect are in line with the existing literature suggesting that mothers without PND exhibited significantly more positive affect than mothers with PND during a play interaction with their infants (e.g., Stern, 1994; Murray et al., 1996; Frizzo & Piccinini, 2005; Schwengber & Piccinini, 2003). A plausible explanation for these findings may be that PND by definition has great impact on maternal facial affect, given that one of the main symptoms of this disorder is sadness (APA, 2013). However, while previous studies reported that mothers with PND exhibited mainly negative affect during their interaction with their babies (Stein et al., 2010; Flykt et al., 2010; Field, 1995), the present study found that the predominant maternal affect state in the clinical group was neutral. This lack of negativity could be attributed to the fact that mothers with PND were aware of the video-recording process and may have experienced the concomitant stress of being observed in a clinical setting (Pawlby et al., 2010). Yet, given that maternal facial affect is one of the first and most salient means of emotional expression and communication in mother-infant interaction, which enhances their attachment and influences infant development (Puura et al., 2019; Fredrickson, 2004; Ramsey & Gentzler, 2015; Aktar et al. 2017; Feldman, 2007; Lecleere et al., 2014; Bouvis et al., 2018), even the neutral affect characterising mothers in the clinical group can present a negative impact.

Concerning the facial affect of the infants in the two groups, while there existed a clear trend in infants of mothers without PND to be more positive than infants in the clinical group, this difference between groups was not of statistical significance. An interpretation of these findings may be the following: a body of research has shown that infants of mothers with PND are influenced by their mothers' affect and present similar profiles by sharing negative affect (Mantymaa et al., 2008). In the current study, even though evidence of shared negative affect was found only in the clinical group (5.6% of the time), mothers with PND, as described above, were predominantly neutral in the play interaction with their infants. This could result in a lack of negative facial affect in their infants, which in turn decreased the difference in infant facial affect between the two groups (for an additional interpretation, see Chapter 4, Section 4.9.1). The current interpretation can also be supported by the finding that there existed an association between infants' and mothers' neutral affect in the clinical group. This concurs with the existing literature demonstrating that the infants of mothers with PND tend to mimic maternal interactive behaviours (Flykt et al., 2010; Field, 1995).

In further support of this notion, the findings indicated that infants of mothers with PND seemed to be more vulnerable to maternal facial affect. In particular, in the clinical group, infants' positive affect was associated with maternal positive affect, whereas this association was not found in the comparison group. This may lead to the assumption that infants of mothers with PND perceived the maternal positive affect as novel, which then had a direct impact on their affect. A study on 3-month-old infants conducted by Hernandez-Reif and colleagues (2006c) demonstrated that infants of mothers with PND are more habituated to sad rather than happy faces, highlighting that sad maternal facial affect during the mother-infant interaction is predominant in the case of PND.

The lack of a respective association between maternal positive affect in mothers without PND and their infants within the context of this study may be explained by the fact that, according to the literature, in the interaction of mothers without PND and their infants maternal positive affect predominates, while their interaction is also characterised by shared pleasure, with well-coordinated cycles of matches and mismatches (Puura et al., 2019; Tronick & Weinberg, 1997). The findings of the present study – that is, when the participant infants displayed positive affect, the mothers without PND shared that positive affect for 91% of the time, whereas mothers with PND did so for only 65% of the time – resonate with the above argument. The importance of shared pleasure during the mother-infant interaction in infants' emotional, social and cognitive development is well-established (Mantymaa et al., 2015; Fredrickson, 2004; Ramsey & Gentzler, 2015). For example, Mantymaa and colleagues (2015), using a sample of 58 mothers and their 2-month-old infants, found that a longer mean duration of shared pleasure (i.e., shared positive affect) between mother and infant is associated with fewer internalising and externalising problems in children at the age of 2. The same study also supported that shared pleasure could buffer the negative impact of maternal mental health issues on child development and is linked to the child's resilience.

An interpretation of this divergence in the duration of shared pleasure between mothers with and without PND and their infants may be based on the differences at the level of perception between mothers with and without PND (Murray et al., 1996). Specifically, one may attribute the difficulty of mothers with PND in producing reciprocal positive interaction with their infants to the fact that they display a distorted interpretation of infant facial expressions (Stein et al., 2010). In particular, mothers with PND perceive infants' happy faces as neutral and infants' neutral faces as sad (Gur et al., 1992). This appraisal bias can generate a negative interactive cycle between the mother and her infant, which prevents the exchange of positive affect. Taking into account that for the clinical group our findings revealed a positive association of maternal positive affect with infant self-regulation, the above-mentioned negative interactive cycle can pose an increased risk of poor developmental outcomes to the infants of mothers with PND (for information about the importance of self-regulation in infant development, see Chapter 4, Section 4.4).

Moreover, there exists general agreement among researchers indicating the catalytic role of the mother in the infant's emotional well-being (Gillibrand et al., 2011); this is also supported by our findings, which showed that infant positive affect was associated with reciprocity and maternal sensitivity in both groups. However, the present study was the first to demonstrate that infant positive affect is linked to different modalities of communication between groups. Specifically, in the comparison group, infant positive affect was linked to infant physical contact with the mother, which affirms proximity and comfort (Ciaunica & Fotopoulou, 2017). In contrast, in the clinical group, infant positive affect was associated with infant gaze towards the mother. There is evidence that 'infant production of facial expressions during gaze to the mother is an index of directed and oriented communication of positive affective state' (Colonnesi et al., 2012, p. 175). In the context of PND, an interpretation of these results may posit that infants of mothers with PND undertook a more active role in their interaction, using positive facial affect while looking at the mother, as an attempt to elicit a similar reaction from their mothers. This is in line with the argument that, in the SF paradigm, infants use their NVC skills as an interactional regulatory tool to re-engage their mothers and revive their communication (Bouvris et al., 2018). The following section will examine the importance of the gaze in mother-infant interaction.

6.7.2 Gaze

While many studies have assessed gaze behaviours using a 'gaze on and off' approach (e.g., Colonnesi et al., 2012; Beebe & Steele, 2013; Væver et al., 2015), the present study investigated a range of different types of gazes, along with their duration, in both mothers and infants, so as to convey a better understanding of this central modality of communication in mothers with PND and their infants. In terms of the infant gaze, the findings demonstrated that there are no statistically significant differences between the two groups. However, there exists a clear trend in infants in the two groups, as they follow different gaze patterns when interacting with their mothers, with infants in the comparison group seeming to have a more active gaze in a positive affect state than do infants of the clinical group. This coincides with a recent study conducted by Væver et al. (2015); assessing infants' gaze behaviour in dyads of 27 mothers with PND and 49 mothers without PND, Væver and colleagues found no difference in the gaze duration between the two groups. However, the same study reported differences in infants' gaze patterns, with infants of PND mothers exhibiting reduced gaze activity. Even though the study by Væver and colleagues (2015) did not use a group of mothers with clinical PND, the interpretation of their findings – namely, that infants of mothers with PND may adopt the depressive patterns of interaction of their mothers (Field et al., 1988) – could also apply to the present research.

According to our findings, the main tendency in the gaze direction of infants in the clinical group was to look at their mothers' face. While great controversy exists among the authors of the existing literature regarding the infant gaze in the case of PND (e.g., Egmose et al., 2021; Field et al., 2009; Væver et al., 2015; Striano et al., 2002), the present findings fall in line with studies suggesting that infants of mothers with PND look more at their mothers' faces (Beebe et al., 2008) and show less gaze aversion (Field, 1981). As plausible explanation, mothers with PND may be less active in the interaction with their infants and, consequently, infants feel less of a need to avert their gaze to process information (Field, 1981).

Participant infants of mothers without PND exhibited a clear trend to direct their gaze more towards objects. According to the literature, while neonates show a preference for the maternal face (Field et al., 2009; Hayes & Watson, 1981), this preference varies considerably with age (Robledo et al., 2010), as infants gradually show an increased curiosity about their surroundings and willingness to explore objects (Nomikou et al., 2016). In line with our findings, Gredeback and colleagues (2010), using a video-based micro-behavioural analysis of mother-infant play interaction, indicated that 3- to 11-month-old infants strongly preferred looking at their mothers who manipulate objects, rather than watching their mother's face or a static object. However, the lack of respective findings in the present study's clinical group may underscore a potential deficit in explorational skills in infants of mothers with PND, accompanied by restricted gaze behaviour.

Infants in the comparison group also tended to sustain more eye-contact with their mothers than did infants from the clinical group. The mutual gaze is a fundamental element of face-to-face interaction, which can also predict the quality of mother-infant interaction (Britton et al., 2001), reinforce infants' positive affect (Hains & Muir, 1996) and enhance their attention control (Niedzwiecka et al., 2018). The findings of this study reasserted this notion, given that an association was found among eye-contact, reciprocity and maternal sensitivity in the comparison group, which reflects the quality of the mother-infant interaction. There also exists evidence that the mutual gaze between the mother and her infant contributes to the infant's subsequent socio-emotional and cognitive development (Væver et al., 2015; Astor et al., 2020; Zukow-Goldring & Arbib, 2007; Field, 1981). As a consequence, the more limited eye-contact in the clinical group could pose to the infants an increased risk for developmental disadvantages.

Furthermore, the findings also showed that infants in the comparison group had better self-regulatory skills than did those in the clinical group; only in the comparison group was there a negative association between infant self-regulation and infants' gaze aversion (i.e., elsewhere). Specifically, gaze aversion is a well-known effective self-regulatory skill that infants use to achieve self-comfort and reduce their arousal (Stern, 1974). The deficits in self-regulatory skills in infants from the clinical group may have detrimental effects on their development (on the importance of self-regulation in infant development, see Chapter 4, Section 4.4).

In terms of maternal gaze patterns, mothers without PND looked significantly more towards objects than did mothers from the clinical group. This finding is in line with previous conceptualisations, according to which the maternal gaze changes according to the infants' age, since the mother adapts to the infants' stage in social development (De Pascalis, 2017). Towards the end of the first half year of life, the maternal gaze and actions are structured so as to meet the infants' curiosity about the external world and, thereby, increase infants' exploration opportunities (Gredeback et al., 2010). However, when interacting with their infants, mothers in the clinical group were found to look significantly more elsewhere than did mothers without PND. This is quite important, given that a study conducted by Beebe & Steele (2013) demonstrated that extensive gazing away in mothers reflected maternal discomfort and dissociation, as well as a disturbance in maternal sensitivity. These mothers were also more likely to have disorganised infants (Main et al., 2008). Thus, maternal gazing away in the clinical group can have a significant impact on infants' emotional and social well-being.

6.7.3 Touch

Although the importance of touch in mother-infant interaction and infant development is well-demonstrated (Serra et al., 2020), the touching behaviour of mothers with severe depressive symptoms remains neglected and understudied (Mantis et al., 2019). Another omission in the respective literature consists of the fact that, of the few studies examining the association between PND and touching behaviours, the focus has mainly been on negative patterns of maternal touch; however, the range of different types of touch that occurs in mother-infant interaction has yet to be investigated in depth when it comes to the vulnerable at-risk population of PND mothers and their infants (Mantis et al., 2019). The present study has aimed to address this gap by investigating different maternal touch patterns in mothers with severe PND.

The findings of the present study revealed that, in a comparison between groups, a playful touch pattern was predominantly apparent in mothers of the comparison group. These results correspond to those of a previous study conducted by Mantis and colleagues (2019), which features a methodological design different from the one employed in the current study. Specifically, Mantis et al. (2019) used the SF+T condition to assess tactile behaviours in 41 mothers with higher and lower depressive symptomatology when interacting with their 4-month-old infants. The results revealed that mothers with higher levels of PND symptoms spent significantly less time with their infants and engaged in fewer playful/stimulating touch patterns with them, when compared to mothers with lower levels of PND symptoms. However, mothers with lower levels of PND symptoms were quite playful and stimulating in terms of their touch behaviours towards their infants during interactions (Mantis et al., 2019). Given that playful touch by mothers has been found to reinforce infants' social skills and the quality of mother-infant interaction (Lowe et al., 2016; Egmose et al., 2018; Moreno et al., 2006; Peláez-Nogueras et al., 1997), the low rate in playful touch behaviour among mothers with severe PND in our sample poses a potential risk of adverse developmental outcomes for the infants.

In addition, this study's findings revealed that there were no significant differences in the maternal tactile behaviours between the two groups, apart from the playful touch pattern.

These results are similar to those of the study by Lundy and colleagues' (1996), which found no differences in maternal touching behaviours when comparing mothers with and without PND during an interaction with their infants (Lundy et al., 1996). It is also worth mentioning that no rough touch behaviour was observed in either group. In contrast to the previous research suggesting the predominant presence of intrusive or withdrawal touching behaviours in mothers with PND during the interaction with their infants (Ferber et al., 2008; Field, 2010), this study indicated that mothers with PND can also effectively use positive touch patterns. Positive touch behaviours are associated with maternal sensitivity and, consequently, the level of synchrony in the mother-infant interaction (Botero et al., 2020). This echoes the present study's findings that, in the clinical group, maternal affectionate touch (a positive touch pattern) was linked to maternal sensitivity and reciprocity between the mother and her infant. Considering the important role of maternal touch in infant development, these results are quite encouraging and give further support to the need to integrate touch behaviour in the existing interventions, as a significant means of emotional communication between mothers with PND and their infants, so as to enhance the quality of their interaction and positively influence infant development.

Moreover, in the comparison group, maternal affectionate touch was negatively associated with infant self-regulation. A plausible explanation may be that mothers without PND used more affectionate touch to calm the infant when the infant was already distressed. According to the literature, the main function of affectionate touch pattern is to reinforce infants' relaxation and reduce infants' negative affect (Lowe et al., 2016; Egmose et al., 2018; Arnold, 2002; Moreno et al., 2006; Peláez-Nogueras et al., 1997). The co-existence of maternal affectionate touch and infant distress may result in these findings; however, further research is needed to clarify the quality of this association. Yet, in the clinical group maternal touch with the infants due to position was negatively linked to infant self-regulation. There exists evidence that mothers with PND use restricted positions when interacting with their infants, which can increase infants' distress; for instance, Herrera and colleagues (2004) found that mothers with PND tended to restrain their infants' behaviour by lifting them more during their interaction than did mothers without PND.

Concerning infant touching behaviours, research on infant touch to date has been quite sparse (Crucianelli et al., 2019; Mercuri, 2017; Beebe & Steele, 2013), while the majority of research-studies adopted a unidirectional perspective, investigating exclusively either maternal or infant touch (Mantis et al., 2014). Another gap one may identify in the relevant literature is the following: while touch constitutes a multi-dimensional phenomenon containing various sub-categories, infant touch has been approached mainly through the prism of self-touch rather than infant touch towards the mother (Crunianelli et al., 2019). The present study aimed to cover the above-mentioned gaps by exploring a range of different tactile patterns in both mothers and infants, as they can be observed concurrently during the same interaction. The findings demonstrated that, even though infants in the comparison group tended to exhibit more touching behaviours towards their mothers, there was no statistically significant difference between the two groups. However, these findings deserve further investigation in order to clarify whether this trend in the comparison group may become significant in the case of a larger sample. Last but not least, this study found that no touch behaviour in infants was associated with no touch behaviour in mothers in both groups. This is in line with the findings of a current study that focused on touch behaviours between healthy mothers and their infants; it revealed that infants physically react to their mothers' inadequate tactile response by decreasing proximity along with affectionate touch behaviour towards their mothers (Crucianelli et al., 2019). Our study takes these findings a step further, by suggesting that maternal and infants' tactile behaviours are interconnected and interdependent in both clinical and healthy populations.

6.8 Conclusion

The current study expands knowledge about the NVC that occurs between mothers with severe PND and their infants, in contrast to the majority of research-studies in this field, which focuses on non-clinically depressed mothers (Feldman et al., 2004). In particular, the detailed examination of emerging NVC skills in the infants of inpatient mothers who suffer from PND at a micro-analytic level, as well as the adaption of a bidirectional approach including maternal behaviours when examining infants' NVC developmental skills, constitute fairly novel aspects. The core findings suggested that (1) the occurrence of PND in mothers appeared to be markedly associated with some deficits in mother-infant interaction and, therefore, in infants' NVC skills, and (2) maternal and infants' NVC behaviours were inextricably linked and interdependent in dyads of infants and mothers with as well as without PND.

Specifically, infants of mothers with PND seemed to exhibit a less active gaze, fewer touching behaviours and more neutral affect when compared to infants of mothers without PND; however, not all these differences were statistically significant. Similarly, mothers with PND exhibited more neutral affect, gaze 'elsewhere' and less playful touch in comparison to mothers without PND; for their infants, the accumulation of these deficits can pose an increased risk of adverse developmental trajectories (Koulomzin et al., 2002; Field et al., 2009; Tronick & Weinberg, 1997; Colegrove & Havighurst, 2017). However, both mothers with and without PND showed several similar patterns of NVC behaviours, such as lack of negativity in the NVC with their infants.

Overall, the present research findings contribute to the existing literature by providing evidence concerning both strengths and difficulties in the NVC behaviours of inpatient mothers with PND and their infants. Hence, the results pave the way for future research on how to improve difficulties and promote strengths, aiming at a reduction of the adverse effect of PND on mother-infant relationship and infant development, so as to promote a better quality of life for this population. For instance, there exists a growing focus on touch interventions in the postnatal period, such as skin-to skin contact, Kangaroo Care and gentle touch intervention; these have proven remarkably effective and associated with short- and long-term improvements in both maternal well-being and infant outcomes (Kida & Shinohara, 2014; Feldman et al., 2014). Our data strongly support these efforts, while suggesting the inclusion of other modalities in future interventions, such as gaze and affect, as integral and interdependent elements of mother-infant interaction and well-being.

Overall, the small sample size of the present study limits the generalisability of the results, but the latter represent areas upon which future research can expand. However, an enhanced understanding of the impact of PND on NVC in samples of infants at risk for poor developmental outcomes, which this study attempted to provide, is of pivotal importance for thinking about how best to promote child well-being and plan interventions.

Chapter 7: Mother-Infant Play Interaction

7.1 Introduction

This chapter will examine the importance of play in infant development and well-being, as well as the role of the mother in the quality of this activity. The impact of PND on play interaction and, consequently, infant development will also be discussed, by providing scientific evidence based on sound research. The second part of this chapter describes Study 4, which investigated the effect of PND on the mother-infant play interaction and on infants' verbal and nonverbal communication skills. Furthermore, the methodology underlying the present study will receive discussion, while the last section integrates the main findings derived from this research-study into the existing literature.

7.1.1 Defining Play

While play is a ubiquitous activity during early life, it remains a challenge among theorists and researchers to produce a unifying and universal definition (Rayment, 2013; Neale et al., 2018; Tamis-LeMonda et al., 2002; Sutton-Smith, 2001). This challenge can be attributed to the multidimensional nature of play: it includes many forms, types and contexts, as well as numerous classifications based on different theoretical approaches (Slater & Lewis, 2007). For instance, considering the substantial changes in play behaviour across the life-span (Power, 1999), a classification has been created according to the child's different developmental stages. Such a taxonomy was proposed by the developmental psychologist Jean Piaget (1962), who distinguished types of play into sensorimotor play (0-2 years), symbolic play (2-5 years) and games with rules (7+ years), with each category reflecting a different cognitive developmental stage in childhood. Another classification of mother-infant play may be called dyadic (or interpersonal) versus extradyadic (or object-focused) forms of play (e.g., Tamis-LeMonda et al., 2002; Bornstein & Tamis-LeMonda, 1990).

Therefore, a number of definitions of play has emerged (Rayment, 2013). For example, according to Stern, the mother-infant play interaction is defined as a process during which the mother-infant dyad has no other goal than to 'have fun, interest and delight and be with one another' (Stern, 2009, p. 91). Along the same lines, Ginsburg suggested that 'play is a simply joy that is a cherished part of childhood' (Ginsburg, 2007, p. 183). Another definition of play (Kransor & Pepler, 1980) proposed that it includes flexible and fun activities done voluntarily and not to achieve anything, with children being reasonably free to do whatever they wish. Tamis-LeMonda and colleagues expanded the definition of play further, suggesting that the main characteristics of play in parent-child interaction include …

> … engaging in play for its own sake, its seemingly intrinsic motivation, and its accompaniment by positive affect; the nonliteral quality of play, its pretense, creative, and fantasy aspects; and the repetitive, assimilatory character of play, its direction toward a free refiguration of what is known rather than toward new understanding. […] Thus, play is not to be identified with a specific set of activities, but includes any activity that is meaningfully linked with this constellation of defining characteristics (Tamis-LeMonda et al., 2002, p. 222).

Despite the numerous definitions of play available in literature, there exists consensus among theorists and researchers that play is very much linked to infant development, contributing to the optimal development of social and cognitive skills and emotional well-being (e.g., Neale et al., 2018; St. George et al., 2016; Fung & Cheng, 2017; Tamis-LeMonda et al., 2002;

Ginsburg, 2007). There is also a body of research supporting the positive association between play and language development (e.g., Bigelow et al., 2004; Lewis et al., 2000; Orr, 2021; Quinn et al., 2018). For example, in a recent meta-analysis which included a cohort of 6,848 children between 1 and 6 years of age, Quinn and colleagues (2018) found a significant association between language acquisition and symbolic play. Overall, the beneficial role of play in child holistic development is well-documented (Neale et al., 2018), and it is also supported by an accumulation of various theoretical frameworks. The following section will present several of the main theories concerning the importance of play in child development.

7.1.2 Theoretical Background of Play

The importance of play in child development and learning has been investigated over the decades through the work of key 'play pioneers' such as Friedrich Froebel (1782-1852) and Maria Montessori (1870-1952), who still influence Early Years Education (El Gemayel, 2020). Research on this topic remains ongoing and flourishes, thanks to various research capacities that new technology offers (i.e., video-recordings of mother-infant play interaction). According to Froebel, play leads children to the highest forms of learning (Bruce, 2012). Play, in Froebel's view, cultivates the children's inner world through connections to external stimuli, encouraging creativity, imagination, experiment and problem-solving as they grow up (Read, 2006). Therefore, children learn to reflect, innovate and think abstractly through play, so that they gradually become competent symbol-users and -makers (Bruce, 2012). Likewise, Winnicott (1971) suggested that, during play, the child is free to be creative and has the unique opportunity to use its whole personality, which in turn contributes to the child's emotional expressiveness and self-awareness.

The current literature on the role of play in child development resonates with Froebelian theory; there exists general agreement that for child development play is as vital as eating and sleeping (Hindle & Smith, 1999). According to Winnicott (1971), 'it is play that is the universal and that belongs to health: playing facilitates growth and therefore health; playing leads into group relationships; playing can be a form of communication' (Winnicott, 1971, p. 56). Through play with the mother, the child formulates a relationship with the external world (Gillibrand et al., 2011). Froebel suggested that, since the mother is the link between the child, the community and the wider word, she should encourage play, offering both freedom and guidance, and enjoy this creative and productive play interaction that benefits the child holistically (Bruce, 2011).

The above-mentioned Froebelian approach regarding the importance of the maternal role in the child's play experiences corresponds to what the psychologist Lev Vygotsky (1896-1934) described as the 'zone of proximal development' (ZPD). The ZPD refers to the knowledge that children acquire during play when having the support of a more sophisticated partner, such as the mother (Vygotsky, 1978). ZPD is defined as 'the distance between the actual development level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers' (Vygotsky, 1978, p.85-86). In line with Froebel, Vygotsky (1978), highlighting the social dimension of play, argued that only through maternal (or other adults') scaffolding children could reach their full potential and advance within the ZPD. This underscores the catalytic role of the mother in one of the primary Froebelian values underpinning the right of every child to achieve their potential (Tovey, 2016). Specifically, maternal scaffolding is pervasive already from birth, aiming to transform infancy into a period of play that allows for infants' exploration and experimentation (Rochat, 2009).

Parallel to maternal scaffolding in infants' play, evidence shows that sensorimotor and cognitive developmental skills are also tightly interwoven with the level of play in infancy, as they both contribute to and are fostered by play activity (Bergen, 2019; Neale et al., 2018).

According to Piaget's Cognitive Theory (1952), sensorimotor play encompasses the first two years of life and is instrumental in enhancing higher levels of both cognitive development and play (Bergen, 2019). This developmental stage reflects the infants' tension to initially explore the external world via action and then to gradually become able to use symbolic representations (Keenan et al., 2016). Infants' engagement with play objects during this stage constitutes a platform of world discovery, communication with others and expression of themselves (Gillibrand et al., 2011). Piaget (1952) argued that the sensorimotor stage of development consists of six sub-categories related to infants' behaviour during an object-play activity (Keenan et al., 2016). The six sub-categories, along with the significant accomplishments and limitations in the infants' sensorimotor play characterising each sub-stage, are presented in Table 7.1.

Table 7.1

Piaget's 6 Sub-stages of Sensorimotor Development (adapted from Keenan et al., 2016, p. 171, and Feldman, 2009, p. 144)

Sub-stage	Significant Accomplishments & Limitations	Age	Example
Reflexive schemes	Infants gain control over and practice reflex behaviours	0 to 1 months	The sucking reflex causes the infant to suck at anything placed in its lips
Primary Circular Reactions	Infants repeat chance behaviours that leads to satisfying results, and show a limited ability to anticipate events	1 to 4 months	An infant might combine grasping an object within sucking on it, or staring at something with touching it

Secondary Circular Reactions	Infants can combine single schemes into larger structures. However, this behaviour is not goal-directed	4 to 8 months	A child who repeatedly picks up a rattle in her crib and shakes it in different ways to see how the sound changes is demonstrating her ability to modify her cognitive scheme about shaking rattles
Coordination of Secondary Circular Reactions	Secondary circular reactions are combined into new actions, and become intentional	8 to 12 months	An infant will push one toy out of the way to reach another toy that is lying, partially exposed, under it
Tertiary Circular Reactions	Infants begin to repeat actions and vary them in a deliberately exploratory manner and develop object performance	12 to 18 months	A child will drop a toy repeatedly, varying the position from which he drops it, carefully observing each time to see where it fails
The Invention of New Means through Mental Combinations	Onset of the child's ability to think symbolically and mentally represent reality. Also heralds the beginning of pretend play	18 to 24 months	Children can even plot in their heads unseen trajectories of objects, so that if a ball rolls under a piece of furniture, they can figure out where it is likely to emerge on the other side

Both the sociocultural theory of play (Froebel and Vygotsky) and its developmental counterpart (Piaget and Winnicott), as presented above, converge, albeit through different pathways, in the idea that play has a great impact on child development and psychological wellness (Tambelli et al., 2015). In addition, these theories highlight the close-knit mother-infant relationship, as it can be forged through play interaction, and argue for the maternal role's importance for child development by using playful and stimulating activities. The following sections will explore in greater detail the distinctive characteristics of play during infancy and also discuss the maternal contribution to the quality of this activity.

7.1.3 Play in Infancy

While there exists an extensive and diverse literature on play and child development, relatively limited research has been conducted on children under 2 (Rayment, 2013). This is quite surprising given that object exploration behaviours related to play activity across infancy are of pivotal importance for infant development, as they enhance infants' cognitive, socio-emotional, language and perceptual motor skills (Lobo et al., 2014, 2013; Barsalou, 2008). Already at the age of 3 months, young infants are active partners in a play interaction with their mothers (Abels et al., 2017), while by the age of 6 months, the infants have turned into intense, variable and sophisticated explorers during play (Lobo et al., 2014). In particular, the infants' ability to manipulate objects in play is present very soon after birth and undergoes a significant transition in the first year of life, influenced by distinct developmental trajectories (Lobo et al., 2014; Lobo & Galloway, 2013b; Molina & Jouen, 2004; Rochat, 1987; Bigelow et al., 2004).

At around 3 months, infants perform similar motor actions with all objects in play, such as mouthing, shaking, banging, fingering and palpation, in an attempt to extract information about the perceivable qualities of the objects (Neale et al., 2018; Bergen, 2019; Lobo et al., 2014; Bigelow et al., 2004). These motor activities and exploratory abilities characterising the infant play experience increase through 5 months (Lobo et al., 2014) and are related to infant development (Fagan & Iverson, 2007; Bergen, 2019). For example, a study conducted by Fagan and Iverson (2007) found that mouthing in 6- to 9-month-old infants during play with their mothers contributes not only to the discovery of object properties, but also to the discovery of infants' vocalisations and consonant properties, which are linked to infant language development.

As infants' sensorimotor and cognitive skills continue to increase (Bergen, 2019), these developmental changes are apparent in the way in which the infants engage with objects during play (Markova, 2018; Oyserman et al., 2000). According to studies of object play development, infants progress from simple undifferentiated object manipulation to more complex and higher levels of activity with play objects, performing a greater variety of fine motor behaviours during the second half of the first year (Bigelow et al., 2004; Lobo et al., 2014). This transition to non-symbolic play towards the end of the first year is characterised by infants' active attempts to explore the unique functions of play objects through appropriate yet concrete manners (Tamis-LeMonda et al., 2002). During this period, infants' play interaction transforms into a triadic affair that includes mother, infant and object (Stern, 2009); the play activity is now organised around the use of objects, with the mother being in the wings of the infant's attention (Stern, 2009), allowing infants to use new combinations of behaviour with objects and rendering them competent explorers (Rochat, 2009; Tamis-LeMonda et al., 2001). Yet, the maternal role remains of significant importance for demonstrating the functional aspects of objects to their infants (Tamis-LeMonda et al., 2002) and, therefore, helping them become intentional in their play with objects (Bigelow et al., 2004). The following section will look more closely at the crucial role of mothers in infant play.

7.1.4 The Maternal Role in Infants' Play

Research on infants' play provides overwhelming evidence of the catalytic role of the mother in modelling and promoting infants' skills through play activities (e.g., Tamis-LeMonda et al., 2001; Neale et al., 2018; Valentino et al., 2011; Bernier et al., 2016). During play, the mothers respond to infants' exploratory engagements, encourage their actions and engage them in turn-taking activities in order to foster autonomous development in their infants (e.g., Tamis-LeMonda et al., 2001; Neale et al., 2018). This is reflected in a study conducted by Bigelow and colleagues (2004) on 30 1-year old infants and their mothers. In a comparison between the quality of infants' play with their mothers and when alone, the findings indicated that infants displayed a more advanced, functional and appropriate relational play when playing with their mothers than when they played alone; when they played alone, the infants' play was mainly characterised by stereotypical qualities. This is in accordance with a body of prior research supporting that infants' play is more mature when playing with their mothers rather than when alone (e.g., Bornstein et al., 1996; Beizer & Howes, 1992; Fiese, 1990).

Nevertheless, it is not the maternal presence per se or her engagement with objects, but the maternal responsiveness and sensitivity that lead infants to advanced play and, consequently, contribute to their optimal developmental outcomes (Bigelow et al., 2004; Mermelshtine & Barnes, 2016; Loureiro et al., 2016; Sliwerski et al., 2020; Tamis-LeMonda et al., 2001). In support of this notion, Tamis-LeMonda and colleagues (2001) found that infants whose mothers showed responsiveness to their play activities achieved language milestones earlier than infants of less responsive mothers. Likewise, Mermelshtine and Barnes (2016) revealed that the appropriate and contingent maternal responses to their 10-month-old infants during play positively predicted higher cognitive skills in infants, such as problem-solving, knowledge and memory at the age of 18 months. This effect remained the same after controlling for other factors, such as maternal education, home adversity and the infant's advanced object play.

In a similar vein, a recent naturalistic study that repeatedly measured 390 unique play interactions of 49 mother-infant dyads found that maternal sensitivity during play not only contributed to infants' greater engagement, but also to mothers' more positive and vigorous feelings after completing the play interaction (Goldwater-Adler et al., 2018). This is of fundamental importance, given the great impact of maternal affect on infants' emotional development (for further information, see Chapter 6, Section 6.2.2), highlighting that an effective and synchronous play interaction between mother and infant can be beneficial for both partners' well-being. Furthermore, the interplay between mother-infant synchrony and infants' play has been documented by systematic reviews (Provenzi et al., 2018; Leclere et al., 2014), showing that the quality of mother-infant synchrony can predict the infant's symbolic play, while higher synchrony is linked to the infant's more positive emotionality during play and more play activities with the mother (Provenzi et al., 2018).

In yet another systematic review regarding the quality of the mother-infant interaction (Sliwerski et al., 2020), the attachment style was found to have great impact on the quality of and the time devoted to play, with insecure dyads displaying deficits in their play interaction. According to the literature, secure mother-infant dyads display more positive and longer duration of engagement matches in play activities, as well as greater involvement in play with an object, when compared to insecurely attached dyads (Crugnola et al., 2013; Evans & Porter, 2009; Main, 1983; Rayment, 2013). In particular, secure (versus insecure) infants tend to exhibit more playful behaviours, longer attention spans and more spontaneous pleasure in their play with an object (Main, 1983). Yet, securely attached mothers appear to be more engaged in play with their infants and more encouraging about their infants' activity, providing a better scaffolding function, in comparison to insecurely attached mothers (Crugnola et al., 2013).

Overall, maternal sensitivity and responsiveness are key elements that define the quality of infants' play, while the kind of mother-infant attachment is fundamental to the nature of the play experience that they share:

> A secure attachment to a parent or other primary carer gives children a 'safe haven' from which to explore the world, to play, to learn and to retreat to when they need comfort and help. When parents respond to their children's cues during play, for example, when they react to signs of boredom or overstimulation, they help to teach their children to manage their feelings and soothe themselves (Rayment, 2013, p. 18).

However, PND is associated with deficits in maternal ability to respond sensitively and contingently to infants' cues, as well as to form a secure attachment with the infant (for further information, see Chapter 4, Sections 4.2 and 4.3). Hence, the presence of this psychopathology can significantly affect the quality of mother-infant play interaction and infants' play experience in a negative way. The following section will discuss how PND affects mother-infant play and, consequently, can compromise the infants' developmental skills linked to this play interaction.

7.2 Play in PND

7.2.1 Mothers with PND during Play with Their Infants

A substantial body of research indicates that mothers with PND (versus mothers without PND) engaged significantly less in play and enrichment activities with their infants (e.g., Paulson et al., 2006; Lovejoy et al., 2000). The disturbances that PND caused in the quality of the play interaction appear to be universal, affecting mother-infant dyads across different cultures and socio-economic status groups (Field, 2010). During the play interaction, mothers with PND are less responsive to their infants' signals (Humphreys et al., 2018; Field, 2010; Muzik et al., 2017) and less sensitive to their object-directed actions, such as grasping and touching (Meins et al., 2001). When playing with their infants, mothers with PND also display less positive affect (Muzik et al., 2017; Field, 2010; Campbell et al., 1995; Lovejoy et al., 2000) and fewer positive behaviours such as smiling and/or imitation (Livelli et al, 2006), speak less to the infant (Cornish et al., 2008; Rowe et al., 2005) and use less affect-salient speech than do mothers without PND (Herrera et al., 2004).

Another distinctive characteristic of maternal behaviour during mother-infant play interaction among mothers with PND is intrusiveness (Cornish et al., 2008; Oyserman et al., 2000; Reissland et al., 2005; Lovejoy et al., 2000). Indicatively, in a meta-analysis of 46 observational studies on the early play interactions of PND mothers and their infants, mothers who suffered from PND during the first 3 months of the infant's life were less likely to be involved in play activities, and during play they seemed to be more irritable, hostile and disengaged, as well as less positive than mothers without PND (Lovejoy et al., 2000). This corresponds to the findings of the study by Reissland and colleagues (2005), which assessed the association between maternal mood state and mothers' play interaction with their infants while using a soft toy. A sample of 15 mothers with and 15 mothers without self-reported PND took part, along with their infants (mean age: 6.7 months). The findings revealed that mothers with PND were more likely to poke rather than nestle with the toy, provoking more negative reactions from the infants during this play encounter, when compared to dyads of infant-mother without PND. Given that no mother in this sample was clinically diagnosed with PND, the results highlight that even mild PND may affect the quality of mother-infant play interaction and, consequently, infants' play experience and well-being.

Yet, there is a dearth of knowledge regarding mothers with clinically diagnosed PND and their play capacities in the interaction with their infants. Indicatively, Hipwell and colleagues (2000), over the first year of the infants' life, followed up on a case group of 25 mothers with severe PND, who had been admitted to a psychiatric ward jointly with their infants, and 16 pairs of infant and mother with PND from a community sample. The results of the comparison suggested that severe PND had an ongoing effect on the quality of mother-infant play interaction; mothers from the case group were found to be less sensitive, less appropriate and less positive in their play with their infants, performing impaired rather than mutually satisfying play. Similarly, Schacht and colleagues (2017) found that mothers who had been hospitalised for severe PND used significantly less appropriate and more non-attuned comments during the play interaction with their infants than psychologically well mothers.

These deficits in their play interaction can have detrimental effect on infant development, given that non-attuned mind-related comments are negatively linked to a child's early language development and symbolic play (Meins et al., 2013). The following sub-section will further elaborate on the impact of PND on infants' play experience and the respective developmental outcomes.

7.2.2. Infants' Play Interaction with Their PND Mothers

A wealth of evidence indicates that infants' interaction patterns during play with their mothers differ in the case of PND (e.g., Lovejoy et al., 2000; Tronick & Reck, 2009; Cornish et al., 2008). Overall, infants of mothers with PND are less likely to engage in play activities with their mothers (Lovejoy et al., 2000), while during play they show decreased interest in objects (Tronick & Reck, 2009; Cornish et al., 2008). They also seem to be less curious and focused on their play activity (Edhborg et al., 2001), show less sociability to a stranger during playtime (Kenny et al., 2013) and be more vulnerable and less involved in exploratory play than infants of mothers without PND (Field et al., 1996; Oyserman et al., 2000). In addition, during the play interaction, infants whose mothers suffer from PND usually display negative affect and gaze aversion (Reissland et al., 2005; Tronick & Reck, 2009). It is worth mentioning that these interactive behaviours are also met in infants of mothers without depression in the case of the Still-Face Paradigm, as a reaction to their mothers' momentary unresponsiveness in order to regulate their arousal and negative emotions (for further information, see Chapter 4, Section 4.3.1.1). This similarity of infants' reactions under the two completely different conditions may allow for a better understanding of the quality of mother-infant play in the context of PND and demonstrate how the infants experience and react to the maternal emotional unavailability during a playful situation.

The adverse effects of PND on mother-infant play can be lasting and compromise infants' developmental skills later in life (Rayment, 2013; Righetti-Veltema et al., 2003; Hipwell et al., 2005; McFadden & Tamis-LeMonda et al., 2013). For instance, in a prospective longitudinal study of 5-year-old children of mothers with and without PND showed that exposure to PND was associated with children's aggressive behaviours during play with their peers, with girls being mainly verbally aggressive, while boys were predominantly physically aggressive (Hipwell et al., 2005). In another study by the same authors, 5-year-old children of postnatally depressed mothers performed less free and creative play in the classroom setting when compared to children of mothers without PND (Murray et al., 1999). Likewise, in a case-control study Righetti-Veltema and colleagues (2003) indicated that infants who had been exposed to maternal PND during their first 3 months exhibited less play interaction at 15 months of age and worse performance in object concept tasks at 18 months of age than did infants of mothers without PND. Finally, a study by McFadden and Tamis-LeMonda (2013) demonstrated that PND linked to maternal intrusiveness and negativity during play with infants could predict lower cognitive scores in infants at 15 months of age.

7.3 Conclusion

There exists general agreement that play should be a joyful and everyday experience in infants' lives, through which they can explore the external and inner world, form relationships with others and their surroundings, as well as develop their capacities (e.g., Froebel, 1887; Winnicott, 1971; Rayment, 2013; Neale et al., 2018; Tamis-LeMonda et al., 2002; Sutton-Smith, 2001). In this process, the maternal role is catalytic for promoting infants' advanced play through scaffolding, which, in turn, hones infants' social, emotional, cognitive and language skills and renders them competent explorers (e.g., Vygotsky, 1978; Tamis-LeMonda et al., 2001; Neale et al., 2018; Valentino et al., 2011; Bernier et al., 2016). However, converging evidence demonstrates that maternal PND interferes with the mothers' ability to promote infants' socio-emotional, cognitive and language skills during playtime (Sohr-Preston & Scaramella, 2006; Rayment, 2013; Righetti-Veltema et al., 2003; Hipwell et al., 2005; McFadden & Tamis-LeMonda et al., 2013).

Overall, there has accumulated a body of research on community samples of mothers with PND, showing that the high rate of disturbances in mother-infant playtime puts the infants of mothers with PND at an increased risk of impairments in their developmental trajectories later in life (e.g., Rayment, 2013; Righetti-Veltema et al., 2003; Hipwell et al., 2005; McFadden & Tamis-LeMonda et al., 2013). However, evidence from mothers with clinically diagnosed PND and their infants during playtime remains limited; therefore, further investigation is needed to shed light on the qualities of play interaction in this population, in order to assess how best to support disadvantaged children whose mothers suffer from a severe mental health illness, such as PND.

7.4 The Present Study

The main aim of Study 4 is to examine the patterns of mother-infant play interaction in the case of PND, focusing on the infant's verbal and non-verbal communication skills during this activity. To achieve this, a quantitative approach to the actual play interactions was used, applying a moment-by-moment analysis of the mother-infant pair's observable way of using toys during their play interaction. While the importance of mother-infant play interaction is well-established in the literature, this interaction is usually measured through parenting processes, such as maternal sensitivity, support and responsiveness (Neale et al., 2018). The unique contribution of this study consists of the following: the occurrence or absence of objective and observable mother-infant behaviours during playtime were coded and analysed in order to assess the mother-infant play interaction in the sample of a negligible population

(Pawlby et al., 2010) – that is, infants and their mothers who suffered from severe PND and warranted hospitalisation. To the author's knowledge, this is the first study to focus on this population to provide a detailed examination of inpatient mother-infant behaviours and exchanges related to toys during a play interaction, taking into consideration mother-infant reciprocity, maternal sensitivity and infant self-regulation (i.e., variables of Study 1).

The occurrence and duration of different behaviours related to the use of a toy organised around a play interaction between infants and their mothers with and without PND were explored to address the main research question: Do the infants of mothers with PND differ in the way in which they use a toy during a play interaction with their mothers, when compared to infants of mothers without PND? The principal hypothesis posits that PND is associated with impairments in the quality and quantity of play between the mother and her infant. To answer the main research question and test the hypothesis, the following additional research questions emerged:

1) What are the differences between the two groups in terms of the quality, type and duration of maternal and infant behaviours related to the use of a toy?
2) Is there any association between the three variables of Study 1 (mother-infant reciprocity, maternal sensitivity and infant self-regulation) and maternal and infant behaviours related to the use of a toy? (The answer requires a comparison between clinical and control groups.)
3) Is there any association among variables of infant behaviour (i.e., positive affect, gaze towards the toy or hand that the mother is using as part of their interaction, explorational use of a toy, no toy manipulation, object-related use of toy_rule-based behaviour and non-object-related use of toy) and variables of maternal behaviour (i.e., object-related use of toy, joint manipulation, talk)? (The answer requires a comparison between clinical and control groups.)

4) What kind of maternal and infant behaviours related to the use of a toy co-occur when infants display positive affect during the play interaction and when mothers use the toy in an object-related way during the play interaction? (The answer requires a comparison between clinical and control groups.)

7.5 Material and Methods

7.5.1 Participants and Procedure

A total of 52 videos containing footage of 104 participants (52 mother-infant pairs) were analysed and compared. In particular, the clinical group consisted of 22 inpatient mothers with PND interacting with their infants (aged 3-12 months); their interaction was video-recorded for intervention purposes in the clinical context of an MBU. A comparison group of 30 mothers without PND was recruited from several Children's Centres in London, and their play interaction with their infants (aged 3-12 months) was also video-recorded. Video-recordings of both groups (n= 52) were analysed and compared. Detailed information about the participants' characteristics is provided in Chapter 3, Section 3.4, while Section 3.7 presents a detailed description of the procedure.

7.5.2 Measures

The assessment tools used in this study have been presented in detail in Chapter 3, Section 3.8. The following reliable assessment tools were employed:

1) Measurement of Maternal Depressive Mood: Edinburgh Postnatal Depression Scale (Cox et al., 1987);
2) Measurement of Maternal Sensitivity: Infant CARE-index (Crittenden, 2005); and

3) Global Ratings Scales of Mother-Infant Interaction: A Coding Scheme for Structured Play Interaction (Murray et al, 1996b; Murray & Karpf, 2000). In this study, the mother-infant reciprocity measure was applied.

