Kangaroo Care Procedure as a Primary Environment for Preterm Infants and Their Caregivers

Lucia Genesoni

UCL

Department of Cognitive, Perceptual and Brain Sciences

‘I, Lucia Genesoni, confirm that the work presented in this thesis is my own..

Where information has been derived from other sources, I confirm that this has been indicated in the thesis.’

Signature:

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Abstract

Background

A preterm birth, usually accompanied by the need for neonatal intensive care (NICU) and subsequent parents-infant separation, can disrupt infants' early development, parental psychological well-being and parent-infant bonding. Recent research indicates that the early environment and experiences play a critical role in infant development and parenting processes. Kangaroo Care (KC) procedure has been introduced in high technology settings to supplement incubator care and to reduce the initial parents-infant separation through skin-to-skin contact. Research has demonstrated its medical benefits but only partially documented its psychological effects on infants' long-term development and parenting outcomes, and controversial data has emerged in the UK.

Aim

The aim is to evaluate the psychological and behavioural impact of KC in high technology NICU during the first year of life. The domains investigated are: 1) parental psychological stress; 2) parents-preterm infant relationships; 3) mother-infant dyadic interaction; 4) proximal environment and 5) preterm infants cognitive, motor, socio-emotional and behavioural development.

Method

56 mother-preterm infant dyads in KC were compared to a control group of 34 in traditional care. Within this sample, a study was conducted with 28 fathers whose partner experienced KC contact with their infant and 16 fathers who were part of the Control group. Data was

collected at 6 stages: before the initiation of KC procedure, after discharge from hospital, and at 3, 6, 9 and 12 months.

Results

KC mothers have less parental stress, better attachment and interaction with their preterm infant across the research times and they provide a better home environment at 3 months than the Control group. Moreover, KC infants are more responsive during interaction, present better development in terms of motor and adaptive behaviors skills at 6 months, and better communication skills at 12 months than the TC group. Conversely, KC does not directly influence fathers' psychological stress and the formation of father-infant relationships.

Conclusions

The KC procedure promotes maternal psychological well-being and mother-infant dyadic relationships with a consequent positive influence on mother-child attachment and infant development.

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Introduction

A preterm birth disrupts the primary environment of the infant and of the parent-infant early post-natal experiences, due to the medical intervention necessary for the infant's survival. The care required by a preterm infant is complex and is mostly carried out by specialised medical staff supported by modern technology. Such care usually entails a separation of the infant from his/her parents for a period of time that can vary in length. This separation can negatively affect the infant's earliest development as well as the initial parent-infant bonding. These effects can be observed not only during the hospitalisation period but also throughout the first year of the infant's life. The psychological state of the parents, the early parent-infant relationship, as well as the infant's development, can all be influenced by both medical and environmental factors. Consequently, the early environmental experiences and the developmental path of preterm infants deviate from ordinary development, and parents in their transition to parenthood have experiences different to the usual ones.

The aim of the present study was to investigate whether the provision of skin-to-skin contact between mother and infant, in the form of the Kangaroo Care procedure (KC), fosters the psychological health of preterm infants and their families. The literature seems to support the idea that, after in-uterus development, skin-to skin contact can be the natural environment for preterm infant growth and for the formation of bonding (Nyqvist, & an Expert Group of the International Network on Kangaroo Mother: Anderson, Bergman, Cattaneo, Charpak, et al., 2010a). However, the positive psychological effects of KC have not always been repeated in the literature and its potential implications for long-term benefits need to be further investigated. Thus, the issue remains open as to whether KC practiced in the neonatal period has lasting effects.

This study focused on the first 12 months of infant life, looking at areas that have been identified as being of pivotal importance for the healthy development of the preterm infant and the parent-infant relationship: 1) parental psychological distress, 2) parental attachment to and representation of their own infant, 3) mother- infant dyadic interaction, 4) the infants' proximal environment and 5) the preterm infant's development.

This thesis is structured in 6 Chapters:

Chapter 1 provides the background literature that studies the preterm infant's development as well as the development of the parent-preterm infant dyad. It includes an introduction to the theoretical context of the study, discusses foetal development in the last trimester of gestation and, finally, reports upon the impact of preterm birth during the hospitalisation period and throughout the first year of the infant's life.

Chapter 2 focuses on the existing literature on KC intervention, presenting the evidence regarding its physiological effects and reviewing the literature on its psychological impact on the preterm infant as well as on the mother and father.

Chapter 3 presents the objectives and hypotheses of this research study and gives details regarding its methodology, including research design, participants, explanatory variables, measures and KC procedure and implementation.