7.5.3 Data Analysis

7.5.3.1 Mother-Infant Play Interaction: A Micro-Analytic Approach. The micro-analytic approach was applied to gain an in-depth understanding of both mother and infant behaviours organised around the use of a toy during playtime. The Noldus Observer XT 16.0 software package (a computer-aided coding system; Noldus, Wageningen, the Netherlands) was used for the management, analysis and presentation of the time-structured data from the video-recorded material (for further information on the micro-analytic approach, the Noldus Observer XT 16.0 software and the data analysis process, see Chapter 3, Section 3.9.1).

7.5.3.1.1 Infants' NVC Skills: Coding Scheme. In applying the micro-analytic approach, a coding scheme was developed to record the onsets, offsets and types of mothers' and infants' behaviours related to the use of a toy during their play interaction. This coding scheme was derived from the adaptation of a pre-existing coding scheme developed by Neale and colleagues (2018), who used this novel dimensional framework for analysing infant-mother play patterns in a healthy population. According to the authors, 'an important feature of this framework is that it does not assume any one definition of play. Instead, [they] grounded the framework in specific observable behaviours that are considered important factors across different conceptualizations of play' (Neale et al., 2018, p. 4). The frequency and duration of each mother-infant behaviour related to the use of a toy during their play interaction was coded frame by frame and classified, as presented in Table 7.2.

Table 7.2

Coding Scheme: Behavioural Categories and Variables in Terms of Mothers' and Infants' Behaviours Related to the Use of a Toy

Behavioural Categories	Variables
Mothers: Use of Toy	Play without the use of a toy
	Non-object-related use of the toy
	Object-related use of the toy
	Holding the toy
	Taking the toy
	Offering the toy
	No toy manipulation
Infants: Use of toy	Holding without interest
	Non-object-related use of the toy
	Object-related use of the toy
	Grasping
	Explorational use of toy
	No physical contact with the toy

All the above-mentioned categories, for both maternal and infant behaviours, are mutually exclusive and thus cannot co-occur.

7.5.3.2 Description of Behavioural Variables. The following table contains all the descriptions and/or operational definitions that correspond to the behavioural codes with regard to the use of a toy included in the proposed coding scheme for three subjects: the infant, the mother and the dyad. Examples have also been used to better explain some of the sub-categories of behavioural aspects.

Table 7.3

A. Descriptions of Maternal Play Behavioural Codes Included in the Coding Scheme

Play without the use of toy	Engagement in playful activity without the use of toy
Non-object related use of toy	Any kind of activity with the object that does not involve appreciation of the object's particular properties, i.e., the action could be done with almost any object (Neale et al., 2018)
Object related use of toy	Mother demonstrates or presents an object to infant in a way that involves appreciation of the object's particular properties (Neale et al., 2018) (i.e., the mother shows to the baby how to play with a telephone by pressing the buttons).
Holding the toy	Physical contact with object and no actions (e.g., holding) (Neale et al., 2018)
Taking the toy	The action or process of taking the object from the infant that followed by the infants' extension of the arm with the object in hand and directed toward the hand of the mother
Offering the toy	Extension of the arm with the object in hand and directed toward the hand of the infant (Zuccarrini et al., 2018)
No physical contact with the toy	No toy manipulation

B. Descriptions of Infants' Play Behavioural Codes Included in the Coding Scheme

Holding without interest	Physical contact with object and no actions (e.g., holding) (Neale et al., 2018)
Non-object related use of toy	Physical contact with object & non-object-specific exploration of object, using circular/repetitive action/motion with object (e.g., banging, shaking, mouthing) (Neale et al., 2018)
Object related use of toy	Physical contact with object with rule-based behaviour related to object (Neale et al., 2018)
Grasping	Curling of fingers around a new stimulus (Moszkowski & Stack, 2007) offered by mum or chosen by infant
Explorational use of toy	Physical contact with object and object-specific exploration of object (Neale et al., 2018) (i.e., through palpation)
Joint manipulation	Mother actively helping the infant manipulate an object. Joint manipulation entails mother and infant touching the same object at the same time
No toy manipulation	No physical contact with the toy

7.6 Results

7.6.1 Reliability Test

Coding of all videos was performed by one trained coder. To establish inter-rater reliability, 15 videos were coded by a second coder, who had been trained independently from the first coder and was blind to the maternal mental health status. The rate of agreement for the occurrence of each behaviour ranged from .82 to .97 for the observation of maternal play-related behaviours and from .78 to .93 for the observation of infant play-related behaviours, indicating a high level of agreement.

7.6.2 Means and Standard Deviations for Infants' Behavioural Variables Related to the Use of a Toy

Differences between the two groups were found in the way in which the infants used the toy during the play interaction with their mothers, with the effect sizes ranging from small to medium, represented as Pearson's r, with .1 meaning small, .3 medium, and .5 large (Cohen, 1988). In the differences of statistical significance in the current analysis, the effect sizes ranged from r = .2 to .3. Infants in the clinical group were observed to hold the toy without interest significantly longer (M = 51.2, SD = 43.1) than did infants from the comparison group (M = 22.4, SD = 22), $t(50) = -2.5$, p= .01, r= 0.3. However, infants in the comparison group used the toy significantly more in an object-related manner (M = 28, SD = 4), when compared to the infants of mothers with PND (M = 8.7, SD = 13.4), $t(50) = 44$, p= .05, r= 0.2. Likewise, infants from the comparison group were found to use the toy in an explorational way more often (M = 35.5, SD =49.7) than did the infants in the clinical group (M = 27.6, SD = 24), $t(50)$= 49.7, p = .08, r= 0.3, with their difference being marginally significant. No other statistically significant differences were observed between the two study groups in the mean duration of the different types of infants' use of the toy during the interaction with their mothers.

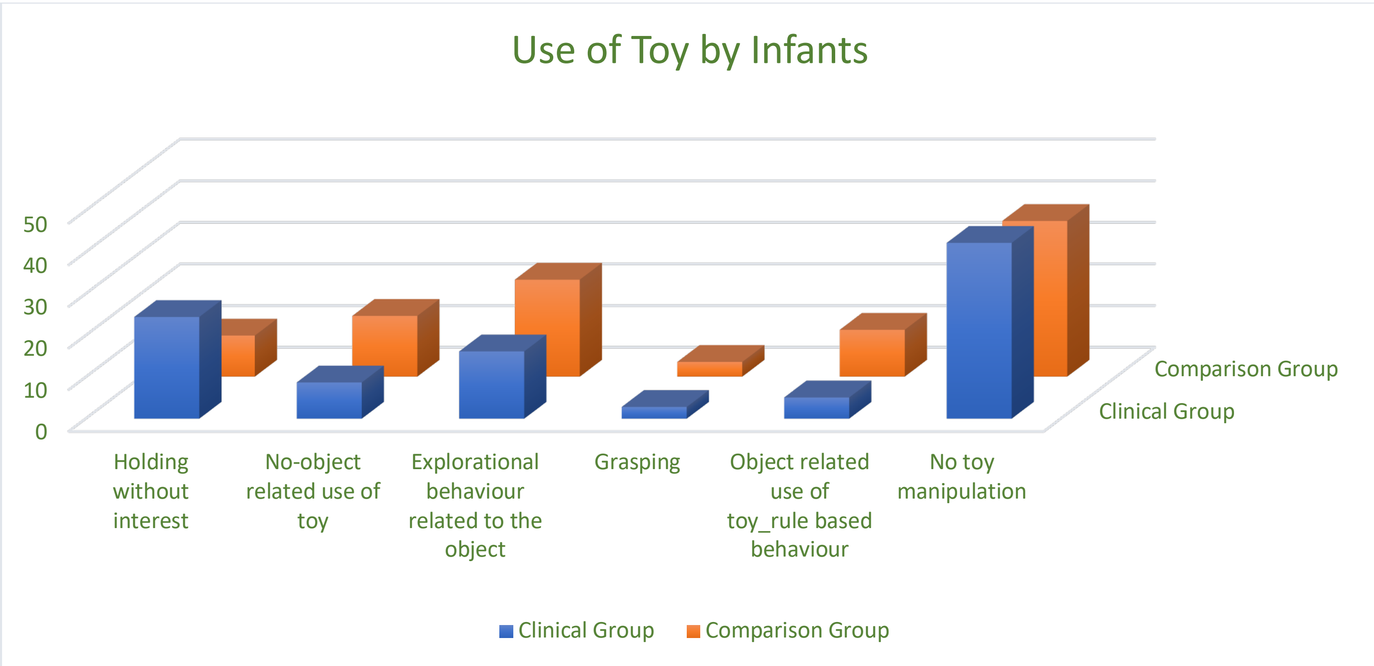
Table 7.4

Infants' Behaviour Related to the Use of a Toy

	Clinical group (n=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Holding without Interest	51.2	43.1	22.4	22	-2.5	.01	0.3
Non-object-related use of the toy	14.9	15.2	26.5	41.8	38.7	.17	0.4
Object-related use of the toy_rule-based behaviour	8.7	13.4	20.4	28	44	.05	0.2
Grasping	4.8	6	6.4	8.2	50	.44	0.1
Explorational use of the toy	27.6	24	42.3	35.5	49.7	.08	0.2
No toy manipulation	72.2	54.5	68	57	50	.78	0.03

Figure 7.1

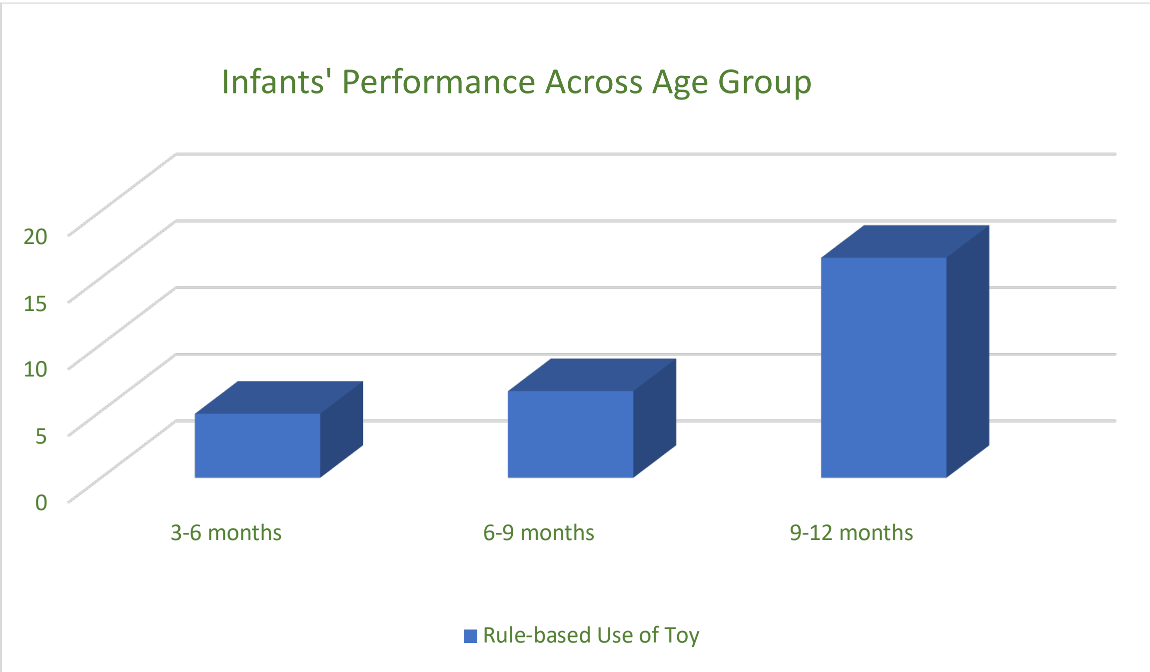
Percentage of the Different Types of Infants' Behaviours Related to the Toy: A Comparison Between Groups



A general linear model was used to compare the mean duration of the explorational use of the toy and the rule-based use of the toy in infants from both clinical and comparison groups, with the infant's age and gender added as covariates. Controlling for infants' gender and age, no statistically significant difference was found between groups in terms of the infant's explorational use of toy. However, age was found to act as a covariate for the 'object-related use of the toy_rule-based behaviour' in infants. Specifically, as infants become older, an increase in their rule-based use of the toy was found across different developmental stages (Figure 7.2).

Figure 7.2

Percentage of the 'Object-Related Use of the Toy_Rule-Based Use of the Toy' Behaviour in Infants Across Age Groups



7.6.3 Partial Correlations Between Reciprocity, Maternal Sensitivity, Maternal Reciprocity and Infants' Different Patterns of the Use of a Toy

To address the second research question, a series of partial correlations was run in order to examine the association between the different types of infants' 'use of the toy' behaviours and the variables of Study 1 (i.e., reciprocity, maternal sensitivity and infant self-regulation) in the two groups, after controlling for infant age. As displayed in Table 7.5, for the clinical group, there are significant associations between the infants' 'holding without interest' behaviour and the following variables of Study 1: maternal sensitivity and reciprocity, $r(52) = .55$, $p = .02$ and $r(52) = .46$, $p = .05$, respectively. For both groups, a significant negative association was found between infant self-regulation and no toy manipulation [clinical group: *r*(52) = -.47, *p*= .05; comparison group: *r*(52) = -.61, *p*= .002]. Finally, a weak negative correlation between mother-infant reciprocity and no toy manipulation in infants was also apparent in the comparison group, *r*(52) = -.36, *p*= .08.

Table 7.5

Correlations among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Infant Patterns of the Use of a Toy Between Groups

	Clinical Group			Comparison group		
Infant codes for the use of toy	Maternal Sensitivity	Reciprocity	Infant Self-regulation	Maternal Sensitivity	Reciprocity	Infant Self-regulation
Holding without interest	**.55***	**.46***	.45	.04	-.02	.15
Non-object-related use of the toy	-.29	-.36	-.29	.23	.27	.45
Object-related use of the toy	.16	.13	.24	.22	.31	.02
Grasping	.33	.28	.17	-.24	-.12	-.02
Explorational use of the toy	-.12	-.04	.10	-.07	.10	.28
No toy manipulation	-.44(.07)	-.27	**-.47***	-.21	-.36	**-.61****

$^{*}p < .05$, $^{**}p < .01$

7.6.4 Maternal Behaviours Related to the Use of a Toy during the Play Interaction with Their Infants

Mothers with and without PND differed significantly in their use of toys during a play interaction with their infants (Figure 7.3,) with the effect sizes ranging from small to large, represented as Pearson's r, with .1 meaning small, .3 medium, and .5 large (Cohen, 1988). In terms of the differences in statistical significance, the effect sizes ranged from r = .2 to .4. In particular, a statistically significant difference was found in the mean duration of both the object-related and non-object-related use of the toy, with these behaviours being evident more frequently among mothers without PND ($M = 70$, $SD = 34.2$ & $M = 20.2$, $SD = 27$ respectively) than in mothers with PND [($M = 40.1$, $SD = 28.6$), $t(50) = 3.3$, $p = .002$, $r = 0.4$ & ($M = 6.9$, $SD = 8.4$), $t(50) = 2.5$, $p = .01$, $r = 0.3$, respectively]. On the contrary, mothers from the clinical group used a toy less often during playtime ($M = 81.5$, $SD = 48$) than did mothers from the comparison group ($M = 57.8$, $SD = 28.5$), $t(50) = -.2$, $p = .04$, $r = 0.2$. Finally, in a play interaction with their infants, mothers with PND were found to play without the use of a toy more often ($M = 13.2$, $SD = 29.8$) than did mothers from the comparison group ($M = 1.22$, $SD = 6.7$); however, this difference was of marginal statistical significance ($p = .07$, $r = 0.3$).

Table 7.6

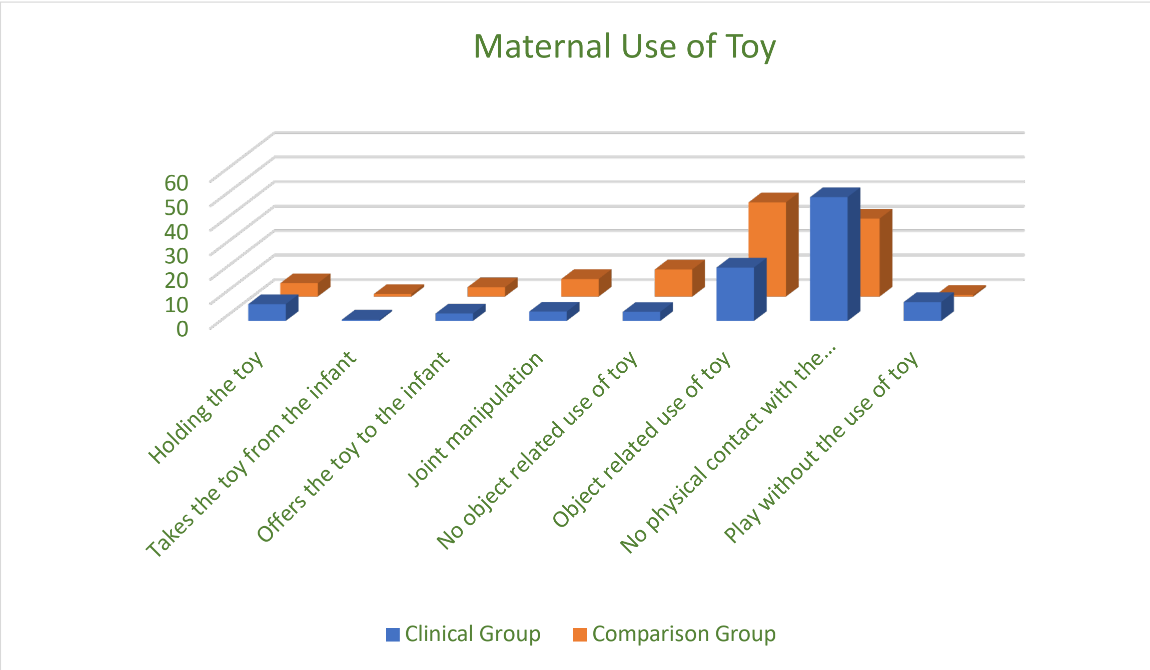
Maternal Behaviour and the Use of Toys

	Clinical group (n=22)		Comparison group (n=30)		*t*	*p-value*	*r*
	M	SD	M	SD			
Play without the use of a toy	13.2	29.8	1.22	6.7	-1.8	.07	0.2
No physical contact with the toy	81.5	48	57.8	28.5	-2	**.04**	0.3
Object-related use of the toy	40.1	28.6	70	34.2	3.3	**.002**	0.4
Non-object-related use of the toy	6.9	8.4	20.2	27	2.5	**.01**	0.3
Joint manipulation	7.76	16.2	13	16.5	1.1	.25	0.15
Offering the toy to the infant	5.2	5.9	7	6.2	1.1	.30	0.15
Taking the toy from the infant	.89	1.8	1.9	5.5	.84	.40	0.12
Holding the toy	12.1	13.3	9.9	12	-.63	.53	0.08

A general linear model was used to compare the mean duration of the object-related use of the toy and joint manipulation of the toy by mothers from the clinical and comparison groups, with the infant's age added as covariate. Controlling for infants' age, no statistically significant difference was found between groups in terms of maternal object-related use of the toy and joint manipulation of the toy.

Figure 7.3

Percentage of the Different Types of Maternal Behaviours Related to the Toy: A Comparison Between Groups



7.6.5 Partial Correlations Between Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Different Maternal 'Use of the Toy' Patterns

A partial correlation analysis was run between the variables of Study 1 and maternal 'use of the toy' patterns: (1) play without the use of a toy, (2) no physical contact with the toy, (3) object-related use of the toy, (4) non-object-related use of the toy, (5) joint manipulation, (6) offers the toy to the infant, (7) takes the toy from the infant, and (8) holding the toy. Having controlled for infant age, for the first series of correlations (Table 7.7), significant results were exhibited only concerning measures of maternal sensitivity and non-object-related use of the toy. Particularly, in the clinical group a higher rating in maternal sensitivity is positively correlated with maternal non-object-related use of the toy, *r*(52) = .42, *p*= .05. In addition, a weak association was found between maternal 'offers the toy to the infant' behaviour and maternal sensitivity in the clinical group, *r*(52) = .39, *p*= .07. No associations were observed among the variables of Study 1 and maternal different patterns of the use of the toy for the comparison group.

Table 7.7

Correlations among Measures of Reciprocity, Maternal Sensitivity, Infant Self-Regulation and Maternal Patterns of the Use of the Toy Between Groups

	Clinical Group			Comparison group		
Maternal codes for the use of a toy	Maternal Sensitivity	Reciprocity	Infant Self-regulation	Maternal Sensitivity	Reciprocity	Infant Self-regulation
Play without the use of a toy	.30	.29	.21	-.12	-.18	.11
No physical contact with the toy	-.03	-.006	.118	-.10	.07	.04
Object-related use of toy	-.21	-.18	-.27	-.06	-.14	-.16
Non-object-related use of the toy	**.42***	.35	.37	.07	-.04	.05
Joint manipulation	-.27	-.26	-.26	-.11	-.13	-.03
Offers the toy to the infant	.39	.23	.34	.27	.27	.32
Takes the toy from the infant	-.09	-.13	.18	.05	.02	.05
Holding the toy	.04	.003	-.19	.27	.30	.18

$^{*}p < .05$, $^{**}p < .01$

7.6.6 Partial Correlations among Measures of Maternal Joint Manipulation, Object-Related Use of the Toy and Six Infants' Behaviours during Play Between Groups

Finally, partial correlation analysis was run between the maternal variables of joint manipulation, object-related use of the toy and talk, and a group of infants' variables, which include the following: infant positive affect, gaze towards the toy or hand that the mother is using, explorational use of the toy, no toy manipulation, object-related use of the toy_rule-based behaviour and non-object-related use of the toy. In both groups, a high association was found between joint manipulation and infants' explorational use of the toy, $r(52) = .54$, $p = .01$ for the comparison group and $r(52) = .39$, $p = .03$ for the clinical group. A marginally significant association was found between joint manipulation and infants' gaze towards the toy or the hand that the mother is using as part of the interaction, $r(52) = 40$, $p = .07$ and $r(52) = .34$, $p = .06$ for the clinical and the comparison group, respectively. For the clinical group, a significant positive correlation was found between the maternal object-related use of the toy and infants' gaze towards the toy or the hand that the mother is using as part of the interaction, $r(52) = .81$, $p = .00$. Furthermore, a negative association was found for the comparison group between the maternal object-related use of the toy and the infants' non-object-related use of the toy, $r(52) = -.41$, $p = .03$.

Table 7.8

Correlations among Measures of Maternal Joint Manipulation, Object-Related Use of the Toy, Maternal Talk and 6 Infants' Behaviours during Play Between Groups

	Clinical Group			Comparison group		
Infants' codes	Maternal Joint Manipulation	Maternal Object-related use of the toy	Maternal talk	Maternal Joint Manipulation	Maternal Object-related use of the toy	Maternal talk
Positive affect	-.32	-.32	-.20	-.03	-.03	.33
Infants' gaze towards the toy or hand that the mother is using	.40	**.81****	.18	.34	.22	-.12
Explorational use of the toy	**.54****	-.007	.19	**.39***	-.02	-.26
No toy manipulation	-.13	.33	.17	-.21	.31	.16
Object-related use of the toy_rule-based behaviour	.04	.08	-.12	.28	.01	.23
Non-object-related use of the toy	.005	-.05	.04	-.32	**-.40***	-.18

$^{*}p < .05$, $^{**}p < .01$

7.6.7 Descriptive Analysis of Co-Existing Maternal and Infants' Behaviours Related to the Use of a Toy during Infant Positive Affect

What kind of maternal and infants' behaviours related to the use of a toy are apparent when infants display positive affect during the interaction with their mothers? To produce a comprehensive picture of the interrelated maternal and infants' behaviours regarding the use of a toy during their interaction, an analysis of the accumulation of the different play patterns that co-exist with infant positive affect was conducted. The aim of this analysis was to illustrate what happens in terms of the use of a toy both in mothers and infants when the infant is happy (Table 7.9). As described in the previous chapter, the findings of this study showed that infants of mothers without PND displayed more positive affect (12.5% of the time) than did infants of mothers with PND (5.3% of the time) in a play session with their mothers (for further information, see Chapter 6, Section 6.7.1).

7.6.7.1 Maternal and Infants' Behaviours Related to the Use of a Toy during Infant Positive Affect: Comparison Between Groups. As depicted in Table 7.9, mothers without PND made significantly more use of a toy (69.5% of the time) than did mothers with PND (4% of the time) when their infants were happy. On the contrary, when the infants exhibited positive facial affect, mothers from the clinical group spent most of the time (51% of the time) playing with them without using a toy, when compared to mothers without PND (4.5% of the time). Finally, in the comparison group, infants' positive affect co-existed with the use of a toy for 65% of the time, while in the clinical group positive affect and the use of a toy co-occurred for 37% of the time.

Table 7.9

Co-Occurrence of Maternal and Infant Behaviours Related to the Use of a Toy during Infant Positive Affect

Behaviours		Clinical Group		Healthy Group	
		Mothers	Infants	Mothers	Infants
USE OF A TOY	Use of a toy	4%	37%	69.5%	65%
	No use of a toy	45%	63%	26%	35%
	Play without the use of a toy	51%	-	4.5%	-

What kind of maternal and infant behaviours are apparent when mothers display the object-related use of a toy during the interaction with their infants? To produce an overall picture of the interrelated maternal and infant behaviours during maternal object-related use of a toy, an analysis of the accumulation of the different mother-infant behavioural patterns co-existing in this type of interaction was conducted. The aim of this analysis was to illustrate what would happen when the mothers provided scaffolding to their infants by demonstrating the function of a toy during their play interaction. This analysis indicated that mothers without PND displayed more of an object-related use of a toy (38.5% of the time) than did mothers with PND (21.8% of the time) during a play session with their infants (Figure 7.3).

7.6.7.2 Maternal and Infant Behaviours during Maternal Object-Related Use of a Toy: Comparison Between Groups. As presented in Table 7.10, in a comparison between groups during maternal object-related use of a toy, mothers without PND exhibited more often positive facial affect (91% of the time), while mothers with PND displayed a positive affect for only 26.5% of the time, mostly remaining neutral (73.5% of the time). In addition, mothers without PND (versus mothers with PND) made more physical contact with their infants (58.5% versus 40% of the time) and talked more to them (59% versus 38% of the time, including the use of sounds) while they made object-related use of the toy. In terms of maternal gaze, mothers from both groups displayed a similar behavioural profile.

The vast majority of infants from both groups was found to be neutral while their mothers were using the toy in an object-related way. However, infants in the comparison group displayed positive affect for 8% of the time, while infants in the control group did so for 4.7% of the time. Regarding their gaze behaviour, infants from both groups seemed to be visually engaged with their mothers' action, with the infants in both the clinical and the comparison group looking elsewhere for 10% and 17% of the time, respectively. Finally, in terms of physical contact during maternal object-related use of a toy, the infants of mothers without PND were more active, displaying different touch patterns (15% of the time) than did infants from the clinical group (1.5% of the time). Regarding infant vocal behaviour, infants in both groups showed a similar profile.

Table 7.10

Co-Occurrence of Maternal and Infant Behaviours When Mothers Display the Object-Related Use of a Toy during Their Interaction

Behaviours		**Clinical Group**		**Healthy Group**	
		Mothers	**Infants**	**Mothers**	**Infants**
AFFECT	Positive	26.5%	4.7%	65%	8%
	Negative	-	2%	-	1%
	Neutral	73.5%	93.3%	35%	91%
GAZE	Towards the partner	56%	5%	47%	4.5%
	Towards the object	42%	10%	52%	24.5%
	Elsewhere	1%	10%	1%	17%
	Towards the mother's hands	-	75%	-	54%
TOUCH	Touch due to the position	36.5%	36.5%	50%	33%
	Other types of touch	3.5%	1.5%	8.5%	15%
	No touch	60%	62%	41.5%	52%
MATERNAL TALK	Talk	33%	-	50%	-
	Use of sounds	5%		9%	
	No talk	62%	-	41%	-
INFANT VOCALISATION	Vocalisation	-	3.6%	-	3.3%
	No vocalisation	-	96.4%	-	96.7%

7.7 Discussion

The aim of the study presented in this chapter was to explore the effects of PND on the quality of the mother-infant play interaction, with a particular interest in the use of a toy. Given that play is a diverse and multi-faceted process (Neale et al., 2018), this study attempted to provide a first comprehensive and multidimensional picture of this kind of interaction among mother-infant dyads who had been hospitalised in an MBU. A comparison group of mothers without PND and their infants was also used. The fine-grain sequential play patterns extracted from continuous mother-infant play-related behaviours were objectively measured for both groups. To the best of the author's knowledge, this is the first study to employ such an extensive coding system designed for the play interaction between mothers with PND and their infants.

The unique contribution of this study also consists of the use of both qualitative assessment tools and quantitative coding of the actual play interaction in order to provide a detailed examination of mothers' and infants' interrelated play behavioural patterns. In particular, the association of these play patterns with significant qualities in mother-infant interaction – such as mother-infant reciprocity, maternal sensitivity and infant self-regulation (i.e., variables from Study 1) – was investigated. Also, the four main modalities of communication (i.e., affect, gaze, talk and touch, as they constituted variables in Studies 2 and 3), which are corporeally intertwined with mothers' and infants' play behavioural patterns, were included in this analysis.

Despite the existence of a substantial body of research indicating that infants and mothers with PND (versus infants and mothers without PND) display deficits in the quality of their play interaction (e.g., Paulson et al., 2006; Lovejoy et al., 2000; Humphreys et al., 2018; Field, 2010; Muzik et al., 2017), the present study provides new evidence regarding the actual way in which mothers with PND and their infants engaged in play activity. Apart from the rich data presented here, the purpose of this discussion is to underscore the most novel and significant findings so as to integrate them into and expand the existing literature on this topic. The following sections will discuss the current findings in the light of the available literature, highlighting their contribution to knowledge in the relevant field.

7.7.1 Maternal Play-Related Patterns during the Interaction with Their Infants

The findings of this study showed that, in the presence of a toy-box, mothers without PND were significantly more engaged in play involving objects during the interaction with their infants than were mothers with PND. In particular, mothers without PND (versus mothers with PND) were observed to display significantly more object-related use of a toy, by demonstrating the qualities and functions of the objects to their infants, as well as more of a non-object-related use of a toy, reinforcing infants' creativity and imagination and therefore providing essential scaffolding to their development. This finding is in accordance with the current literature, which supports that mothers with PND engage significantly less in play and enrichment activities with their infants (e.g., Paulson et al., 2006; Lovejoy et al., 2000). It also adds that, similarly to insecure mothers (Crugnola et al., 2013; Evans & Porter, 2009; Main, 1983; Rayment, 2013), mothers with PND displayed less involvement in play with an object when compared to mothers without PND. This finding is of pivotal importance, given that play with objects has been considered a pervasive activity in infancy, presenting a significant role in infant development (Morgenthaler, 2006).

Specifically, the transition to triadic interaction (i.e., mother-infant-object) is essential for many developmental aspects in infancy (Neale et al., 2018; De Schuymer et al., 2011; Morgenthaler, 2006). The use of objects in shaping play has been found to enhance infants' language skills (Orr, 2021; Yu et al., 2019; Quinn et al., 2018), as well as reasoning, problem-solving, goal achievement, attention exploration and other cognitive functioning (Neale et al., 2018 in Clearfield et al., 2014; Morgenthaler, 2006; Bjorklund & Gardiner, 2011). In addition, through play with objects, infants discover challenges and learn to interpret their emotions and the world around them, which fosters their socio-emotional abilities (Dauch et al., 2018; Morgenthaler, 2006). Finally, in a sociocultural view, infants' understanding of the function and use of objects during play contributes to the early symbolic awareness of sociocultural contexts and the acquisition of cultural norms (Neale et al., 2018; Morgenthaler, 2006). Therefore, the findings of the present study – that is, mothers with PND face difficulties in using toys during the play interaction with their infants – may underscore that infants of mothers with PND are at increased risk for poor developmental outcomes.

Furthermore, the data revealed that, despite the fact that mothers with PND did not utilise toys in their play interactions with their infants very often, they demonstrated alternate ways to entertain them, primarily by playing without using a toy. The predominant presence of play without objects in the dyads from the clinical group and infants' familiarity with this type of play interaction is also reflected in another finding of the present study. In the scope of this research, the co-occurrence of different maternal play-related patterns and infants' positive affect was examined: when the infants from the clinical group displayed positive affect, 51% of the time the mothers played with them without the use of a toy, and only 4% of the time the mothers organised the play activity around the presence of a toy. The respective findings for the comparison group indicated that, when the infants were happy, 69.5% of the time the mothers were using a toy as part of their play interaction.

The fact that dyads from the clinical group usually play without the use of a toy is a novel and encouraging finding indicating the maternal ability to engage in a play interaction through different ways in the case of PND. However, this play pattern may create a sterile atmosphere that compromises the above-mentioned educational and developmental benefits that infants may receive from play activities with toys (Tamis-LeMonda & Bornstein, 2002). This points to the need to integrate such findings into training activities for professionals working in inpatient MBUs, so that they will reinforce the maternal ability to play and encourage mothers to use toy-objects effectively in the daily mother-infant play routine.

An additional finding that highlights the difficulty faced by mothers in the clinical group in the effective engagement with object activity emerged from the analysis of maternal and infant behavioural profiles while mothers perform an object-related use of a toy. During this play pattern, mothers with PND displayed significantly less positive affect, less physical contact with their infants and talked less to them than did mothers without PND. This corresponds to evidence from prior research, indicating that mothers with PND are less likely to display positive affect (Muzik et al., 2017; Field, 2010; Campbell et al., 1995; Lovejoy et al., 2000) and positive behaviours such as smiling and/or imitation (Livelli et al, 2006), that they speak less to their infants during this kind of interaction and show less affective sharing (Cornish et al., 2008; Rowe et al., 2005; Kenny et al., 2013; Lovejoy et al., 2000; Tronick & Reck, 2009). Even though the maternal behavioural profile during the object-related use of a toy was found to be rather positive in the clinical group, it is worth mentioning that the maternal action per se managed to capture infants' attention during this play pattern.

Specifically, in a comparison between the two groups, infants in the clinical group were found to be slightly more visually engaged with the maternal actions during the object-related use of toy. Only 10% of the time, the infants looked elsewhere, and 75% of the time they looked at the mother's hands while she was demonstrating the function of the toy. In comparison, the numbers for the infants of the other group totalled 17% and 50% of the time, respectively. The findings on the high rates of attention during the maternal object-related use of a toy reported in infants in both groups conforms with a body of previous research indicating the association between infants' attentiveness and maternal object-handling (Deák et al., 2014; Yu & Smith, 2013; Zukow-Goldring, 1996). Indicatively, the findings of a recent study which assessed the toy-play interactions between mothers and their infants (3 to 11 months, n= 35) and coded attention-related behaviours showed that the mother's action, when she is physically engaged with an object, elicits the infants' attention, more so than other modalities of communication, such as maternal gaze, verbalisation and gesture (Deak et al., 2018). The combination of the present research findings with the those of the existing literature provides further support to the above suggestion regarding the importance of embedding objects in mother-infant play interaction in the case of PND.

The novel findings of the present study – that is, mothers with PND tended to play with infants using alternative ways – are also supported by the fact that, in the clinical group, an association was found between maternal sensitivity and maternal non-object-related use of the toy. There exists evidence that maternal sensitivity during the play interaction can lead infants to advanced play and, consequently, contribute to infant development (Bigelow et al., 2004; Mermelshtine & Barnes, 2016; Loureiro et al., 2016; Sliwerski et al., 2020; Tamis-LeMonda et al., 2001). However, the present findings highlight that sensitive mothers with PND preferred to use the toy in an abstract way, rather than demonstrating the toy's actual functions and qualities to their infants, which would have provided scaffolding for their developmental stages. The combined research findings that mothers with PND were more engaged in a play activity without using a toy and that sensitive mothers with PND mainly employed a non-object-related use of a toy are of pivotal importance for the following reasons: these data point to the maternal ability to be involved in playful interaction with their infant, using alternative ways in the case of PND. In parallel, these highlight the maternal difficulty to engage effectively in an object-related use of toys as part of their interaction with their infants, which could compromise the infants' development. A specifically designed treatment for this population in order to enhance maternal abilities and at the same time address disturbances in the way in which they use toys as part of the interaction with their infants is highly recommended.

Finally, the important contribution of maternal play-related patterns to infants' quality of play is well-documented in the literature (e.g., Tamis-LeMonda et al., 2001; Neale et al., 2018; Valentino et al., 2011; Bernier et al., 2016). The findings of this study strengthen this assertion by showing that there exists a positive association between maternal joint manipulation and infants' explorational use of the toy in both groups. Particularly, maternal active involvement in infants' play by providing scaffolding is linked to infants' explorational behaviours towards the object, which in turn promotes infants' developmental aspects, such as problem-solving, gestures, attention, word comprehension and vocal production (Zuccarini et al., 2018; Neale et al., 2018; Poon et al., 2012; Clearfield et al., 2014). For instance, Bornstein and Tamis-LeMonda (1990) found that infants of mothers who encourage them to orient themselves towards and explore objects in their surroundings at the age of 2 months are more likely to show curiosity about and explore objects at the age of 5 months. In the same vein, the findings also demonstrated a negative association between the maternal object-related use of a toy and infants' non-object-related use of a toy in the comparison group. Again, this finding highlights that the high quality of maternal play-related patterns can encourage infants to engage in more advanced and sophisticated play, which consequently supports them in achieving their developmental milestones (Bigelow et al., 2004; Mermelshtine & Barnes, 2016; Loureiro et al., 2016; Sliwerski et al., 2020; Tamis-LeMonda et al., 2001).

7.7.2 Infants' Play-Related Patterns during the Interaction with Their Mothers

Our findings showed that infants of mothers with PND were less active in their play interaction, exhibiting significantly more often the behaviour of 'holding the toy without interest' than did infants in the comparison group. This is in line with previous studies suggesting that infants of mothers with PND are less likely to engage in play activities with their mothers and display a decreased level of curiosity about and interest in objects during playtime (Lovejoy et al., 2000;

Tronick & Reck, 2009; Cornish et al., 2008; Hart et al., 1998; 1999; Edhborg et al., 2001). Infants of mothers with PND have also been reported to show less engagement in exploratory play (Field et al., 1996). Likewise, according to the findings, infants of mothers without PND (versus infants of mothers with PND) significantly more often displayed explorational and object-related use of a toy when playing with their mothers. This affords them an advanced position to achieve optimal developmental outcomes, given the beneficial role of explorational and object-related use of toys in infant development, as reported in the literature (e.g., Zuccarini et al., 2018; Ginsburg, 2007).

Specifically, Zuccarini and colleagues (2018) recently investigated the associations between 6-month active exploratory behaviours in 20 infants and 12-month word comprehension, gestures and vocal production. The findings showed an association between oral exploration during play and word comprehension; manual exploration was linked to gestures and vocal production in the overall sample (Zuccarini et al., 2018). For the purposes of the present study, the respective category combines both oral and manual exploration of the toy's qualities; therefore, the high frequency of this behaviour which occurred among the infants in the comparison group may be linked to benefits for a range of cognitive developmental skills. In addition, evidence showed that, through these play patterns, infants master their world by developing new competencies linked to their emotional and social well-being (Ginsburg, 2007).

Another finding of interest consisted of the relations between the lack of physical contact with the toy and infants' self-regulation. More specifically, the results showed that there exists a negative association between infant self-regulation and no toy manipulation in both groups. This finding is of importance in terms of the emotional function of object play in infants' well-being, which contributes to children's emotional expressiveness, self-regulation and self-awareness (Froebel, 1887; Winnicott, 1971; Tamis-LeMonda et al., 2002). The use of toys at playtime creates a space where infants engage with the toys, not only to discover the world, but also to manage their emotions and soothe themselves (Rayment, 2013): 'Parent-child interactions during object play provide ample opportunity for the sharing and the extension of emotions as children experience the joys and frustrations of accomplishing and struggling in goal-directed activities. Additionally, object play is a context for parents' labelling and interpreting their children's feelings' (Tamis-LeMonda et al., 2002, p. 228).

Hence, the fact that in the present sample mothers with PND were found to introduce significantly less use of toy-objects in the play interaction with their infants may result in deficits in infants' self-regulatory skills (for further information regarding the importance of self-regulation in infant development, see Chapter 4, Section 4.4). One of the best-established risk factors for poor self-regulation in infants is maternal PND (Bates et al., 2020; Vaever et al., 2020; Sun et al., 2020; for a review, see Goodman et al., 2011). However, the findings of the present study add to the existing literature and take it a step further, by proposing an additional explanation for these deficits in infants' self-regulatory abilities in the case of PND, which is related to the lack of the use of toys during mother-infant play interaction.

7.8 Conclusion

Embracing the importance of play in infants' development and well-being, this study aimed to explore the nature of play in mothers with severe PND and their infants in the context of an MBU. The findings of the present study derived from a detailed examination of actual and observable play actions of mothers with and without PND and their infants. These data were analysed frame by frame at a micro-analytic level, while additional modalities of communication (i.e., gaze, touch, affect and vocal behaviour), along with qualities involved in the mother-infant interaction (i.e., maternal sensitivity, reciprocity and infant self-regulation), were also included in the analysis. This approach, which differentiates this study from previous ones, facilitated achieving the researcher's main goal. This goal was to provide an integrative picture of the mother-infant play interaction in the case of PND, reflecting the multidimensional nature of play, as well as discovering both the strengths and challenges that emerged in a play interaction within inpatient mother-infant dyads.

The most salient findings emerging from the present study are the following: firstly, while mothers without PND predominantly engaged with their infant in play activities that were organised around the use of toy-objects, mothers with PND were mainly playing with their infants without the use of a toy. Secondly, while the infants of mothers with PND (versus infants of mothers without PND) showed a more immature and passive way of playing, they were observed to be significantly happier during the process of maternal play without an object and more engaged during the maternal demonstration of a toy-object, which highlights the triadic nature of play. Therefore, the significant and intertwined role of both mothers and objects in infants' play experience was reflected in these findings. Finally, a negative association was found between the absence of toy manipulation in infants and their self-regulatory skills, indicating how object play may contribute to infants' emotional well-being.

Overall, the findings of the present study call for the inclusion of toy-objects in play activities between mothers with PND and their infants, in order to create an optimal developmental milieu for infants. Even though the present findings lack the capacity for generalisation due to the small sample size, they provide a fertile ground for further research focusing on the mother-infant play interaction in the presence of PND. In particular, the novel finding that mothers with PND were engaged in play activities in a different yet less effective way than were mothers without PND can contribute to recommendations on how existing interventions should be adjusted in efficient and productive ways. Interventions to support mothers with severe mental health illness, including PND, should both promote their strengths and improve their weaknesses related to play activity, as well as provide proper guidance for them in both clinical settings and the community.

Chapter 8: General Discussion

8.1 Introduction

The four previous chapters provided a comprehensive presentation of the data generated by the four studies underlying this research project, in conjunction with a detailed analysis through the prism of the current literature on mother-infant interaction and infant development. The present chapter aims to summarise the main findings stemming from these four different studies and to create a dialogue between these findings and Froebelian theory, in order to provide insight into the applicability of his theories to contemporary research. In addition, methodological considerations along with the strengths and limitations of the present research are included, followed by suggestions for future research, as well as implications for policy, clinical, educational and professional practice.

8.2 Summary of the Study within the Froebelian Framework

The Froebelian principles arguing for the right of every child to achieve his/her full potential and the right of children to protection from disadvantaged home circumstances and the promotion of their overall well-being constituted the cornerstone of this research agenda. There exists general agreement in the literature that families with mothers with PND are likely to experience unstable living conditions (Hipwel et al., 2000). The novel aspect of this study consists of the focus on a negligible at-risk population (Pawlby et al., 2010) – namely, infants and their mothers who suffer from PND severely enough to warrant hospitalisation. A comparison group of mothers without PND and their infants were used to illustrate the real differences between the two groups. In particular, infants of mothers who are resident in an MBU constitute a vulnerable sub-population; these infants are at an increased risk, not only due to exposure to disturbed maternal behaviours that have been linked to severe impairments in infant development and the mother-infant relationship, but also due to a variety of implications related to institutionalisation. For instance, these may include the involvement of multiple substitute caregivers when the mother due to her mental health illness is too unwell to provide appropriate care for her baby (Kumar, 1992).

The present research project is based on the Froebelian approach, which places the child at the centre of attention, while requiring adults to have a comprehensive understanding of young children's needs and abilities. This study was the first to focus on inpatient mothers with PND and their infants in order to provide a detailed and extensive examination of the four main modalities (i.e., affect, gaze, vocal tone and touch). These modalities represent four domains of emotional communication – facial, oral, attentional and tactile (Colonnesi et al., 2012) – through the prism of mother-infant reciprocity, maternal sensitivity and infant self-regulation. In parallel, following the Froebelian view of the importance of play and maternal singing as central integrating elements in child development and learning, a fine-grained examination of actual and observable play actions of mothers with and without PND and their infants took place. Furthermore, the actual mother-infant behavioural patterns that co-exist with maternal singing were analysed.

Froebel believed that only observation could lead to real understanding, encouraging his colleagues to use child observation as a starting point of their methods (Bruce, 2012). This study adopted a video-based observation research method, utilising the different research capacities that current technology offers (i.e., observation through video recordings). Specifically, for the purposes of this study a mixed-method sequential approach was applied to the analysis of these videos: verbal and NVC patterns, along with play-related behavioural patterns, were analysed frame by frame at a micro-analytic level. At the same time, emotional qualities (i.e., mother-infant emotional tone, mother-infant reciprocity, maternal sensitivity, maternal coercive behaviours, infant self-regulation and general atmosphere) were assessed with the help of reliable assessment tools. This approach is highly recommended for exploring more complex aspects of human relationships (Malina et al., 2011).

Finally, Froebel placed great emphasis on the maternal role in child development and learning. Within the scope of this research, it was also considered essential to include maternal behavioural patterns and emotional qualities in the analysis, embracing the assertion that mother-infant communication patterns are inextricably linked and interrelated (Beebe & Steele, 2013). This aspect, which differentiates this research project from earlier ones, contributed to producing a more coherent and comprehensive picture of both mother-infant interaction and infants' developmental skills and to filling the gap in the literature. However, to our knowledge, the lack of relevant research focused on verbal and NVC behaviours during a play session in mothers and infants from 3 to 12 months of age in an inpatient population restricts our ability to draw direct comparisons with findings from previous studies. Overall, this study aimed to provide a better understanding of the verbal and non-verbal world of mother-infant interaction, as well as to discover both strengths and weaknesses emerging in a play interaction within inpatient mother-infant dyads, so as to arrive at suggestions for how to promote mother-infant well-being and, in turn, infants' developmental skills in this at-risk population. Ultimately, the goal of this research endeavour was to confirm the primary Froebelian principle supporting the integrity of childhood in its own right.

8.2.1 Summary of Findings on Maternal and Infant Behavioural Profiles within the Froebelian Framework

Chapters 4, 5, 6 and 7 analysed in detail the main findings concerning the participants' behavioural profiles and discussed in depth how these can be integrated into and expand the existing literature. In line with the Froebelian theory regarding the role of the mother in child development, this study adopted an approach emphasising that the development of verbal and

NVC skills in infants is a dyadic process which involves both the mother and the infant and which is achieved through maternal sensitivity and responsiveness to her infant's cues (Trevarthen & Aitken, 2001). The findings of the present study corroborated this, by revealing that mother-infant dyads in the clinical group shared similar communication profiles, which differed from the profiles of the mother-infant dyads in the comparison group.

In summary, the findings of this study, echoing the evidence from the existing literature (i.e., Bernard et al., 2018; Raby et al., 2015), indicated that mothers with PND (versus mothers without PND) used their communication skills less effectively when interacting with their infants, as their interaction was characterised by reduced maternal sensitivity and mother-infant reciprocity. Given the significant role of these maternal interactional and emotional qualities in infant development, these findings explicitly underscore the vulnerability of infants of mothers with PND to poor developmental outcomes (Deans, 2020). For instance, to further support this notion, one of the most important findings of this study indicated that there exists an association between maternal verbal behaviour and infants' emotional well-being. Given that, in comparison to mothers without PND, participant mothers with PND exhibited a reduced quality of verbal behaviours when interacting with their infants, this directly puts their infants at an increased risk of adverse outcomes related to emotional development.

Differences were also found in infants' verbal and NVC skills between the clinical and the comparison group. Infants from the clinical group (versus infants from the comparison group) displayed more passive NVC patterns, while they were vocally more active, which could have been a sign of distress (Crittenden, 2010). These findings regarding the high level of vocalisations in infants of mothers with PND is of pivotal importance, since an association exists between higher infant vocalisation frequency and later child psychopathology (Allely et al., 2013). In addition, deficits were found in infants' self-regulatory abilities in the clinical group, which render the infants at an increased risk of impaired developmental trajectories

(Koulomzin et al., 2002; Field et al., 2009; Tronick & Weinberg, 1997; Colegrove & Havighurst, 2017). This research makes a unique contribution to the growing body of scholarship examining the impact of PND on infants' verbal and NVC competencies, providing new evidence derived from an extensive analysis of developmental skills in infants who have been jointly hospitalised with their mothers with PND in an MBU. Overall, this study supported that the distress of these infants overtly reflected on their vocal behaviour, while a somatisation of this distress was attributed to deficits in their self-regulatory skills. Regarding their NVC skills, more passive patterns were observed. The combination of these results points to the need for further investigation in order to examine in greater depth possible evidence of compulsive behaviours in this vulnerable population.

8.2.2 Summary of Findings on Maternal and Infant Behavioural Profiles during Maternal Singing within the Froebelian Framework

Embracing the Froebelian value highlighting the importance of maternal singing in child development, this study showed a particular interest in maternal singing as part of the assessment of maternal vocal behaviour. To the author's knowledge, this is the first study to focus on the use of spontaneous singing in the context of an MBU and to analyse maternal and infants' communication patterns co-occurring during this activity. Recent research has reconfirmed Froebel's emphasis on maternal singing, by supporting that infants have a biological predisposition for perceiving their mothers' unique singing style (de l'Etoile, 2006). Moreover, through maternal singing, the baby receives emotional information – such as maternal love, care and sensitivity – and then becomes able to reproduce these emotional narratives (Trevathen & Aitken, 2001). This process sets a keystone for the child's sense of security, emotional regulation and well-being (Shannon, 2006). Maternal singing also plays a significant role in infant development, maternal well-being and mother-infant attachment

(Fancourt and Perkins, 2018; Edwords, 2011). However, the positive and emotionally synchronised mother-infant interaction that normally occurs during maternal singing could be disturbed in the case of PND (de L'Etoile, 2012).

In comparison to other studies that used maternal singing as a condition of the research design, the present study examined the spontaneous use of singing as a means of communication between mother and infant during a free-play situation in the context of an MBU. The findings revealed that mothers with PND used less spontaneous singing to interact with their infants than did mothers without PND, while deficits in the quality of singing in the case of mothers with PND were also observed. In particular, recent research supports Froebel's emphasis on singing as an effective channel of emotional communication between the mother and the infant in the first year of life (Powell et al, 2013; Creighton et al., 2013). However, this study showed that mother-infant interaction in the case of PND was less affectionate, positive, stimulating and playful during maternal singing, in comparison to the quality of this interaction in the case of mothers without PND and their infants.

Looking more closely at maternal behavioural patterns during singing, this study found that mothers with PND were intensively looking and smiling at their babies while holding them in their hands, without using any toy as part of this activity. Yet, discomfort was reflected in the infants' behavioural profile during maternal singing in the clinical group. In particular, infants in the clinical group (versus infants from the comparison group) were less active and less engaged during the singing process, displaying more gaze aversion, regardless of their mothers' attempts to elicit their attention and create a positive atmosphere. This inconsistency between maternal and infants' behaviours during this activity converted maternal singing into an ineffective way of emotional and joyful communication in the case of PND.

These findings on the deficits in the quality of mother-infant interaction during maternal singing deserve more scientific attention. Froebel strongly argued that maternal singing contributes to the child's physical, social, cognitive, language and spiritual development (Baidya et al., 2014), and over the decades his view has repeatedly received support from a substantial body of research (i.e., Sun et al., 2016; Dyke, 2019; Malloch & Trevarthen, 2009). Considering the beneficial role of maternal singing in the mother-infant relationship and, consequently, the child's holistic development, the findings of the present study underscore that infants whose mothers suffer from PND are at increased risk of poor developmental outcomes.

8.2.3 Summary of Findings on Maternal and Infant Behavioural Profiles during Play within the Froebelian Framework

The research findings on play interaction between mothers with PND and their infants presented and discussed in Chapter 7 reflect an evolving understanding of the actual way in which mothers and infants engage in play activity in the presence of PND. Specifically, this research project generated novel findings on how mothers with PND and their infants organised their behaviours around the use of a toy during a play session. To the author's knowledge, this is the first instance in which such an extensive and detailed coding scheme including, apart from others, behavioural units related to the use of a toy has been applied to this population, while qualities of the mother-infant interaction (i.e., maternal sensitivity, reciprocity and infant self-regulation) were also taken into account.

The focus on mother-infant play interaction makes this study aptly aligned with Froebelian principles. Even in the nineteenth century, Froebel valued play as the highest form of learning; play fosters the child's integral development and, according to his views, play and family relationships serve a crucial role in every child's well-being (Brown, 2012; Bruce, 2012). Since Froebel's time, there has been conducted substantial research indicating the importance of play in infant development, given that play has been found to promote infants' cognitive, socio-emotional, language and perceptual motor skills (Lobo et al., 2014, 2013; Barsalou, 2008; Bergen, 2019). In line with Froebelian theory, recent studies also documented that the maternal role is critical in enhancing infants' advanced play, through scaffolding, which in turn hones infants' social, emotional, cognitive and language skills and renders them competent explorers (e.g., Vygotsky, 1978; Tamis-LeMonda et al., 2001; Neale et al., 2018; Valentino et al., 2011; Bernier et al., 2016).

However, PND interferes with the maternal ability to engage in a mutually satisfying, stimulating, joyful and reciprocal play interaction with the infant (i.e., Sohr-Preston & Scaramella, 2006; Rayment, 2013; Righetti-Veltema et al., 2003; Hipwell et al., 2000, 2005; McFadden & Tamis-LeMonda et al., 2013). The findings of the current investigation not only resonate with this growing body of research, but also expand it by adding new evidence. In particular, among the most salient findings of this study counts that these deficits in the quality of mother-infant play interaction in the case of PND can also be attributed to the observation that mothers with PND were predominantly playing with their infants without using a toy. Another novel finding underscoring maternal difficulty in engaging in an effective object play activity with their infants consists of the observation that, in the clinical group, maternal sensitivity was associated with no-object-related use of a toy. These findings highlight that sensitive mothers with PND preferred to use the toy in an abstract way, rather than demonstrating the toy's actual functions and qualities to their infants, which would thus provide scaffolding for their developmental competencies.

These findings received further support from the data related to the infants' behavioural patterns during a play session with their mothers in the clinical group. While the infants of mothers with PND (versus infants of mothers without PND) showed more immature and passive ways of playing, the observation that they were significantly happier during the process of maternal play without an object reflects the infants' familiarity with this kind of play interaction. Furthermore, the mother's difficulty to effectively engage with the play object in the case of PND was also reflected in the following research findings: only 4% of the time during which mothers with PND organised the play activity around the presence of the toy, their babies were happy.

According to the literature, this interpersonal type of play involves a variety of dyadic exchanges and is typically characterised by a degree of pleasure for both mothers and infants (Tamis-LeMonda et al., 2002). Recognising its importance, Froebel introduced the finger rhymes, as a type of play using fingers/hands to accompany his Mother Songs. "The Froebelian approach to learning finger rhymes was not intended as a 'time filler' to keep the children amused but as a fun educational tool. To help develop speech and language skills and develop subject knowledge and understanding of the environment" (Hoban, 2020, p.1). In particular, Froebel's finger games aimed to enhance the children's use of senses (Blackburn, 2020) as well as to encourage their awareness of symbolic representation (Tovey, 2016) through a nurturing engaging environment (Hoban, 2020). Likewise, mothers from the clinical group of the present study were observed to use their surroundings rather than the toys in a playful way to engage their infants into an interaction and to enhance infants' learning experience. Indicatively, a wristwatch on the mother's hand was transformed into a play object to catch the infant's attention, enhancing his ability to track objects, in a clinical mother-infant dyad. There were also some mothers with PND who used the patterns either on their t-shirts or on the carpet to show the colours and/or the shapes to their infants, creating an educational activity using the surroundings. Finally, crawling fingers up the infants' back or arm like a spider and playing peek-a-boo were two additional ways that some mothers from the clinical group chose to entertain their infants without using a toy.

The accumulation of these observed behaviours in the clinical group underscore the maternal good intentions and willingness to interact with the infant in a playful way and constitute an encouraging finding of the present study. Nonetheless, the predominant occurrence of this interpersonal type of play in conjunction with the lack of the use of a toy as part of the clinical group's play interaction may compromise the beneficial role of play in child development and well-being. More specifically, within the first year of life occurs a gradual and smooth transition from the interpersonal type of play to an object play that has been characterised as extradyadic, and this transition not only follows but also enhances infants' developing competencies (Tamis-LeMonda et al., 2002). This triadic affair includes mother, infant and object (Stern, 2009). The object play is an integral part of child development, and the role of the mother is crucial for creating a stimulating and joyful environment in which the infant is safe and able to learn through exploration and experimentation (Rochat, 2009; Tamis-LeMonda et al., 2001). Even the use of one toy can offer multiple opportunities and benefits for the child's holistic development (Nwokah et al., 2013). Froebel's belief in the imperative need for meaningful play with objects in which the child can be actively engaged led him to invent the concept of 'gifts' (i.e., objects such as balls, free-standing wooden blocks and other materials) (Provenzo, 2009; Correia & Fisher, 2014). Froebel, recognising the importance of the use of objects in play, stated in relation to the perceived educational benefits of 'gifts':

> By means of this manifestation of form and movement these solids and the play with them give many opportunities for the observation and consideration of form, size and number (particular for a somewhat advanced stage of childhood), and in many ways introduce the child into the phenomena of nature and life around him. They are therefore, as it were, the middle point and source of the later training for school and life, as well as for the union of these (Froebel, 1899, p. 317).

Over the decades, the fundamental importance of object play in child development, as also supported by the present study, has been repeatedly documented in the literature (for further information, see Chapter 7). As a corollary, the maternal difficulty in introducing and engaging with this advanced type of play in the case of PND can result in cascading negative effects on infant development. Two main findings of the present research strengthen this argument. Firstly, a negative association was found in both groups between infant self-regulation and the lack of the use of a toy as part of the play interaction. This finding adds further support to the existing evidence on the emotional function of object play in infants' well-being and self-regulatory abilities. It also could further explain the deficits in the quality of mother-infant play interaction in the case of PND, which have been well-documented in the literature (Humphreys et al., 2018; Field, 2010; Muzik et al., 2017).

The second important finding showed that infants from the clinical group (versus infants from the comparison group) were less engaged in exploratory play, which is inextricably linked to the use of a toy and enhances infants' development, including their sensorimotor, language and cognitive developmental trajectories (Zuccarini et al., 2018). The crucial role of mothers in promoting infants' exploratory play is also derived from another salient finding of this investigation, which indicates that there exists a positive association between maternal joint manipulation of the toy and infants' explorational use of a toy in both groups. In other words, the effective introduction and demonstration of the toy by the mother can activate the infant's curiosity and exploratory skills.

Overall, according to one of the main Froebelian principles underpinning the revised Early Years Foundation stage guidance in England today (Department for Education, 2021), a child possesses the inalienable right to play, and the role of the adults (mainly the mother) is to provide a playful and intellectually stimulating environment in which the children will be able to achieve their full potential and personal fulfilment (Tovey, 2016). However, the findings of the current research revealed that the clinical group exhibited deficits in the way in which they engaged in play activity with an object, which consequently detracts from a stimulating environment. These deficiencies related to the quality of play in the case of PND render the infants of the clinical group at high risk of adverse developmental outcomes. Moreover, these deficiencies can also generate a vicious cycle that moves along the following trajectory: maternal difficulty in the use of a toy can lead to the infant's passive behavioural patterns found in this study, and these passive behavioural patterns in turn contribute to the maternal experience of less rewarding and more difficult parenting, which then can have a negative impact on both mother-infant relationship and the dyad's well-being.

8.2.4 Summary of Findings on Maternal Strengths in the Case of PND within the Froebelian Framework

A significant principle of the Froebelian approach is to enhance parental capacities rather than passing judgement on the parents (Bruce, 2019). Embracing this Froebelian principle, the current research attempted to shed light on maternal strengths as well as challenges in the presence of PND. Froebel also suggested that, through training, parents, especially mothers, can become more caring adults and aware of how to enhance children's experience of learning (Werth, 2018). In the same vein, these research findings can inform and be incorporated into existing training activities that encourage mothers with PND to instrumentalise their strengths and to overcome their weaknesses in order to develop their parenting skills more effectively. Particularly, the present section summarises the strengths of mothers with PND found in this research-study, in an attempt to stress the importance of those parenting aspects as in need of encouragement. These parenting aspects can provide a robust cornerstone upon which interventions for this population may be developed in order to increase maternal confidence and help them face the real challenges observed in this study. Embracing the importance of the maternal role in child well-being, the approach adopted for this research project rests on the assumption that, along with therapeutic treatment for PND, the most effective way to secure a child's optimal development in that case is by supporting their mothers to hone and improve their parenting skills.

Specifically, the above-mentioned research findings on maternal singing are of pivotal importance. Although the infants in the clinical group were not fully engaged in the process of maternal singing, their mothers' spontaneous choice to sing as part of their interaction is quite encouraging. This highlights the possibility that, with the necessary support, mothers with PND can enhance this ability so as to create an attuned interaction with their infants during singing, which allows infants to receive full advantage of this process. Likewise, the combination of the findings that mothers with PND were more likely to engage in play activity without using a toy and that sensitive mothers with PND mainly exhibited a no-object-related use of toys are of twofold importance: on one hand, mothers with PND were able to engage in playful interaction with their infant while using alternative ways of play, and this should be acknowledged. On the other hand, these data underscore the maternal difficulty in producing an effective and object-related use of toys as part of their interaction with their infants, and this may restrict infants' developmental outcomes. Effective treatment specifically designed for this population in order to reinforce such maternal abilities and simultaneously address disturbances in the use of toys is highly recommended.

Given the importance of touch in mother-infant interaction and infant development (Serra et al., 2020), another encouraging finding of this research consists of the observation that there were no significant differences in maternal tactile behaviours between the two groups. The use of a detailed and extensive coding scheme encompassing a range of different positive tactile behavioural patterns, one of the present research-study's novel aspects, tried to fill the gap in the respective literature, which has mainly focused on negative patterns of maternal touch in the case of PND (Mantis et al., 2019). The present findings serve to draw researchers' attention to this under-studied communication modality (Mantis et al., 2019), which proved to be an effective channel of emotional communication between mother and infant in the presence of PND. Another novel finding showed that maternal and infant tactile behaviours are interrelated and interdependent, in both the clinical and the comparison group. This gives further support to the maternal role's significance in the development of this NVC modality in infants and, in turn, to the imperative need to further strengthen this aspect of emotional communication in the case of PND. Strengthening this aspect can contribute not only to a better quality of the mother-infant relationship, but also to mothers' and infants' emotional well-being.

Another positive outcome regarding mothers with PND consists of the observation that there was a lack of negativity in all aspects under investigation, combined with no differences in the general atmosphere that characterised the interaction between mother and infant in both groups. Chapter 4, Sections 4.9.1 and 4.9.6, present a line of interpretations concerning this observation; however, these findings in themselves are quite encouraging, underscoring even in the case of PND the maternal intention to sustain a positive interaction with the infant, creating a harmonious atmosphere that in turn, could pave the avenue for improving the quality of mother-infant relationship. Unfortunately, this intention can sometimes be negatively affected by the nature of depression, characterised by symptoms such as sadness and lack of energy. Regardless, the maternal good intentions observed in the clinical sample of this study need to be highlighted. These findings may create an alternative way of thinking about and approaching this population – an alternative way that reduces stigma and discrimination related to this emotional disorder and the parenting abilities of mothers suffering from it, as well as a way to effectively support them by embracing both their strengths and weaknesses as a unit, as Froebel suggested for children and all human beings.

8.3 Methodological Strengths and Limitations

8.3.1 Strengths of the Study

Several strengths of the study pertain to the uniqueness of the sample. This study focused on mother-infant dyads from a rather neglected at-risk population (Pawlby et al., 2010) – namely, mothers with severe PND who had been hospitalised in an MBU jointly with their infants, aged 3 to 12 months. On admission, the participant mothers were assessed and given an ICD-10 diagnosis of PND by a psychiatrist. This aspect constitutes a strength, given that the majority of the research in this field includes community mothers who mainly used a self-reported depression scale for their diagnosis.

The mixed-method design adopted by this study constitutes another strength. The combination of quantitative and qualitative approaches is highly recommended for investigating more complex aspects of mother-infant relationships (Malina et al., 2011). Specifically, reliable assessment tools were used (i.e., CARE-Index, Global Rating Scale), while the inclusion of quantitative methods complemented the qualitative results. In particular, this study was based on a fine-grain micro-analysis in order to gain an in-depth understanding of both mothers' and infants' behaviours. Using an extensive and detailed coding scheme especially designed for the purposes of this research, the study attempted to provide a first comprehensive, detailed and multidimensional picture of infants' verbal and NVC skills during a play interaction with their mothers, through the prism of significant qualities in mother-infant interaction, such as mother-infant reciprocity, maternal sensitivity and infant self-regulation.

To achieve this, an extensive analysis of maternal behaviours also took place, recognising that the infants' behaviours are interdependent with and inextricably linked to their mothers' behaviours. This study, therefore, aimed to provide an integrative picture of infants' communication skills by looking more closely at the dyadic dance that occurs between the mother and the infant, taking both partners into account. Attention to this integrative picture forms another strength that should be acknowledged. However, the process of conducting research always entails a set of limitations, resulting in suggestions for future investigation. The following section addresses the present study's limitations that may lead to fruitful recommendations for improvements and may point to areas upon which future researchers could expand.

8.3.2 Limitations of the Study

A number of limitations must be taken into account when interpreting the findings and identifying points to consider for future research. First, the major limitation of this study is the small sample size, which limits the generalisability of the findings; thus, the results should be interpreted with caution and considered preliminary in nature. However, it is important to mention that, in comparison to other studies using observational methods to assess the quality of the mother-infant interaction in the case of PND (e.g., Egmose et al., 2018, 2021; Stein et al., 2010; Skotheim et al., 2013) and especially in the context of an MBU (e.g., Wan et al., 2007a, 2008; Pawlby et al., 2010; Kenny et al., 2013), even the sample of the present study should be considered moderately sized. Overall, future research will require larger samples to provide more robust evidence in terms of the effect of PND on infants' verbal and NVC skills.

Secondly, this is a cross-sectional study; therefore, a conclusion regarding the direct link between PND and infants' verbal and NVC skills cannot be drawn. More specifically, this study design generates as results merely associations, while the causal relations can only be suggested (Setia, 2016). Even though the cause-effect relationships may be of great scientific and theoretical interest, in the research field of mother-infant interaction and child mental health the association of the phenomena can be equally important, given that the verification of a linear causal relationship is difficult to establish. This is because of the extremely complex and dynamic interplay between nature and nurture in child development. However, it will be essential to investigate these associations longitudinally in order to produce an in-depth understanding of the long-term developmental outcomes in infants whose mothers suffer from PND. Longitudinal studies are therefore needed to shed light on the impact of PND on the mother and infant interaction and, consequently, on the developmental trajectories of infants' verbal and NVC skills. Unfortunately, in the case of this research project, such an approach was not feasible because of time constraints.

Another limitation of the present research design consists of the use of secondary data for the clinical group. Specifically, pre-existing video-recorded material that contains footage of mother-infant play interaction in the clinical setting was used. Given that mothers from the clinical group gave permission only for the use of their video-recordings for research purposes, direct contact with mothers and infants from the clinical group was forbidden due to ethical reasons. The lack of direct access to and in-person contact with the clinical participants led to the following restrictions in the study design:

a) It compromised the ability to apply developmental screening tools, specifically designed for the assessment of infants' verbal and NVC skills, such as the Bayley Scales of Infant Development (Bayley, 1993) and the Communication and Symbolic Behaviour Scales Developmental Profile (CSBS-DP) Infant-Toddler Checklist: Screening Report (Wetherby & Prizant, 2002). The use of these developmental screening tools could have provided additional information about the infants' communication abilities, which could have added to the infants' behavioural profile derived from the findings of the present study.

b) Lack of contact led to a lack of access to additional information about the clinical group's sociodemographic characteristics, such as maternal educational level and socio-economic status, which restricted the ability to control all potential confounding factors. This limitation may be mitigated in future studies, through the assessment of these demographic characteristics, as there is evidence that they can contribute, as a mediated path model, to the effect of PND on mother-infant interaction and infant development (Kurstejens & Wolke, 2001; Zajicek-Farber, 2009; Santos et al., 2020). Also, regarding the main demographic characteristics of participants from both groups (i.e., gender/age), an attempt was made to recruit participants with similar demographic profile in both groups as well as to create fairly equal 'matching numbers' of participants according to gender and age groups (for relevant information, see Table 3.3 in Chapter 3, section 3.4), even if this is not an experimental study where matching participants based on their demographic characteristics is a requirement (Zwarun, 2017). The use of a matched pairs design could strengthen the reliability of the results (Zwarun, 2017), by minimising the gander- and age-related differences between groups and it is highly recommended for future research.

c) The duration of the pre-existing video-recorded data was 3 minutes. This prevented the researcher from incorporating longer interactive sessions that would have produced a larger volume of data, which in turn would have expanded the possibility to observe a wider range of behavioural aspects in both mothers and infants. For instance, for some variables included in this study, such as maternal coercion and general atmosphere, the short duration of interaction analysed for each dyad may minimise the generalisability of the results. Future research should reconsider this research design element and examine these measures more extensively. However, it is worth mentioning that in the field of research on mother-infant interaction, a 3-minute video-taped adult-infant play interaction is considered sufficient to draw conclusions about the quality of the mother-infant interaction and to observe mother-infant behavioural patterns (Crittenden, 2010; Egmose et al., 2018).

The lack of access to the medical records of mothers from the clinical group that contain data about the use of pharmacological treatment during the prenatal or/and postnatal period is also a limitation of the present research project. There is a body of research indicating that psychotropic medication in mothers with PND could influence early infant behaviour (for recent reviews, see Gemmel et al., 2018; Grieb & Ragan, 2019; Millard et al., 2017; Ramsteijn et al., 2020; Hutchison et al., 2021) as well as the mother-infant interaction (Hutchison et al., 2021; Höflich et al., 2022; Mavrogiorgou et al., 2022; Lindensmith, 2018; Tsivos et al., 2015; Weikum et al., 2013). In particular, research shows that medication is included as a first agent in the treatment plan for mothers with severe PND (for relevant information, see Chapter 2, Section 2.6.2). However, there are controversies around the use of medication perinatally due to concerns about transmission both in womb and/or through breast milk that could adversely affect infant development (Hutchison et al., 2021; Adina et al., 2021; Shephens et al., 2016; Dennis & Chung-Lee, 2006; Pearlstein, 2008; Turner et al., 2008) (for relevant information, see Chapter 2, Section 2.6.2.1). Even though the above-mentioned limitation rendered an evaluation of the effects of pharmacological treatment on mother-infant interaction and infant development beyond the scope of this study, it is highly recommended for future research to further and continuously investigate the complex association among the use of medication, maternal mood, infant behavior and mother-infant interaction. The present study argues for the imperative need for individualized interventions in medical practice, specifically designed for mothers with PND and their infants. Therefore, it is of pivotal importance for future research to explore the effects of antidepressant medication on mother-infant interaction while parallel, to consider the individual application of the recommendations derived from this study, so as that a tailor-made and comprehensive treatment to be designed according to the needs of each mother-infant dyad.

In this study, infant age at the assessment time varied from 3 to 12 months. While the proposed infant age range resulted in an increase in the final sample size of the clinical group, this could also serve as limitation, considering the rapid developmental changes in infants during the first year of life (Keenan et al., 2016). To address this limitation, infant age was taken into account and used as covariate in the analyses; therefore, the findings of this study remain robust. However, it would be preferable either to have more participants in order to create subgroups based on their developmental stages (i.e., 3-6 months, 6-9 months and 9-12 months), which would allow for additional comparisons across and within groups, or to have all infants video-taped at the same developmental stage.

An additional limitation of the present study is attributed to the use of one camera to capture maternal and infants' gaze direction for the comparison group. Given that the pre-existing video recordings for the clinical group had been produced in a room equipped with cameras mounted on the walls at the MBU, it was financially and practically impossible to create the same video-recording conditions for the comparison group. Also, the use of a mobile eye tracker system to record maternal and infants' gaze, which is highly recommended (i.e., Gredeback et al., 2010; De Pascalis et al., 2017), was also excluded as an option due to the use of pre-existing data for the clinical group. Overall, despite the fact that previous studies suggested that the use of one camera is also an effective way to assess NVC baheviours, including the direction of gaze, in mother-infant dyads (i.e., Crugnola et al., 2014; Ierardi et al., 2019; Palazzi et al., 2021), this research project adopted the term "gaze towards" instead of "gaze at" for all the variables under the "gaze" behavioural category for both mothers and infants in order to compromise this limitation. However, future research will benefit from addressing this limitation, so as that to continue building a robust evidence base for the role of gaze in mother-infant relationship.

Finally, in this study participant mothers from both groups were aware of being observed during the interaction with their infants, and this could have an impact on their parenting performance during the video-recording process. However, the fact that this condition was the same for both groups should minimise its effect. It is worth mentioning, however, that the mothers of the clinical group may experience the concomitant stress of being video-recorded with their infants while being unwell (Pawlby et al., 2010). Moreover, these mothers could also fear being questioned about their parenting abilities, given that the risk of having their infant removed to care is apparent and threatening (Wan et al., 2008). This limitation could have an impact on the maternal profile observed in the case of PND in this study, and it may also serve as explanation for the lack of significant differences in some behavioural aspects between the two groups.

8.4 Recommendations for Future Research

As derived from the above discussion, a follow-up study examining this phenomenon at different points in time and using a larger sample is highly recommended. However, the resulting increase in workload and the time spent coding a larger volume of video-recorded data based on micro-analysis should also receive consideration. In addition, future work could explore the role of infant gender in the developmental outcomes in the case of PND, instead of using it as a covariate, as did this study. Infant gender is an important variable that should constitute a separate domain of scientific interest. There is strong evidence that this variable may influence the effects of PND on both mother-infant interaction and infant development (e.g., Myers & Johns, 2019; Murray et al., 2011; Cornish et al.,2005; De Tychey et al., 2008; Sohr-Preston & Scaramella, 2006). Consequently, it deserves further examination. In parallel, the inclusion of a third group of community mothers with PND and their infants could also be beneficial to illustrate among groups the real differences related to the severity of PND. In particular, there is a body of research indicating that the severity of PND can have detrimental effects on mother-infant relationship and, thus, on infant development (e.g., Bernard et al., 2018; Mills-Koonce et al., 2008; Campbell et al., 2004).

The present research focused on the detailed examination of the four main communication modalities, in conjunction with the actual and observable acts related to the use of a toy that co-occurred in a mother-infant interaction. Future research should also focus on the interactive sequences between these mothers' and infants' behavioural patterns. One may suggest delving into the exchange of initiatives and sensory stimuli/responses, as well as into the orbit of turn-taking during the mother-infant interaction. Such an approach could produce a more thorough picture of the emerging interactive matrix between the mother and the infant, which sets the base for the development of infants' verbal and NVC skills. In particular, this study presents a methodological contribution by designing an extensive coding scheme inspired mainly by Neale and colleagues' work (2018), which can serve as foundation and starting point for further analysis of additional behavioural aspects, such as the one suggested above.

Moreover, a future research focus on the important role of the father in infant development and family relations is strongly recommended. Nowadays there is a heightened scientific interest in the key role of the father in child development, especially in the case of PND (Walsh et al., 2020; Psychogiou et al., 2020; Fredriksen et al., 2019; Philpott & Corcoran, 2018). Moreover, there exists evidence that mothers perceive partners as the main support system during the postnatal period (Mayers et al., 2020; Rowe et al., 2013). Thus, notwithstanding the essential role of fathers in infant development, fathers can also contribute to the mothers' well-being, given that they are at the core of their support network. Yet, the present research could not include fathers in the study design, due to the restrictions regarding direct contact with families in the clinical group. However, this research project emphasises the imperative need for future studies to include fathers into the analysis, for the following reason: the fathers from the specific population under examination find themselves in the challenging position that they not only have to support their wives who suffer from a severe mental health issue, but they also have to deal with the experience of separation from their families due to hospitalisation. Further research should examine the effect of these experiences on paternal parenting skills and look more closely at the role of paternal behaviour in infants' verbal and non-verbal communication in this population.

Finally, as part of the initial research design, in order to address the research question regarding the differences in the quality of mother-infant interaction in the case of PND, maternal vocal behaviour was also assessed through maternal tone of voice, as a complementary form of evaluation of this variable. In particular, evidence shows that mothers with PND speak with a significantly higher voice when addressing their babies, when compared to mothers without PND (Reissland et al., 2003). In this case, the maternal irritated tone of voice could negatively affect the quality of the interaction with the infant (Pawlby et al., 2010). To further explore this aspect linked to mother-infant interaction and maternal sensitivity (Dau et al., 2019), soundwave was used to represent graphically the mothers' tone of voice, while vocal pitch and intensity values were estimated for all mothers from both groups. Unfortunately, this analysis was excluded from the final version of the study, since it was considered unreliable, due to sound quality deficits attributed to the different equipment used to capture sound in the clinical setting and the Children's Centres. These differences compromised the ability to compare the soundwaves between maternal groups, even if such an investigation could have constituted an interesting input for the assessment of maternal sensitivity and vocal behaviour and its respective effects on infant development and well-being.

However, the steps followed to access maternal tone of voice may inform future research, and for this reason they are presented here: initially, audio files were exported from the video files, using QuickTime technology (by Apple Computers Inc.) to produce audio files in M4A format. Then, all audio files were converted into WAV file format in order to render them compatible with the software chosen for calculating pitch and intensity levels. Subsequently, Audacity audio software was used to extract a 10-second segment of each audio file that was completely clean, without any offending noise present – for instance, the baby's vocalisations or noise from the toys. Audacity audio software is free and available online. Also, no license was required, as it had been published by the Free Software Foundation.

For automatically estimating the pitch and intensity values of maternal voices for further analysis, Praat Software (version 5.3.53) (Boersma & Weenink, 2013) was used. In particular, the maximum, minimum and mean of these specific speech-related features were measured. Soundwaves of maternal voice were extracted with the help of Praat Software, as additional visual information. This software has been extensively used in research in vocal communication, linguistics and phonology (e.g., Moradi et al., 2014; Wang, 2019; Sauder et al., 2017; Moura et al., 2008). It is also free and available online.

8.5 Implications for Policy and Practice

The findings of this study added to the existing literature on the importance of mother-infant interaction as contributing to early childhood outcomes in vulnerable women with PND and their infants. An enhanced understanding of the impact of this interaction in samples of infants at risk for poor developmental outcomes is of pivotal importance for thinking about how best to promote child well-being and planning intervention accordingly. The research findings can contribute to the improvement of treatment options focused on enhancing the developing relationship between mothers with PND and infants through play, maternal singing and speaking, as well as face-to face and physical contact, thereby promoting a better quality of life for this population. The use of research findings that uphold Froebelian values aims to ensure the integrity of childhood and the right of every child to achieve their potential, by reducing the impact of the challenging beginning on their future life.

In particular, the novel findings regarding the interactive play patterns between mothers and infants in the case of PND can inform existing interventions. Improved interventions should incorporate new techniques to enhance the maternal strengths observed in this study and to help mothers improve their play-related skills in order to effectively engage in a play interaction with their infants, organised around the use of a toy. This, in turn, will secure a higher quality of mother-infant play interaction, having a positive impact on both their relationship and the infant's holistic development and well-being. In parallel, the data of this research point to the need for including an accumulation of communication modalities (i.e., affect, gaze, touch, vocal) in future interventions, as integral, interrelated and indivisible elements of mother-infant interaction and well-being. Specifically, individually tailored guidance and therapy for each mother-infant pair is needed, considering their interaction style and the strengths and challenges observed in each dyad. Still, these early interventions should simultaneously aim to ameliorate PND symptoms in conjunction with enhancing maternal sensitivity and parenting skills so as to preserve the quality of mother-infant interaction which then promotes the infant's holistic development.

Another practical implication of this study's findings can be to inform guidelines and strategies for intensive educational programmes especially designed for pre-schoolers of mothers with depression, who are at high risk for cognitive and language difficulties. This should be done to support young children to develop their verbal and NVC skills effectively and, therefore, to enhance the child's overall well-being and school readiness. It is worth mentioning, however, that the child's school readiness, as used here, is not about preparing the child for the next stage; rather, it is about providing the richest and most appropriate environment for their development, as suggested by Froebel. Also, the findings recommend changes in teacher training, so that teachers will be able to adapt teaching activities appropriately in order to meet these children's individual needs.

Overall, the findings of the study may have direct implications for Early Childhood Education and Care (ECEC), even though this research goes beyond ECEC. More importantly, this study relates to education and care in a variety of contexts – including inpatient MBUs, educational settings for pre-schoolers and the home, and especially the disadvantaged home circumstances when mothers suffer from severe PND. Therefore, this research project provides a springboard for furthering the impact and visibility of Froebelian principles, by promoting new and effective partnerships among educational and clinical settings as well as families. Moreover, this study attempted to provide a broader picture and in-depth understanding, not only of infants' needs in the case of PND, but also of inpatient mothers' strengths and challenges in regard to their maternal role. Therefore, these findings may also inform MBUs' multidisciplinary teams – consisting of psychiatrists, psychologists and occupational therapists, as well as mental health and nursery nurses – about the specific needs of this population, so as to nurture high-quality and sensitive interaction between the clinical staff at MBUs and inpatient mothers with their babies.

8.6 Closing Remarks

The process of analysing the mother-infant interaction through 3-minute videos could be conceptualised as 'seeing the world in a grain of sand'. A wide range of behavioural combinations unfolded during the video-recorded observation, which not only contributed to further our knowledge about the importance of this interaction in infant development, but also posed the challenge to translate this knowledge into practice. The present research endeavour aimed to provide a comprehensive and integrative picture of the effect of PND on maternal and infant communication patterns, which influence the quality of their relationship as well as the development of verbal and NVC skills in infants. This picture serves as a mosaic of smaller varied pieces that this study attempted to put together, considering the multidimensional nature of the mother-infant interaction.

While the findings revealed deficits in maternal interactive patterns in the case of PND, which could be associated with impairments in infants' verbal and NVC skills in the clinical group, the results also showed maternal good intentions and willingness to interact with their infants using maternal singing, play, face-to-face contact and tactile behaviours in the clinical group. These maternal good intentions found in mothers with PND could be considered significant aspects in stimulating mother-infant interactional competence which, with the necessary support, could enhance the quality of mother-infant interaction. This research project takes a stand against the deterministic view that maternal PND necessarily compromises early mother-infant interaction and infant developmental trajectories, a notion that stigmatises these mothers (Wan & Green, 2009). Thus, shedding light on both maternal strengths and weaknesses in the case of PND, the current PhD project paves an avenue for future research to further investigate how to enhance these maternal strengths and ameliorate the respective maternal weaknesses. The goal should be to promote maternal intuitive trust that their parenting skills can secure the optimal development of infants' verbal and NVC competencies.

Overall, embracing the Froebelian principle that every child deserves equal opportunities to lead a healthy and fulfilling life, this study produced suggestions for improvement in the existing policies for early intervention. It is driven by the assumption that helping children from the very first years of their life is the most effective way to give them the opportunity for personal fulfilment and individual growth, a value highly endorsed by Froebel's theory.

Appendices

Appendix A. Additional Information About the Demographic Profile of the Comparison Group

Amongst the participant mothers of the comparison group, the most common way of childbirth was a virginal delivery (62.5%) while 35% of mothers had to deliver via caesarean section. Mothers had predominantly completed studies at a university level (43.3%) while 30% and 16.7 % had completed postgraduate education and college respectively. Regarding their occupational status, 66.7% of participants worked full time and 6.7% had a part-time job. Regarding infants' birth order, the vast majority of the infants was a first-born child (96.7%).

Table A.

Maternal Demographic Characteristics for the Comparison Group

Maternal demographic characteristics (n=30)		
Educational level[1]	Secondary school (%)	1 (3.3%)
	College/Diploma (%)	5 (16.7%)
	University/Degree (%)	13 (43.3%)
	Postgraduate (%)	9 (30%)
Occupational status[2]	Employed full-time	20 (80%)
	Employed part-time	2 (8%)
	Other	3 (12%)
Infants' general information		
Primiparity	1st child (%)	29 (96.7%)
	2nd child (%)	1 (3.3%)

[1]For this variable, data was available for 28 out of 30 mothers without PND. Missing data was excluded from analyses.
[2]For this variable, data was available for 25 out of 30 mothers without PND. Missing data was excluded from analyses.

Appendix B. Honorary Contract with South London and Maudsley National Health System Foundation Trust (SLaM, NHS)

South London and Maudsley NHS
NHS Foundation Trust

Human Resources Department
HR Support Services
6th Floor, Jeanette Wallace House
1 Edridge Road, Croydon
Surrey CR0 1FE
Tel: 0203 228 5371
Fax: 0203 228 4899

01 June 2018

Private & Confidential

Ms Vasiliki Eirinaki

Dear Ms Eirinaki,

Re: Honorary Researcher

I am pleased to confirm the arrangements for you to carry out your Honorary Attachment under the supervision of **Dr Robin Schacht** within:

Mother and Baby Unit, Bethlem Royal Hospital
Monks Orchard Road
Beckenham, Kent BR3 3BX
PMIC CAG

South London and Maudsley NHS Foundation Trust with effect from:

1st October 2018 – 1st October 2019

(Extension requests to be submitted one month before expiry date - 1 year maximum)

You will have a formal number of clinical sessions with the Trust. You will also have access to patient data.

Your supervisor/manager will ensure that you are familiar with all relevant HR and Operational Policies and Procedures of the Trust, that you work in accordance with these, and conduct your work to the standards of behaviour and performance required by the Trust. Please also read the 'Conditions of Attachment' enclosed.

If you agree to accept this clinical placement, please could you sign both copies of this letter, returning one copy to me as your acceptance of these arrangements and retaining the second for your own information.

I hope you enjoy your placement.

Marta Subocz
HR Support Services Administrator
South London and Maudsley NHS Foundation Trust

I hereby accept the offer of an Honorary Attachment as set out in the Terms and Conditions, which accompany this letter.

Signed

Dated 04/06/2018

Managers' signature

THE SOUTH LONDON & MAUDSLEY NHS TRUST
HONORARY ATTACHMENT – CONDITIONS OF ATTACHMENT

1. The Attachment will be without remuneration from the Trust. Travelling expenses etc., will not be met by the Trust unless prior formal approval has been given

2. The Trust will not be responsible for the reimbursement of course, lecture or examination fees unless prior application has been made for a refund of such expenses and formal approval has been given.

3. The Trust has an obligation under the Health and Safety at Work Act 1974 to provide safe and healthy working conditions and methods. You are required to co-operate with Management in discharging its responsibilities under the Act and to take reasonable care for the health and safety of yourself and others.

4. During the course of the Attachment you may have access to see or hear information of a confidential nature and you are required to undertake not to disclose such information to any unauthorised persons. Breach of confidentiality may result in the termination of the Attachment.

5. Any event of misconduct or poor performance may result in the termination of your Honorary Attachment. In cases of alleged serious misconduct you will be required to leave Trust premises pending investigation.

6. Your Honorary Attachment to the Trust does not constitute employment per se and you will not be entitled to any form of payment on its cessation. Employment with the Trust is not guaranteed in any way or conferred by this letter.