Chapter 4 is divided in two sections. It reports on the statistical analyses conducted in this study and presents the results obtained. The first section presents the research outcomes pertaining to the areas investigated. The second section is dedicated to the analyses of the predictive power of the KC procedure on maternal attachment, mother-infant dyadic interaction, infant language development and maternal distress.

Chapter 5 presents the Pilot Study that was done in order to examine whether the effect of the results found with the mother-infant dyads is repeated with father-infant dyads.

Chapter 6 concludes the thesis through a discussion of the implications of its findings for KC practice.

Definition of Terms

Abbreviations and definitions of the terms used in this thesis are as follows:

- GA – abbreviation for gestational age.

Gestational age describes the age of the foetus or newborn infant. It refers to the time elapsed between the first day of the last menstrual period and the day of delivery. It is conventionally expressed in completed weeks.

- Preterm or premature infant refers to all infants born before 37 weeks gestation.

They are considered as:

  - Extremely preterm: infants born at less than 28 completed weeks gestation.
  - Very preterm: infants born between 28-32 completed weeks gestation.
  - Mildly preterm: infants born between 33-37 completed weeks gestation.

- Full-term are infants born after 37 completed weeks gestation.
- Chronological age is the time elapsed after birth. It is usually described in days, weeks, months, and/or years.
- CA – abbreviation for corrected age.

“Corrected age" (or "adjusted age") is a term used to describe the age of children who were born preterm, up to 2 years of age. It indicates the age of the child, using as a starting point the expected date of delivery. Corrected age is calculated by subtracting from the chronological age the number of weeks the child is born before 40 weeks of gestation.

- NICU – abbreviation for Neonatal Intensive Care Unit. Neonatal intensive care unit is a ward designed for premature and ill newborns.
- KC – abbreviation for Kangaroo Care. Kangaroo Mother Care is an early form of intervention for preterm infants and their families.

Chapter 1

Development in typical and atypical primary environment: the last trimester of pregnancy versus preterm birth

1.1 Introduction

This chapter is divided into three sections. The first section provides an introduction to the theoretical context of the study, with specific attention paid to the effects of early experiences and environment. The second section looks at foetal development with particular emphasis on the last trimester of gestation. Finally, the third section illustrates the impact of preterm birth during the hospitalisation period. It also looks at the birth's impact on the infant and parents, during the first year of life.

The aim of this chapter is to establish the ordinary developmental path of a foetus, presenting it in parallel with the developmental path of a preterm infant. The last trimester of pregnancy is the time during which, due to preterm birth, a disruption takes place. This means that the developmental paths of the infants this thesis studies deviate at this point from ordinary development.

Introducing this field of research offers an understanding of the environmental, developmental and psychological experiences of preterm infants and their parents, suggesting long-term implications throughout the first year post-hospital discharge. This understanding is achieved by highlighting those patterns of development that differ from the ones that exist in the full term population.

1.2 Theoretical framework: an interdisciplinary perspective on development

The recent developmental psychology and neuroscience literature recognises the direct link between infant neuropsychological development and the infant's very early experiences within his/her primary environment. Traditionally in the framework of developmental psychology, growth processes used to be explained either by emphasising the child's genetic properties or his/her environmental experiences, in an open debate between *nature* and *nurture*. Recently, theories of developmental psychology have applied a more dialectical perspective in relation to nature and nurture. As Sameroff (2010) states, "*there is a unity of opposites in that development will not occur without both, and there is an interpenetration of opposites in that one's nature changes one's nurture and conversely one's nurture changes one's nature*" (p. 9). This perspective is validated by neuroscience and biological research. Both fields demonstrate how the development of the brain systems involved in cognitive processes depends upon the dynamic interaction between genetic factors and environmental influences (Grossmann & Johnson, 2007; Friederici, 2006; Grossmann, Churchill, McKinney, Kodish, Otte, & Greenough, 2003). Examples of environmental influences include the type and the modality of stimulations that the infant receives, as well as the inter-relational experiences of the infant with his/her social realm. With the adoption of this framework, developmental processes are understood in the context of evolving biological systems as they interact with the social realm (Grossmann & Johnson, 2007; Sameroff, 2010; Schore, 2010; Shonkoff, 2010). As will be illustrated, in the case of the preterm infant population, the infant at birth presents a different biological stage of development compared to the full term infant. On preterm infant biological stage of development perinatal environmental stimulation plays an important role for his/her growth and development.