7. If, for any reason e.g. sickness, you are unable to attend for the purpose of your Attachment, you should inform your immediate superior as soon as possible.

8. Whilst on an Honorary Attachment to the Trust you will comply with its policies and procedures as prescribed.

9. The Trust does not normally accept responsibility for articles lost or damaged on NHS property.

10. Copies of the Trust's disciplinary policy and rules (relating to summary dismissal offences), grievance procedure and Health and Safety documents can be viewed in the Personnel Department. Although applicable to employees, the principles of both the Health and Safety documents and the disciplinary rules may be applied directly to the terms of your Attachment. The grievance procedure and disciplinary policy should also be interpreted as referring to your Honorary Attachment wherever there is a reference to 'employee' or 'service' although your rights of appeal cannot extend beyond the Trust, i.e. as far as possible the policies and procedures applicable to you shall mirror those of the Trust's employees.

11. The Trust indemnified you against any legal claims arising from the proper execution of your recognised duties on Trust or other authorised premises.

Extension of Honorary Contract with South London and Maudsley National Health System Foundation Trust (SLaM, NHS)

South London and Maudsley **NHS**
NHS Foundation Trust

Human Resources Department
HR Support Services
6th Floor, Jeanette Wallace House
1 Edridge Road, Croydon
Surrey CR0 1FE
Tel: 0203 228 5371
Fax: 0203 228 4899

16 September 2019

Private & Confidential

Ms Vasiliki Eirinaki

EXTENSION

Dear Ms Eirinaki,

Re: Honorary Researcher

I am pleased to confirm the arrangements for you to carry out your Honorary Attachment under the supervision of **Dr Robin Schacht** within:

Mother and Baby Unit, Bethlem Royal Hospital,
Monks Orchard Road
Beckenham, Kent BR3 3BX
Croydon Directorate/PMIC CAG

South London and Maudsley NHS Foundation Trust with effect from:

1st October 2019 – 1st October 2020

(Extension requests to be submitted one month before expiry date - 1 year maximum)

You will have a formal number of clinical sessions with the Trust. You will also have access to patient data.

Your supervisor/manager will ensure that you are familiar with all relevant HR and Operational Policies and Procedures of the Trust, that you work in accordance with these, and conduct your work to the standards of behaviour and performance required by the Trust. Please also read the 'Conditions of Attachment' enclosed.

If you agree to accept this clinical placement, please could you sign both copies of this letter, returning one copy to me as your acceptance of these arrangements and retaining the second for your own information.

I hope you enjoy your placement.

Marta Subocz
Honorary Contracts Co-Ordinator
South London and Maudsley NHS Foundation Trust

Appendix C. Consent Forms for the Clinical Group

One copy to be kept with Film. **One copy with Patient's Case Notes.**

INSTITUTE OF PSYCHIATRY/BETHLEM ROYAL HOSPITAL AND MAUDSLEY HOSPITAL

Consent Form - Recorded Interviews

I consent to the recording of an interview with me/my relative being made and kept on videotape/audiotape.

I understand that this recording may be used for purposes of assessment, teaching or research. Strict confidentiality will always be observed, and it will be seen only within the Institute of Psychiatry and the Bethlem Royal and Maudsley Hospitals by professional staff or their trainees.

I understand that I will be further consulted before this recording is shown to a wider audience. (Any permission for wider showing to be noted here and separately signed and dated).

NAMES OF ALL THOSE APPEARING ON THE RECORDING	AGE (if under 18)	SIGNATURES
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....

NAME OF PARENT OR RELATIVE SIGNING ON BEHALF OF A CHILD OR PATIENT UNABLE TO GIVE CONSENT	AGE	SIGNATURE
....	....	....

Name of Interviewer	Signature of Interviewer
....	....
Name of Consultant (Hospital Patients only)	**Date**
....	....

Serial No. of tape ....

This form must be signed at the conclusion of the recording by all those who appear on the recording. In the case of young children, the parent or guardian should sign, or in the case of patients unable to give consent, their nearest relative should sign on their behalf.

The complete form should be filed in the patient's notes.

PLEASE NOTE that it is still necessary to inform the interviewees during the first part of the recording that a recording is being made, and that their written permission for its preservation will be requested at the end.

Appendix D. Ethical Approval from the University of Roehampton

Ethics Application Ref: PSYC 18/ 321 - Final Approval

Jan Harrison

Wed 09/01/2019 10:07

To: Vasiliki Eirinaki (Research Student) <eirinakv@roehampton.ac.uk>;

Cc: Amanda Holmes <A.Holmes@roehampton.ac.uk>; Diane Bray <D.Bray@roehampton.ac.uk>; Cecilia Essau <C.Essau@roehampton.ac.uk>;

Dear Vasiliki,

Ethics Application
Applicant: **Vasiliki Eirinaki**
Title: **The effect of maternal postnatal depression on infants' verbal and nonverbal communication skills: a video-based analysis**
Reference: **PSYC 18/ 321**
Department: **Psychology**

Under the procedures agreed by the University Ethics Committee I am pleased to advise you that your Department has confirmed their approval of your application and that any conditions for approval of this project have now been met, and that the risk assessment for your project has been reviewed and approved by the Health & Safety Office. We do not require anything further in relation to this application.

Please note that on a standalone page or appendix the following phrase should be included in your thesis:

The research for this project was submitted for ethics consideration under the reference PSYC 18/ 321 in the Department of Psychology and was approved under the procedures of the University of Roehampton's Ethics Committee on 09.01.19.

Please Note:

- **This email confirms that all conditions have been met and thus confirms final ethics approval (it is assumed that you will adhere to any minor conditions still outstanding, therefore we do not require a response to these).**
- **University of Roehampton ethics approval will always be subject to compliance with the University policies and procedures applying at the time when the work takes place. It is your responsibility to ensure that you are familiar and compliant with all such policies and procedures when undertaking your research.**
- **Please advise us if there are any changes to the research during the life of the project. Minor changes can be advised using the Minor Amendments Form on the Ethics Website, but substantial changes may require a new application to be submitted.**
- **If this project involves clinical procedures or administering substances it is a condition of Ethics approval that all relevant SOPs published on the department communities pages are fully complied with.**

Many thanks,

Jan

Appendix E. Information Sheet and Participant Consent Form for Mothers without PND

University of Roehampton London

INFORMATION SHEET & PARTICIPANT CONSENT FORM

Title of Research Project:

The Effect of Maternal Postnatal Depression on Infants' Verbal and Non-verbal Communication Skills: A Video-based Analysis

Brief Description of Research Project:

The aim of this study is to examine the effect of maternal PND on infants' verbal and non-verbal communication skills during three crucial activities in child development: play, mother singing and face-to-face interaction. Pre-existing videos from an inpatient Mother Baby Unit (MBU) in London containing footage of 40 mothers with PND interacting with their babies during these three activities will be used. MBUs provide psychiatric care for mothers with severe mental health problems, including PND, and therapeutic input for mothers in order to address their relationship difficulties. In this in-patient ward, mothers are admitted with their babies and the mother-infant interaction is video-recorded for interventions purposes.

A comparison group of 40 mothers without PND and their babies will be recruited from Maternity Services and Children's Centres in London. Mothers without PND and infant interaction will be video-recorded in order to illustrate the real differences - strengths and challenges-in the interaction between mothers with PND and their infants.

We hope that the findings of the study will produce suggestions for improvement in existing policies for early intervention of children at risk and will contribute to the improvement of treatment options focused on enhancing the developing relationship between mothers with mental health issues (i.e., PND) and their infants.

What Participation Involves:

Participation involves one session with you and your baby lasting approximately 30 minutes in total. The first phase will take about 10-12 minutes and you will be asked to complete a set of self-report questionnaires with closed-ended questions related to your demographic characteristics and personal history of depression. The second phase focuses on mother-infant interaction and will be video-recorded. The video production of this interaction will take about 5-8 minutes and you will be asked to interact with your baby as you normally do. The "warm-up" period before the video production and short intervals if required are included in the total estimated duration of the session. Please note that you have the right to interrupt the video-recording process at any point. A quiet room in your preferred environment (i.e. in Maternity Services/Children's Centres or at home) will be needed to preserve familiarity with the context, at a time convenient to you.

The participation in the study is voluntary; you will be free to withdraw at any time without providing justification for this. There are no adverse consequences for withdrawing. You could ask for the video to be deleted if you wish so. No names or identifying personal details will be fed back to the University or given in any presentation of the findings, and it should not be possible for anyone to recognize you in any report of the project. No images from the videos will be reproduced in any document produced from this research.

The information derived from this session will be used as a comparison to a separate sample of mothers with postnatal depression. The researcher will be available for a short meeting with you either in person or over the phone to explain the project in more detail, and to discuss any question raised at any point.

Investigator contact details:

Vicky Eirinaki
Department of Psychology I School of Education
University of Roehampton
London SW15 5PJ
Telephone: 020 8392 3085
Email:
eirinakv@roehampton.ac.uk

Consent statement:

I agree to take part in this research, and am aware that I am free to withdraw at any point without giving a reason by contacting Vicky Eirinaki. I understand that if I do withdraw, my data may not be erased but will only be used in an anonymised form as part of an aggregated dataset. I understand that the personal data collected from me during the course of the project will be used for the purposes outlined above in the public interest.

By signing this form, you are confirming that you have read, understood and agree with the University's Data Privacy Notice for Research Participants and the University's Data Protection Policy.

The information you have provided will be treated in confidence by the researcher and your identity will be protected in the publication of any findings. Your data will be kept presumably 10 years. The purpose of the research may change over time, and your data may be re-used for research projects by the University in the future. If this is the case, you will normally be provided with additional information about the new project.

Name ……………………………………

Signature ……………………………….

Date ……………………………………..

Please note: if you have a concern about any aspect of your participation or any other queries please raise this with the investigator (or if the researcher is a student you can also contact the Director of Studies.) However, if you would like to contact an independent party please contact the Head of Department.

Director of Studies Contact Details:

Prof Cecilia A. Essau
Professor of Developmental Psychopathology
Department of Psychology
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Head of Department Contact Details:

Dr Diane Bray
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Appendix F. Initial Contact with the Mother-Baby Unit

The researcher had worked as a trainee assistant psychologist at the MBU in the Bethlem Royal Hospital, under the supervision of Dr Pawlby, as part of her clinical placement as a postgraduate student at the Institute of Psychiatry, King's College London in 2012. This experience cultivated her interest in this field and has been inextricably linked to the conceptualisation of this study. Therefore, in the initial attempt to confirm permission of accessing and using pre-existing data (i.e., video-recordings of inpatient mothers interacting with their infants) for the purpose of this project, the researcher contacted Dr Pawlby and Dr Seneviratne who is a consultant psychiatrist, lead clinician and perinatal psychiatrist at the Bethlem Royal Hospital, Mother-Baby Unit.

In a meeting with Dr Pawlby in October 2016 it was confirmed that the use of pre-existing data for a new purpose (i.e., for the present study) did not require additional consent forms from mothers with severe PND. In the consent forms signed by the mothers who have been video recorded in this clinical setting, they fully agreed for the videos to be used for future studies by professional staff or their trainees within SLaM or the Institute of Psychiatry, King's College London. For this research project, Dr Pawlby suggested that the way for the researcher to gain access to these videos was by signing an honorary contract with South London and Maudsley NHS Foundation Trust. Dr Pawlby and Dr Seneviratne agreed to send an application to the SLaM ethics committee so the researcher can have access to the archived video materials in order to analyse the content. After the completion of this process in April 2018, the researcher also submitted an honorary contract application to SLaM ethics committee in May 2018.

The SLaM honorary contract application was approved in October 2018. Since then, the researcher obtained an honorary contract with SLaM, NHS, under the supervision of Dr

Robin Schacht who works as a clinical psychologist within the MBU at the Bethlem Royal Hospital. In the meantime, Dr Pawlby got retired and as a consequence, she could not undertake the role of a clinical supervisor, but she was still in charge of the clinal video-recorded material and the respective database, as a visiting senior research fellow. The initial meeting with the clinical supervisor, Dr Schacht, was held in November 2018; in this meeting the researcher got informed that the video tapes and DVDs are stored in locked cabinets. They cannot be copied or taken off site, they should be viewed only at the MBU and the originals should be returned to where they are stored. Consequently, the analysis of video footage of PND mothers and their infants would take place onto the psychiatric ward and all participants' personal data should be contained within Bethlem Royal Hospital.

Appendix G. Letters Describing the Project Sent to the Children's Centres as Part of the Recruitment Process for the Comparison Group

University of Roehampton London

Research Project:

The Effect of Maternal Postnatal Depression on Infants' Verbal and Non-verbal Communication Skills: A Video-based Analysis

Researcher: Vicky Eirinaki
Supervisors: Prof Cecilia Essau & Dr Olympia Palikara

Dear xxxxxx,

I am writing to introduce myself and inform you of a collaborative research project between the Department of Psychology and the School of Education that we are conducting at the University of Roehampton. The ***effect of maternal postnatal depression on infants' verbal and non-verbal communication skills: a video-based analysis*** is a 2-year research project funded by the Froebel Trust to investigate the consequences of maternal postnatal depression (PND) on infants' development, with a specific focus on language development. For further information about this research project, please refer to the attached document "Participant consent form".

We are approaching a number of Maternity Services and Children's Centres in London working with new mothers and their babies, and we hope that you will be interested in taking part. We would like to arrange an initial meeting with you to introduce ourselves and to discuss the details of our project. Please note that the participation of your organisation in this project does not require any additional work from the professionals and does not make any additional time demands. The only involvement would be to give permission to the researcher to approach the mothers who visit the place. A quite room in each participant's preferred environment (i.e. in Maternity Services/Children's Centres or at ho me) will be needed to preserve familiarity with the context. Therefore, this request might include access to your premises for some sessions, if necessary. Each session will last approximately 20- 30 minutes and will be arranged at the most convenient time for your organisation and the participant. The researcher obtains DBS clearance and will always follow the health and safety policy and procedures of your setting.

Throughout the project we would be happy to communicate with you to describe our research, disseminate our findings and provide feedback, both orally and in written form.

We hope this information is helpful but if you would like further details please do not hesitate to contact us using the contact details below.

Thank you for your support on this project. We will call shortly to arrange a time for a meeting.

Kind regards,

Vicky Eirinaki
Department of Psychology I School of Education
University of Roehampton,London SW15 5PJ
Telephone: 020 8392 3085 Email: eirinakv@roehampton.ac.uk

Appendix H. Flyer of the Project Description Specifically Designed for Mothers without PND

DO YOU HAVE A CHILD AGED BETWEEN 3 TO 12 MONTHS?

Mother-Child Interaction Project at the University of Roehampton

Aims of the Project:
To improve the quality of children's lives. To achieve this we need to explore how mother-child interaction might affect children's development.

How you can help:

- Complete a set of questionnaires (takes about 10 minutes).
- Take part in 5 minutes of play with your child, which will be video-taped. For the video-recording process, a quiet room will be need in a familiar environment of your preference (i.e. in Maternity Services/Children's Centres or at home), at a time convenient to you.

All data gathered during this study will be held securely and anonymously.

Your cooperation is crucial for the success of this research. **We hope that you will agree to take part**; If you are happy to participate in our research, I would be most grateful if you could please kindly contact me:

Vasiliki Eirinaki
Telephone: 0742 8880 930
Email: eirinakv@roehampton.ac.uk

Appendix I. Self-Report Questionnaires for Mothers without PND

University of Roehampton London

Self-Report Questionnaire for Mothers

Title of Research Project:

The Effect of Maternal Postnatal Depression on Infants' Verbal and Non-verbal Communication Skills: A Video-based Analysis

Thank you very much for taking part in our study, we greatly appreciate your contribution!

Your participation will help us obtain a better understanding of the effect of mothers' postnatal depression on infants' language development. The information provided from you will be used as a comparison to a separate sample of mothers with postnatal depression. All data gathered during this study will be held securely and anonymously. Please, try to answer the best way you can.

Instructions: Please answer all the questions and for choice fields please place a firm cross e.g. ☒in a single box per item.

A. Demographic Characteristics

1- Ethnicity

A. White
- ☐ British
- ☐ Irish
- ☐ Any other white background

B. Mixed
White and Black Caribbean
- ☐ White and black African
- ☐ White and Asian
- ☐ Any other mixed background

C. Asian or Asian British
- ☐ Indian
- ☐ Pakistani
- ☐ Bangladeshi
- ☐ Any other Asian Background

D. Black or Black British
- ☐ Caribbean
- ☐ African
- ☐ Any other Black background

E. Other Ethnic Groups
- ☐ Chinese
- ☐ Other ethnic category

2- **Marital status:**
- ☐ Single
- ☐ Married
- ☐ Divorced or separated
- ☐ Widowed
- ☐ Other, please specify

____

3- **Education**
- ☐ Primary school
- ☐ Secondary school
- ☐ College/Diploma
- ☐ University/Degree
- ☐ Postgraduate

4- **Occupational status**
- ☐ Employed full-time
- ☐ Employed part-time
- ☐ Unemployed
- ☐ Casual worker
- ☐ Housewife
- ☐ Other

5- **Age** ______________________________

B. Maternal Mental Health

1- **Have you ever been diagnosed with a mental illness?**

☐Yes ☐No

If yes, please indicate the diagnosis and treatment: ______________________________

2- Before or during your pregnancy did you have any mental health issues?

☐Yes ☐No

3- Have you ever taken any medication for mental health issues?

☐Yes ☐No

C. Information about your Child

1- What is the date of birth of the participating child? ______________________________

2- Child's gender:

☐Male ☐Female

3- If you have more than one child, what us the participating child's birth order?

____

Thank you for your time and collaboration!

Appendix J. Edinburgh Postnatal Depression Scale

Edinburgh Postnatal Depression Scale[1] (EPDS)

Name: ______________________________ Address: ___________________________

Your Date of Birth: ____________________ ___________________________

Baby's Date of Birth: ___________________ Phone: ___________________________

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today.

Here is an example, already completed.

I have felt happy:
- ☐ Yes, all the time
- ☒ Yes, most of the time
- ☐ No, not very often
- ☐ No, not at all

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - ☐ As much as I always could
   - ☐ Not quite so much now
   - ☐ Definitely not so much now
   - ☐ Not at all

2. I have looked forward with enjoyment to things
   - ☐ As much as I ever did
   - ☐ Rather less than I used to
   - ☐ Definitely less than I used to
   - ☐ Hardly at all

*3. I have blamed myself unnecessarily when things went wrong
   - ☐ Yes, most of the time
   - ☐ Yes, some of the time
   - ☐ Not very often
   - ☐ No, never

4. I have been anxious or worried for no good reason
   - ☐ No, not at all
   - ☐ Hardly ever
   - ☐ Yes, sometimes
   - ☐ Yes, very often

*5 I have felt scared or panicky for no very good reason
   - ☐ Yes, quite a lot
   - ☐ Yes, sometimes
   - ☐ No, not much
   - ☐ No, not at all

*6. Things have been getting on top of me
   - ☐ Yes, most of the time I haven't been able to cope at all
   - ☐ Yes, sometimes I haven't been coping as well as usual
   - ☐ No, most of the time I have coped quite well
   - ☐ No, I have been coping as well as ever

*7 I have been so unhappy that I have had difficulty sleeping
   - ☐ Yes, most of the time
   - ☐ Yes, sometimes
   - ☐ Not very often
   - ☐ No, not at all

*8 I have felt sad or miserable
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Not very often
   - ☐ No, not at all

*9 I have been so unhappy that I have been crying
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Only occasionally
   - ☐ No, never

*10 The thought of harming myself has occurred to me
   - ☐ Yes, quite often
   - ☐ Sometimes
   - ☐ Hardly ever
   - ☐ Never

Administered/Reviewed by ______________________________ Date ____________________________

[1]Source: Cox, J.L., Holden, J.M., and Sagovsky, R. 1987. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry* 150:782-786 .

[2]Source: K. L. Wisner, B. L. Parry, C. M. Piontek, Postpartum Depression N Engl J Med vol. 347, No 3, July 18, 2002, 194-199

Appendix K. Theoretical Definitions (from Provenzi et al., 2018 p. 348)

Dyadic concepts	**Theoretical definition**
Mutuality	Mutual contribution of the interactive partners, which might not be equal in terms of frequency and intensity of the behaviours of the two partners.
Reciprocity	Reciprocal influence between interactive partners.
Attunement	Sharing of actions and intentions which includes maternal identification of infant's inner feelings/states and infant's comprehension that the mother is referring to his own original state.
Contingency	Reciprocal adjustment of trans-modal affective and behavioural signals within a micro-temporal window that leads to infants' learning and regulation skills and interactive patterns.
Coordination	Bidirectional rhythmic exchanges characterized by specific timing and turn taking which facilitates the reciprocal prediction of future behavioural states.
Matching	Simultaneous exhibition of the same affective and/or behavioural state by the mother and the infant.
Mirroring	Exaggerated/marked reflection of trans-modal child behaviours by the mother through imitation of affective quality reproduction in a temporally contingent way.
Reparation	Dyadic process in which unmatched dyadic states are transformed in matched dyadic states producing opportunity to learn interactive strategies and to achieve better stress and emotion regulation.
Synchrony	Degree of congruence between trans-modal behaviours of two partners which is lagged in time and which promotes infants' learning of emotional regulation skills and the emergence of expectations on interactive repertoires.

Appendix L. Additional Statistical Analysis for Study 2 Data

Table I Correlations (Pearson's r) Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Behaviour

	1	2	3	4	5	6	7	8	9	10
Infant Emotional Tone	1									
Self-Regulation	.73**	1								
Maternal Emotional Tone	.59**	.55**	1							
Maternal Sensitivity	.77**	.83**	.66**	1						
Atmo-sphere	.71**	.75**	.59**	.81**	1					
Reci-procity	.75**	.81**	.68**	.96**	.86**	1				
Verbal Control Strong (E.C.)	.03	.12	.04	.10	.00	.10	1			
Verbal Control Mild (E.C.)	-.04	.13	.24	.05	-.02	.01	.12	1		
Verbal Elabora-tion (R.S.)	.45**	.47**	.61**	.43**	.42**	.43**	-.01	.17	1	
Positive Ex-pressed Emotion (E.C.)	-.06	-.09	.22	-.08	.02	-.01	.11	.14	.16	1

Negative Expressed Emotion (E.C.)	-.02	.07	-.14	.03	.08	.01	.40**	-.12	-.06	-.13
Coercions	-.48**	-.29*	-.29*	-.43**	-.45**	-.47**	.17	.12	-.25	.11

Note. E.C.= Event Count
*p < .05, **p < .01

Table II Correlations (Pearson's r) Between Measures of Emotional Functioning and Quality of Interactions and Measures of Infant Verbal Behaviour

	1	2	3	4	5	6	7	8
Infant Emotional Tone	1							
Self-Regulation	.73**	1						
Maternal Emotional Tone	.59**	.55**	1					
Maternal Sensitivity	.77**	.83**	.66**	1				
Atmosphere	.71**	.75**	.59**	.81**	1			
Reciprocity	.75**	.81**	.68**	.96**	.86**	1		
Infant Vocalisation (RS)	-.07	-.04	-.05	.04	.18	.08	1	
Infant Vocalisation (EC)	-.07	-.08	-.13	.01	.12	.06	.77**	1

Note. R.S.= Rating Scale; E.C.= Event Count
*p < .05, **p < .01

Table III   Correlations (Pearson's r) Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Strong Verbal Control

	1	2	3	4	5	6	7	8	9	10
Infant Emotional Tone	1									
Self-Regulation	$.73^{**}$	1								
Maternal Emotional Tone	$.59^{**}$	$.55^{**}$	1							
Maternal Sensitivity	$.77^{**}$	$.83^{**}$	$.66^{**}$	1						
Atmo-sphere	$.71^{**}$	$.75^{**}$	$.59^{**}$	$.81^{**}$	1					
Reci-procity	$.75^{**}$	$.81^{**}$	$.68^{**}$	$.96^{**}$	$.86^{**}$	1				
Com-mands (E.C.)	-.05	.05	-.16	.01	-.01	.03	1			
Request (E.C.)	.16	.16	.26	.25	.06	.24	.07	1		
Inhibition (E.C.)	.21	.22	.26	.23	.22	.25	-.11	.13	1	
Forbids (E.C.)	-.03	-.02	-.13	-.19	-.12	-.21	.12	-.02	-.04	1
Caution-ing (E.C.)	-.24	-.12	-.27	-.18	-.11	-.24	.06	-.13	-.02	-.04
Correcting (E.C.)	$.30^{*}$	$.31^{*}$	.25	$.32^{*}$	$.32^{*}$	$.36^{*}$	.15	$.49^{**}$	$.70^{**}$	-.06

Note. E.C.= Event Count
$^{*}p < .05$, $^{**}p < .01$

Table IV Correlations (Pearson's r) Between Measures of Emotional Functioning and Quality of Interactions and Measures of Maternal Mild Verbal Control

	1	2	3	4	5	6	7	8	9	10
Infant Emotional Tone	1									
Self-Regulation	.73**	1								
Maternal Emotional Tone	.59**	.55**	1							
Maternal Sensitivity	.77**	.83**	.66**	1						
Atmosphere	.71**	.75**	.59**	.81**	1					
Reciprocity	.75**	.81**	.68**	.96**	.86**	1				
Suggests (E.C.)	.43**	.32*	.21	.41**	.21	.32*	1			
Prompts (E.C.)	-.23	-.04	.03	-.13	-.18	-.14	-.26	1		
Requests (E.C.)	.34*	.22	.33*	.25	.31*	.24	.10	-.07	1	
Joint Suggestions (E.C.)	.17	.30*	.46**	.37**	.29*	.33*	-.06	-.13	.22	1
Guide (E.C.)	-.07	-.04	-.03	-.23	-.13	-.24	-.01	.22	.41**	-.08

Note. E.C.= Event Count
*p < .05, **p < .01

References

Abels, M., Papaligoura, Z., Lamm, B., & Yovsi, R. D. (2017). How usual is “play as you usually would? A comparison of naturalistic mother-infant interactions with videorecorded play sessions in three cultural communities. *Child Development Research, 2017*, e7842030. https://doi.org/10.1155/2017/7842030

Abney, D. H., Warlaumont, A. S., Oller, D. K., Wallot, S., & Kello, C. T. (2017). Multiple coordination patterns in infant and adult vocalizations. *Infancy*, *22*(4), 514-539.

Abreu, A. C., & Stuart, S. (2005). Pharmacologic and hormonal treatments for postpartum depression. *Psychiatr Ann., 35,* 568-576.

Acosta, A. C. A. (2016). *Impact de trois interventions: Méthode Mère Kangourou, Massage en Incubateur et Massage en Position Kangourou sur la croissance et le développement des enfants prématurés nés à moins de 33 semaines d’âge gestationnel* [Unpublished doctoral dissertation, Universite Laval, Quebec].

Adamson, L. B., & Bakeman, R. (1985). Affect and attention: Infants observed with mothers and peers. *Child Development, 56*, 582-593.

Adina, J., Morawska, A., Mitchell, A. E., & McBryde, M. (2021). Effect of Parenting Interventions on Perinatal Depression and Implications for Infant Developmental Outcomes: A Systematic Review and Meta-Analysis. *Clinical child and family psychology review*, 1-23.

Ahun, M. N., Geoffroy, M. C., Herba, C. M., Brendgen, M., Séguin, J. R., Sutter-Dallay, A. L., ... & Côté, S. M. (2017). Timing and chronicity of maternal depression symptoms and children's verbal abilities. *The Journal of pediatrics*, *190*, 251-257.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. N. (1978). *Patterns of attachment: A psychological study of the strange situation*. Oxford: Lawrence Erlbaum.

Aktar, E., Colonnesi, C., de Vente, W., Majdandžić, M., & Bögels, S. M. (2017). How do parents’ depression and anxiety, and infants’ negative temperament relate to parent–infant face-to-face interactions. *Development and Psychopathology*, *29*(3), 697-710.

Alderdice, F., McNeill, J., & Lynn, F. (2013). A systematic review of systematic reviews of interventions to improve maternal mental health and well-being. *Midwifery*, *29*(4), 389-399.

Alhusen, J. L., Hayat, M. J., & Gross, D. (2013). A longitudinal study of maternal attachment and infant developmental outcomes. *Archives of women's mental health*, *16*(6), 521-529.

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*(1), 1-12.

Alise, M. A., & Teddlie, C. (2010). A continuation of the paradigm wars? Prevalence rates of methodological approaches across the social/behavioral sciences. *Journal of Mixed Methods Research*, *4*(2), 103-126.

Allely, C. S., Purves, D., McConnachie, A., Marwick, H., Johnson, P., Doolin, O., ... & Wilson, P. (2013). Parent–infant vocalisations at 12 months predict psychopathology at 7 years. *Research in Developmental Disabilities*, *34*(3), 985-993.

Alvarenga, P., Dazzani, M. V. M., Lordelo, E. D. R., Alfaya, C. A. D. S., & Piccinini, C. A. (2013). Predictors of sensitivity in mothers of 8-month-old infants. *Paidéia (Ribeirão Preto)*, *23*(56), 311-320.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual for Psychiatric Disorders, 4th Edition.* Washington, DC.

American Psychiatric Association. (2013). *Depressive Disorders: DSM-5® Selections*. American Psychiatric Pub.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Ammerman, R. T., Putnam, F. W., Bosse, N. R., Teeters, A. R., & Van Ginkel, J. B. (2010). Maternal depression in home visitation: A systematic review. *Aggression and Violent Behavior*, *15*(3), 191-200.

Anderson, S. E., Gooze, R. A., Lemeshow, S., & Whitaker, R. C. (2012). Quality of early maternal–child relationship and risk of adolescent obesity. *Pediatrics*, *129*(1), 132-140.

Andrews, J., Robinson, D., & Hutchinson, J. (2017). *Closing the gap? Trends in educational attainment and Disadvantage*. Education Policy Institute https://epi.org.uk/wp-content/uploads/2017/08/Closing-the-Gap_EPI-.pdf

Anisfeld, E., & Lipper, E. (1983). Early contact, social support, and mother-infant bonding. *Pediatrics*, *72*(1), 79-83.

Ann Easterbrooks, M., Biesecker, G., & Lyons-Ruth, K. (2000). Infancy predictors of emotional availability in middle childhood: The roles of attachment security and maternal depressive symptomatology. *Attachment & Human Development*, *2*(2), 170-187.

Anokye, R., Acheampong, E., Budu-Ainooson, A., Obeng, E. I., & Akwasi, A. G. (2018). Prevalence of postpartum depression and interventions utilized for its management. *Annals of general psychiatry*, *17*(18), 1-8.

Aoyagi, S. S., & Tsuchiya, K. J. (2019). Does maternal postpartum depression affect children's developmental outcomes?. *Journal of Obstetrics and Gynaecology Research*, *45*(9), 1809-1820.

Aoyagi, S. S., Takei, N., Nishimura, T., Nomura, Y., & Tsuchiya, K. J. (2019). Association of late-onset postpartum depression of mothers with expressive language development during infancy and early childhood: the HBC study. *PeerJ*, *7*, 1-22.

Appleby, L., Warner, R., Whitton, A., & Faragher, B. (1997). A controlled study of fluoxetine and cognitive-behavioural counselling in the treatment of postnatal depression. *Bmj*, *314*(7085), 932-936.

Arifin, S. R. M., Cheyne, H., & Maxwell, M. (2018). Review of the prevalence of postnatal depression across cultures. *AIMS public health*, *5*(3), 260-295.

Armstrong, K. L., O'donnell, H., McCallum, R., & Dadds, M. (1998). Childhood sleep problems: association with prenatal factors and maternal distress/depression. *Journal of paediatrics and child health*, *34*(3), 263-266.

Arnold, S. L. (2002). *Maternal tactile-gestural stimulation and infants' nonverbal behaviors during early mother-infant face-to-face interactions: Contextual, age, and birth status effects* [Doctoral dissertation, Concordia University].

Arnon, S., Diamant, C., Bauer, S., Regev, R., Sirota, G. & Litmanovitz, I. (2014) Maternal singing during kangaroo care led to autonomic stability in preterm infants and reduced maternal anxiety. *Acta Paediatrica. 103*(10), 1039-1044.

Asan, O., & Montague, E. (2014). Using video-based observation research methods in primary care health encounters to evaluate complex interactions. *Informatics in primary care*, *21*(4), 161-170.

Ashman, S. B., Dawson, G., & Panagiotides, H. (2008). Trajectories of maternal depression over 7 years: Relations with child psychophysiology and behavior and role of contextual risks. *Development and psychopathology*, *20*(1), 55-77.

Asmussen, J., Skovgaard, A. M., & Bilenberg, N. (2021). Trajectories of dysregulation in preschool age. *European Child & Adolescent Psychiatry*, 1-12.

Asselmann, E., Venz, J., Wittchen, H. U., & Martini, J. (2018). Maternal anxiety and depressive disorders prior to, during and after pregnancy and infant interaction behaviors during the Face-to-Face Still Face Paradigm at 4 months postpartum: A prospective-longitudinal study. *Early human development*, *122*, 45-53.

Astor, K., Lindskog, M., Forssman, L., Kenward, B., Fransson, M., Skalkidou, A., ... & Gredebäck, G. (2020). Social and emotional contexts predict the development of gaze following in early infancy. *Royal Society open science*, *7*(9), 201178.

Athari, P., Dey, R., & Rvachew, S. (2021). Vocal imitation between mothers and infants. *Infant Behavior and Development*, *63*, 1-15.

Aureli, T., Grazia, A., Cardone, D., & Merla, A. (2015). Behavioral and facial thermal variations in 3-to 4-month-old infants during the Still-Face Paradigm. *Frontiers in psychology*, *6*, 1586.

Austin, M. P., Tully, L., & Parker, G. (2007). Examining the relationship between antenatal anxiety and postnatal depression. *Journal of affective disorders*, *101*(1-3), 169-174.

Baidya, M.N., Mondal, A. & Saha, A. (2015) Educational thoughts of friedrich william A. froebel: A theoritical study. *International Journal of Applied Research, 1*(2), 135-137.

Bailey, B.A., Davidson, J.W., (2005). Effects of group singing and performance for marginalized and middle-class singers. *Psychology of Music, 33*, 269–303.

Bainbridge, C. M., Bertolo, M., Youngers, J., Atwood, S., Yurdum, L., Simson, J., ... & Mehr, S. A. (2021). Infants relax in response to unfamiliar foreign lullabies. *Nature Human Behaviour*, *5*(2), 256-264.

Baker, F., Wigram, T., & Gold, C. (2005). The effects of a song-singing programme on the affective speaking intonation of people with traumatic brain injury. *Brain Injury*, *19*(7), 519-528.

Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., & Juffer, F. (2003). Less is more: meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological bulletin*, *129*(2), 195-215.

Bakker, N. (2013). Cylinders and séances: Elise van Calcar and the spirit of Froebel. *History of Education*, *42*(2), 147-165.

Banti, S., Mauri, M., Oppo, A., Borri, C., Rambelli, C., Ramacciotti, D., Montagnani, M.S., Camilleri, V., Cortopassi, S., Rucci, P., & Cassano, G. B. (2011). From the third month of pregnancy to 1 year postpartum. Prevalence, incidence, recurrence, and new onset of depression. Results from the Perinatal Depression–Research & Screening Unit study. *Comprehensive psychiatry*, *52*(4), 343-351.

Barnes, D. L. (2006). Postpartum depression: Its impact on couples and marital satisfaction. *Journal of Systemic Therapies*, *25*(3), 25-42.

Barnett, L. (2005). Keep in touch: The importance of touch in infant development. *Infant Observation*, *8*(2), 115-123.

Barsalou, L. W. (2008). Grounded cognition. *Annu. Rev. Psychol.*, *59*, 617-645.

Barsky, A. J., & Silbersweig, D. A. (2017). *Depression in medical illness*. McGraw Hill Professional.

Bass III, P. F., & Bauer, N. S. (2018). Parental postpartum depression: More than" baby blues". *Contemporary Pediatrics*, *35*(9), 35-38.

Bate, A. (2017). *Early intervention briefing paper, No. 7647*. House of Commons Briefing Paper.

Bates, R. A., Salsberry, P. J., Justice, L. M., Dynia, J. M., Logan, J. A., Gugiu, M. R., & Purtell, K. M. (2020). Relations of Maternal Depression and Parenting Self-Efficacy to the Self-Regulation of Infants in Low-Income Homes. *Journal of Child and Family Studies*, *29*(8), 2330-2341.

Bateson, M. C. (1971). The interpersonal context of infant vocalization. *Quarterly progress report of the research laboratory of electronics*, *100*, 170-176.

Bateson, M. C. (1979). The epigenesis of conversational interaction: A personal account of research development. In M. Bullowa (Ed.), *Before speech: The beginning of human communication* (pp. 63–77). London: Cambridge University Press.

Beck, A. T., & Haigh, E. A. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual review of clinical psychology*, *10*, 1-24.

Beck, C. T. (1996). A meta-analysis of predictors of postpartum depression. *Nursing research*, *45*(5), 297-303.

Beck, C. T. (2001). Predictors of postpartum depression: an update. *Nursing research*, *50*(5), 275-285.

Beck, C. T. (2002). Postpartum depression: A metasynthesis. *Qualitative health research*, *12*(4), 453-472.

Beebe, B., & Lachmann, F. (2003). The relational turn in psychoanalysis: A dyadic systems view from infant research. *Contemporary Psychoanalysis*, *39*(3), 379-409.

Beebe, B., & Steele, M. (2013). How does microanalysis of mother–infant communication inform maternal sensitivity and infant attachment?. *Attachment & human development*, *15*(5-6), 583-602.

Beebe, B., Badalamenti, A., Jaffe, J., Feldstein, S., Marquette, L., Helbraun, E., ... & Ellman, L. (2008b). Distressed mothers and their infants use a less efficient timing mechanism in creating expectancies of each other's looking patterns. *Journal of psycholinguistic research*, *37*(5), 293-307.

Beebe, B., Jaffe, J., Buck, K., Chen, H., Cohen, P., Feldstein, S., & Andrews, H. (2008). Six-week postpartum maternal depressive symptoms and 4-month mother–infant self-and interactive contingency. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *29*(5), 442-471.

Beebe, B., Jaffe, J., Markese, S., Buck, K., Chen, H., Cohen, P., ... & Feldstein, S. (2010). The origins of 12-month attachment: A microanalysis of 4-month mother–infant interaction. *Attachment & human development*, *12*(1-2), 3-141.

Beebe, B., Lachmann, F., Jaffe, J., Markese, S., Buck, K. A., Chen, H., ... & Andrews, H. (2012). Maternal postpartum depressive symptoms and 4-month mother–infant interaction. *Psychoanalytic Psychology*, *29*(4), 383-407.

Beebe, B., Messinger, D., Bahrick, L. E., Margolis, A., Buck, K. A., & Chen, H. (2016). A systems view of mother–infant face-to-face communication. *Developmental psychology*, *52*(4), 556-571.

Beizer, L., & Howes, C. (1992). Mothers and toddlers: Partners in early symbolic play: Illustrative study #1. In C. Howes (Ed.), *The collaborative construction of pretend* (pp. 25–43). Albany, NY: State University of New York.

Belsky, J., Garduque, L., & Hrncir, E. (1984). Assessing performance, competence, and executive capacity in infant play: Relations to home environment and security of attachment. *Developmental psychology*, *20*(3), 406-417.

Bergelson, E., & Swingley, D. (2012). At 6–9 months, human infants know the meanings of many common nouns. *Proceedings of the National Academy of Sciences*, *109*(9), 3253-3258.

Bergen, D. (2019). *Infant sensorimotor play: Development of sociocultural competence and enactive cognition.* In P. K. Smith & J. L. Roopnarine (Eds.), *Cambridge handbooks in psychology. The Cambridge handbook of play: Developmental and disciplinary perspectives* (pp. 125–141). Cambridge University Press.

Bergeson, T. R., & Trehub, S. E. (2002). Absolute pitch and tempo in mothers' songs to infants. *Psychological Science*, *13*(1), 72-75.

Bernard, K., Nissim, G., Vaccaro, S., Harris, J. L., & Lindhiem, O. (2018). Association between maternal depression and maternal sensitivity from birth to 12 months: a meta-analysis. *Attachment & human development*, *20*(6), 578-599.

Bernier, A., Calkins, S. D., & Bell, M. A. (2016). Longitudinal associations between the quality of mother–infant interactions and brain development across infancy. *Child development*, *87*(4), 1159-1174.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children’s executive functioning. *Child development*, *81*(1), 326-339.

Bernier, A., Matte-Gagné, C., Bélanger, M. È., & Whipple, N. (2014). Taking stock of two decades of attachment transmission gap: Broadening the assessment of maternal behavior. *Child development*, *85*(5), 1852-1865.

Bettes, B. A. (1988). Maternal depression and motherese: temporal and intonational features. *Child development*, 1089-1096.

Bieleninik, Ł., Ghetti, C., & Gold, C. (2016). Music therapy for preterm infants and their parents: A meta-analysis. *Pediatrics*, *138*(3).

Biesta, G. (2010). Pragmatism and the philosophical foundations of mixed methods research. *Sage handbook of mixed methods in social and behavioral research*, *2*, 95-118.

Bigelow, A. E., MacLean, K., & Proctor, J. (2004). The role of joint attention in the development of infants' play with objects. *Developmental Science, 7*(4), 419-421.

Bilszta, J. L., Buist, A. E., Wang, F., & Zulkefli, N. R. (2012). Use of video feedback intervention in an inpatient perinatal psychiatric setting to improve maternal parenting. *Archives of women's mental health*, *15*(4), 249-257.

Binda, V., Figueroa-Leigh, F., & Olhaberry, M. (2019). Antenatal and postnatal depressive symptoms: Association with quality of mother–infant interaction. *Infant Behavior and Development*, *57*, 1-12.

Blackburn, C. (2020). The people in the purple shirts': Froebelian insights to a Singing Medicine project in a children's hospital. *Journal of Early Childhood Research*, *18*(3), 287-305.

Blair, C. (2010). Stress and the development of self-regulation in context. *Child development perspectives*, *4*(3), 181-188.

Blair, C., & Raver, C. C. (2016). Poverty, stress, and brain development: New directions for prevention and intervention. *Academic pediatrics*, *16*(3), 30-36.

Blandon, A. Y., & Scrimgeour, M. B. (2015). Child, parenting, and situational characteristics associated with toddlers' prosocial behaviour. *Infant and Child Development*, *24*(6), 643-660.

Bledsoe, S. E., & Grote, N. K. (2006). Treating Depression During Pregnancy and the Postpartum: A Preliminary Meta-Analysis. *Research on Social Work Practice*, *16*(2), 109–120.

Boath, E., & Henshaw, C. (2001). The treatment of postnatal depression: a comprehensive literature review. *Journal of reproductive and infant psychology*, *19*(3), 215-248.

Boath, E., Bradley, E., & Henshaw, C. (2004). Women's views of antidepressants in the treatment of postnatal depression. *Journal of Psychosomatic Obstetrics & Gynecology*, *25*(3-4), 221-233.

Boersma, P., & Weenink, D. (2013). Praat: Doing phonetics by computer [Computer program]. Version 5.3.53. (2013) Retrieved from: http://www.praat.org.

Born, L., Zinga, D., & Steiner, M. (2004). Challenges in Identifying and Diagnosing Postpartum Disorders. *Primary Psychiatry, 11*, 29–36.

Bornatein, M. H., & Tamis-LeMonda, C. S. (1990). Activities and interactions of mothers and their firstborn infants in the first six months of life: Covariation, stability, continuity, correspondence, and prediction. *Child development*, *61*(4), 1206-1217.

Bornstein, M. H., Arterberry, M. E., Mash, C., & Manian, N. (2011). Discrimination of facial expression by 5-month-old infants of nondepressed and clinically depressed mothers. *Infant Behavior and Development*, *34*(1), 100-106.

Bornstein, M. H., Hahn, C. S., & Suwalsky, J. T. (2013). Physically developed and exploratory young infants contribute to their own long-term academic achievement. *Psychological science*, *24*(10), 1906-1917.

Bornstein, M. H., Haynes, O. M., O'Reilly, A. W., & Painter, K. M. (1996). Solitary and collaborative pretense play in early childhood: Sources of individual variation in the development of representational competence. *Child development*, *67*(6), 2910-2929.

Botero, M., Langley, H. A., & Venta, A. (2020). The untenable omission of touch in maternal sensitivity and attachment research. *Infant and Child Development*, *29*(2), e2159.

Bourvis, N., Singer, M., Saint Georges, C., Bodeau, N., Chetouani, M., Cohen, D., & Feldman, R. (2018). Pre-linguistic infants employ complex communicative loops to engage mothers in social exchanges and repair interaction ruptures. *Royal Society open science*, *5*, 1-14.

Bowlby, J. (1975). Attachment theory, separation anxiety, and mourning. *American handbook of psychiatry*, *6*, 292-309.

Bowlby, J. (1977). The making and breaking of affectional bonds: I. Aetiology and psychopathology in the light of attachment theory. *The British journal of psychiatry*, *130*(3), 201-210.

Boyce, P. M. (2003). Risk factors for postnatal depression: a review and risk factors in Australian populations. *Archives of Women's Mental Health*, *6*(2), 43-50.

Bozicevic, L., De Pascalis, L., Schuitmaker, N., Tomlinson, M., Cooper, P. J., & Murray, L. (2016). Longitudinal association between child emotion regulation and aggression, and the role of parenting: a comparison of three cultures. *Psychopathology*, *49*(4), 228-235.

Brake, E., Berle, D., Reilly, N. M., & Austin, M. P. (2020). The relationship between emotion dysregulation and postnatal attachment in women admitted to a mother baby unit. *Australian Journal of Psychology*, *72*(3), 283-292.

Brand, R. J., Shallcross, W. L., Sabatos, M. G., & Massie, K. P. (2007). Fine-grained analysis of motionese: Eye gaze, object exchanges, and action units in infant-versus adult-directed action. *Infancy*, *11*(2), 203-214.

Brandes-Aitken, A., Braren, S., Swingler, M., Voegtline, K., & Blair, C. (2019). Sustained attention in infancy: A foundation for the development of multiple aspects of self-regulation for children in poverty. *Journal of experimental child psychology*, *184*, 192-209.

Braungart-Rieker, J. M., Garwood, M. M., Powers, B. P., & Wang, X. (2001). Parental sensitivity, infant affect, and affect regulation: Predictors of later attachment. *Child development*, *72*(1), 252-270.

Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. In M. Lewis & L. A. Rosenblum (Eds.), *The effect of the infant on its caregiver* (pp. 49- 76). New York: Wiley-lnterscience.

Brehony, K. J. (2013). Play, Work and Education: Situating a Froebelian Debate (Juego, trabajo y educación: situando un debate froebeliano). *Online Submission*, *65*(1), 59-77.

Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational transmission of self-regulation: A multidisciplinary review and integrative conceptual framework. *Psychological bulletin*, *141*(3), 602-654.

Brignell, A., Williams, K., Prior, M., Donath, S., Reilly, S., Bavin, E. L., ... & Morgan, A. T. (2016). Parent-reported patterns of loss and gain in communication in 1-to 2-year-old children are not unique to autism spectrum disorder. *Autism*, *21*(3), 344-356.

Brisola, E. B. V., & Cury, V. E. (2018). Investigating experience of mothers singing to their infants: in search of meanings. *Psicologia em Estudo*, *23*.

Brisola, E. B. V., & Ilari, B. (2021). Can mothers just 'sing their troubles away'?: an integrative review of singing and maternal mental health. *Cadernos Brasileiros de Saúde Mental/Brazilian Journal of Mental Health*, *13*(35), 16-42.

British Psychological Society (2018). *Code of Ethics and Conduct*. Leicester: Author.

Britton, H. L., Gronwaldt, V., & Britton, J. R. (2001). Maternal postpartum behaviors and mother-infant relationship during the first year of life. *The Journal of pediatrics*, *138*(6), 905-909.

Bronson, M. B., & Bronson, M. (2001). *Self-regulation in early childhood: Nature and nurture*. Guilford press.

Brookman, R., Kalashnikova, M., Conti, J., Xu Rattanasone, N., Grant, K. A., Demuth, K., & Burnham, D. (2020). Maternal depression affects infants' lexical processing abilities in the second year of life. *Brain sciences*, *10*(12), 1-18.

Brookman, R., Kalashnikova, M., Conti, J., Xu Rattanasone, N., Grant, K. A., Demuth, K., & Burnham, D. (2020). Depression and anxiety in the postnatal period: An examination of infants' home language environment, vocalizations, and expressive language abilities. *Child development*, *91*(6), 1211-1230.

Brooks, R., & Meltzoff, A. N. (2008). Infant gaze following and pointing predict accelerated vocabulary growth through two years of age: A longitudinal, growth curve modeling study. *Journal of child language*, *35*(1), 207-220.

Brown, S. (2012). The changing of the seasons in the child garden. *Early childhood practice: Froebel today*, 29-42.

Bruce, T. (2010). *Early Childhood: A guide for students*. Sage Publications.

Bruce, T. (2012). *Learning Through Play, For Babies, Toddlers and Young Children.* Hachette UK.

Bruce, T. (2019). *Educating Young Children: A Lifetime Journey Into a Froebelian Approach: the Selected Works of Tina Bruce*. Routledge.

Bruce, T. (2012). *Early childhood practice: Froebel today*. Sage.

Bruce, T., & Dyke, J. (2017). Learning from Froebel… the symbolic life of the child. *Nursery World*, *2017*(8), 25-27.

Bruce, T., & Spratt, J. (2011). *Essentials of literacy from 0-7: A whole-child approach to communication, language and literacy*. Sage.

Brummelte, S., & Galea, L. A. (2016). Postpartum depression: etiology, treatment and consequences for maternal care. *Hormones and behavior*, *77*, 153-166.

Bruner, J. (1983). Play, thought, and language. *Peabody Journal of Education*, *60*(3), 60-69.

Bryman, A. (2016). *Social research methods*. Oxford university press.

Buckley, B. (2003). *Children's communication skills: From birth to five years*. Psychology Press.

Buder, E. H., Warlaumont, A. S., Oller, D. K., Peter, B., & MacLeod, A. (2013). An acoustic phonetic catalog of prespeech vocalizations from a developmental perspective. *Comprehensive perspectives on child speech development and disorders: Pathways from linguistic theory to clinical practice*, *4*, 103-134.

Butler, S., McMahon, C., & Ungerer, J. A. (2003). Maternal speech style with prelinguistic twin infants. *Infant and Child Development: An International Journal of Research and Practice*, *12*(2), 129-143.

Byrn, M. D., & Hourigan, R. (2010). A comparative case study of music interactions between mothers and infants. *Contributions to Music Education*, *37*(1) 65-79.

Bystrova, K., Ivanova, V., Edhborg, M., Matthiesen, A. S., Ransjö-Arvidson, A. B., Mukhamedrakhimov, R., ... & Widström, A. M. (2009). Early contact versus separation: effects on mother–infant interaction one year later. *Birth*, *36*(2), 97-109.

Calkins, S. D., & Hill, A. (2007). Caregiver influences on biological and behavioral aspects of emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 229–248). New York: The Guilford Press.

Campbell, S. B., Brownell, C. A., Hungerford, A., Spieker, S. J., Mohan, R., & Blessing, J. S. (2004). The course of maternal depressive symptoms and maternal sensitivity as predictors of attachment security at 36 months. *Development and psychopathology*, *16*(2), 231-252.

Campbell, S. B., Cohn, J. F., & Meyers, T. (1995). Depression in first-time mothers: mother-infant interaction and depression chronicity. *Developmental Psychology*, *31*(3), 349-357.

Campbell, S. B., Morgan-Lopez, A. A., Cox, M. J., & McLoyd, V. C. (2009). A latent class analysis of maternal depressive symptoms over 12 years and offspring adjustment in adolescence. *Journal of abnormal psychology*, *118*(3), 479-493.

Campbell, S., & Cohn, J. (1997). The timing and chronicity od postpartum depression: the implications for infant development. In L. Murray & P.J. Cooper (Eds.), *Postpartum depression and child development* (pp. 165-197). Guilford, New York.

Cantero, M. J., Alfonso-Benlliure, V., & Melero, R. (2016). Creativity in middle childhood: Influence of perceived maternal sensitivity, self-esteem, and shyness. *Creativity Research Journal*, *28*(1), 105-113.

Carlson, E. A., Egeland, B., & Sroufe, L. A. (2009). A prospective investigation of the development of borderline personality symptoms. *Development and psychopathology*, *21*(4), 1311-1334.

Carolan, M., Barry, M., Gamble, M., Turner, K., & Mascareñas, Ó. (2012). The limerick lullaby project: an intervention to relieve prenatal stress. *Midwifery*, *28*(2), 173-180.

Carvajal, F., & Iglesias, J. (2002). Face-to-face emotion interaction studies in Down Syndrome infants. *International Journal of Behavioral Development, 26*, 104–112.

Carvalho, M. E. S., Justo, J. M., Gratier, M., Tomé, T., Pereira, E., & Rodrigues, H. (2019). Vocal responsiveness of preterm infants to maternal infant-directed speaking and singing during skin-to-skin contact (Kangaroo Care) in the NICU. *Infant Behavior and Development*, *57*, 101332.

Cascio, C. J., Moore, D., & McGlone, F. (2019). Social touch and human development. *Developmental Cognitive Neuroscience*, *35*, 5-11.

Cevasco, A. M. (2008). The effects of mothers' singing on full-term and preterm infants and maternal emotional responses. *Journal of music therapy*, *45*(3), 273-306.

Chabrol, H., Bron, N., & Le Camus, J. (1996). Mother-infant and father-infant interactions in postpartum depression. *Infant Behavior and Development*, *19*(1), 149-152.

Chabrol, H., Teissedre, F., Armitage, J., Danel, M., & Walburg, V. (2004). Acceptability of psychotherapy and antidepressants for postnatal depression among newly delivered mothers. *Journal of Reproductive and Infant Psychology*, *22*(1), 5-12.

Chang, H. C., Yu, C. H., Chen, S. Y., & Chen, C. H. (2015). The effects of music listening on psychosocial stress and maternal–fetal attachment during pregnancy. *Complementary therapies in medicine*, *23*(4), 509-515.

Chang, H. P., Chen, J. Y., Huang, Y. H., Tyan, J. Y., Yeh, C. J., Su, P. H., & Chen, V. C. H. (2014). Prevalence and factors associated with depressive symptoms in mothers with infants or toddlers. *Pediatrics & Neonatology*, *55*(6), 470-479.

Chericoni, N., de Brito Wanderley, D., Costanzo, V., Diniz-Gonçalves, A., Leitgel Gille, M., Parlato, E., ... & Muratori, F. (2016). Pre-linguistic vocal trajectories at 6–18 months of age as early markers of autism. *Frontiers in Psychology*, *7*, 1595.

Chess, S., & Thomas, A. (1987). *Origins and evolution of behavior disorders: From infancy to early adult life*. Harvard University Press.

Chew-Graham, C. A., Sharp, D., Chamberlain, E., Folkes, L., & Turner, K. M. (2009). Disclosure of symptoms of postnatal depression, the perspectives of health professionals and women: a qualitative study. *BMC family practice*, *10*(1), 1-9.

Chojenta, C. L., Lucke, J. C., Forder, P. M., & Loxton, D. J. (2016). Maternal health factors as risks for postnatal depression: a prospective longitudinal study. *PloS one*, *11*(1), 1-9.

Christl, B., Reilly, N., Yin, C., & Austin, M. P. (2015). Clinical profile and outcomes of women admitted to a psychiatric mother-baby unit. *Archives of women's mental health*, *18*(6), 805-816.

Ciaunica, A., & Fotopoulou, A. (2017). The touched self: Psychological and philosophical perspectives on proximal intersubjectivity and the self. In C. Durt, T. Fuchs, & C. Tewes (Eds.), *Embodiment, enaction, and Culture investigating the constitution of the shared world* (pp. 173–192). Cambridge, MA: MIT Press.

Cirelli, L. K., & Trehub, S. E. (2020). Familiar songs reduce infant distress. *Developmental Psychology, 56*(5), 861.

Cirelli, L. K., Jurewicz, Z. B., & Trehub, S. E. (2020). Effects of maternal singing style on mother–infant arousal and behavior. *Journal of cognitive neuroscience*, *32*(7), 1213-1220.

Clark, R., Tluczek, A., & Wenzel, A. (2003). Psychotherapy for postpartum depression: a preliminary report. *American Journal of Orthopsychiatry*, *73*(4), 441-454.

Clearfield, M. W., Bailey, L. S., Jenne, H. K., Stanger, S. B., & Tacke, N. (2014). Socioeconomic status affects oral and manual exploration across the first year. *Infant Mental Health Journal*, *35*(1), 63-69.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Erlbaum.

Cohen, L., Manion, L., & Morrison, K. (2017). *Research methods in education*. Routledge.

Cohn, J. F., & Campbell, S. B. (1992). III Influence of Maternal Depression on Infant Affect Regulation. *Developmental perspectives on depression*, *4*, 103-130.

Cohn, J. F., & Tronick, E. (1989). Specificity of infants' response to mothers' affective behavior. *Journal of the American Academy of Child & Adolescent Psychiatry*, *28*(2), 242-248.

Cohn, J. F., & Tronick, E. Z. (1987). Mother–infant face-to-face interaction: The sequence of dyadic states at 3, 6, and 9 months. *Developmental psychology*, *23*(1), 68-77.

Cohn, J. F., & Tronick, E. Z. (1988). Mother-infant face-to-face interaction: Influence is bidirectional and unrelated to periodic cycles in either partner's behavior. *Developmental psychology*, *24*(3), 386-392.

Cohn, J. F., Ambadar, Z., & Ekman, P. (2007). Observer-based measurement of facial expression with the Facial Action Coding System. *The handbook of emotion elicitation and assessment*, *1*(3), 203-221.

Cohn, J. F., Campbell, S. B., & Ross, S. (1991). Infant response in the still-face paradigm at 6 months predicts avoidant and secure attachment at 12 months. *Development and Psychopathology*, *3*(4), 367-376.

Cohn, J. F., Campbell, S. B., Matias, R., & Hopkins, J. (1990). Face-to-face interactions of postpartum depressed and nondepressed mother-infant pairs at 2 months. *Developmental psychology*, *26*(1), 15-23.

Cohn, J. F., Matias, R., Tronick, E. Z., Lyons-Ruth, K., & Connell, D. (1986). Face-to-face interactions, spontaneous and structured, of mothers with depressive symptoms. *Maternal depression and child development*, *34*, 31-46.

Cole, P. M., Dennis, T. A., Smith-Simon, K. E., & Cohen, L. H. (2009). Preschoolers' emotion regulation strategy understanding: Relations with emotion socialization and child self-regulation. *Social Development*, *18*(2), 324-352.

Colegrove, V. M., & Havighurst, S. S. (2017). Review of nonverbal communication in parent–child relationships: Assessment and intervention. *Journal of Child and Family Studies*, *26*(2), 574-590.

Coleman, J. M., Pratt, R. R., Stoddard, R. A., Gerstmann, D. R., & Abel, H.-H. (1997). The effects of the male and female singing behaviours and speaking voices on selected physiological and behavioural measures of premature infants in the intensive care unit. *International Journal of Arts Medicine, 5*(2), 4–11.

Colonnesi, C., Zijlstra, B. J., van der Zande, A., & Bögels, S. M. (2012). Coordination of gaze, facial expressions and vocalizations of early infant communication with mother and father. *Infant Behavior and Development*, *35*(3), 523-532.

Conroy, S., Pariante, C. M., Marks, M. N., Davies, H. A., Farrelly, S., Schacht, R., & Moran, P. (2012). Maternal psychopathology and infant development at 18 months: the impact of maternal personality disorder and depression. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(1), 51-61.

Cooper, P. J., Murray, L., Wilson, A., & Romaniuk, H. (2003). Controlled trial of the short-and long-term effect of psychological treatment of post-partum depression: I. Impact on maternal mood. *The British Journal of Psychiatry*, *182*(5), 412-419.

Corbeil, M., Trehub, S. E., & Peretz, I. (2016). Singing delays the onset of infant distress. *Infancy, 21*(3), 373– 391.

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.

Cornish, A. M., McMahon, C., & Ungerer, J. A. (2008). Postnatal depression and the quality of mother-infant interactions during the second year of life. *Australian Journal of Psychology*, *60*(3), 142-151.

Correia, J., & Fisher, M. H. (2014). Froebel gifts: a tool to reinforce conceptual knowledge of fractions. *Ohio Journal of School Mathematics, 69*, 31-35.

Cox, J.L., Chapman, G., Murray, D. & Jones, P. (1996). Validation of the Edinburgh Postnatal Depression Scale (EPDS) in non-postnatal women. *Journal of affective disorders*, *39*(3), 185-189.

Cox, J.L., Holden, J.M. and Sagovsky, R. (1987). Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *The British journal of psychiatry*, *150*(6), 782-786.

Creighton, A. L., Atherton, M., Kitamura, C., & Trondalen, G. (2013). Singing play songs and lullabies: Investigating the subjective contributions to maternal attachment constructs. *Australian Journal of Music Therapy*, *24*, 17-47.

Creswell, J. W. (2009). Mapping the field of mixed methods research. *Journal of Mixed Methods Research, 3,* 95-108.

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research.* Prentice Hall, Pearson/Merrill.

Creswell, J. W., Plano Clark, V. L. (2011). *Designing and conducting mixed methods research (2nd ed.).* Thousand Oaks, CA: Sage.

Crittenden, P. M. (2005). Using the CARE-Index for Screening. Intervention, and Research. *Bindungsorientierte Ansätze in der Praxis der Frühförderung, 3*(24), 99-106. [*English version published online at: http://www.patcrittenden.com/images/CARE-Index.pdf*]

Crittenden, P. M. (2010). *CARE-Index. Infants. Coding Manual.* Miami: Family Relations Institute.

Crittenden, P. M. (2013). *Raising parents: Attachment, parenting and child safety*. Routledge.

Crown, C. L., Feldstein, S., Jasnow, M. D., Beebe, B., & Jaffe, J. (2002). The cross-modal coordination of interpersonal timing: Six-week-old infants' gaze with adults' vocal behavior. *Journal of Psycholinguistic Research, 31*, 1–23.

Crucianelli, L., Wheatley, L., Filippetti, M. L., Jenkinson, P. M., Kirk, E., & Fotopoulou, A. K. (2019). The mindedness of maternal touch: An investigation of maternal mind-mindedness and mother-infant touch interactions. *Developmental cognitive neuroscience*, *35*, 47-56.

Crugnola, C. R., Gazzotti, S., Spinelli, M., Ierardi, E., Caprin, C., & Albizzati, A. (2013). Maternal attachment influences mother–infant styles of regulation and play with objects at nine months. *Attachment & human development*, *15*(2), 107-131.

Crugnola, C. R., Ierardi, E., Ferro, V., Gallucci, M., Parodi, C., & Astengo, M. (2016). Mother-infant emotion regulation at three months: the role of maternal anxiety, depression and parenting stress. *Psychopathology*, *49*(4), 285-294.

Crugnola, C. R., Ierardi, E., Gazzotti, S., & Albizzati, A. (2014). Motherhood in adolescent mothers: Maternal attachment, mother–infant styles of interaction and emotion regulation at three months. *Infant Behavior and Development*, *37*(1), 44-56.

Cryan, E., Keogh, F., Connolly, E., Cody, S., Quinlan, A., & Daly, I. (2001). Depression among postnatal women in an urban Irish community. *Irish Journal of Psychological Medicine*, *18*(1), 5-10.

Cuijpers, P., Berking, M., Andersson, G., Quigley, L., Kleiboer, A., & Dobson, K. S. (2013). A meta-analysis of cognitive-behavioural therapy for adult depression, alone and in comparison with other treatments. *The Canadian Journal of Psychiatry*, *58*(7), 376-385.

Cuijpers, P., Brännmark, J. G., & van Straten, A. (2008). Psychological treatment of postpartum depression: a meta-analysis. *Journal of clinical psychology*, *64*(1), 103-118.

Custodero, L. A., Britto, P. R., & Brooks-Gunn, J. (2003). Musical lives: A collective portrait of American parents and their young children. *Journal of Applied Developmental Psychology*, *24*(5), 553-572.

Cuthbert, C., Rayns, G., & Stanley, K. (2011). All babies count. *Prevention and protection for vulnerable babies*, 12-15.

Daley, A. J., MacArthur, C., & Winter, H. (2007). The role of exercise in treating postpartum depression: a review of the literature. *Journal of midwifery & women's health*, *52*(1), 56-62.

Daley, A., Jolly, K., & MacArthur, C. (2009). The effectiveness of exercise in the management of post-natal depression: systematic review and meta-analysis. *Family practice*, *26*(2), 154-162.

Dau, A. L. B., Callinan, L. S., & Smith, M. V. (2019). An examination of the impact of maternal fetal attachment, postpartum depressive symptoms and parenting stress on maternal sensitivity. *Infant Behavior and Development*, *54*, 99-107.

Dauch, C., Imwalle, M., Ocasio, B., & Metz, A. E. (2018). The influence of the number of toys in the environment on toddlers' play. *Infant Behavior and Development*, *50*, 78-87.

Dawson, G., Ashman, S. B., Panagiotides, H., Hessl, D., Self, J., Yamada, E., & Embry, L. (2003). Preschool outcomes of children of depressed mothers: Role of maternal behavior, contextual risk, and children's brain activity. *Child development*, *74*(4), 1158-1175.

de Barbaro, K., Johnson, C. M., Forster, D., & Deák, G. O. (2016). Sensorimotor decoupling contributes to triadic attention: A longitudinal investigation of mother–infant–object interactions. *Child development*, *87*(2), 494-512.

de l'Etoile, S. K. (2006). Infant-directed singing: A theory for clinical intervention. *Music Therapy Perspectives*, *24*(1), 22-29.

de l'Etoile, S. K. (2006a). Infant behavioral responses to infant-directed singing and other maternal interactions. *Infant Behavior and Development*, *29*(3), 456-470.

de l'Etoile, S. K. (2012). Responses to infant-directed singing in infants of mothers with depressive symptoms. *The Arts in Psychotherapy*, *39*(5), 353-366.

de l'Etoile, S. K., & Leider, C. N. (2011). Acoustic parameters of infant-directed singing in mothers with depressive symptoms. *Infant Behavior and Development*, *34*(2), 248-256.

De Pascalis, L., Kkeli, N., Chakrabarti, B., Dalton, L., Vaillancourt, K., Rayson, H., ... & Murray, L. (2017). Maternal gaze to the infant face: effects of infant age and facial configuration during mother-infant engagement in the first nine weeks. *Infant Behavior and Development*, *46*, 91-99.

De Schuymer, L., De Groote, I., Striano, T., Stahl, D., & Roeyers, H. (2011). Dyadic and triadic skills in preterm and full term infants: A longitudinal study in the first year. *Infant Behavior and Development*, *34*(1), 179-188.

De Tychey, C., Briançon, S., Lighezzolo, J., Spitz, E., Kabuth, B., De Luigi, V., ... & Vincent, S. (2008). Quality of life, postnatal depression and baby gender. *Journal of clinical nursing*, *17*(3), 312-322.

De Wolff, M. S., & Van Ijzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child development*, *68*(4), 571-591.

Deák, G. O., Krasno, A. M., Jasso, H., & Triesch, J. (2018). What leads to shared attention? Maternal cues and infant responses during object play. *Infancy*, *23*(1), 4-28.

Deak, G. O., Krasno, A. M., Triesch, J., Lewis, J., & Sepeta, L. (2014). Watch the hands: Infants can learn to follow gaze by seeing adults manipulate objects. *Developmental science*, *17*(2), 270-281.

Deans, C. L. (2020). Maternal sensitivity, its relationship with child outcomes, and interventions that address : a systematic literature review. *Early Child Development and Care*, *190*(2), 252-275.

Deave, T., Heron, J., Evans, J., & Emond, A. (2008). The impact of maternal depression in pregnancy on early child development. *BJOG: An International Journal of Obstetrics & Gynaecology*, *115*(8), 1043-1051.

Defelipe, R. P., de Resende, B. D., David, V. F., & Bussab, V. S. R. (2019). Postpartum depression in high-risk Brazilian women: psychosocial predictors and effects on maternal vocalization. *Early Child Development and Care*, *189*(9), 1480-1493.

Delgado, C. E., Messinger, D. S., & Yale, M. E. (2002). Infant responses to direction of parental gaze: A comparison of two still-face conditions. *Infant Behavior and Development*, *25*(3), 311-318.

Delgado, C., Mundy, P., Crowson, M., Markus, J., Yale, M., & Schwartz, H. (2002). Responding to joint attention and language development: A comparison of target locations. *Journal of Speech, Language & Hearing Research, 45*, 715–719.

Denham, S. A. (2006). Social-emotional competence as support for school readiness: What is it and how do we assess it?. *Early education and development*, *17*(1), 57-89.

Dennis C. L. (2005). Psychosocial and psychological interventions for prevention of postnatal depression: systematic review. *BMJ (Clinical research ed.)*, *331*(15), 1-8.

Dennis, C. L. (2004). Treatment of postpartum depression, part 2: a critical review of nonbiological interventions. *The Journal of clinical psychiatry*, *65*(9), 1252-1265.

Dennis, C. L., & Chung-Lee, L. (2006). Postpartum depression help-seeking barriers and maternal treatment preferences: A qualitative systematic review. *Birth*, *33*(4), 323-331.

Dennis, C. L., & Dowswell, T. (2013). Interventions (other than pharmacological, psychosocial or psychological) for treating antenatal depression. *Cochrane Database of Systematic Reviews*, *4*(7), 1-20.

Dennis, C. L., & Hodnett, E. D. (2007). Psychosocial and psychological interventions for treating postpartum depression. *Cochrane database of systematic reviews*, *1*(4), 1-46.

Dennis, C. L., & McQueen, K. (2009). The relationship between infant-feeding outcomes and postpartum depression: a qualitative systematic review. *Pediatrics*, *123*(4), 736-751.

Dennis, C. L., Brown, H. K., Wanigaratne, S., Fung, K., Vigod, S. N., Grigoriadis, S., ... & Brennenstuhl, S. (2018). Prevalence, incidence, and persistence of postpartum depression, anxiety, and comorbidity among Chinese immigrant and nonimmigrant women: a longitudinal cohort study. *The Canadian Journal of Psychiatry*, *63*(1), 44-53.

Department for Communities and Local Government (DCLG) & Office for National Statistics (ONS) (2015). *The English Indices of Deprivation 2015 Statistical Release.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads /attachment_data/file/465791/English_Indices_of_Deprivation_2015_-_Statistical_Release.pdf.

Department for Education (2021). *Statutory framework for the early years foundation stage Setting the standards for learning, development and care for children from birth to five.* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data /file/974907/EYFS_framework_-_March_2021.pdf

Di Scalea, T. L., & Wisner, K. L. (2009). Antidepressant medication use during breastfeeding. *Clinical obstetrics and gynecology*, *52*(3), 483-497.

Douglas, A. S. (2020). Contradictions in Children's Centre service provision: the art of the possible in multi-professional work. *International Journal of Early Years Education*, *28*(4), 319-335.

Ducharme, D. A., & Arcand, I. (2009). Using Noldus Observer XT for research on deaf signers learning to read: An innovative methodology. *Behavior research methods*, *41*(3), 833-840.

Duhn, L. (2010). The importance of touch in the development of attachment. *Advances in Neonatal Care*, *10*(6), 294-300.

Dunst, C. J., Gorman, E., & Hamby, D. W. (2010). Effects of adult verbal and vocal contingent responsiveness on increases in infant vocalizations. *Center for Early Literacy Learning*, *3*(1), 1-11.

Dyke, J. (2019). *Songs, rhymes and finger plays* [Pamphlets]. Froebel Trust.

Edhborg, M., Lundh, W., Seimyr, L., & Widström, A. M. (2001). The long-term impact of postnatal depressed mood on mother-child interaction: A preliminary study. *Journal of Reproductive and Infant Psychology*, *19*(1), 61-71.

Egmose, I., Cordes, K., Smith-Nielsen, J., Væver, M. S., & Køppe, S. (2018). Mutual regulation between infant facial affect and maternal touch in depressed and nondepressed dyads. *Infant Behavior and Development*, *50*, 274-283.

Egmose, I., Nørkær, E., Stuart, A. C., Blurton, S. P., Køppe, S., & Væver, M. S. (2021). Temporal coordination between maternal looming and infant gaze in depressed and nondepressed dyads: A bootstrapping approach. *Infant Behavior and Development*, *62*, 101523.

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological inquiry*, *9*(4), 241-273.

El Gemayel, S. (2020). *Childhood and play 'in-between': Young Iraqi and Syrian child refugees' play following armed conflict and forced displacement to the northern suburbs of Beirut, Lebanon* [Doctoral dissertation, UCL (University College London)].

Ellington, V. (2002). Philoshophy of education- Influence of Friedrich Froebel *www.froebelweb.org [Accessed on: 3 May 2021]*

Elliott, S. (2007). Postnatal depression. In S. Ayers, A. Baum, C. McManus, S. Newman, K. Wallston, J. Weinman, et al. (Eds.), *Cambridge Handbook of Psychology, Health and Medicine* (pp. 820-823). Cambridge: Cambridge University Press.

Epstein, S., Bauer, S., Levkovitz Stern, O., Litmanovitz, I., Elefant, C., Yakobson, D., & Arnon, S. (2021). Preterm infants with severe brain injury demonstrate unstable physiological responses during maternal singing with music therapy: A randomized controlled study. *European Journal of Pediatrics*, *180*(5), 1403-1412.

Estevao, C., Fancourt, D., Dazzan, P., Chaudhuri, K. R., Sevdalis, N., Woods, A., ... & Pariante, C. M. (2021). Scaling-up Health-Arts Programmes: the largest study in the world bringing arts-based mental health interventions into a national health service. *BJPsych bulletin*, *45*(1), 32-39.

Ettenberger, M., & Ardila, Y. M. B. (2018). Music therapy song writing with mothers of preterm babies in the Neonatal Intensive Care Unit (NICU)–A mixed-methods pilot study. *The Arts in Psychotherapy*, *58*, 42-52.

Evans, C. A., & Porter, C. L. (2009). The emergence of mother–infant co-regulation during the first year: Links to infants' developmental status and attachment. *Infant Behavior and Development*, *32*(2), 147-158.

Evans, J., Heron, J., Francomb, H., Oke, S., & Golding, J. (2001). Cohort study of depressed mood during pregnancy and after childbirth. *Bmj*, *323*(7307), 257-260.

Evans, J., Melotti, R., Heron, J., Ramchandani, P., Wiles, N., Murray, L., & Stein, A. (2012). The timing of maternal depressive symptoms and child cognitive development: a longitudinal study. *Journal of Child Psychology and Psychiatry*, *53*(6), 632-640.

Fagan, M. K. (2009). Mean length of utterance before words and grammar: Longitudinal trends and developmental implications of infant vocalizations. *Journal of child language*, *36*(3), 495-527.

Fagan, M. K., & Doveikis, K. N. (2019). What Mothers Do After Infants Vocalize: Implications for Vocal Development or Word Learning?. *Journal of Speech, Language, and Hearing Research*, *62*(8), 2680-2690.

Fagan, M. K., & Iverson, J. M. (2007). The influence of mouthing on infant vocalization. *Infancy*, *11*(2), 191-202.

Falk, D. (2004). Prelinguistic evolution in early hominins: Whence motherese?. *Behavioral and brain sciences*, *27*(4), 491.

Falk, S., & Tsang, C. D. (2020). The role and functions of infant- directed singing in early development. In F. Russo, B. Ilari, & A. Cohen (Eds.), The Routledge companion to interdisciplinary studies in singing, Volume I: Development (pp. 179– 188). Routledge.

Falk, S., Fasolo, M., Genovese, G., Romero-Lauro, L., & Franco, F. (2021). Sing for me, Mama! Infants' discrimination of novel vowels in song. *Infancy*, *26*(2), 248-270.

Fancourt, D. & Perkins, R. (2018) The effects of mother–infant singing on emotional closeness, affect, anxiety, and stress hormones. *Music & Science, 1,* 1-10.

Fancourt, D., & Perkins, R. (2017). Associations between singing to babies and symptoms of postnatal depression, wellbeing, self-esteem and mother-infant bond. *Public Health*, *145*, 149-152.

Fancourt, D., & Perkins, R. (2018). Effect of singing interventions on symptoms of postnatal depression: three-arm randomised controlled trial. *The British Journal of Psychiatry*, *212*(2), 119-121.

Fancourt, D., & Perkins, R. (2018). Maternal engagement with music up to nine months post-birth: Findings from a cross-sectional study in England. *Psychology of Music*, *46*(2), 238-251.

Fancourt, D., & Perkins, R. (2018). The effects of mother–infant singing on emotional closeness, affect, anxiety, and stress hormones. *Music & Science*, *1*, 1-10.

Fancourt, D., & Perkins, R. (2019). Does attending community music interventions lead to changes in wider musical behaviours? The effect of mother–infant singing classes on musical behaviours amongst mothers with symptoms of postnatal depression. *Psychology of Music*, *47*(1), 132-143.

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child development perspectives*, *8*(4), 258-264.

Feldman, R. (2003). Infant–mother and infant–father synchrony: The coregulation of positive arousal. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *24*(1), 1-23.

Feldman, R. (2007). Parent–infant synchrony: Biological foundations and developmental outcomes. *Current directions in psychological science*, *16*(6), 340-345.

Feldman, R. (2010). The relational basis of adolescent adjustment: trajectories of mother–child interactive behaviors from infancy to adolescence shape adolescents' adaptation. *Attachment & Human Development*, *12*(1-2), 173-192.

Feldman, R., & Eidelman, A. I. (2003). Skin-to-skin contact (Kangaroo Care) accelerates autonomic and neurobehavioural maturation in preterm infants. *Developmental Medicine & Child Neurology*, *45*(4), 274-281.

Feldman, R., & Eidelman, A. I. (2004). Parent-infant synchrony and the social-emotional development of triplets. *Developmental psychology*, *40*(6), 1133-1147.

Feldman, R., & Eidelman, A. I. (2005). Does a triplet birth pose a special risk for infant development? Assessing cognitive development in relation to intrauterine growth and mother-infant interaction across the first 2 years. *Pediatrics*, *115*(2), 443-452.

Feldman, R., & Eidelman, A. I. (2007). Maternal postpartum behavior and the emergence of infant–mother and infant–father synchrony in preterm and full-term infants: The role of neonatal vagal tone. *Developmental psychobiology*, *49*(3), 290-302.

Feldman, R., & Eidelman, A. I. (2009). Biological and environmental initial conditions shape the trajectories of cognitive and social-emotional development across the first years of life. *Developmental science*, *12*(1), 194-200.

Feldman, R., & Greenbaum, C. W. (1997). Affect regulation and synchrony in mother—infant play as precursors to the development of symbolic competence. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *18*(1), 4-23.

Feldman, R., Granat, A. D. I., Pariente, C., Kanety, H., Kuint, J., & Gilboa-Schechtman, E. (2009). Maternal depression and anxiety across the postpartum year and infant social engagement, fear regulation, and stress reactivity. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*(9), 919-927.

Feldman, R., Greenbaum, C. W., & Yirmiya, N. (1999a). Mother–infant affect synchrony as an antecedent of the emergence of self-control. *Developmental psychology*, *35*(1), 223-231.

Feldman, R., Keren, M., Gross-Rozval, O., & Tyano, S. A. M. (2004). Mother–child touch patterns in infant feeding disorders: Relation to maternal, child, and environmental factors. *Journal of the American Academy of Child & Adolescent Psychiatry*, *43*(9), 1089-1097.

Feldman, R., Singer, M., & Zagoory, O. (2010). Touch attenuates infants' physiological reactivity to stress. *Developmental science*, *13*(2), 271-278.

Feldman, R.S (2009). *Child development* (5^{th} ed.). Pearson.

Ferber, S. G., Feldman, R., & Makhoul, I. R. (2008). The development of maternal touch across the first year of life. *Early human development*, *84*(6), 363-370.

Fernald, A., & Simon, T. (1984). Expanded intonation contours in mothers' speech to newborns. *Developmental psychology*, *20*(1), 104-113.

Field, T. (1995). Infants of depressed mothers. *Infant Behavior and Development, 18*, 1–13.

Field, T. (2008). Breastfeeding and antidepressants. *Infant Behavior and Development*, *31*(3), 481-487.

Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: a review. *Infant Behavior and Development*, *33*(1), 1-6.

Field, T. (2010). Touch for socioemotional and physical well-being: A review. *Developmental review*, *30*(4), 367-383.

Field, T. (2014). Massage therapy research review. *Complementary therapies in clinical practice*, *20*(4), 224-229.

Field, T. (2014). *Touch*. MIT press.

Field, T. (2019). Social touch, CT touch and massage therapy: A narrative review. *Developmental Review*, *51*, 123-145.

Field, T. M. (1981). Infant gaze aversion and heart rate during face-to-face interactions. *Infant behavior and development*, *4*, 307-315.

Field, T. M. (1984). Early interactions between infants and their postpartum depressed mothers. *Infant behavior & development, 7,* 517-522.

Field, T. M. (2002). Prenatal effects of maternal depression. In S. H. Goodman & I. H. Gotlib (Eds.), *Children of depressed parents: Mechanisms of risk and implications for treatment* (pp. 59–88). Washington, DC: American Psychological Association.

Field, T., Diego, M., & Hernandez-Reif, M. (2009). Infants of depressed mothers are less responsive to faces and voices: A review. *Infant behavior & development*, *32*(3), 239-244.

Field, T., Grizzle, N., Scafidi, F., Abrams, S., Richardson, S., Kuhn, C., & Schanberg, S. (1996). Massage theraphy for infants of depressed mothers. *Infant behavior and development*, *19*(1), 107-112.

Field, T., Healy, B. T., Goldstein, S., & Guthertz, M. (1990). Behavior-state matching and synchrony in mother-infant interactions of nondepressed versus depressed dyads. *Developmental psychology*, *26*(1), 7-14.

Field, T., Healy, B., Goldstein, S., Perry, S., Bendell, D., Schanberg, S., ... & Kuhn, C. (1988). Infants of depressed mothers show" depressed" behavior even with nondepressed adults. *Child development*, 1569-1579.

Field, T., Hemandez-Reif, M., Hart, S., Theakston, H., Schanberg, S., & Kuhn, C. (1999). Pregnant women benefit from massage therapy. *Journal of Psychosomatic Obstetrics & Gynecology*, *20*(1), 31-38.

Field, T., Hernandez-Reif, M., & Diego, M. (2006). Intrusive and withdrawn depressed mothers and their infants. *Developmental Review*, *26*(1), 15-30.

Field, T., Hernandez-Reif, M., Vera, Y., Gil, K., Diego, M., & Sanders, C. (2005). Infants of depressed mothers facing a mirror versus their mother. *Infant Behavior and Development*, *28*(1), 48-53.

Field, T., Hernandez-Reif, M., Vera, Y., Gil, K., Diego, M., Bendell, D., & Yando, R. (2005). Anxiety and anger effects on depressed mother–infant spontaneous and imitative interactions. *Infant Behavior and Development*, *28*(1), 1-9.

Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., Gil, K., & Sanders, C. (2007). Still-face and separation effects on depressed mother-infant interactions. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *28*(3), 314-323.

Field, T., Sandberg, D., Garcia, R., Vega-Lahr, N., Goldstein, S., & Guy, L. (1985). Pregnancy problems, postpartum depression, and early mother–infant interactions. *Developmental psychology*, *21*(6), 1152-1156.

Fiese, B. H. (1990). Playful relationships: A contextual analysis of mother-toddler interaction and symbolic play. *Child development*, *61*(5), 1648-1656.

Filippa, M., Della Casa, E., D'amico, R., Picciolini, O., Lunardi, C., Sansavini, A., & Ferrari, F. (2021). Effects of early vocal contact in the neonatal intensive care unit: Study protocol for a multi-centre, randomised clinical trial. *International journal of environmental research and public health*, *18*(8), 3915.

Filippa, M., Devouche, E., Arioni, C., Imberty, M., & Gratier, M. (2013). Live maternal speech and singing have beneficial effects on hospitalized preterm infants. *Acta paediatrica*, *102*(10), 1017-1020.

Filippa, M., Gratier, M., Devouche, E., & Grandjean, D. (2018). Changes in infant-directed speech and song are related to preterm infant facial expression in the neonatal intensive care unit. *Interaction Studies*, *19*(3), 427-444.

Filippa, M., Menin, D., Panebianco, R., Monaci, M. G., Dondi, M., & Grandjean, D. (2020). Live maternal speech and singing increase self-touch and eye-opening in preterm newborns: A preliminary study. *Journal of Nonverbal Behavior*, *44*(4), 453-473.

Filippa, M., Monaci, M. G., Spagnuolo, C., Serravalle, P., Daniele, R., & Grandjean, D. (2021). Maternal speech decreases pain scores and increases oxytocin levels in preterm infants during painful procedures. *Scientific Reports*, *11*(1), 1-10.

Filippa, M., Nardelli, M., Della Casa, E., Berardi, A., Picciolini, O., Meloni, S., ... & EVC Group. (2022). Maternal Singing but Not Speech Enhances Vagal Activity in Preterm Infants during Hospitalization: Preliminary Results. *Children*, *9*(2), 140.

Filipi, A. (2009). *Toddler and parent interaction: The organisation of gaze. Pointing and Vocalisation*. Amsterdam: John Benjamin.

Fisher, J., Mello, M. C. D., Patel, V., Rahman, A., Tran, T., Holton, S., & Holmes, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: a systematic review. *Bulletin of the World Health Organization*, *90*, 139-149.

Fitelson, E., Kim, S., Baker, A. S., & Leight, K. (2011). Treatment of postpartum depression: clinical, psychological and pharmacological options. *International journal of women's health*, *3*, 1-14.

Flykt, M., Kanninen, K., Sinkkonen, J., & Punamäki, R. L. (2010). Maternal depression and dyadic interaction: the role of maternal attachment style. *Infant and Child Development*, *19*(5), 530-550.

Fogel, A. (1993). *Developing through relationships*. University of Chicago Press.

Fogel, A. (1993). Two principles of communication: Coregulation and framing. In J. Nadel & L. Camaioni (Eds.), *New perspectives in early communicative development* (pp. 9-22). London: Routledge.

Fogel, A. (2006). Dynamic systems research on interindividual communication: The transformation of meaning-making. *Journal of developmental processes*, *1*(1), 7-30.

Fogel, A., Dedo, J. Y., & McEwen, I. (1992). Effect of postural position and reaching on gaze during mother-infant face-to-face interaction. *Infant Behavior and Development*, *15*(2), 231-244.

Fogel, A., Messinger, D. S., Dickson, K. L., & Hsu, H. C. (1999). Posture and gaze in early mother–infant communication: Synchronization of developmental trajectories. *Developmental science*, *2*(3), 325-332.

Fonseca, V. R. J., Silva, G. A. D., & Otta, E. (2010). Relação entre depressão pós-parto e disponibilidade emocional materna. *Cadernos de saúde pública*, *26*(4), 738-746.

Fortinguerra, F., Clavenna, A., & Bonati, M. (2009). Psychotropic drug use during breastfeeding: a review of the evidence. *Pediatrics*, *124*(4), 547-556.

Fotopoulou, A., & Tsakiris, M. (2017). Mentalizing homeostasis: The social origins of interoceptive inference. *Neuropsychoanalysis*, *19*(1), 3-28.

Fournier, J. C., DeRubeis, R. J., Hollon, S. D., Dimidjian, S., Amsterdam, J. D., Shelton, R. C., & Fawcett, J. (2010). Antidepressant drug effects and depression severity: a patient-level meta-analysis. *Jama*, *303*(1), 47-53.

Fraley, R. C., Roisman, G. I., & Haltigan, J. D. (2013). The legacy of early experiences in development: formalizing alternative models of how early experiences are carried forward over time. *Developmental Psychology*, *49*(1), 109-126.

Francis, L. A., & Susman, E. J. (2009). Self-regulation and rapid weight gain in children from age 3 to 12 years. *Archives of pediatrics & adolescent medicine*, *163*(4), 297-302.

Franck, E., Vanderhasselt, M. A., Goubert, L., Loeys, T., Temmerman, M., & De Raedt, R. (2016). The role of self-esteem instability in the development of postnatal depression: A prospective study testing a diathesis-stress account. *Journal of behavior therapy and experimental psychiatry*, *50*, 15-22.

Fredrickson, B. L. (2004). The broaden–and–build theory of positive emotions. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *359*(1449), 1367-1377.

Fredriksen, E., von Soest, T., Smith, L., & Moe, V. (2019). Parenting stress plays a mediating role in the prediction of early child development from both parents' perinatal depressive symptoms. *Journal of abnormal child psychology*, *47*(1), 149-164.

Freeman, M. P. (2009). Postpartum depression treatment and breastfeeding. *The Journal of clinical psychiatry*, *70*(9), e35.

Frick, M. A., Forslund, T., & Brocki, K. C. (2019). Does child verbal ability mediate the relationship between maternal sensitivity and later self-regulation? A longitudinal study from infancy to 4 years. *Scandinavian journal of psychology*, *60*(2), 97-105.

Frick, M. A., Forslund, T., Fransson, M., Johansson, M., Bohlin, G., & Brocki, K. C. (2018). The role of sustained attention, maternal sensitivity, and infant temperament in the development of early self-regulation. *British Journal of Psychology*, *109*(2), 277-298.

Friedman, D. D., Beebe, B., Jaffe, J., Ross, D., & Triggs, S. (2010). Microanalysis of 4-month infant vocal affect qualities and maternal postpartum depression. *Clinical social work journal*, *38*(1), 8-16.

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, *86*, 186-204.

Frizzo, G. B., & Piccinini, C. A. (2005). Interação mãe-bebê em contexto de depressão materna: aspectos teóricos e empíricos. *Psicologia em Estudo*, *10*(1), 47-55.

Froebel, F. (1843). *Mother-Play and Nursery Songs; Poetry, Music and Pictures for the Noble Culture of Child Life*. Boston: Lee & Shepard.

Froebel, F. (1886) *Autobiography of Friedrich Froebel* (E. Michaelis & H. Moore, Trans.). London: Swan Sonnenschein.

Froebel, F. (1887). *The education of man: Vol. Original work published 1826* (W. N. Hailmann, Trans.). D Appleton & Company.

Froebel, F. (1895). *The Mottoes and Commentaries of Friedrich Froebel's Mother Play* (H.R. Eliot & S. Blow, Trans.). New York and London: D. Appleton and company.

Froebel, F. (1899). *Pedagogics of the Kindergarten* (J. Jarvis, Trans.). London: Appleton Press.

Fung, W. K., & Cheng, R. W. Y. (2017). Effect of school pretend play on preschoolers' social competence in peer interactions: Gender as a potential moderator. *Early Childhood Education Journal*, *45*(1), 35-42.

Gable, S., & Isabella, R. A. (1992). Maternal contributions to infant regulation of arousal. *Infant Behavior and Development*, *15*(1), 95-107.

Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: a systematic review of prevalence and incidence. *Obstetrics & Gynecology*, *106*(5 Part 1), 1071-1083.

Gaynes, B. N., Gavin, N., Meltzer-Brody, S., Lohr, K. N., Swinson, T., Gartlehner, G., ... & Miller, W. C. (2005). Perinatal depression: Prevalence, screening accuracy, and screening outcomes: Summary. *Evid. Rep. Technol. Assess (Summ), 119*, 1-225.

Gazzola, V., Spezio, M. L., Etzel, J. A., Castelli, F., Adolphs, R., & Keysers, C. (2012). Primary somatosensory cortex discriminates affective significance in social touch. *Proceedings of the National Academy of Sciences*, *109*(25), 1657-1666.

Gemmel, M., Bögi, E., Ragan, C., Hazlett, M., Dubovicky, M., van den Hove, D. L., ... & Pawluski, J. L. (2018). Perinatal selective serotonin reuptake inhibitor medication (SSRI) effects on social behaviors, neurodevelopment and the epigenome. *Neuroscience & Biobehavioral Reviews*, *85*, 102-116.

Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry*, *3*(10), 973-982.

Gerhardt, S. (2004). *Why love matters: How affection shapes a baby's brain*. London: Routledge.

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), 1-7.

Ghazban, N. (2013). *Emotion regulation in infants using maternal singing and speech.* [Unpublished doctoral dissertation, Ryerson University].

Gianino, A. & Tronick, E. (1988). The mutual regulation model: The infant's self and interactive regulation and coping defensive capacities. In T. Field, P. McCabe, & N. Schneiderman, (Eds.), *Stress and coping* (pp. 47–68). Hillsdale, N.J.: Erlbaum Publishing.

Gilkerson, J., Richards, J. A., Warren, S. F., Oller, D. K., Russo, R., & Vohr, B. (2018). Language experience in the second year of life and language outcomes in late childhood. *Pediatrics*, *142*(4), 1-13.

Gillham, R., & Wittkowski, A. (2015). Outcomes for women admitted to a mother and baby unit: a systematic review. *International journal of women's health*, *7*, 459-476.

Gillibrand, R., Lam, V. & O'Donnell, V. (2011). *Developmental Psychology.* Pearson Education Limited.

Ginsburg, K. R. (2007). The importance of play in promoting healthy child development and maintaining strong parent-child bonds. *Pediatrics*, *119*(1), 182-191.

Glangeaud-Freudenthal, N. C., Sutter, A. L., Thieulin, A. C., Dagens-Lafont, V., Zimmermann, M. A., Debourg, A., ... & Khoshnood, B. (2011). Inpatient mother-and-child postpartum psychiatric care: factors associated with improvement in maternal mental health. *European psychiatry*, *26*(4), 215-223.

Glavin, K., Smith, L., Sørum, R., & Ellefsen, B. (2010). Redesigned community postpartum care to prevent and treat postpartum depression in women–a one-year follow-up study. *Journal of clinical nursing*, *19*(21-22), 3051-3062.

Glover, V., O'Connor, T.G., Heron, J., Golding, J. and ALSPAC Study Team, (2004). Antenatal maternal anxiety is linked with atypical handedness in the child. *Early human development*, 79(2), 107-118.

Goldman, R., Erickson, F., Lemke, J. & Derry, S. (2007). Selection in video. In S. Derry (Ed.), *Guidelines For Video Research In Education: Recommendations From An Expert Panel, Data Research and Development Center* (pp. 19-27). NORC at the University of Chicago.

Goldstein, M. H., & Schwade, J. A. (2008). Social feedback to infants' babbling facilitates rapid phonological learning. *Psychological science*, *19*(5), 515-523.

Goldstein, M. H., King, A. P., & West, M. J. (2003). Social interaction shapes babbling: Testing parallels between birdsong and speech. *Proceedings of the National Academy of Sciences*, *100*(13), 8030-8035.

Goldstein, M. H., Schwade, J. A., & Bornstein, M. H. (2009). The value of vocalizing: Five-month-old infants associate their own noncry vocalizations with responses from caregivers. *Child development*, *80*(3), 636-644.

Goldstein, M. H., Schwade, J., Briesch, J., & Syal, S. (2010). Learning while babbling: Prelinguistic object-directed vocalizations indicate a readiness to learn. *Infancy*, *15*(4), 362-391.

Goldwater-Adler, S., Wozney, L., & McGrath, P. J. (2018). Do mothers enjoy playing sensitively with their infants?. *Journal of reproductive and infant psychology*, *36*(3), 312-326.

Golinkoff, R. M., Can, D. D., Soderstrom, M., & Hirsh-Pasek, K. (2015). (Baby) talk to me: the social context of infant-directed speech and its effects on early language acquisition. *Current Directions in Psychological Science*, *24*(5), 339-344.

Goodman, S. H. (2015). Infant vulnerability to psychopathology. In S. Calkins (Ed.), *Handbook of infant biopsychosocial development* (pp. 392–424). New York: Guilford Press.

Goodman, S.H., & Brand, S.R. (2009). Infants of depressed mothers: Vulnerabilities, risk factors and protective factors for the later development of psychopathology. In C.H Zeanah, (Ed.), *Handbook of infant mental health* (3rd ed., pp. 153-170). New York, NY: Guilford Press.

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical child and family psychology review*, *14*(1), 1-27.

Granat, A., Gadassi, R., Gilboa-Schechtman, E., & Feldman, R. (2017). Maternal depression and anxiety, social synchrony, and infant regulation of negative and positive emotions. *Emotion*, *17*(1), 11-27.

Gredebäck, G., Fikke, L., & Melinder, A. (2010). The development of joint visual attention: a longitudinal study of gaze following during interactions with mothers and strangers. *Developmental science*, *13*(6), 839-848.

Greenberg, M., & Morris, N. (1974). Engrossment: the newborn's impact upon the father. *American journal of Orthopsychiatry*, *44*(4), 520-531.

Greer, T. L., & Trivedi, M. H. (2009). Exercise in the treatment of depression. *Current psychiatry reports*, *11*(6), 466-472.

Grieb, Z. A., & Ragan, C. M. (2019). The effects of perinatal SSRI exposure on anxious behavior and neurobiology in rodent and human offspring. *European Neuropsychopharmacology*, *29*(11), 1169-1184.

Groh, A. M., Fearon, R. P., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Roisman, G. I. (2017). Attachment in the early life course: Meta-analytic evidence for its role in socioemotional development. *Child Development Perspectives*, *11*(1), 70-76.

Gros-Louis, J., West, M. J., Goldstein, M. H., & King, A. P. (2006). Mothers provide differential feedback to infants' prelinguistic sounds. *International Journal of Behavioral Development*, *30*(6), 509-516.

Gros-Louis, J., West, M. J., & King, A. P. (2014). Maternal responsiveness and the development of directed vocalizing in social interactions. *Infancy*, *19*(4), 385-408.

Grote, N. K., Zuckoff, A., Swartz, H., Bledsoe, S. E., & Geibel, S. (2007). Engaging women who are depressed and economically disadvantaged in mental health treatment. *Social work*, *52*(4), 295-308.

Guest, G. (2013). Describing mixed methods research: An alternative to typologies. *Journal of Mixed Methods Research*, *7*(2), 141-151.

Gunning, M., Conroy, S., Valoriani, V., Figueiredo, B., Kammerer, M. H., Muzik, M., ... & Murray, L. (2004). Measurement of mother-infant interactions and the home environment in a European setting: preliminary results from a cross-cultural study. *The British Journal of Psychiatry*, *184*(46), 38-44.

Gur, R. C., Erwin, R. J., Gur, R. E., Zwil, A. S., Heimberg, C., & Kraemer, H. C. (1992). Facial emotion discrimination: II. Behavioral findings in depression. *Psychiatry research*, *42*(3), 241-251.

Gusella, J. L., Muir, D., & Tronick, E. Z. (1988). The effect of manipulating maternal behavior during an interaction on three-and six-month-olds' affect and attention. *Child Development, 59*, 1111-1124.

Hahn-Holbrook, J., Cornwell-Hinrichs, T., & Anaya, I. (2018). Economic and health predictors of national postpartum depression prevalence: a systematic review, meta-analysis, and meta-regression of 291 studies from 56 countries. *Frontiers in psychiatry*, *8* (248), 1-23.

Hains, S. M., & Muir, D. W. (1996). Infant sensitivity to adult eye direction. *Child development*, *67*(5), 1940-1951.

Haist, F., & Anzures, G. (2017). Functional development of the brain's face-processing system. *Wiley Interdisciplinary Reviews: Cognitive Science*, *8*(1-2), 1-18.

Halberstadt, A. G., Parker, A. E., & Castro, V. L. (2013). Nonverbal communication: developmental perspectives. In J.A. Hall & M.L. Knapp (Eds.), *Nonverbal communication* (pp. 93-128). De Gruyter Mouton.

Halbreich, U., & Karkun, S. (2006). Cross-cultural and social diversity of prevalence of postpartum depression and depressive symptoms. *Journal of affective disorders*, *91*(2-3), 97-111.

Halligan, S. L., Murray, L., Martins, C., & Cooper, P. J. (2007). Maternal depression and psychiatric outcomes in adolescent offspring: a 13-year longitudinal study. *Journal of affective disorders*, *97*(1-3), 145-154.

Hamilton, J. A. (1962). Chapter 12, History: In Postpartum Psychiatric Problems. *St Louis: Mosby Harwin*, 127-36.

Haque, A., Namavar, A., & Breene, K. A. (2015). Prevalence and risk factors of postpartum depression in Middle Eastern/Arab women. *Journal of Muslim mental health*, *9*(1), 65-84.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Paul H Brookes Publishing.

Hart, S., Field, T., del Valle, C., & Pelaez-Nogueras, M. (1998). Depressed mothers' interactions with their one-year-old infants. *Infant Behavior and Development*, *21*(3), 519-525.

Hart, S., Jones, N. A., Field, T., & Lundy, B. (1999). One-year-old infants of intrusive and withdrawn depressed mothers. *Child psychiatry and human development*, *30*(2), 111-120.

Hatzinikolaou, K., & Murray, L. (2010). Infant sensitivity to negative maternal emotional shifts: Effects of infant sex, maternal postnatal depression, and interactive style. *Infant Mental Health Journal*, *31*(5), 591-610.

Hayes, L. A., & Watson, J. S. (1981). Facial orientation of parents and elicited smiling by infants. *Infant Behavior and Development*, *4*, 333-340.

Hayes, L. J., Goodman, S. H., & Carlson, E. (2013). Maternal antenatal depression and infant disorganized attachment at 12 months. *Attachment & human development*, *15*(2), 133-153.

Henning, A., Striano, T., & Lieven, E. V. (2005). Maternal speech to infants at 1 and 3 months of age. *Infant behavior and development*, *28*(4), 519-536.

Henshaw, C. (2003). Mood disturbance in the early puerperium: a review. *Archives of women's mental health*, *6*(2), 33-42.

Hernandez-Reif, M., Field, T., Diego, M., Vera, Y., & Pickens, J. (2006). Happy faces are habituated more slowly by infants of depressed mothers. *Infant Behavior and Development*, *29*(1), 131-135.

Hernandez-Reif, M., Kendrick, A. & Avery, D.M. (2018) Pregnant women with depressive and anxiety symptoms read, talk, and sing less to their fetuses. *Journal of Affective Disorders, 15*(229), 532-537.

Hernandez-Reif, M., Field, T., Diego, M., & Largie, S. (2002). Depressed mothers' newborns show longer habituation and fail to show face/voice preference. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *23*(6), 643-653.

Herrera, E. (2010). *The effects of maternal depressive mood on mother-infant communication in the postnatal period* [Doctoral dissertation, University of Aberdeen].

Herrera, E., Reissland, N., & Shepherd, J. (2004). Maternal touch and maternal child-directed speech: effects of depressed mood in the postnatal period. *Journal of Affective Disorders*, *81*(1), 29-39.

Hertenstein, M. J. (2002). Touch: Its communicative functions in infancy. *Human Development*, *45*(2), 70-94.

Hipwell, A. E., Goossens, F. A., Melhuish, E. C., & Kumar, R. (2000). Severe maternal psychopathology and infant–mother attachment. *Development and psychopathology*, *12*(2), 157-175.

Hipwell, A. E., Murray, L., Ducournau, P., & Stein, A. (2005). The effects of maternal depression and parental conflict on children's peer play. *Child: Care, health and development*, *31*(1), 11-23.

Hirsh, J. L., Stockwell, F., & Walker, D. (2014). The effects of contingent caregiver imitation of infant vocalizations: A comparison of multiple caregivers. *The Analysis of verbal behavior*, *30*(1), 20-28.

Hirst, K. P., & Moutier, C. Y. (2010). Postpartum major depression. *Am Fam Physician*, *82*(8), 926-933.

Hiscock, H., & Wake, M. (2001). Infant sleep problems and postnatal depression: a community-based study. *Pediatrics*, *107*(6), 1317-1322.

Hoban, M. (2020). *Froebelian Finger Rhymes In a Modern Setting.* https://www.froebel.ed.ac.uk/project/froebelian-finger-rhymes-in-a-modern-setting/

Höflich, A., Kautzky, A., Slamanig, R., Kampshoff, J., & Unger, A. (2022). Depressive symptoms as a transdiagnostic mediator of mother-to-infant bonding: Results from a psychiatric mother-baby unit. *Journal of Psychiatric Research*, *149*, 37-43.

Hofmann, W., Schmeichel, B. J., & Baddeley, A. D. (2012). Executive functions and self-regulation. *Trends in cognitive sciences*, *16*(3), 174-180.

Hood, J. C. (2007). Orthodoxy vs. power: The defining traits of grounded theory. *The Sage handbook of grounded theory*, 151-164.

Horowitz, J. A., & Goodman, J. (2004). A longitudinal study of maternal postpartum depression symptoms. *Research and theory for nursing practice*, *18*(2/3), 149-163.

Hoskins, K., & Smedley, S. (2016). Life history insights into the early childhood and education experiences of Froebel trainee teachers 1952–1967. *History of Education*, *45*(2), 206-224.

House of Common Library (2021). *Maternal Mental Health. https://researchbriefings.files.parliament.uk/documents/CDP-2021-0025/CDP-2021-0025.pdf*

Housman, D. K. (2017). The importance of emotional competence and self-regulation from birth: A case for the evidence-based emotional cognitive social early learning approach. *International Journal of Child Care and Education Policy*, *11*(1), 1-19.

Howard, L. M., Molyneaux, E., Dennis, C. L., Rochat, T., Stein, A., & Milgrom, J. (2014). Non-psychotic mental disorders in the perinatal period. *The Lancet*, *384*(9956), 1775-1788.

Howell, E. A., Mora, P. A., DiBonaventura, M. D., & Leventhal, H. (2009). Modifiable factors associated with changes in postpartum depressive symptoms. *Archives of women's mental health*, *12*(2), 113-120.

Howes, C., & Hong, S. S. (2008). Early emotional availability: predictive of pre-kindergarten relationships among Mexican-heritage children?. *Journal of Early Childhood and Infant Psychology*, *4*, 4-26.

Hughes, A. S. (2016). Mixed methods research. *APS Observer*, *29*(5), 5-6.

Humphreys, K. L., King, L. S., Choi, P., & Gotlib, I. H. (2018). Maternal depressive symptoms, self-focus, and caregiving behavior. *Journal of affective disorders*, *238*, 465-471.

Husain, N., Cruickshank, J. K., Tomenson, B., Khan, S., & Rahman, A. (2012). Maternal depression and infant growth and development in British Pakistani women: a cohort study. *BMJ open*, *2*(2), 1-6.

Hutchison, S. M., Mâsse, L. C., Pawluski, J. L., & Oberlander, T. F. (2021). Perinatal selective serotonin reuptake inhibitor (SSRI) and other antidepressant exposure effects on anxiety and depressive behaviors in offspring: A review of findings in humans and rodent models. *Reproductive Toxicology*, *99*, 80-95.

Hwa-Froelich, D. A., Loveland Cook, C. A., & Flick, L. H. (2008). Maternal sensitivity and communication styles: Mothers with depression. *Journal of Early intervention*, *31*(1), 44-66.

Ierardi, E., Ferro, V., Trovato, A., Tambelli, R., & Riva Crugnola, C. (2019). Maternal and paternal depression and anxiety: their relationship with mother-infant interactions at 3 months. *Archives of women's mental health*, *22*(4), 527-533.

Ilari, B., Moura, A., & Bourscheidt, L. (2011). Between interactions and commodities: Musical parenting of infants and toddlers in Brazil. *Music Education Research*, *13*(1), 51-67.

Jaffe, J., Beebe, B., & Feldstein, S., Crown, C. L., Jasnow, M. D., Rochat, P., & Stern, D. N. (2001). *Rhythms of dialogue in infancy: Coordinated timing in development.* Oxford: Blackwell.

Jean, A. D., & Stack, D. M. (2009). Functions of maternal touch and infants’ affect during face-to-face interactions: New directions for the still-face. *Infant Behavior and Development*, *32*(1), 123-128.

Jean, A. D., Stack, D. M., & Arnold, S. (2014). Investigating maternal touch and infants' self-regulatory behaviours during a modified face-to-face Still-Face with Touch procedure. *Infant and Child Development*, *23*(6), 557-574.

Jean, A. D., Stack, D. M., & Fogel, A. (2009). A longitudinal investigation of maternal touching across the first 6 months of life: Age and context effects. *Infant Behavior and Development*, *32*(3), 344-349.

Jewitt, C. (2012). *An introduction to using video for research* (Working paper). London: National Centre for Research Methods.

Jeynes, W. (2006). Standardized Tests and Froebel. *Teachers College Record*, *108*(10), 1937-1959.

Johnson, M. H., Dziurawiec, S., Ellis, H., & Morton, J. (1991). Newborns' preferential tracking of face-like stimuli and its subsequent decline. *Cognition*, *40*(1-2), 1-19.

Johnson, M. H., Senju, A., & Tomalski, P. (2015). The two-process theory of face processing: modifications based on two decades of data from infants and adults. *Neuroscience & Biobehavioral Reviews*, *50*, 169-179.

Jongerius, C., Hessels, R. S., Romijn, J. A., Smets, E. M., & Hillen, M. A. (2020). The Measurement of Eye Contact in Human Interactions: A Scoping Review. *Journal of Nonverbal Behavior*, 1-27.

Jung, V., Short, R., Letourneau, N., & Andrews, D. (2007). Interventions with depressed mothers and their infants: Modifying interactive behaviours. *Journal of affective disorders*, *98*(3), 199-205.

Juslin, P. N. (1997). Perceived emotional expression in synthesized performances of a short melody: Capturing the listener's judgment policy. *Musicae scientiae*, *1*(2), 225-256.

Kamiloğlu, R. G., Fischer, A. H., & Sauter, D. A. (2020). Good vibrations: A review of vocal expressions of positive emotions. *Psychonomic bulletin & review*, *27*(2), 237-265.

Kaplan, P. S., Bachorowski, J. A., Smoski, M. J., & Zinser, M. (2001). Role of clinical diagnosis and medication use in effects of maternal depression on infant-directed speech. *Infancy*, *2*(4), 537-548.

Kaplan, P. S., Burgess, A. P., Sliter, J. K., & Moreno, A. J. (2009). Maternal Sensitivity and the Learning-Promoting Effects of Depressed and Nondepressed Mothers' Infant-Directed Speech. *Infancy*, *14*(2), 143-161.

Kaplan, P. S., Danko, C. M., Everhart, K. D., Diaz, A., Asherin, R. M., Vogeli, J. M., & Fekri, S. M. (2014). Maternal depression and expressive communication in one-year-old infants. *Infant Behavior and Development*, *37*(3), 398-405.

Kaplan, P. S., Danko, C. M., Kalinka, C. J., & Cejka, A. M. (2012). A developmental decline in the learning-promoting effects of infant-directed speech for infants of mothers with chronically elevated symptoms of depression. *Infant Behavior and Development*, *35*(3), 369-379.

Karoly, P. (1993). Mechanisms of self-regulation: A systems view. *Annual review of psychology*, *44*(1), 23-52.

Karreman, A., Van Tuijl, C., van Aken, M. A., & Deković, M. (2006). Parenting and self-regulation in preschoolers: A meta-analysis. *Infant and Child Development: An International Journal of Research and Practice*, *15*(6), 561-579.

Kawai, E., Takagai, S., Takei, N., Itoh, H., Kanayama, N., Tsuchiya, K. J., & HBC Study Team. (2017). Maternal postpartum depressive symptoms predict delay in non-verbal communication in 14-month-old infants. *Infant Behavior and Development*, *46*, 33-45.

Keenan, T., Evans, S., & Crowley, K. (2016). *An introduction to child development*. Sage.

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.

Kemppinen, K., Kumpulainen, K., Raita-Hasu, J., Moilanen, I., & Ebeling, H. (2006). The continuity of maternal sensitivity from infancy to toddler age. *Journal of Reproductive and Infant Psychology*, *24*(3), 199-212.

Kendell, R. E., Chalmers, J. C., & Platz, C. (1987). Epidemiology of puerperal psychoses. *The British Journal of Psychiatry*, *150*(5), 662-673.

Kenny, M., Conroy, S., Pariante, C. M., Seneviratne, G., & Pawlby, S. (2013). Mother–infant interaction in mother and baby unit patients: before and after treatment. *Journal of psychiatric research*, *47*(9), 1192-1198.

Keren, M., Feldman, R., Eidelman, A. I., Sirota, L., & Lester, B. (2003). Clinical interview for high-risk parents of premature infants (CLIP) as a predictor of early disruptions in the mother–infant relationship at the nursery. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *24*(2), 93-110.

Kersten-Alvarez, L. E., Hosman, C. M., Riksen-Walraven, J. M., Van Doesum, K. T., & Hoefnagels, C. (2010). Long-term effects of a home-visiting intervention for depressed mothers and their infants. *Journal of Child Psychology and Psychiatry*, *51*(10), 1160-1170.

Kessler, R. C., Sampson, N. A., Berglund, P., Gruber, M. J., Al-Hamzawi, A., Andrade, L., ... & Wilcox, M. A. (2015). Anxious and non-anxious major depressive disorder in the World Health Organization World Mental Health Surveys. *Epidemiology and psychiatric sciences*, *24*(3), 210-226.

Kibor, E. J. (2004). The impact of Friedrick Froebel on education through the 19th and 20th centuries. *Africa Journal of Evangelical Theology*, *23*(2), 187-197.

Kida, T., & Shinohara, K. (2013). Gentle touch activates the prefrontal cortex in infancy: an NIRS study. *Neuroscience letters*, *541*, 63-66.

King, K. L., Priddis, L. E., & Kane, R. T. (2015). Enhancing maternal sensitivity and emotional wellbeing through a preventative parent–child relationship intervention in a community setting. *Journal of Child and Family Studies*, *24*(6), 1582-1592.

Kingston, D., Tough, S., & Whitfield, H. (2012). Prenatal and postpartum maternal psychological distress and infant development: a systematic review. *Child Psychiatry & Human Development*, *43*(5), 683-714.

Kitamura, C., & Lam, C. (2009). Age-specific preferences for infant-directed affective intent. *Infancy*, *14*(1), 77-100.

Klainin, P., & Arthur, D. G. (2009). Postpartum depression in Asian cultures: a literature review. *International journal of nursing studies*, *46*(10), 1355-1373.

Klein-Velderman, M., Bakermans-Kranenburg, M. J., Juffer, F., & Van Ijzendoorn, M. H. (2006). Effects of attachment-based interventions on maternal sensitivity and infant attachment: differential susceptibility of highly reactive infants. *Journal of family psychology*, *20*(2), 266-274.

Klerman, G.L., Weissman, M.M., Rounsaville, B.J. & Chevron, E.S. (1984). *Interpersonal Psychotherapy of Depression.* New York: Basic Books.

Klier, C. M., Muzik, M., Rosenblum, K. L., & Lenz, G. (2001). Interpersonal psychotherapy adapted for the group setting in the treatment of postpartum depression. *The Journal of psychotherapy practice and research*, *10*(2), 124-131.

Kluczniok, D., Boedeker, K., Fuchs, A., Hindi Attar, C., Fydrich, T., Fuehrer, D., ... & Bermpohl, F. (2016). Emotional availability in mother–child interaction: The effects of maternal depression in remission and additional history of childhood abuse. *Depression and anxiety*, *33*(7), 648-657.

Koch, S., De Pascalis, L., Vivian, F., Meurer Renner, A., Murray, L., & Arteche, A. (2019). Effects of male postpartum depression on father–infant interaction: The mediating role of face processing. *Infant mental health journal*, *40*(2), 263-276.

Kokkinaki, T., & Kugiumutzakis, G. (2000). Basic aspects of vocal imitation in infant-parent interaction during the first 6 months. *Journal of reproductive and infant psychology*, *18*(3), 173-187.

Koopmans-van Beinum, F. J., & van der Stelt, J. M. (1986). Early stages in the development of speech movements. In B. lindblom & R. Zetterstrom (Eds.), *Precursors of early speech* (pp. 37-50). Palgrave Macmillan, London.

Koren-Karie, N., Oppenheim, D., Dolev, S., Sher, E., & Etzion-Carasso, A. (2002). Mothers' insightfulness regarding their infants' internal experience: relations with maternal sensitivity and infant attachment. *Developmental Psychology*, *38*(4), 534-542.

Kostilainen, K., Mikkola, K., Erkkilä, J., & Huotilainen, M. (2021). Effects of maternal singing during kangaroo care on maternal anxiety, wellbeing, and mother-infant relationship after preterm birth: A mixed methods study. *Nordic Journal of Music Therapy*, *30*(4), 357-376.

Kostyrka-Allchorne, K., Wass, S. V., & Sonuga-Barke, E. J. (2020). Research Review: Do parent ratings of infant negative emotionality and self-regulation predict psychopathology in childhood and adolescence? A systematic review and meta-analysis of prospective longitudinal studies. *Journal of Child Psychology and Psychiatry*, *61*(4), 401-416.

Koulomzin, M., Beebe, B., Anderson, S., Jaffe, J., Feldstein, S., & Crown, C. (2002). Infant gaze, head, face and self-touch at 4 months differentiate secure vs. avoidant attachment at 1 year: A microanalytic approach. *Attachment & Human Development*, *4*(1), 3-24.

Koutra, K., Chatzi, L., Bagkeris, M., Vassilaki, M., Bitsios, P. and Kogevinas, M. (2013). Antenatal and postnatal maternal mental health as determinants of infant neurodevelopment at 18 months of age in a mother– child cohort (Rhea Study) in Crete, Greece. *Social psychiatry and psychiatric epidemiology*,48(8), 1335-1345.

Koutra, K., Chatzi, L., Roumeliotaki, T., Vassilaki, M., Giannakopoulou, E., Batsos, C., ... & Kogevinas, M. (2012). Socio-demographic determinants of infant neurodevelopment at 18 months of age: Mother–Child Cohort (Rhea Study) in Crete, Greece. *Infant Behavior and Development*, *35*(1), 48-59.

Krasnor, L. R., & Pepler, D. J. (1980). The study of children's play: Some suggested future directions. *New Directions for Child and Adolescent Development*, *1980*(9), 85-95.

Kruckman, L., & Smith, S. (2008). *An Introduction to Postpartum Illness*. USA: Postpartum Support International.

Kuhl, P. K., & Meltzoff, A. N. (1996). Infant vocalizations in response to speech: Vocal imitation and developmental change. *The journal of the Acoustical Society of America*, *100*(4), 2425-2438.

Kumar, C., Hawton, K., & Cowen, P. (1992). Mentally ill mothers and their babies: what are the benefits and risks of joint hospital admission? In K. Hawton & P. Cowen (Eds.), *Practical Problems in Clinical Psychiatry* (pp. 184–196). Oxford University Press.

Kumar, R., & Robson, K. M. (1984). A prospective study of emotional disorders in childbearing women. *The British Journal of Psychiatry*, *144*(1), 35-47.

Kurstjens, S., & Wolke, D. (2001). Effects of maternal depression on cognitive development of children over the first 7 years of life. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*(5), 623-636.

Kuschner, D. (2015). Play and early childhood education. *The handbook of the study of play*, *2*, 287-98.

Laakso, M. L., Poikkeus, A. M., Katajamäki, J., & Lyytinen, P. (1999). Early intentional communication as a predictor of language development in young toddlers. *First Language*, *19*(56), 207-231.

Lam-Cassettari, C., & Kohlhoff, J. (2020). Effect of maternal depression on infant-directed speech to prelinguistic infants: Implications for language development. *Plos one*, *15*(7), e0236787.

Landesman, P. (2011). *Maternal depression and the management of infant gaze aversion* [Doctoral dissertation, New York University].

Lanes, A., Kuk, J. L., & Tamim, H. (2011). Prevalence and characteristics of postpartum depression symptomatology among Canadian women: a cross-sectional study. *BMC public health*, *11*(302), 1-9.

Lang, S., Bartl-Pokorny, K. D., Pokorny, F. B., Garrido, D., Mani, N., Fox-Boyer, A. V., ... & Marschik, P. B. (2019). Canonical babbling: A marker for earlier identification of late detected developmental disorders?. *Current Developmental Disorders Reports*, *6*(3), 111-118.

Lavelli, M., & Fogel, A. (2005). Developmental changes in the relationship between the infant's attention and emotion during early face-to-face communication: the 2-month transition. *Developmental psychology*, *41*(1), 265-280.

Lavelli, M., & Fogel, A. (2013). Interdyad differences in early mother–infant face-to-face communication: Real-time dynamics and developmental pathways. *Developmental Psychology*, *49*(12), 2257-2271.

Leahy-Warren, P., & McCarthy, G. (2007). Postnatal depression: prevalence, mothers' perspectives, and treatments. *Archives of psychiatric nursing*, *21*(2), 91-100.

Leclère, C., Viaux, S., Avril, M., Achard, C., Chetouani, M., Missonnier, S., & Cohen, D. (2014). Why synchrony matters during mother-child interactions: a systematic review. *PloS one*, *9*(12), e113571.

Lee, S., Tsang, A., & Kwok, K. (2007). Twelve-month prevalence, correlates, and treatment preference of adults with DSM-IV major depressive episode in Hong Kong. *Journal of Affective Disorders*, *98*(1-2), 129-136.

Leerkes, E. M. (2010). Predictors of maternal sensitivity to infant distress. *Parenting: Science and Practice*, *10*(3), 219-239.

Legerstee, M., & Varghese, J. (2001). The role of maternal affect mirroring on social expectancies in three-month-old infants. Child Development, 72(5), 1301-1313.

Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC psychiatry*, *8*(1), 1-11.

Leigh, P., Nievar, M. A., & Nathans, L. (2011). Maternal sensitivity and language in early childhood: A test of the transactional model. *Perceptual and motor skills*, *113*(1), 281-299.

Letourneau, N. L., Dennis, C. L., Cosic, N., & Linder, J. (2017). The effect of perinatal depression treatment for mothers on parenting and child development: A systematic review. *Depression and anxiety*, *34*(10), 928-966.

Lewis, Jill Boucher, Laura Lupton, Samantha Watson, V. (2000). Relationships between symbolic play, functional play, verbal and non-verbal ability in young children. *International Journal of Language & Communication Disorders*, *35*(1), 117-127.

Lewkowicz, D. J. (1998). Infants' response to the audible and visible properties of the human face: II. Discrimination of differences between singing and adult-directed speech. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, *32*(4), 261-274.

Lieberman, A. F., & Van Horn, P. (2008). *Psychotherapy with infants and young children: Repairing the effects of stress and trauma on early childhood.* The Guilford Press.

Liebschner, J. (1985). Children learning through each other. *Early Child Development and Care*, *21*(1-3), 121-134.

Liebschner, J. (1993). Aims of a Good School: The Curriculum of Friedrich Froebel Edited Highlights from Froebel's Writings. *Early Years*, *14*(1), 54-57.

Lilley, I. M. (1967). *Friedrich Froebel: A selection from his writings*. Cambridge University Press.

Lindensmith, R. (2018). Interventions to improve maternal-infant relationships in mothers with postpartum mood disorders. *MCN: The American Journal of Maternal/Child Nursing*, *43*(6), 334-340.

Little, E. E., Legare, C. H., & Carver, L. J. (2018). Mother–Infant physical contact predicts responsive feeding among US breastfeeding mothers. *Nutrients*, *10*(9), 1251.

Lobo, M. A., & Galloway, J. C. (2013b). The onset of reaching significantly impacts how infants explore both objects and their bodies. *Infant Behavior and Development*, *36*(1), 14-24.

Lobo, M. A., Harbourne, R. T., Dusing, S. C., & McCoy, S. W. (2013). Grounding early intervention: physical therapy cannot just be about motor skills anymore. *Physical therapy*, *93*(1), 94-103.

Lobo, M. A., Kokkoni, E., de Campos, A. C., & Galloway, J. C. (2014). Not just playing around: Infants' behaviors with objects reflect ability, constraints, and object properties. *Infant Behavior and Development*, *37*(3), 334-351.

Locke, J. L. (2001). First communion: The emergence of vocal relationships. *Social Development*, *10*(3), 294-308.

Logsdon, M. C., Mittelberg, M., Jacob, A. E., Luther, J. F., Wisniewski, S. R., Confer, A., ... & Wisner, K. L. (2015). Maternal–Infant interaction in women with unipoloar and bipolar depression. *Applied Nursing Research*, *28*(4), 381-383.

Lotzin, A., Romer, G., Schiborr, J., Noga, B., Schulte-Markwort, M., & Ramsauer, B. (2015). Gaze synchrony between mothers with mood disorders and their infants: maternal emotion dysregulation matters. *PLoS one*, *10*(12), e0144417.

Loureiro, A. T. M. (2016). *The impact of maternal sensitivity on 3-month infant´ s self-regulatory and social engagement behaviors* [Master dissertation, University of Porto].

Lovejoy, M. C., Graczyk, P. A., O'Hare, E., & Neuman, G. (2000). Maternal depression and parenting behavior: A meta-analytic review. *Clinical psychology review*, *20*(5), 561-592.

Lowe, J. R., Coulombe, P., Moss, N. C., Rieger, R. E., Aragón, C., MacLean, P. C., ... & Handal, A. J. (2016). Maternal touch and infant affect in the Still Face Paradigm: A cross-cultural examination. *Infant Behavior and Development*, *44*, 110-120.

Lucci, T. K., & Otta, E. (2013). Postpartum depression and child development in first year of life. *Estudos de Psicologia (Campinas)*, *30*(1), 7-17.

Lundy, B., Field, T., & Pickens, J. (1996). Newborns of mothers with depressive symptoms are less expressive. *Infant Behavior and Development*, *19*(4), 419-424.

Luthar, S. S., Crossman, E. J., & Small, P. J. (2015). Resilience and adversity. In R. Lerner (Ed.) *Handbook of child psychology and developmental science* (pp. 247-386). Wiley. New York, USA.

Lyons-Ruth, K., Zoll, D., Connell, D., & Grunebaum, H. U. (1986). The depressed mother and her one-year-old infant: Environment, interaction, attachment, and infant development. *New Directions for Child and Adolescent Development*, *34*, 61-82.

MacLean, P. C., Rynes, K. N., Aragón, C., Caprihan, A., Phillips, J. P., & Lowe, J. R. (2014). Mother–infant mutual eye gaze supports emotion regulation in infancy during the still-face paradigm. *Infant Behavior and Development*, *37*(4), 512-522.

Main, M. (1983). Exploration, play, and cognitive functioning related to infant-mother attachment. *Infant Behavior and Development*, *6*(2-3), 167-174.

Main, M., Hesse, E., & Goldwyn, R. (2008). Studying differences in language usage in recounting attachment history: An introduction to the AAI. In H. Steele & M. Steele (Eds.), *Clinical applications of the Adult Attachment Interview* (pp. 31–68). New York: Guilford.

Makkar, D. (2018). Postpartum Depression—An Overview. *Pan Asian Journal of Obstetrics & Gynecology*, *1*, 11-17.

Malina, M. A., Nørreklit, H. S., & Selto, F. H. (2011). Lessons learned: advantages and disadvantages of mixed method research. *Qualitative Research in Accounting & Management*, *8*(1), 59-71.

Malloch, S. and Trevarthen, C. (2009). *Communicative Musicality: Exploring the Basis of Human Companionship.* Oxford: Oxford University Press.

Malphurs, J. E., Raag, T., Field, T., Pickens, J., & Pelaez-Nogueras, M. (1996). Touch by intrusive and withdrawn mothers with depressive symptoms. *Early Development and Parenting: An International Journal of Research and Practice*, *5*(2), 111-115.

Mammen, M. A., Moore, G. A., Scaramella, L. V., Reiss, D., Shaw, D. S., Leve, L. D., & Neiderhiser, J. M. (2016). Infant patterns of reactivity to tactile stimulation during parent-child interaction. *Infant Behavior and Development*, *44*, 121-132.

Mancini, F., Carlson, C., & Albers, L. (2007). Use of the Postpartum Depression Screening Scale in a collaborative obstetric practice. *Journal of midwifery & women's health*, *52*(5), 429-434.

Manning, J. P. (2005). Rediscovering Froebel: A call to re-examine his life & gifts. *Early Childhood Education Journal*, *32*(6), 371-376.

Mantis, I., Mercuri, M., Stack, D. M., & Field, T. M. (2019). Depressed and non-depressed mothers' touching during social interactions with their infants. *Developmental Cognitive Neuroscience*, *35*, 57-65.

Mäntymaa, M., Puura, K., Luoma, I., Kaukonen, P., Salmelin, R. K., & Tamminen, T. (2008). Infants' social withdrawal and parents' mental health. *Infant Behavior and Development*, *31*(4), 606-613.

Mäntymaa, M., Puura, K., Luoma, I., Salmelin, R. K., & Tamminen, T. (2004). Early mother–infant interaction, parental mental health and symptoms of behavioral and emotional problems in toddlers. *Infant Behavior and Development*, *27*(2), 134-149.

Mäntymaa, M., Tamminen, T., Puura, K., Luoma, I., Koivisto, A. M., & Salmelin, R. K. (2006). Early mother–infant interaction: Associations with the close relationships and mental health of the mother. *Journal of reproductive and infant psychology*, *24*(3), 213-231.

Margaret, B., Lewis, L. E., Bhat, R. Y., Nayak, B. S., Pai, M. S., & Mundkur, S. C. (2018). Impact of depressive symptoms on mother infant attachment among mothers of preterm neonates. *Online J Health Allied Sci*, *17*, 1-5.

Marino, C., Riva, V., Mornati, G., Piazza, C., Del Giudice, R., Dionne, G., ... & Cantiani, C. (2019). Postnatal maternal symptoms of depression and child emotion dysregulation: The mediation role of infant EEG alpha asymmetry. *Infant Behavior and Development*, *57*, 1-10.

Markova, G. (2018). The games infants play: Social games during early mother–infant interactions and their relationship with oxytocin. *Frontiers in psychology*, *9* (1041), 1-12.

Marsee, M. A., & Frick, P. J. (2007). Exploring the cognitive and emotional correlates to proactive and reactive aggression in a sample of detained girls. *Journal of abnormal child psychology*, *35*(6), 969-981.

Martin, C. J. H. (2014). A narrative literature review of the therapeutic effects of music upon childbearing women and neonates. *Complementary therapies in clinical practice*, *20*(4), 262-267.

Martin, C. R. (Ed.). (2012). *Perinatal mental health: A clinical guide*. M&K Update Ltd.

Marwick, H., & Murray, L. (2009). The effects of maternal depression on the 'musicality' of infant-directed speech and conversational engagement. In S. Malloch & C. Trevarthen (Eds.), *Communicative musicality: Exploring the basis of human companionship* (pp. 281–300). Oxford, UK: Oxford University Press.

Marwick, H., Doolin, O., Allely, C. S., McConnachie, A., Johnson, P., Puckering, C., ... & Wilson, P. (2013). Predictors of diagnosis of child psychiatric disorder in adult–infant social-communicative interaction at 12 months. *Research in developmental disabilities*, *34*(1), 562-572.

Masur, E. F., & Olson, J. (2008). Mothers' and infants' responses to their partners' spontaneous action and vocal/verbal imitation. *Infant behavior and Development*, *31*(4), 704-715.

Maughan, A., Cicchetti, D., Toth, S. L., & Rogosch, F. A. (2007). Early-occurring maternal depression and maternal negativity in predicting young children's emotion regulation and socioemotional difficulties. *Journal of abnormal child psychology*, *35*(5), 685-703.

Mavrogiorgou, P., Diop, S., Turmes, L., Specht, C., Vanscheidt, S., Seehagen, S., & Juckel, G. (2022). Computer-based mother–infant interaction analysis and mental functioning in postpartum depression. *Psychiatry Research*, 114506.

Maxwell, J. A. (2008). Designing a qualitative study. *The SAGE handbook of applied social research methods*, *2*, 214-253.

Mayberry, L. J., Horowitz, J. A., & Declercq, E. (2007). Depression symptom prevalence and demographic risk factors among US women during the first 2 years postpartum. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, *36*(6), 542-549.

Mayers, A., Hambidge, S., Bryant, O., & Arden-Close, E. (2020). Supporting women who develop poor postnatal mental health: what support do fathers receive to support their partner and their own mental health?. *BMC pregnancy and childbirth*, *20*(1), 1-9.

McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early childhood research quarterly*, *21*(4), 471-490.

McClelland, M. M., Cameron Ponitz, C., Messersmith, E., & Tominey, S. (2010). Self-regulation: The integration of cognition and emotion. In W. Overton & R. Lerner (Eds.), *Handbook of life-span human development: Vol. 1. Cognition, biology and methods* (pp. 509–553). Hoboken, NJ: Wiley.

McClure, E. B., & Nowicki, S. (2001). Associations between social anxiety and nonverbal processing skill in preadolescent boys and girls. *Journal of Nonverbal Behavior*, *25*(1), 3-19.

McFadden, K. E., & Tamis-Lemonda, C. S. (2013). Maternal responsiveness, intrusiveness, and negativity during play with infants: Contextual associations and infant cognitive status in a low-income sample. *Infant Mental Health Journal*, *34*(1), 80-92.

McFarland, D. H., Fortin, A. J., & Polka, L. (2020). Physiological measures of mother–infant interactional synchrony. *Developmental Psychobiology*, *62*(1), 50-61.

McGillion, M. L., Herbert, J. S., Pine, J. M., Keren-Portnoy, T., Vihman, M. M., & Matthews, D. E. (2013). Supporting early vocabulary development: What sort of responsiveness matters?. *IEEE Transactions on Autonomous Mental Development*, *5*(3), 240-248.

McMahon, C., Barnett, B., Kowalenko, N., & Tennant, C. (2005). Psychological factors associated with persistent postnatal depression: past and current relationships, defence styles and the mediating role of insecure attachment style. *Journal of affective disorders*, *84*(1), 15-24.

Meder, U., Tarjanyi, E., Kovacs, K., Szakmar, E., Cseko, A. J., Hazay, T., ... & Jermendy, A. (2021). Cerebral oxygenation in preterm infants during maternal singing combined with skin-to-skin care. *Pediatric Research*, *90*(4), 809-814.

Meins, E., Fernyhough, C., Arnott, B., Leekam, S. R., & de Rosnay, M. (2013). Mind-mindedness and theory of mind: Mediating roles of language and perspectival symbolic play. *Child development*, *84*(5), 1777-1790.

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *Journal of child Psychology and Psychiatry*, *42*(5), 637-648.

Mello, E. L., Maia, S. M., & de Andrada e Silva, M. A. (2009). Singing voice and the constitution of mother/baby relationship. *Revista CEFA*C, *11*, 127–133.

Meltzer-Brody, S. (2011). New insights into perinatal depression: pathogenesis and treatment during pregnancy and postpartum. *Dialogues in clinical neuroscience*, *13*(1), 89-100.

Menashe, A., & Atzaba-Poria, N. (2016). Parent–child interaction: Does parental language matter?. *British Journal of Developmental Psychology*, *34*(4), 518-537.

Mercuri, M. (2017). *Love at First Touch: Maternal, Paternal, and Infant Touch During Early Triadic and Dyadic Parent-Infant Interactions* [Doctoral dissertation, Concordia University].

Meredith, P., & Noller, P. (2003). Attachment and infant difficultness in postnatal depression. *Journal of Family Issues*, *24*(5), 668-686.

Mermelshtine, R., & Barnes, J. (2016). Maternal responsive–didactic caregiving in play interactions with 10-month-olds and cognitive development at 18 months. *Infant and Child Development*, *25*(3), 296-316.

Merz, E. C., Zucker, T. A., Landry, S. H., Williams, J. M., Assel, M., Taylor, H. B., ... & School Readiness Research Consortium. (2015). Parenting predictors of cognitive skills and emotion knowledge in socioeconomically disadvantaged preschoolers. *Journal of Experimental Child Psychology*, *132*, 14-31.

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental review*, *29*(2), 120-162.

Messinger, D., & Fogel, A. (2007). The interactive development of social smiling. In R.V. Kail (Eds.), *Advances in child development and behaviour* (pp. 327-366). Elsevier, Oxford.

Milgrom, J., & Beatrice, G. (2003). Coping with the stress of motherhood: cognitive and defence style of women with postnatal depression. *Stress and Health: Journal of the International Society for the Investigation of Stress*, *19*(5), 281-287.

Milgrom, J., & Holt, C. (2014). Early intervention to protect the mother-infant relationship following postnatal depression: study protocol for a randomised controlled trial. *Trials*, *15*(1), 1-7.

Milgrom, J., Gemmill, A. W., Bilszta, J. L., Hayes, B., Barnett, B., Brooks, J., ... & Buist, A. (2008). Antenatal risk factors for postnatal depression: a large prospective study. *Journal of affective disorders*, *108*(1-2), 147-157.

Milgrom, J., Gemmill, A. W., Ericksen, J., Burrows, G., Buist, A., & Reece, J. (2015). Treatment of postnatal depression with cognitive behavioural therapy, sertraline and combination therapy: a randomised controlled trial. *Australian & New Zealand Journal of Psychiatry*, *49*(3), 236-245.

Milgrom, J., Negri, L. M., Gemmill, A. W., McNeil, M., & Martin, P. R. (2005). A randomized controlled trial of psychological interventions for postnatal depression. *British Journal of Clinical Psychology*, *44*(4), 529-542.

Milgrom, J., Westley, D. T., & Gemmill, A. W. (2004). The mediating role of maternal responsiveness in some longer term effects of postnatal depression on infant development. *Infant Behavior and Development*, *27*(4), 443-454.

Millard, S. J., Weston-Green, K., & Newell, K. A. (2017). The effects of maternal antidepressant use on offspring behaviour and brain development: Implications for risk of neurodevelopmental disorders. *Neuroscience & Biobehavioral Reviews*, *80*, 743-765.

Miller, J. L., & Lossia, A. K. (2013). Prelinguistic infants' communicative system: Role of caregiver social feedback. *First Language*, *33*(5), 524-544.

Milligan, K., Atkinson, L., Trehub, S.E., Benoit, D. & Poulton, L. (2003). Maternal attachment and the communication of emotion through song. *Infant Behavior and Development, 26*(1), 1-13.

Mills-Koonce, W. R., Gariepy, J. L., Sutton, K., & Cox, M. J. (2008). Changes in maternal sensitivity across the first three years: are mothers from different attachment dyads differentially influenced by depressive symptomatology?. *Attachment & Human Development*, *10*(3), 299-317.

Misri, S., Reebye, P., Corral, M., & Milis, L. (2004). The use of paroxetine and cognitive-behavioral therapy in postpartum depression and anxiety: a randomized controlled trial. *The Journal of clinical psychiatry*, *65*(9), 1236-41.

Moehler, E., Brunner, R., Wiebel, A., Reck, C., & Resch, F. (2006). Maternal depressive symptoms in the postnatal period are associated with long-term impairment of mother–child bonding. *Archives of women's mental health*, *9*(5), 273-278.

Moehler, E., Kagan, J., Parzer, P., Brunner, R., Reck, C., Wiebel, A., ... & Resch, F. (2007). Childhood behavioral inhibition and maternal symptoms of depression. *Psychopathology*, *40*(6), 446-452.

Molina, M., & Jouen, F. (2004). Manual cyclical activity as an exploratory tool in neonates. *Infant Behavior and Development*, *27*(1), 42-53.

Molyneaux, E., Howard, L. M., McGeown, H. R., Karia, A. M., & Trevillion, K. (2017). Antidepressant treatment for postnatal depression. *Issues in mental health nursing*, *38*(2), 188-190.

Molyneaux, E., Trevillion, K., & Howard, L. M. (2015). Antidepressant treatment for postnatal depression. *Jama*, *313*(19), 1965-1966.

Moradi, N., Baghban, K., Soltani, M., Javadipour, S., & Seihei, E. (2014). Survey of Some acoustic features of maternal speech in Persian speaking mothers. *Pajouhan Scientific Journal*, *12*(3), 52-57.

Morawska, A., Dittman, C. K., & Rusby, J. C. (2019). Promoting self-regulation in young children: the role of parenting interventions. *Clinical child and family psychology review*, *22*(1), 43-51.

Moreno, A. J., Posada, G. E., & Goldyn, D. T. (2006). Presence and quality of touch influence coregulation in mother–infant dyads. *Infancy*, *9*(1), 1-20.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, *1*(1), 48-76.

Morgenthaler, S.K. (2006). The meaning in playing with objects. In Fromberg, D. P., & Bergen, D. (Eds.), *Play from birth to twelve: Contexts, perspectives, and meanings* (pp. 65-74). Routledge.

Morrell, C. J., Slade, P., Warner, R., Paley, G., Dixon, S., Walters, S. J., ... & Nicholl, J. (2009). Clinical effectiveness of health visitor training in psychologically informed approaches for depression in postnatal women: pragmatic cluster randomised trial in primary care. *Bmj*, *338*, 1–14.

Morrell, J., & Murray, L. (2003). Parenting and the development of conduct disorder and hyperactive symptoms in childhood: A prospective longitudinal study from 2 months to 8 years. *Journal of Child Psychology and Psychiatry*, *44*(4), 489-508.

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social development*, *16*(2), 361-388.

Morse, J. M., Niehaus, L. (2009). *Mixed methods design: Principles and procedures*. Walnut Creek, CA: Left Coast Press.

Moszkowski, R. J., & Stack, D. M. (2007). Infant touching behaviour during mother–infant face-to-face interactions. *Infant and Child Development: An International Journal of Research and Practice*, *16*(3), 307-319.

Moszkowski, R. J., Stack, D. M., & Chiarella, S. S. (2009). Infant touch with gaze and affective behaviors during mother–infant still-face interactions: Co-occurrence and functions of touch. *Infant Behavior and Development*, *32*(4), 392-403.

Moszkowski, R. J., Stack, D. M., Girouard, N., Field, T. M., Hernandez-Reif, M., & Diego, M. (2009). Touching behaviors of infants of depressed mothers during normal and perturbed interactions. *Infant Behavior and Development*, *32*(2), 183-194.

Moura, C. P., Cunha, L. M., Vilarinho, H., Cunha, M. J., Freitas, D., Palha, M., ... & Pais-Clemente, M. (2008). Voice parameters in children with Down syndrome. *Journal of Voice*, *22*(1), 34-42.

Mualem, O., & Klein, P. S. (2013). The communicative characteristics of musical interactions compared with play interactions between mothers and their one-year-old infants. *Early Child Development and Care*, *183*(7), 899-915.

Mulcahy, R., Reay, R. E., Wilkinson, R. B., & Owen, C. (2010). A randomised control trial for the effectiveness of group interpersonal psychotherapy for postnatal depression. *Archives of women's mental health*, *13*(2), 125-139.

Munk-Olsen, T., Laursen, T. M., Pedersen, C. B., Mors, O., & Mortensen, P. B. (2006). New parents and mental disorders: a population-based register study. *Jama*, *296*(21), 2582-2589.

Murray, D. W., Rosanbalm, K., & Christopoulos, C. (2016a). *Self-regulation and toxic stress report 3: A comprehensive review of self-regulation interventions from birth through young adulthood* (Report #2016-34). Washington DC: Office of Planning, Research and Evaluation, Administration of Children and Families, U.S. Department of Health and Human Services.

Murray, D. W., Rosanbalm, K.D., & Christopoulos, C. (2016b). *Self-regulation and toxic stress report 4: Implications for programs and practice* (Report # 2016-97). Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Murray, J. (2018). Value/s in early childhood education. *International Journal of Early Years Education, 26*(3), 215-219.

Murray, L. (1992). The impact of postnatal depression on infant development. *Child Psychology & Psychiatry & Allied Disciplines, 33* (3), 543–561.

Murray, L. & Cooper, P. J. (1997a). The role of infant and maternal factors in postpartum depression and mother-infant interactions, and infant outcomes. In L. Murray & P. J. Cooper (Eds.), *Postpartum depression and child development* (pp. 111-135). Amsterdam, Philadelphia: John Benjamins Publishing Company.

Murray, L. & Cooper, P. J. (1997b). *Postpartum depression and child development.* New York, London. The Guilford Press.

Murray, L. & Cooper, P. J. (1997c). *Postpartum depression and child development.* New York, London. The Guilford Press.

Murray, L., & Cooper, P. (2017). Postnatal depression and the under-twos. In P. Leach (Ed.), *Transforming infant wellbeing: Research, policy and practice for the first 1001 critical days* (pp. 56-67). Routledge.

Murray, L., & Cooper, P. J. (1997). Effects of postnatal depression on infant development. *Archives of disease in childhood*, *77*(2), 99-101.

Murray, L., & Cooper, P. J. (1997). Postpartum depression and child development. *Psychological medicine*, *27*(2), 253-260.

Murray, L., & Karpf, J. (2000). *Coding scheme for structured mother-infant play interaction at 12 months.* University of Reading.

Murray, L., & Trevarthen, C. (1985). Emotional regulation of interactions between two- month-olds and their mothers. In T. Field & N. Fox (Eds.), *Social perception in infants* (pp. 177–197). Norwood, NJ: Ablex.

Murray, L., Arteche, A., Fearon, P., Halligan, S., Goodyer, I., & Cooper, P. (2011). Maternal postnatal depression and the development of depression in offspring up to 16 years of age. *Journal of the American Academy of Child & Adolescent Psychiatry*, *50*(5), 460-470.

Murray, L., De Pascalis, L., Bozicevic, L., Hawkins, L., Sclafani, V., & Ferrari, P. F. (2016). The functional architecture of mother-infant communication, and the development of infant social expressiveness in the first two months. *Scientific Reports*, *6*(1), 1-9.

Murray, L., Fearon, P., & Cooper, P. (2015). Postnatal depression, mother-infant interactions, and child development: Prospects for screening and treatment. In J. Milgrom & A. W. Gemmill (Eds.), *Identifying Perinatal Depression and Anxiety: Evidence-based Practice in Screening, Psychosocial Assessment and Management* (pp.139-164). Wiley Blackwell, Oxford.

Murray, L., Fiori-Cowley, A., Hooper, R., & Cooper, P. (1996). The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child development*, *67*(5), 2512-2526.

Murray, L., Halligan, S., & Cooper, P. (2010). Effects of postnatal depression on mother–infant interactions and child development. *The Wiley-Blackwell handbook of infant development*, *2*, 192-220.

Murray, L., Halligan, S., & Cooper, P. (2018). Postnatal depression and young children's development. *Handbook of infant mental health*, *4*, 172-186.

Murray, L., Hentges, F., Hill, J., Karpf, J., Mistry, B., Kreutz, M., ... & Cleft Lip and Palate Study Team. (2008). The effect of cleft lip and palate, and the timing of lip repair on mother–infant interactions and infant development. *Journal of Child Psychology and Psychiatry*, *49*(2), 115-123.

Murray, L., Hipwell, A., Hooper, R., Stein, A., & Cooper, P. (1996). The cognitive development of 5-year-old children of postnatally depressed mothers. *Journal of Child Psychology and Psychiatry*, *37*(8), 927-935.

Murray, L., Hipwell, A., Woolgar, M., & Cooper, P. (2001). Cognitive vulnerability to depression in 5-year-old children of depressed mothers. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*(7), 891-899.

Murray, L., Kempton, C., Woolgar, M., & Hooper, R. (1993). Depressed mothers' speech to their infants and its relation to infant gender and cognitive development. *Journal of Child psychology and Psychiatry*, *34*(7), 1083-1101.

Murray, L., Sinclair, D., Cooper, P., Ducournau, P., Turner, P., & Stein, A. (1999). The socioemotional development of 5-year-old children of postnatally depressed mothers. *Journal of Child Psychology and Psychiatry*, *40*(8), 1259-1271.

Murray, L., Stanley, C., Hooper, R., King, F., & Fiori-Cowley, A. (1996). The role of infant factors in postnatal depression and mother-infant interactions. *Developmental Medicine & Child Neurology*, *38*(2), 109-119.

Music, G. (2011). *Nurturing Natures. Attachment and Children's Emotional Sociocultural and Brain Development.* Hove: Psychology Press.

Musser, E. D., Ablow, J. C., & Measelle, J. R. (2012). Predicting maternal sensitivity: The roles of postnatal depressive symptoms and parasympathetic dysregulation. *Infant Mental Health Journal*, *33*(4), 350-359.

Muzik, M., Morelen, D., Hruschak, J., Rosenblum, K. L., Bocknek, E., & Beeghly, M. (2017). Psychopathology and parenting: An examination of perceived and observed parenting in mothers with depression and PTSD. *Journal of affective disorders*, *207*, 242-250.

Myers, S., & Johns, S. E. (2019). Male infants and birth complications are associated with increased incidence of postnatal depression. *Social Science & Medicine*, *220*, 56-64.

National Health System (NHS), England. (2013). *NHS standard contract for specialised vascular services (adults).* https://www.vascularsociety.org.uk/_userfiles/pages/files/Document%20Library/Service-Specification.pdf

Nadel, J., Soussignan, R., Canet, P., Libert, G., & Gérardin, P. (2005). Two-month-old infants of depressed mothers show mild, delayed and persistent change in emotional state after non-contingent interaction. *Infant behavior and Development, 28*(4), 418-425.

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball sampling: A purposeful method of sampling in qualitative research. *Strides in Development of Medical Education*, *14*(3), 1-4.

Nakata, T., & Trehub, S. E. (2004). Infants' responsiveness to maternal speech and singing. *Infant Behavior and Development*, *27*(4), 455-464.

National Collaborating Centre for Mental Health, & National Institute for Health and Clinical Excellence. (2008). *Antenatal and postnatal mental health: clinical management and service guidance*. British Psychological Society and Gaskell.

National Institute for Health and Care Excellence. (2014). *Antenatal and postnatal mental health: clinical management and service guidance.* NICE clinical guideline 192.

National Institute of Child Health & Human Development (NICHD) Early Child Care Research Network. (1999). Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Developmental psychology*, *35*(5), 1297-1310.

National Offender Management Service (NOMS) (2015, February). *All about Mother and Baby Units*.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/498374/mbu-ad-hoc-release-2013-2015.pdf

Neale, D., Clackson, K., Georgieva, S., Dedetas, H., Scarpate, M., Wass, S., & Leong, V. (2018). Toward a Neuroscientific Understanding of Play: A Dimensional Coding Framework for Analyzing Infant–Adult Play Patterns. *Frontiers in psychology*, *9*(273), 1-17.

Nicely, P., Tamis-LeMonda, C. S., & Bornstein, M. H. (1999). Mothers' attuned responses to infant affect expressivity promote earlier achievement of language milestones. *Infant Behavior and Development*, *22*(4), 557-568.

NICHD Early Child Care Research Network. (1999). Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Developmental Psychology, 35,* 1297-1310.

Niedźwiecka, A., Ramotowska, S., & Tomalski, P. (2018). Mutual gaze during early mother–infant interactions promotes attention control development. *Child Development*, *89*(6), 2230-2244.

Nigg, J. T. (2017). Annual Research Review: On the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. *Journal of child psychology and psychiatry*, *58*(4), 361-383.

Noe, D., Schluckwerder, S., & Reck, C. (2015). Influence of dyadic matching of affect on infant self-regulation. *Psychopathology*, *48*(3), 173-183.

Nomikou, I., Leonardi, G., Rohlfing, K. J., & Rączaszek-Leonardi, J. (2016). Constructing interaction: The development of gaze dynamics. *Infant and Child Development*, *25*(3), 277-295.

Nomikou, I., Rohlfing, K. J., & Szufnarowska, J. (2013). Educating attention: Recruiting, maintaining, and framing eye contact in early natural mother–infant interactions. *Interaction Studies*, *14*(2), 240-267.

Noorlander, Y., Bergink, V., & Van den Berg, M. P. (2008). Perceived and observed mother–child interaction at time of hospitalization and release in postpartum depression and psychosis. *Archives of Women's Mental Health*, *11*(1), 49-56.

Norcross, P. L., Bailes, L. G., & Leerkes, E. (2020). Effects of maternal depressive symptoms on sensitivity to infant distress and non-distress: Role of SES and race. *Infant Behavior and Development*, *61*, 1-6.

Norhayati, M. N., Hazlina, N. N., Asrenee, A. R., & Emilin, W. W. (2015). Magnitude and risk factors for postpartum symptoms: a literature review. *Journal of affective Disorders*, *175*, 34-52.

Northrup, J. B., & Iverson, J. M. (2015). Vocal coordination during early parent–infant interactions predicts language outcome in infant siblings of children with autism spectrum disorder. *Infancy*, *20*(5), 523-547.

Northrup, J. B., & Iverson, J. M. (2020). The development of mother–infant coordination across the first year of life. *Developmental psychology*, *56*(2), 221-236.

Nowicki, S., & Duke, M. (2013). ccuracy in interpreting nonverbal cues. In J.A. Hall & M.L. Knapp (Eds.), *Nonverbal communication* (pp. 441-470). De Gruyter Mouton.

Nwokah, E., Hsu, H. C., & Gulker, H. (2013). The Use of Play Materials in Early Intervention: The Dilemma of Poverty. *American Journal of Play*, *5*(2), 187-218.

O'Connor, E., Bureau, J. F., Mccartney, K., & Lyons-Ruth, K. (2011). Risks and outcomes associated with disorganized/controlling patterns of attachment at age three years in the National Institute of Child Health & Human Development Study of Early Child Care and Youth Development. *Infant mental health journal*, *32*(4), 450-472.

O'Connor, T. G., Heron, J., Golding, J., Beveridge, M., & Glover, V. (2002). Maternal antenatal anxiety and children's behavioural/emotional problems at 4 years: Report from the Avon Longitudinal Study of Parents and Children. *The British Journal of Psychiatry*, *180*(6), 502-508.

O'Hara, M. W. (2009). Postpartum depression: what we know. *Journal of clinical psychology*, *65*(12), 1258-1269.

O'Hara, M. W., & McCabe, J. E. (2013). Postpartum depression: current status and future directions. *Annual review of clinical psychology*, *9*, 379-407.

O'Hara, M. W., & Segre, L. S. (2008). Psychologic disorders of pregnancy and the postpartum period. *Danforth's obstetrics and gynecology*, 504-514.

O'Hara, M. W., & Swain, A. M. (1996). Rates and risk of postpartum depression—a meta-analysis. *International review of psychiatry*, *8*(1), 37-54.

O'Hara, M. W., & Wisner, K. L. (2014). Perinatal mental illness: definition, description and aetiology. *Best Practice & Research Clinical Obstetrics & Gynaecology*, *28*(1), 3-12.

O'Hara, M. W., Stuart, S., Gorman, L. L., & Wenzel, A. (2000). Efficacy of interpersonal psychotherapy for postpartum depression. *Archives of general psychiatry*, *57*(11), 1039-1045.

O'Leary, N., Jairaj, C., Molloy, E. J., McAuliffe, F. M., Nixon, E., & O'Keane, V. (2019). Antenatal depression and the impact on infant cognitive, language and motor development at six and twelve months postpartum. *Early human development*, *134*, 41-46.

Oates, M. R., Cox, J. L., Neema, S., Asten, P., Glangeaud-Freudenthal, N., Figueiredo, B., ... & Yoshida, K. (2004). Postnatal depression across countries and cultures: a qualitative study. *The British journal of psychiatry*, *184*(S46), 10-16.

Oldfield, A., & Bunce, L. (2001). 'Mummy can play too. . .' – short term music therapy with mothers and young children. *British Journal of Music Therapy*, *15*, 27–36.

Oldfield, A., Adams, M., & Bunce, L. (2003). An investigation into short-term music therapy with mothers and young children. *British Journal of Music Therapy*, *17*(1), 26-45.

Olhaberry, M., Leòn, M. J., Seguel, M., & Mena, C. (2015). Video-feedback intervention in mother-baby dyads with depressive symptomatology and relationship difficulties. *Research in Psychotherapy: Psychopathology, Process and Outcome*, *18*(2), 82-92.

Olino, T. M., Lopez-Duran, N. L., Kovacs, M., George, C. J., Gentzler, A. L., & Shaw, D. S. (2011). Developmental trajectories of positive and negative affect in children at high and low familial risk for depressive disorder. *Journal of Child Psychology and Psychiatry*, *52*(7), 792-799.

Oller, D. K. (1980). The emergence of speech sound in Infancy. In G.H. Yeni-Komshian, J.F. Kavanagh & C.A. Ferguson, *Child Phonology: 1, production* (pp. 92–112). New York: Academic.

Oller, D. K. (2000). *The emergence of the speech capacity*. Psychology Press.

Oller, J. W., Oller, S. D., & Oller, S. N. (2012). *Milestones: Normal speech and language development across the lifespan*. Plural Publishing.

Onwuegbuzie, A. J., & Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *Qualitative Report*, *12*(2), 281-316.

Oppo, A., Mauri, M., Ramacciotti, D., Camilleri, V., Banti, S., Borri, C., ... & Cassano, G. B. (2009). Risk factors for postpartum depression: the role of the Postpartum Depression Predictors Inventory-Revised (PDPI-R). *Archives of women's mental health*, *12*(4), 239-249.

Orr, E. (2021). The relationship between play and language milestones in infancy. *Early Child Development and Care*, 1-8.

Ouvry, M. (2012). Froebel's mother songs today. In T. Bruce (Ed.), *Early childhood practice: Froebel today* (pp. 107–121). London: Sage Publications Ltd.

Ouvry, M. (2014). Cycle of Musical Discovery: singing and music making in the early years. *An Leanbh Óg*, *8,* 5-23.

Oyserman, D., Mowbray, C. T., Meares, P. A., & Firminger, K. B. (2000). Parenting among mothers with a serious mental illness. *American Journal of Orthopsychiatry*, *70*(3), 296-315.

Ozturk, O., Krehm, M., & Vouloumanos, A. (2013). Sound symbolism in infancy: Evidence for sound–shape cross-modal correspondences in 4-month-olds. *Journal of experimental child psychology*, *114*(2), 173-186.

Paavola, L., Kemppinen, K., Kunnari, S., Kumpulainen, K., Moilanen, I., & Ebeling, H. (2006). characteristics of mother-infant communicative interaction: relations to the ratings of maternal sensitivity and infant co-operation. *journal of early childhood research*, *4*(3), 203-222.

Palazzi, A., Filippa, M., Meschini, R., & Piccinini, C. A. (2021). Music therapy enhances preterm infant's signs of engagement and sustains maternal singing in the NICU. *Infant Behavior and Development*, *64*, 101596.

Palazzi, A., Meschini, R., & Piccinini, C. A. (2019). Music therapy intervention for the mother-preterm infant dyad: A proposal of intervention in the neonatal intensive care unit. *Psicologia em Estudo*, *24*.

Palazzi, A., Meschini, R., Dal Magro Medeiros, M., & Piccinini, C. A. (2020). NICU music therapy and mother-preterm infant synchrony: A longitudinal case study in the South of Brazil. *Nordic Journal of Music Therapy*, *29*(4), 334-352.

Pandey, A., Hale, D., Das, S., Goddings, A. L., Blakemore, S. J., & Viner, R. M. (2018). Effectiveness of universal self-regulation–based interventions in children and adolescents: A systematic review and meta-analysis. *JAMA pediatrics*, *172*(6), 566-575.

Panhwar, A. H., Ansari, S., & Shah, A. A. (2017). Post-positivism: an effective paradigm for social and educational research. *International Research Journal of Arts & Humanities (IRJAH)*, *45*(45), 253-260.

Papoušek, M. (1989). Determinants of responsiveness to infant vocal expression of emotional state. *Infant behavior and development*, *12*(4), 507-524.

Parameshwaran, S., & Chandra, P. S. (2018). Will the DSM-5 and ICD-11 "Make-over" really make a difference to women's mental health?. *Indian Journal of Social Psychiatry*, *34*(5), 79-85.

Patel, M., Bailey, R. K., Jabeen, S., Ali, S., Barker, N. C., & Osiezagha, K. (2012). Postpartum depression: a review. *Journal of health care for the poor and underserved*, *23*(2), 534-542.

Paterson, B. L., Bottorff, J. L., & Hewat, R. (2003). Blending observational methods: Possibilities, strategies, and challenges. *International Journal of Qualitative Methods*, *2*(1), 29-38.

Pauli-Pott, U., Schloß, S., & Becker, K. (2018). Maternal responsiveness as a predictor of self-regulation development and attention-deficit/hyperactivity symptoms across preschool ages. *Child Psychiatry & Human Development*, *49*(1), 42-52.

Paulson, J. F., Dauber, S., & Leiferman, J. A. (2006). Individual and combined effects of postpartum depression in mothers and fathers on parenting behavior. *Pediatrics*, *118*(2), 659-668.

Paulson, J. F., Keefe, H. A., & Leiferman, J. A. (2009). Early parental depression and child language development. *Journal of Child Psychology and Psychiatry*, *50*(3), 254-262.

Pawlby, S., Fernyhough, C., Meins, E., Pariante, C. M., Seneviratne, G., & Bentall, R. P. (2010). Mind-mindedness and maternal responsiveness in infant–mother interactions in mothers with severe mental illness. *Psychological Medicine*, *40*(11), 1861-1869.

Pawlby, S., Marks, M., Clarke, R., Best, E., Weir, D., & O'Keane, V. (2005). Mother-infant interaction in postpartum women with severe mental illness, before and after treatment. *Archives of Women's Mental Health*, *8*, 120.

Pawlby, S., Sharp, D., Hay, D. and O'Keane, V. (2008). Postnatal depression and child outcome at 11 years: the importance of accurate diagnosis. *Journal of affective disorders*, *107*(1), 241-245.

Payne, J. L. (2007). Antidepressant use in the postpartum period: practical considerations. *American Journal of Psychiatry*, *164*(9), 1329-1332.

Pearlstein, T. (2008). Perinatal depression: treatment options and dilemmas. *Journal of Psychiatry & Neuroscience*, *33,* 302-318.

Pearlstein, T., Howard, M., Salisbury, A., & Zlotnick, C. (2009). Postpartum depression. *American journal of obstetrics and gynecology*, *200*(4), 357-364.

Peláez-Nogueras, M., Field, T., Gewirtz, J. L., Cigales, M., Gonzalez, A., Sanchez, A., & Richardson, S. C. (1997). The effects of systematic stroking versus tickling and poking on infant behavior. *Journal of Applied Developmental Psychology*, *18*(2), 169-178.

Peláez-Nogueras, M., Field, T. M., Hossain, Z., & Pickens, J. (1996). Depressed mothers' touching increases infants' positive affect and attention in still-face interactions. *Child development*, *67*(4), 1780-1792.

Pelaez, M., Virués-Ortega, J., & Gewirtz, J. L. (2011). Contingent and noncontingent reinforcement with maternal vocal imitation and motherese speech: Effects on infant vocalizations. *European Journal of Behavior Analysis*, *12*(1), 277-287.

Pereira, A. T., Soares, M. J., Bos, S., Marques, M., Maia, B., Valente, J., ... & Macedo, A. (2014). Why should we screen for perinatal depression? Ten reasons to do it. *IJCNMH, 1*(10), 1–7.

Perkins, R. (2021) Group singing to support women experiencing symptoms of postnatal depression. *International Journal of Birth and Parent Education, 8* (4).

Perkins, R., Yorke, S., & Fancourt, D. (2018). How group singing facilitates recovery from the symptoms of postnatal depression: a comparative qualitative study. *BMC psychology*, *6*(1), 1-12.

Perry, N. B., Calkins, S. D., Dollar, J. M., Keane, S. P., & Shanahan, L. (2018). Self-regulation as a predictor of patterns of change in externalizing behaviors from infancy to adolescence. *Development and psychopathology*, *30*(2), 497-510.

Persico, G., Antolini, L., Vergani, P., Costantini, W., Nardi, M. T., & Bellotti, L. (2017). Maternal singing of lullabies during pregnancy and after birth: Effects on mother–infant bonding and on newborns' behaviour. Concurrent Cohort Study. *Women and Birth*, *30*(4), 214-220.

Petterson, S. M., & Albers, A. B. (2001). Effects of poverty and maternal depression on early child development. *Child development*, *72*(6), 1794-1813.

Pettit, G. S., & Arsiwalla, D. D. (2008). Commentary on special section on "bidirectional parent–child relationships": The continuing evolution of dynamic, transactional models of parenting and youth behavior problems. *Journal of abnormal child psychology*, *36*(5), 711-718.

Philpott, L. F., & Corcoran, P. (2018). Paternal postnatal depression in Ireland: Prevalence and associated factors. *Midwifery*, *56*, 121-127.

Piaget, J. (1952). *The Origins of intelligence in children.* New York: Norton.

Piaget, J. (1962). *Play, dreams, and imitation in childhood*. London: Rout.

Piaget, J. (1962). The relation of affectivity to intelligence in the mental development of the child. *Bulletin of the Menninger clinic*, *26*(3), 129-137.

Piccinini, C. A., Frizzo, G. B., Brys, I., & Lopes, R. D. C. S. (2014). Parenthood in the context of maternal depression at the end of the infant's first year of life. *Estudos de Psicologia (Campinas)*, *31*, 203-214.

Piteo, A. M., Yelland, L. N., & Makrides, M. (2012). Does maternal depression predict developmental outcome in 18 month old infants?. *Early human development*, *88*(8), 651-655.

Plano Clark, V., & Ivankova, N. V. (2016). How to use mixed methods research?: Understanding the basic mixed methods designs. In V.L.P. Clark & N.V. Ivankova (Eds.), *Mixed methods research: A guide to the field* (pp. 105-134). SAGE Publications Ltd.

Polan, H. J., & Ward, M. J. (1994). Role of the mother's touch in failure to thrive: A preliminary investigation. *Journal of the American Academy of Child & Adolescent Psychiatry*, *33*(8), 1098-1105.

Poon, K. K., Watson, L. R., Baranek, G. T., & Poe, M. D. (2012). To what extent do joint attention, imitation, and object play behaviors in infancy predict later communication and intellectual functioning in ASD?. *Journal of autism and developmental disorders*, *42*(6), 1064-1074.

Porritt, L. L., Zinser, M. C., Bachorowski, J. A., & Kaplan, P. S. (2014). Depression diagnoses and fundamental frequency-based acoustic cues in maternal infant-directed speech. *Language Learning and Development*, *10*(1), 51-67.

Pound, G. A. (2006). *The relationship between postpartum depression and infant development*. Alliant International University, San Diego.

Powell, S., & Goouch, K. (2012). Whose hand rocks the cradle? Parallel discourses in the baby room. *Early Years*, *32*(2), 113-127.

Powell, S., & Goouch, K. (2018). Mother's songs in daycare for babies. In T. Bruce, P. Elfer, S. Powell & L. Werth (Eds.), *The Routledge International Handbook of Froebel and Early Childhood Practice* (pp. 154-165). Routledge.

Powell, S., Goouch, K., & Werth, L. (2013, November 1-2). *Seeking Froebel's 'Mother Songs' in Daycare for Babies* [Conference session]. TACTYC Annual Research Conference, International Convention Centre, Birmingham.

Powell, S., Goouch, K., & Werth, L. (2015). Special songs. *Nursery World*, *25*, 16-17.

Power, T. G. (1999). *Play and exploration in children and animals*. Psychology Press.

Prenoveau, J. M., Craske, M. G., West, V., Giannakakis, A., Zioga, M., Lehtonen, A., ... & Stein, A. (2017). Maternal postnatal depression and anxiety and their association with child emotional negativity and behavior problems at two years. *Developmental Psychology*, *53*(1), 50-62.

Pretzer, G. M., Lopez, L. D., Walle, E. A., & Warlaumont, A. S. (2019). Infant-adult vocal interaction dynamics depend on infant vocal type, child-directedness of adult speech, and timeframe. *Infant Behavior and Development*, *57*, 1-15.

Provenzi, L., Scotto di Minico, G., Giusti, L., Guida, E., & Müller, M. (2018). Disentangling the dyadic dance: theoretical, methodological and outcomes systematic review of mother-infant dyadic processes. *Frontiers in psychology*, *9*(348), 1-22.

Provenzo Jr, E. F. (2009). Friedrich Froebel's Gifts: Connecting the Spiritual and Aesthetic to the Real World of Play and Learning. *American Journal of Play*, *2*(1), 85-99.

Psychogiou, L., Russell, G., & Owens, M. (2020). Parents' postnatal depressive symptoms and their children's academic attainment at 16 years: Pathways of risk transmission. *British Journal of Psychology*, *111*(1), 1-16.

Punch, K. (2005). Quantitative Research Design. In K. Punch (Ed.), *Introduction to Social Research – Quantitative and Qualitative Approaches* (pp. 62-84). Thousand Oaks, California: Sage Publications.

Puura, K., Guedeney, A., Mäntymaa, M., & Tamminen, T. (2007). Detecting infants in need: Are complicated measures really necessary?. *Infant Mental Health Journal*, *28*(4), 409-421.

Puura, K., Leppänen, J., Salmelin, R., Mäntymaa, M., Luoma, I., Latva, R., ... & Tamminen, T. (2019). Maternal and infant characteristics connected to shared pleasure in dyadic interaction. *Infant mental health journal*, *40*(4), 459-478.

Quevedo, L. A., Silva, R. A., Godoy, R., Jansen, K., Matos, M. B., Tavares Pinheiro, K. A., & Pinheiro, R. T. (2012). The impact of maternal post-partum depression on the language development of children at 12 months. *Child: care, health and development*, *38*(3), 420-424.

Quinn, S., Donnelly, S., & Kidd, E. (2018). The relationship between symbolic play and language acquisition: a meta-analytic review. *Developmental review*, *49*, 121-135.

Raby, K. L., Roisman, G. I., Fraley, R. C., & Simpson, J. A. (2015). The enduring predictive significance of early maternal sensitivity: Social and academic competence through age 32 years. *Child development*, *86*(3), 695-708.

Rahman, A., Bunn, J., Lovel, H., & Creed, F. (2007). Association between antenatal depression and low birthweight in a developing country. *Acta Psychiatrica Scandinavica*, *115*(6), 481-486.

Rai, S., Pathak, A., & Sharma, I. (2015). Postpartum psychiatric disorders: Early diagnosis and management. *Indian journal of psychiatry*, *57*(2), 216-221.

Ramírez-Esparza, N., García-Sierra, A., & Kuhl, P. K. (2017). Look who’s talking NOW! Parentese speech, social context, and language development across time. *Frontiers in psychology*, *8* (1008), 1-12.

Ramírez-Esparza, N., García-Sierra, A., & Kuhl, P. K. (2014). Look who's talking: Speech style and social context in language input to infants are linked to concurrent and future speech development. *Developmental science*, *17*(6), 880-891.

Ramsey, M. A., & Gentzler, A. L. (2015). An upward spiral: Bidirectional associations between positive affect and positive aspects of close relationships across the life span. *Developmental review*, *36*, 58-104.

Ramsteijn, A. S., Van de Wijer, L., Rando, J., van Luijk, J., Homberg, J. R., & Olivier, J. D. (2020). Perinatal selective serotonin reuptake inhibitor exposure and behavioral outcomes: a systematic review and meta-analyses of animal studies. *Neuroscience & Biobehavioral Reviews*, *114*, 53-69.

Rasch, D., & Guiard, V. (2004). The robustness of parametric statistical methods. *Psychology Science*, *46*, 175-208.

Rasmussen, M. L. H., Strøm, M., Wohlfahrt, J., Videbech, P., & Melbye, M. (2017). Risk, treatment duration, and recurrence risk of postpartum affective disorder in women with no prior psychiatric history: a population-based cohort study. *PLoS medicine*, *14*(9), 1-13.

Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child development*, *75*(2), 346-353.

Rayment, J. (2013). Parents and children playing together: a research overview on the benefits of play for the development of children under two. *Journal of the NCT*, *20*, 13-20.

Read, J. (2006). Free play with Froebel: Use and abuse of progressive pedagogy in London's infant schools, 1870–c. 1904. *Paedagogica historica*, *42*(03), 299-323.

Read, J. (2013). Bringing Froebel into London's infant schools: the reforming practice of two head teachers, Elizabeth Shaw and Frances Roe, from the 1890s to the 1930s. *History of Education*, *42*(6), 745-764.

Read, J. (2018). Tracing Froebel's legacy: The spread of the kindergarten movement across Europe and beyond and his influence on educators. In T. Bruce, P. Elfer, S. Powell & L. Werth (Eds.), *The Routledge International Handbook of Froebel and Early Childhood Practice* (pp. 14-18). Routledge.

Reale, A. E. (2011). *Maternal growing and shrinking movements in mother-infant interaction correspondent to maternal self-criticism and dependency: Application and utilization of the Kestenberg Movement Profile (KMP) in a microanalysis* [Doctoral Dissertation*, ETD Collection for Pace University*].

Reay, R. E., Owen, C., Shadbolt, B., Raphael, B., Mulcahy, R., & Wilkinson, R. B. (2012). Trajectories of long-term outcomes for postnatally depressed mothers treated with group interpersonal psychotherapy. *Archives of women's mental health*, *15*(3), 217-228.

Reck, C., Hunt, A., Fuchs, T., Weiss, R., Noon, A., Moehler, E., ... & Mundt, C. (2004). Interactive regulation of affect in postpartum depressed mothers and their infants: an overview. *Psychopathology*, *37*(6), 272-280.

Reck, C., Noe, D., Stefenelli, U., Fuchs, T., Cenciotti, F., Stehle, E., ... & Tronick, E. Z. (2011). Interactive coordination of currently depressed inpatient mothers and their infants during the postpartum period. *Infant Mental Health Journal*, *32*(5), 542-562.

Reece, C., Ebstein, R., Cheng, X., Ng, T., & Schirmer, A. (2016). Maternal touch predicts social orienting in young children. *Cognitive Development*, *39*, 128-140.

Regus, P. (2007). *The Emerging Medicalization of Postpartum Depression: Tightening the Boundaries of Motherhood* [Unpublished Masters Thesis, Georgia State University].

Reilly, N., Turner, G., Taouk, J., & Austin, M. P. (2019). 'Singing with your baby': an evaluation of group singing sessions for women admitted to a specialist mother-baby unit. *Archives of women's mental health*, *22*(1), 123-127.

Reilly, S., Eadie, P., Bavin, E. L., Wake, M., Prior, M., Williams, J., ... & Ukoumunne, O. C. (2006). Growth of infant communication between 8 and 12 months: A population study. *Journal of paediatrics and child health*, *42*(12), 764-770.

Reissland, N., & Shepherd, J. (2006). The Effect of Maternal Depressed Mood on Infant Emotional Reaction in a Surprise-Eliciting Situation. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *27*(2), 173-187.

Reissland, N., Shepherd, J., & Herrera, E. (2002b). The pitch of maternal voice: a comparison of mothers suffering from depressed mood and non-depressed mothers reading books to their infants. *Journal of Child Psychology and Psychiatry*, *43*(7), 1-7.

Reissland, N., Shepherd, J., & Herrera, E. (2003). The pitch of maternal voice: a comparison of mothers suffering from depressed mood and non-depressed mothers reading books to their infants. *Journal of Child Psychology and Psychiatry*, *44*(2), 255-261.

Reissland, N., Shepherd, J., & Herrera, E. (2005). Teasing play in infancy: Comparing mothers with and without self-reported depressed mood during play with their babies. *European Journal of Developmental Psychology*, *2*(3), 271-283.

Renzi, D. T., Romberg, A. R., Bolger, D. J., & Newman, R. S. (2017). Two minds are better than one: Cooperative communication as a new framework for understanding infant language learning. *Translational Issues in Psychological Science*, *3*(1), 19-33.

Reyna, B. A., Brown, L. F., Pickler, R. H., Myers, B. J., & Younger, J. B. (2012). Mother–infant synchrony during infant feeding. *Infant Behavior and Development*, *35*(4), 669-677.

Rigby, J., Conroy, S., Miele-Norton, M., Pawlby, S., & Happé, F. (2016). Theory of mind as a predictor of maternal sensitivity in women with severe mental illness. *Psychological medicine*, *46*(9), 1853-1863.

Righetti-Veltema, M., Bousquet, A., & Manzano, J. (2003). Impact of postpartum depressive symptoms on mother and her 18-month-old infant. *European child & adolescent psychiatry*, *12*(2), 75-83.

Riise, K. M. (2020). *Music therapy as a means for increased bonding and attachment between mother and infant-A qualitative literature review exploring how music therapy, or the use of music* *could promote bonding and attachment between mothers with postpartum depression and their infants*. [Unpublished Master's Thesis, The University of Bergen].

Rivas-Vazquez, R. A., Saffa-Biller, D., Ruiz, I., Blais, M. A., & Rivas-Vazquez, A. (2004). Current Issues in Anxiety and Depression: Comorbid, Mixed, and Subthreshold Disorders. *Professional Psychology: Research and Practice*, *35*(1), 74-83.

Robertson, E., Celasun, N., & Stewart, D. E. (2003). Risk factors for postpartum depression. In D. E. Stewart, E. Robertson, C. L. Dennis, S. L. Grace, & T. Wallington (Eds.), *Postpartum depression: literature review of risk factors and interventions* (pp. 9–70). Toronto: Toronto Public Health.

Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: a synthesis of recent literature. *General hospital psychiatry*, *26*(4), 289-295.

Robledo, M., Deák, G.O., & Kolling, T. (2010). *Infants' visual processing of faces and objects: age-related changes in interest, and stability of individual differences*. Proceedings of the 32nd Annual Conference of the Cognitive Science Society (pp. 2482–2487). Austin, TX: Cognitive Science Society.

Rochat, P. (1987). Mouthing and grasping in neonates: Evidence for the early detection of what hard or soft substances afford for action. *Infant behavior and development*, *10*(4), 435-449.

Rochat, P. (2009). *The infant's world*. Harvard University Press.

Roe, K. V., & Drivas, A. (1997). Reciprocity in mother-infant vocal interactions: Relationship to the quantity of mothers' vocal stimulation. *American Journal of Orthopsychiatry*, *67*(4), 645-649.

Roe, K. V., Roe, A., Drivas, A., & Bronstein, R. (1990). A curvilinear relationship between maternal vocal stimulation and three-month-olds' cognitive processing: A cross-cultural phenomenon. *Infant Mental Health Journal*, *11*(2), 175-189.

Romeo, R. R., Leonard, J. A., Robinson, S. T., West, M. R., Mackey, A. P., Rowe, M. L., & Gabrieli, J. D. (2018). Beyond the 30-million-word gap: Children's conversational exposure is associated with language-related brain function. *Psychological science*, *29*(5), 700-710.

Rosenblum, K. L., McDonough, S., Muzik, M., Miller, A., & Sameroff, A. (2002). Maternal representations of the infant: Associations with infant response to the still face. *Child development*, *73*(4), 999-1015.

Roskam, I., Stievenart, M., Meunier, J. C., & Noël, M. P. (2014). The development of children's inhibition: Does parenting matter?. *Journal of experimental child psychology*, *122*, 166-182.

Rothbart, M. K., Posner, M. I., & Kieras, J. (2006). Temperament, attention, and the development of self-regulation. In K. McCartney & D. Phillips (Eds.), *Blackwell handbook of early childhood development* (pp. 338–357). Malden, MA: Blackwell.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion review*, *3*(2), 207-213.

Rothbart, M. K., Ziaie, H., & O'boyle, C. G. (1992). Self? regulation and emotion in infancy. *New directions for child and adolescent development*, *1992*(55), 7-23.

Roug, L., Landberg, I., & Lundberg, L. J. (1989). Phonetic development in early infancy: A study of four Swedish children during the first eighteen months of life. *Journal of child language*, *16*(1), 19-40.

Rowe, H. J., Holton, S., & Fisher, J. R. (2013). Postpartum emotional support: a qualitative study of women's and men's anticipated needs and preferred sources. *Australian Journal of Primary Health*, *19*(1), 46-52.

Rowe, M. L., Pan, B. A., & Ayoub, C. (2005). Predictors of variation in maternal talk to children: A longitudinal study of low-income families. *Parenting: Science and Practice*, *5*(3), 259-283.

Royal College of Psychiatrists (RCPsych), Perinatal Maternal Mental Health Services. (2015). Recommendations for Provision of Services for Childbearing Women. *Psychiatric Bulletin*, 25(7), 278-278.

Rubertsson, C., Wickberg, B., Gustavsson, P. and Rådestad, I. (2005). Depressive symptoms in early pregnancy, two months and one year postpartum-prevalence and psychosocial risk factors in a national Swedish sample. *Archives of Women's Mental Health*, 8(2), 97-104.

Rubin, K. H., Coplan, R. J., Fox, N. A., & Calkins, S. D. (1995). Emotionality, emotion regulation, and preschoolers' social adaptation. *Development and psychopathology*, *7*, 49-59.

Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2004). Attentional control and self- regulation. In R. F. Baumeister, & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 283–300). New York: The Guilford Press.

Russell, K. A., & Aldridge, J. (2009). Play, unity and symbols: Parallels in the works of Froebel and Jung. *International Journal of Psychology and Counselling*, *1*(1), 001-004.

Russell, R. L., Stokes, J., Jones, M. E., Czogalik, D., & Rohleder, L. (1993). The role of nonverbal sensitivity in childhood psychopathology. *Journal of Nonverbal Behavior*, *17*(1), 69-83.

Rustin, M. (2006). Infant observation research: What have we learned so far?. *Infant observation*, *9*(1), 35-52.

Ryan, D., Milis, L., & Misri, N. (2005). Depression during pregnancy. *Canadian Family Physician*, *51*(8), 1087-1093.

Saint-Georges, C., Chetouani, M., Cassel, R., Apicella, F., Mahdhaoui, A., Muratori, F., ... & Cohen, D. (2013). Motherese in interaction: at the cross-road of emotion and cognition?(A systematic review). *PloS one*, *8*(10), 1-17.

Salmon, M., Abel, K., Cordingley, L., Friedman, T., & Appleby, L. (2003). Clinical and parenting skills outcomes following joint mother–baby psychiatric admission. *Australian & New Zealand Journal of Psychiatry*, *37*(5), 556-562.

Sanchez, S. E., Puente, G. C., Atencio, G., Qiu, C., Yanez, D., Gelaye, B., & Williams, M. A. (2013). Risk of spontaneous preterm birth in relation to maternal depressive, anxiety and stress symptoms. *The Journal of reproductive medicine*, *58*, 25-33.

Santos, A. K., dos Santos, L. S., & Bussab, V. S. R. (2020). Infant-direct speech and mother-infant attention in depressed and nondepressed mothers. *Interação em Psicologia*, *24*(1), 76-86.

Saracho, O. N. (1991). Educational play in early childhood education. *Early Child Development and Care*, *66*(1), 45-64.

Sauder, C., Bretl, M., & Eadie, T. (2017). Predicting voice disorder status from smoothed measures of cepstral peak prominence using Praat and Analysis of Dysphonia in Speech and Voice (ADSV). *Journal of Voice*, *31*(5), 557-566.

Savage-McGlynn, E., Redshaw, M., Heron, J., Stein, A., Quigley, M. A., Evans, J., ... & Gray, R. (2015). Mechanisms of resilience in children of mothers who self-report with depressive symptoms in the first postnatal year. *PLoS One*, *10*(11), e0142898.

Schachner, D. A., Shaver, P. R., & Mikulincer, M. (2005). Patterns of nonverbal behavior and sensivity in the context of attachment relations. *Journal of Nonverbal Behavior*, *29*(3), 141-169.

Schacht, R., Meins, E., Fernyhough, C., Centifanti, L. C., Pawlby, S., & Bureau, J. F. (2017). Proof of concept of a mind-mindedness intervention for mothers hospitalized for severe mental illness. *Development and psychopathology.*, *29*(2), 555-564.

Schmidt, S. L. & Tolentino, J. C. (2018). DSM-5 criteria and depression severity: implications for clinical practice. *Frontiers in psychiatry*, *9*(450), 1-9.

Schwengber, D. D. D. S., & Piccinini, C. A. (2003). O impacto da depressão pós-parto para a interação mãe-bebê. *Estudos de Psicologia (Natal)*, *8*(3), 403-411.

Segre, L. S., & Davis, W. N. (2013). Postpartum depression and perinatal mood disorders in the DSM. *Postpartum Support International*. http://www.postpartum.net/professionals/postpartum-support-international-the-dsm5/

Serra, J., Miguel, H., Moura, A. A., Sampaio, A., & Pereira, A. F. (2020). The effect of play task on maternal touch patterns when interacting with their 12 months-old infants: An exploratory study. *Infant Behavior and Development*, *59*, 101438.

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian journal of dermatology*, *61*(3), 261-264.

Shannon-Baker, P. (2016). Making paradigms meaningful in mixed methods research. *Journal of mixed methods research*, *10*(4), 319-334.

Shannon, K. (2006). Infant behavioral responses to infant-directed singing and other maternal interactions. *Infant Behavior and Development*, *29*(3), 456-470.

Sharma, V., & Burt, V. K. (2011). DSM-V: modifying the postpartum-onset specifier to include hypomania. *Archives of women's mental health*, *14*(1), 67-69.

Shenfield, T., Trehub, S. E., & Nakata, T. (2003). Maternal singing modulates infant arousal. *Psychology of music*, *31*(4), 365-375.

Shin, H., Park, Y. J., & Kim, M. J. (2006). Predictors of maternal sensitivity during the early postpartum period. *Journal of advanced nursing*, *55*(4), 425-434.

Shonkoff, J. P. (2012). Leveraging the biology of adversity to address the roots of disparities in health and development. *Proceedings of the National Academy of Sciences*, *109*(Supplement 2), 17302-17307.

Shorey, S., Chee, C. Y. I., Ng, E. D., Chan, Y. H., San Tam, W. W., & Chong, Y. S. (2018). Prevalence and incidence of postpartum depression among healthy mothers: a systematic review and meta-analysis. *Journal of psychiatric research*, *104*, 235-248.

Shutter, J. M., & Camras, L. A. (2010). Complexities in the study of infant emotional facial expressions. *Emotion Review*, *2*(2), 137-138.

Sidor, A., Kunz, E., Schweyer, D., Eickhorst, A., & Cierpka, M. (2011). Links between maternal postpartum depressive symptoms, maternal distress, infant gender and sensitivity in a high-risk population. *Child and Adolescent Psychiatry and Mental Health*, *5*(7), 1-7.

Singh, L., Morgan, J. L., & Best, C. T. (2002). Infants' listening preferences: Baby talk or happy talk?. *Infancy*, *3*(3), 365-394.

Skotheim, S., Braarud, H. C., Høie, K., Markhus, M. W., Malde, M. K., Graff, I. E., ... & Stormark, K. M. (2013). Subclinical levels of maternal depression and infant sensitivity to social contingency. *Infant Behavior and Development*, *36*(3), 419-426.

Skuban, E. M., Shaw, D. S., Gardner, F., Supplee, L. H., & Nichols, S. R. (2006). The correlates of dyadic synchrony in high-risk, low-income toddler boys. *Infant Behavior and Development*, *29*(3), 423-434.

Slater, A., & Lewis, M. (2007). *Introduction to infant development*. Oxford University Press.

Śliwerski, A., Kossakowska, K., Jarecka, K., Świtalska, J., & Bielawska-Batorowicz, E. (2020). The effect of maternal depression on infant attachment: A systematic review. *International journal of environmental research and public health*, *17*(8), 2675.

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*, *15*, 1-55.

Smedley, S., & Hoskins, K. (2019). Exploring the role of Froebelian theory in constructing early years practitioners' sense of professionalism. *Early Years*, *1*, 1-15.

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.

Snow, C.E. (1977). Mothers' speech research: From input to interaction. In C.E. Snow & C.A. Ferguson (Eds.), *Talking to children: Language input and acquisition*. Cambridge, England: Cambridge University Press.

Sockol, L. E. (2015). A systematic review of the efficacy of cognitive behavioral therapy for treating and preventing perinatal depression. *Journal of Affective Disorders*, *177*, 7-21.

Soderstrom, M. (2019). ManyBabies1: Infants' preference for infant- directed speech. *The Journal of the Acoustical Society of America,* 145(3), 1728– 1728.

Sohr-Preston, S. L., & Scaramella, L. V. (2006). Implications of timing of maternal depressive symptoms for early cognitive and language development.*Clinical child and family psychology review*, *9*(1), 65-83.

Sparks, R. (2013). *Sadness and Support: A Short History of Postpartum Depression* [Mary Becker Rysavy Essay Contest, UI Carver College].

Spinelli, M. G., & Endicott, J. (2003). Controlled clinical trial of interpersonal psychotherapy versus parenting education program for depressed pregnant women. *American Journal of Psychiatry*, *160*(3), 555-562.

Spinelli, M., Fasolo, M., & Mesman, J. (2017). Does prosody make the difference? A meta-analysis on relations between prosodic aspects of infant-directed speech and infant outcomes. *Developmental Review*, *44*, 1-18.

Spinrad, T. L., & Stifter, C. A. (2002). Maternal sensitivity and infant emotional reactivity: Concurrent and longitudinal relations. *Marriage & family review*, *34*(3-4), 243-263.

Sriraman, N. K., Pham, D. Q., & Kumar, R. (2017). Postpartum depression: what do pediatricians need to know?. *Pediatrics in review*, *38*(12), 541-551.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment & human development*, *7*(4), 349-367.

St George, J., Fletcher, R., & Palazzi, K. (2017). Comparing fathers' physical and toy play and links to child behaviour: An exploratory study. *Infant and Child Development*, *26*(1), 1-22.

Stack, D. M. (2010). Touch and physical contact during infancy: Discovering the richness of the forgotten sense. *The Wiley-Blackwell Handbook of Infant Development*, *1*, 532-567.

Stack, D. M., & Jean, A. D. (2011). Communicating through touch: Touching during parent-infant interactions. In M.J. Hertenstein & S.J. Weiss (Eds.), *The Handbook of Touch: Neuroscience, Behavioral and Health Perspectives* (pp. 273-298). Springer Publishing, New York, NY.

Stack, D. M., & LePage, D. E. (1996). Infants' sensitivity to manipulations of maternal touch during face-to-face interactions. *Social Development*, *5*(1), 41-55.

Stack, D. M., & Muir, D. W. (1990). Tactile stimulation as a component of social interchange: New interpretations for the still-face effect. *British Journal of Developmental Psychology*, *8*(2), 131-145.

Stack, D. M., & Muir, D. W. (1992). Adult tactile stimulation during face-to-face interactions modulates five-month-olds' affect and attention. *Child development*, *63*(6), 1509-1525.

Stack, D. M., Serbin, L. A., Enns, L. N., Ruttle, P. L., & Barrieau, L. (2010). Parental effects on children's emotional development over time and across generations. *Infants & Young Children*, *23*(1), 52-69.

Stamou, G., García-Palacios, A., & Botella, C. (2018). Cognitive-Behavioural therapy and interpersonal psychotherapy for the treatment of post-natal depression: a narrative review. *BMC psychology*, *6*(28), 1-25.

Stark, R. E. (1980). Stages of speech development in the first year of life. In G. H. Yeni-Komshian, J. F. Kavanagh, & C. A. Ferguson (Eds.), *Child phonology* (pp. 73-92). Academic Press.

Steadman, J., Pawlby, S., Mayers, A., Bucks, R. S., Gregoire, A., Miele-Norton, M., & Hogan, A. M. (2007). An exploratory study of the relationship between mother–infant interaction and maternal cognitive function in mothers with mental illness. *Journal of Reproductive and Infant Psychology*, *25*(4), 255-269.

Stein, A., Arteche, A., Lehtonen, A., Craske, M., Harvey, A., Counsell, N., & Murray, L. (2010). Interpretation of infant facial expression in the context of maternal postnatal depression. *Infant Behavior and Development*, *33*(3), 273-278.

Stein, A., Malmberg, L. E., Sylva, K., Barnes, J., Leach, P., & FCCC team. (2008). The influence of maternal depression, caregiving, and socioeconomic status in the post-natal year on children's language development. *Child: care, health and development*, *34*(5), 603-612.

Stephens, S., Ford, E., Paudyal, P., & Smith, H. (2016). Effectiveness of psychological interventions for postnatal depression in primary care: a meta-analysis. *The Annals of Family Medicine*, *14*(5), 463-472.

Stern, D. (1985). The Interpersonal World of the Infant. New York: Basic Book. *Winne, LC and Singer, MT (1963), Thought disorder and family relations of schizophrenics*, *1*, 9-191.

Stern, D. N. (1994). One way to build a clinically relevant baby. *Infant mental health journal*, *15*(1), 9-25.

Stern, D. N. (2009). *The first relationship: Infant and mother*. Harvard University Press.

Stern, D.N. (1974). Mother and infant at play: The dyadic interaction involving facial, vocal, and gaze behaviors. In M. Lewis & L.A. Rosenblum (Eds). *The effect of the infant on its caregiver* (pp. 187–213). New York, NY: John Wiley & Sons.

Stoel-Gammon, C. (1989). Prespeech and early speech development of two late talkers. *First language*, *9*(6), 207-223.

Stoppard, J. (2014). *Understanding depression: Feminist social constructionist approaches*. Routledge.

Street, A., Young, S., Tafuri, J., & Ilari, B. (2003, September). Mothers' attitudes to singing to their infants. In R. Kopiez, A. C. Lehmann, I. Wolther & C. Wolf (Eds.), *Proceedings of the 5th Triennial Conference of the European Society for the Cognitive Sciences of Music (CD-ROM)* (pp. 628-631). Hanover, Germany: Institute for Research in Music Education.

Striano, T., Brennan, P. A., & Vanman, E. J. (2002). Maternal depressive symptoms and 6-month-old infants' sensitivity to facial expressions. *Infancy*, *3*(1), 115-126.

Stuart, S., & O'Hara, M. W. (1995). Interpersonal psychotherapy for postpartum depression: a treatment program. *The Journal of psychotherapy practice and research*, *4*(1), 18-29.

Suen, H. K., & Ary, D. (2014). *Analyzing quantitative behavioral observation data*. Psychology press.

Sun, X., Seeley, J. R., & Allen, N. B. (2020). Parental internalizing disorder and the developmental trajectory of infant self-regulation: The moderating role of positive parental behaviors. *Development and Psychopathology*, *1*, 1-17.

Sung, J., Fausto-Sterling, A., Garcia Coll, C., & Seifer, R. (2013). The dynamics of age and sex in the development of mother–infant vocal communication between 3 and 11 months. *Infancy*, *18*(6), 1135-1158.

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*, *26*(8), 484-489.

Sutton-Smith, B. (2001). Reframing the variability of players and play. *Play and Culture Studies*, *3*, 27-50.

Swami, V., Barron, D., Smith, L., & Furnham, A. (2020). Mental health literacy of maternal and paternal postnatal (postpartum) depression in British adults. *Journal of Mental Health*, *29*(2), 217-224.

Swartz, H. A., Frank, E., Zuckoff, A., Cyranowski, J. M., Houck, P. R., Cheng, Y., ... & Shear, M. K. (2008). Brief interpersonal psychotherapy for depressed mothers whose children are receiving psychiatric treatment. *American Journal of Psychiatry*, *165*(9), 1155-1162.

Székely, E., Lucassen, N., Tiemeier, H., Bakermans-Kranenburg, M.J., Van Ijzendoorn, M.H., Kok, R., Jaddoe, V.W., Hofman, A., Verhulst, F.C. & Herba, C. M. (2014). Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: The Generation R Study. *Development and Psychopathology*, *26*(2), 333-345.

Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics: Pearson new international edition*. Pearson.

Tambelli, R., Cerniglia, L., Cimino, S., & Ballarotto, G. (2015). Parent-infant interactions in families with women diagnosed with postnatal depression: a longitudinal study on the effects of a psychodynamic treatment. *Frontiers in psychology*, *6*, e1210.

Tamis-LeMonda, C. S., Chen, L. A., & Bornstein, M. H. (1998). Mothers' knowledge about children's play and language development: Short-term stability and interrelations. *Developmental Psychology*, *34*(1), 115-124.

Tamis-LeMonda, C. S., Kuchirko, Y., & Song, L. (2014). Why is infant language learning facilitated by parental responsiveness?. *Current Directions in Psychological Science*, *23*(2), 121-126.

Tamis-LeMonda, C.S., Uzgiris, I.C., & Bornstein, M. (2002). Play in parent–child interactions. In M.H. Bornstein, (Ed.), *Handbook of parenting: Vol. 5. Practical issues in parenting (2nd ed)* (pp. 221– 241). Mahwah, NJ: Erlbaum.

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child development*, *72*(3), 748-767.

Tamis-LeMonda, C. S., Bornstein, M. H., Baumwell, L., & Melstein Damast, A. (1996). Responsive parenting in the second year: Specific influences on children's language and play. *Early Development and Parenting: An International Journal of Research and Practice*, *5*(4), 173-183.

Tashakkori, A., Teddlie, C. (2003). *Handbook of mixed methods in social and behavioral research.* Thousand Oaks, CA: Sage.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of mixed methods research*, *1*(1), 77-100.

Terp, I. M., & Mortensen, P. B. (1998). Post-partum psychoses: clinical diagnoses and relative risk of admission after parturition. *The British Journal of Psychiatry*, *172*(6), 521-526.

Teti, D. M., Gelfand, D. M., Messinger, D. S., & Isabella, R. (1995). Maternal depression and the quality of early attachment: an examination of infants, preschoolers, and their mothers. *Developmental psychology*, *31*(3), 364-376.

Thomas, J. C., Letourneau, N., Campbell, T. S., Tomfohr-Madsen, L., & Giesbrecht, G. F. (2017). Developmental origins of infant emotion regulation: Mediation by temperamental negativity and moderation by maternal sensitivity. *Developmental Psychology*, *53*(4), 611-628.

Thurman, S. L., & Corbetta, D. (2019). Changes in Posture and Interactive Behaviors as Infants Progress From Sitting to Walking: A Longitudinal Study. *Frontiers in Psychology*, *10*, 822.

Tomasello, M. (1992). The social bases of language acquisition. *Social development*, *1*(1), 67-87.

Tomlinson, M., Cooper, P., & Murray, L. (2005). The mother–infant relationship and infant attachment in a South African peri-urban settlement. *Child development*, *76*(5), 1044-1054.

Torres, A., Gelabert, E., Roca, A., Navarro, P., Plaza, A., Subirà, S., Martin-Santos, R., Ascaso, C. and Garcia-Esteve, L., (2019). Course of a major postpartum depressive episode: A prospective 2 years naturalistic follow-up study. *Journal of affective disorders*, *245*, 965-970.

Tovey, H. (2016). *Bringing the Froebel approach to your early years practice*. Taylor & Francis.

Tovey, H. (2018). Friedrich Froebel, his life and his ideas. In T. Bruce, P. Elfer, S. Powell & L. Werth (Eds.), *The Routledge International Handbook of Froebel and Early Childhood Practice* (pp. 7-13). Routledge.

Tovey, H. (2020). *Froebel's principles and practice today* [Pamphlets]. Froebel Trust.

Trainor, L.J. & Zacharias, C.A. (1998). Infants prefer higher-pitched singing. *Infant Behavior and Development, 21*(4), 799-805.

Trajectories of Maternal Sensitivity across the First Year of Life: Relations among Emotion Competence and Dyadic Reciprocity. *Parenting*, *19*(3), 217-243.

Trehub, S. E. (2001). Musical predispositions in infancy. *Annals of the New York academy of sciences*, *930*(1), 1-16.

Trehub, S. E. (2017). The maternal voice as a special signal for infants. In M. Filippa, P. Kuhn, & B. Westrup (Eds.), *Early vocal contact and preterm infant brain development* (pp. 39–54). Springer.

Trehub, S. E. (2021). Challenging infant-directed singing as a credible signal of maternal attention. *Behavioral and Brain Sciences*, *44*.

Trehub, S. E., & Trainor, L. J. (1990). Rules for listening in infancy. *Advances in psychology*, *69*, 87-119.

Trehub, S. E., Nakata, T., & Bergeson, T. (2002). *Infants' responsiveness to soothing and playful singing* [Conference session]. 13th Biennial International Conference on Infant Studies, Toronto, Canada.

Trehub, S. E., Unyk, A. M., & Trainor, L. J. (1993). Maternal singing in cross-cultural perspective. *Infant behavior and development*, *16*(3), 285-295.

Trevarthen, C., & Aitken, K. J. (2001). Infant intersubjectivity: Research, theory, and clinical applications. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*(1), 3-48.

Trommsdorff, G., & Friedlmeier, W. (2010). Preschool girls' distress and mothers' sensitivity in Japan and Germany. *European Journal of Developmental Psychology*, *7*(3), 350-370.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American psychologist*, *44*(2), 112.

Tronick, E. Z., & Weinberg, M. K. (1997). Depressed mothers and infants: failure to form dyadic states of consciousness. In L. Murray & P. Cooper (Eds.), *Postpartum depression and child development* (pp. 54-81). The Guilford Press, New York.

Tronick, E. Z., Messinger, D. S., Weinberg, M. K., Lester, B. M., LaGasse, L., Seifer, R., ... & Liu, J. (2005). Cocaine exposure is associated with subtle compromises of infants' and mothers' social-emotional behavior and dyadic features of their interaction in the face-to-face still-face paradigm. *Developmental psychology*, *41*(5), 711-722.

Tronick, E. Z., Ricks, M., & Cohn, J. F. (1982). Maternal and infant affective exchange: Patterns of adaptation. *Emotion and early interaction*, 83-100.

Tronick, E., & Reck, C. (2009). Infants of depressed mothers. A review of longitudinal studies on antenatal and postnatal depression. *Harvard Review of Psychiatry, 17*(2), 147-156.

Tronick, E., Als, H., & Brazelton, T. B. (1980). Monadic phases: A structural descriptive analysis of infant-mother face to face interaction. *Merrill-Palmer Quarterly of Behavior and Development*, *26*(1), 3-24.

Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child psychiatry*, *17*(1), 1-13.

Tsang, C. D., Falk, S., & Hessel, A. (2017). Infants prefer infant- directed song over speech. *Child Development, 88*(4), 1207– 1215.

Tsivos, Z. L., Calam, R., Sanders, M. R., & Wittkowski, A. (2015). Interventions for postnatal depression assessing the mother–infant relationship and child developmental outcomes: a systematic review. *International journal of women's health*, *7*, 429-447.

Turner, K. M., Sharp, D., Folkes, L., & Chew-Graham, C. (2008). Women's views and experiences of antidepressants as a treatment for postnatal depression: a qualitative study. *Family practice*, *25*(6), 450-455.

Underdown, A., Barlow, J., & Stewart-Brown, S. (2010). Tactile stimulation in physically healthy infants: results of a systematic review. *Journal of Reproductive and Infant Psychology*, *28*(1), 11-29.

Underwood, L., Waldie, K. E., D'Souza, S., Peterson, E. R., & Morton, S. M. (2017). A longitudinal study of pre-pregnancy and pregnancy risk factors associated with antenatal and postnatal symptoms of depression: Evidence from growing up in New Zealand. *Maternal and child health journal*, *21*(4), 915-931.

Underwood, L., Waldie, K., D'Souza, S., Peterson, E. R., & Morton, S. (2016). A review of longitudinal studies on antenatal and postnatal depression. *Archives of Women's Mental Health*, *19*(5), 711-720.

Ursache, A., Blair, C., & Raver, C. C. (2012). The promotion of self-regulation as a means of enhancing school readiness and early achievement in children at risk for school failure. *Child Development Perspectives*, *6*(2), 122-128.

Væver, M. S., Cordes, K., Stuart, A. C., Tharner, A., Shai, D., Spencer, R., & Smith-Nielsen, J. (2020). Associations of maternal sensitivity and embodied mentalizing with infant-mother attachment security at one year in depressed and non-depressed dyads. *Attachment & Human Development*, *1,* 1-18.

Væver, M. S., Krogh, M. T., Smith-Nielsen, J., Christensen, T. T., & Tharner, A. (2015). Infants of depressed mothers show reduced gaze activity during mother–infant interaction at 4 months. *Infancy*, *20*(4), 445-454.

Væver, M. S., Pedersen, I. E., Smith-Nielsen, J., & Tharner, A. (2020). Maternal postpartum depression is a risk factor for infant emotional variability at 4 months. *Infant mental health journal*, *41*(4), 477-494.

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review, 30*(3), 607–649.

Valentino, K., Cicchetti, D., Toth, S. L., & Rogosch, F. A. (2011). Mother–child play and maltreatment: A longitudinal analysis of emerging social behavior from infancy to toddlerhood. *Developmental Psychology*, *47*(5), 1280–1294.

Valla, L., Wentzel-Larsen, T., Smith, L., Birkeland, M. S., & Slinning, K. (2016). Association between maternal postnatal depressive symptoms and infants' communication skills: A longitudinal study. *Infant Behavior and Development*, *45*, 83-90.

Vallotton, C. D., Mastergeorge, A., Foster, T., Decker, K. B., & Ayoub, C. (2017). Parenting supports for early vocabulary development: Specific effects of sensitivity and stimulation through infancy. *Infancy*, *22*(1), 78-107.

Vallotton, C. D., Torquati, J., Ispa, J., Chazan-Cohen, R., Henk, J., Fusaro, M., ... & Brophy-Herb, H. (2016). Attachment predicts college students' knowledge, attitudes, and skills for working with infants, toddlers, and families. *Early Education and Development*, *27*(2), 275-302.

van Beek, Y., & Dubas, J. S. (2008). Age and gender differences in decoding basic and non-basic facial expressions in late childhood and early adolescence. *Journal of Nonverbal Behavior*, *32*(1), 37-52.

van Huisstede, L., Winstone, L. K., Ross, E. K., & Crnic, K. A. (2019). Developmental Trajectories of Maternal Sensitivity across the First Year of Life: Relations among Emotion Competence and Dyadic Reciprocity. *Parenting*, *19*(3), 217-243.

Van Puyvelde, M., Loots, G., Vanfleteren, P., Meys, J., Simcock, D., & Pattyn, N. (2014). Do You Hear the Same? Cardiorespiratory responses between mothers and infants during tonal and atonal music. *PloS one*, *9*(9), e106920.

Van Puyvelde, M., Rodrigues, H., Loots, G., De Coster, L., Du Ville, K., Matthijs, L., ... & Pattyn, N. (2014). Shall we dance? Music as a port of entrance to maternal–infant intersubjectivity in a context of postnatal depression. *Infant mental health journal*, *35*(3), 220-232.

Vekovischeva, O. Y., & Lyakso, E. E. (2017). Non-Verbal Behavior of Six-and 12-Month-Old Infants with Neurological Problems from Birth: A Pilot Study. *Neuroscience and Behavioral Physiology*, *47*(4), 459-465.

Verhage, M. L., Schuengel, C., Madigan, S., Fearon, R. M., Oosterman, M., Cassibba, R., ... & van IJzendoorn, M. H. (2016). Narrowing the transmission gap: A synthesis of three decades of research on intergenerational transmission of attachment. *Psychological Bulletin*, *142*(4), 337-366.

Vik, K., & Hafting, M. (2006). Video interaction guidance offered to mothers with postnatal depression: experiences from a pilot study. *Nordic Journal of Psychiatry*, *60*(3), 234-238.

Vliegen, N., Casalin, S., & Luyten, P. (2014). The course of postpartum depression: a review of longitudinal studies. *Harvard review of psychiatry*, *22*(1), 1-22.

Vliegen, N., Casalin, S., Luyten, P., Docx, R., Lenaerts, M., Tang, E., & Kempke, S. (2013). Hospitalization-based treatment for postpartum depressed mothers and their babies: rationale, principles, and preliminary follow-up data. *Psychiatry: Interpersonal & Biological Processes*, *76*(2), 150-168.

Vlismas, W., Malloch, S., & Burnham, D. (2013). The effects of music and movement on mother–infant interactions. *Early Child Development and Care*, *183*(11), 1669-1688.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wade, M., Jenkins, J. M., Venkadasalam, V. P., Binnoon-Erez, N., & Ganea, P. A. (2018). The role of maternal responsiveness and linguistic input in pre-academic skill development: A longitudinal analysis of pathways. *Cognitive Development*, *45*, 125-140.

Wado, Y. D., Afework, M. F., & Hindin, M. J. (2014). Effects of maternal pregnancy intention, depressive symptoms and social support on risk of low birth weight: a prospective study from southwestern Ethiopia. *PloS one*, *9*(5), 1-7.

Walsh, D. J., Chung, S., & Tufekci, A. (2002). Friedrich Wilhelm Froebel 1782–1852. In J. Palmer, L. Bresler & D. Cooper (Eds.), *Fifty Major Thinkers on Education* (pp. 94-99). Routledge.

Walsh, T. B., Davis, R. N., & Garfield, C. (2020). A call to action: Screening fathers for perinatal depression. *Pediatrics*, *145*(1), 1-5.

Wan, M. W., & Green, J. (2009). The impact of maternal psychopathology on child–mother attachment. *Archives of women's mental health*, *12*(3), 123-134.

Wan, M. W., Penketh, V., Salmon, M. P., & Abel, K. M. (2008). Content and style of speech from mothers with schizophrenia towards their infants. *Psychiatry Research*, *159*(1-2), 109-114.

Wan, M. W., Salmon, M. P., Riordan, D. M., Appleby, L., Webb, R., & Abel, K. M. (2007). What predicts poor mother–infant interaction in schizophrenia?. *Psychological medicine*, *37*(4), 537-546.

Wang, S. Y., Chen, C. H., Chin, C. C., & Lee, S. L. (2005). Impact of postpartum depression on the mother-infant couple. *Birth*, *32*(1), 39-44.

Wang, Y. (2019). An Empirical Study on the Effectiveness of Speech Visualization Software Praat in Assisting English Phonetic Rhythm Teaching: a Phonetic Study Based on Minnan-accented Learner. *TC*, *100*(61.42), 39-26.

Warlaumont, A. S., & Ramsdell-Hudock, H. L. (2016). Detection of total syllables and canonical syllables in infant vocalizations. *Interspeech, 2016,* 2676–2680.

Warlaumont, A. S., Richards, J. A., Gilkerson, J., & Oller, D. K. (2014). A social feedback loop for speech development and its reduction in autism. *Psychological science*, *25*(7), 1314-1324.

Weida, C. L. (2013). Frederick Froebel's philosophies of drawing: Play, representation and invention. *Visual Inquiry*, *2*(1), 43-54.

Weikum, W. M., Mayes, L. C., Grunau, R. E., Brain, U., & Oberlander, T. F. (2013). The impact of prenatal serotonin reuptake inhibitor (SRI) antidepressant exposure and maternal mood on mother–infant interactions at 3 months of age. *Infant Behavior and Development*, *36*(4), 485-493.

Weinberg, M. K., & Tronick, E. Z. (1994). Beyond the face: An empirical study of infant affective configurations of facial, vocal, gestural, and regulatory behaviors. *Child development*, *65*(5), 1503-1515.

Weinberg, M. K., & Tronick, E. Z. (1996). Infant affective reactions to the resumption of maternal interaction after the still-face. *Child development*, *67*(3), 905-914.

Weinberg, M. K., Tronick, E. Z., Cohn, J. F., & Olson, K. L. (1999). Gender differences in emotional expressivity and self-regulation during early infancy. *Developmental psychology*, *35*(1), 175-188.

Weisleder, A., & Fernald, A. (2013). Talking to children matters: Early language experience strengthens processing and builds vocabulary. *Psychological science*, *24*(11), 2143-2152.

Weissman, A. M., Levy, B. T., Hartz, A. J., Bentler, S., Donohue, M., Ellingrod, V. L., & Wisner, K. L. (2004). Pooled analysis of antidepressant levels in lactating mothers, breast milk, and nursing infants. *American Journal of Psychiatry*, *161*(6), 1066-1078.

Wellhousen, K., Keif, J. (2001). *A Constructivist Approach to Block Play in Early Childhood.* New York: Delmar.

Wellman, H. M., Lopez-Duran, S., LaBounty, J., & Hamilton, B. (2008). Infant attention to intentional action predicts preschool theory of mind. *Developmental psychology*, *44*(2), 618-623.

Werker, J. F., & McLeod, P. J. (1989). Infant preference for both male and female infant-directed talk: a developmental study of attentional and affective responsiveness. *Canadian Journal of Psychology/Revue canadienne de psychologie*, *43*(2), 230-246.

Wermke, K., & Mende, W. (2009). Musical elements in human infants' cries: in the beginning is the melody. *Musicae Scientiae*, *13*(2), 151-175.

Werth, L. (2018). Froebel's contributions to early childhood pedagogy. In T. Bruce, P. Elfer, S. Powell & L. Werth (Eds.), *The Routledge international handbook of Froebel and early childhood practice* (pp. 33-45). Routledge.

Westall, C., & Liamputtong, P. (2011). *Motherhood and postnatal depression: Narratives of women and their partners*. Springer Science & Business Media.

Weston, P. (1998). *Friedrich Froebel: His life, times and significance*. Roehampton University.

Whinnett, J. (2012). Gifts and Occupations: Froebel's gifts (wooden blockplay) and occupations (construction and workshop experiences) today. In T. Bruce (Ed.), *Early education practice: Froebel today* (pp. 121-136). London: SAGE.

Whinnett, J. MBE (2020). *Froebel's gifts and block play today* [Pamphlets]. Froebel Trust.

Whitton, A., Warner, R., & Appleby, L. (1996). The pathway to care in post-natal depression: women's attitudes to post-natal depression and its treatment. *British Journal of General Practice*, *46*(408), 427-428.

Wilkinson, R. B., & Mulcahy, R. (2010). Attachment and interpersonal relationships in postnatal depression. *Journal of Reproductive and Infant Psychology*, *28*(3), 252-265.

Williams, K. E., & Berthelsen, D. (2017). The development of prosocial behaviour in early childhood: Contributions of early parenting and self-regulation. *International Journal of Early Childhood*, *49*(1), 73-94.

Winberg, J. A. N. (2005). Mother and newborn baby: mutual regulation of physiology and behavior—a selective review. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, *47*(3), 217-229.

Winnicott, D. W. (1969). Transitional objects and transitional phenomena. A study of the first not-me possession. *Psyche*, *23*(9), 666-682.

Winnicott, D.W. (1971). *Playing and reality.* Tavistock Publications Ltd.

Wisner, K. L., Moses-Kolko, E. L., & Sit, D. K. (2010). Postpartum depression: a disorder in search of a definition. *Archives of women's mental health*, *13*(1), 37-40.

Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., & Harris, M. G. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *Journal of Affective Disorders*, *219*, 86-92.

Woolhouse, H., Gartland, D., Mensah, F., & Brown, S. J. (2015). Maternal depression from early pregnancy to 4 years postpartum in a prospective pregnancy cohort study: implications for primary health care. *BJOG: An International Journal of Obstetrics & Gynaecology*, *122*(3), 312-321.

World Health Organization. (2005). *Report of a WHO technical consultation on birth spacing: Geneva, Switzerland 13-15 June 2005* (No. WHO/RHR/07.1). World Health Organization.

Worobey, J., Lopez, M. I., & Hoffman, D. J. (2009). Maternal behavior and infant weight gain in the first year. *Journal of nutrition education and behavior*, *41*(3), 169-175.

Wright, T., Stevens, S., & Wouldes, T. A. (2018). Mothers and their infants co-admitted to a newly developed mother–baby unit: Characteristics and outcomes. *Infant mental health journal*, *39*(6), 707-717.

Wu, R., Tummeltshammer, K. S., Gliga, T., & Kirkham, N. Z. (2014). Ostensive signals support learning from novel attention cues during infancy. *Frontiers in Psychology*, *5* (251), 1-9.

Wu, T., Dixon, W. E., Dalton, W. T., Tudiver, F., & Liu, X. (2011). Joint effects of child temperament and maternal sensitivity on the development of childhood obesity. *Maternal and child health journal*, *15*(4), 469-477.

Wu, Z., & Gros-Louis, J. (2014). Infants' prelinguistic communicative acts and maternal responses: Relations to linguistic development. *First Language*, *34*(1), 72-90.

Wulff, V., Hepp, P., Wolf, O. T., Balan, P., Hagenbeck, C., Fehm, T., & Schaal, N. K. (2021). The effects of a music and singing intervention during pregnancy on maternal well-being and mother–infant bonding: a randomised, controlled study. *Archives of gynecology and obstetrics*, *303*(1), 69-83.

Wulff, V., Hepp, P., Wolf, O. T., Fehm, T., & Schaal, N. K. (2021). The influence of maternal singing on well-being, postpartum depression and bonding–a randomised, controlled trial. *BMC Pregnancy and Childbirth*, *21*(1), 1-15.

Yagmur, S., Mesman, J., Malda, M., Bakermans-Kranenburg, M. J., & Ekmekci, H. (2014). Video-feedback intervention increases sensitive parenting in ethnic minority mothers: a randomized control trial. *Attachment & human development*, *16*(4), 371-386.

Yardley, L. & Bishop, F. (2008). Mixing qualitative and quantitative methods: a pragmatic approach. In C. Willig & W. Stainton-Rogers (Eds.), *The Sage Handbook of Qualitative Research in Psychology* (pp. 240–259). London: Sage Publications.

Yim, I. S., Tanner Stapleton, L. R., Guardino, C. M., Hahn-Holbrook, J., & Dunkel Schetter, C. (2015). Biological and psychosocial predictors of postpartum depression: systematic review and call for integration. *Annual review of clinical psychology*, *11*, 99-137.

Yonkers, K. A., Lin, H., Howell, H. B., Heath, A. C., & Cohen, L. S. (2008). Pharmacological treatment of postpartum women with new onset major depressive disorder: a randomized controlled trial with paroxetine. *The Journal of clinical psychiatry*, *69*(4), 659-665.

Yonkers, K. A., Wisner, K. L., Stewart, D. E., Oberlander, T. F., Dell, D. L., Stotland, N., ... & Lockwood, C. (2009). The management of depression during pregnancy: a report from the American Psychiatric Association and the American College of Obstetricians and Gynecologists. *General hospital psychiatry*, *31*(5), 403-413.

Yoo, H., Bowman, D. A., & Oller, D. K. (2018). The origin of protoconversation: An examination of caregiver responses to cry and speech-like vocalizations. *Frontiers in psychology*, *9*, 1510.

Young, S. (2008). Collaboration between 3-and 4-year-olds in self-initiated play on instruments. *International journal of educational research*, *47*(1), 3-10.

Yu, C., & Smith, L. B. (2013). Joint attention without gaze following: Human infants and their parents coordinate visual attention to objects through eye-hand coordination. *PloS one*, *8*(11), e79659.

Yu, C., Suanda, S. H., & Smith, L. B. (2019). Infant sustained attention but not joint attention to objects at 9 months predicts vocabulary at 12 and 15 months. *Developmental science*, *22*(1), e12735.

Zajicek-Farber, M. L. (2009). Postnatal depression and infant health practices among high-risk women. *Journal of Child and Family Studies*, *18*(2), 236-245.

Zajicek-Farber, M. L. (2010). The contributions of parenting and postnatal depression on emergent language of children in low-income families. *Journal of Child and Family Studies*, *19*(3), 257-269.

Zauche, L. H., Thul, T. A., Mahoney, A. E. D., & Stapel-Wax, J. L. (2016). Influence of language nutrition on children's language and cognitive development: An integrated review. *Early Childhood Research Quarterly*, *36*, 318-333.

Zelkowitz, P., & Milet, T. H. (2001). The course of postpartum psychiatric disorders in women and their partners. *The Journal of nervous and mental disease*, *189*(9), 575-582.

Zeytinoglu, S., Calkins, S. D., Swingler, M. M., & Leerkes, E. M. (2017). Pathways from maternal effortful control to child self-regulation: The role of maternal emotional support. *Journal of Family Psychology*, *31*(2), 170-180.

Zimmerman, F. J., Gilkerson, J., Richards, J. A., Christakis, D. A., Xu, D., Gray, S., & Yapanel, U. (2009). Teaching by listening: The importance of adult-child conversations to language development. *Pediatrics*, *124*(1), 342-349.

Zlochower, A. J., & Cohn, J. F. (1996). Vocal timing in face-to-face interaction of clinically depressed and nondepressed mothers and their 4-month-old infants. *Infant Behavior and Development*, *19*(3), 371-374.

Zuccarini, M., Guarini, A., Iverson, J. M., Benassi, E., Savini, S., Alessandroni, R., ... & Sansavini, A. (2018). Does early object exploration support gesture and language development in extremely preterm infants and full-term infants?. *Journal of communication disorders*, *76*, 91-100.

Zukow-Goldring, P., & Arbib, M. A. (2007). Affordances, effectivities, and assisted imitation: Caregivers and the directing of attention. *Neurocomputing*, *70*(13-15), 2181-2193.

Zukow-Goldring, P. (1996). Sensitive caregiving fosters the comprehension of speech: When gestures speak louder than words. *Early Development and Parenting: An International Journal of Research and Practice*, *5*(4), 195-211.

Zwarun, L. (2018). Matched groups. In M. Allen, (Ed.), *The SAGE encyclopedia of communication research methods* (pp. 923-925). SAGE publications.