1.2.1 Early experiences

The influence of the child's environment is much more salient in the early developmental years compared to the later ones. Indeed, there is increasing evidence that environmental factors and early experiences play a crucial role in coordinating the timing and pattern of gene expression, which in turn determines initial brain architecture during both the prenatal and the early postnatal periods (Fox, Levitt & Nelson, 2010; Hertzman, 2000; Meaney, 2010; Shonkoff, 2010; Shonkoff, Boyce, & McEwen, 2009). They also play a crucial role in the development of basic cognitive processes (Grossmann et al., 2003; Knudsen, 2004; Pascual Leone & Johnson, 2005). In the context of preterm birth, preterm infants are exposed to a very different initial post-natal environment, at a much earlier stage of growth compared to full term infants. This can place them at higher risk of maladaptive development, as will be fully explored in the third section of this Chapter.

The existing literature provides solid evidence that underlines the role of positive early experiences in strengthening brain architecture. There is also a growing understanding of how environmental adversity can damage brain circuits and undermine lifelong behaviour, learning and consequently physical and mental health. Therefore, each person's life outcome is influenced by a dynamic interplay between the cumulative burden of risk factors and the buffering effects of protective factors. These protective factors can be identified within the individual, family, community, and broader socioeconomic and cultural context. They can be considered protective factors when they provide the child with a stable and nurturing environment. As formulated by the transactional model (Sameroff & Fiese, 2000), the developmental process is influenced by reciprocal child-adult interactions, and it is also recognised that young infants play an active role in their own development. Not only does their ability to relate socially to others have profound effects on what infants feel, think and do; this ability is also essential for their healthy development and for optimal functioning during their lifetime (Grossmann & Johnson, 2007).

Thus, the foundations of healthy development as well as the origins of impairments can be found among biological memories that are created through gene-environment interactions in the early years. What this means within this framework is that initial experiences are biologically embedded in the infant's early development, having a long-term impact on the mastery of cognitive, language and social skills (Shonkoff, 2010). These interactions, in some cases, begin as early as the prenatal period (Davis & Sandman, 2010; D'Onofrio et al., 2010).

Beginning with the last trimester of pregnancy, the brain is in a critical period of accelerated growth, because of myelination, reorganisation of synapses and the programmed death of cells. This process, at a biological level, requires a sufficient amount of nutrients; but it also requires regulated interpersonal experiences, necessary for optimal maturation (Levitsky & Strupp, 1995). The structure of the brain architecture is therefore established in the prenatal period. This provides the basis for receiving, interpreting, and acting on information originating in the external world (Hammock & Levitt, 2006). The postnatal experiences initiate and provide the basis for a protracted process of maturation at a structural and functional level (Fox et al., 2010). In fact, the refinement in the neural circuits that mediate sensory, emotional and social behaviours are driven by the infant's early experiences within the primal environment, such as the quality of interaction with the caregivers (Feldman & Knudsen, 1998).

1.2.2 Changes in the "normal" environment

Changes in the environment, particularly when dramatic in nature, may have the power to alter neural connectivity and cognitive processing.

Much of what we know about the impact of early experience on brain architecture comes from studies of animal and human environmental deprivation (Fox et al., 2010). There is compelling evidence from studies of children who have been abused or subjected to chronic neglect in institutionalised settings, which provides support for the theory that significant adversity early in life can induce physiological responses in the service of short-term survival benefits. These responses come at considerable cost to long-term adaptive capacities as well as to both physical and mental health (Cicchetti, Rogosch, Gunnar, & Toth, 2010; Pollak, Nelson, Schllak, Roeber, Wewerka, Wilk, et al., 2010).

Early intervention in the child's environment is generally considered to play a pivotal role for those children who have experienced early biological disruption and who are the most disadvantaged at the youngest ages; in fact, evidence from neurobiological studies indicates that the longer we wait before investing in children who are at great risk, the more difficult it is to achieve an optimal outcome (Fox et al., 2010; Shonkoff, 2010).

Early in life, the brain is particularly plastic, allowing for alternative pathways to form typical behaviour, despite lasting structural deficits. Fox et al. (2010) explain that the neurological concept of *enriched environment*, aimed at correcting a deeply impoverished early environment, has been shown to greatly improve cognitive, linguistic, and emotional capabilities in humans. In behaviourally based studies, one common example of *enriched environment* is the impact of placing institutionalised children in high-quality foster care. A longitudinal study, the Bucharest Early Intervention Project (BEIP), followed three groups of children: an Institutionalised group, children who have lived virtually all their lives in an institutional setting in Bucharest, Romania; a Foster Care group, which includes children who were institutionalised at birth and subsequently placed in foster care; and a Never Institutionalised group, which includes children living with their biological families in the Bucharest region. When the children in the foster group received high-quality foster care before the age of 2, it led to a dramatic increase in IQ (Nelson, Zeanah, Fox, Marshall, Smyke, & Guthrie, 2007) and to greater language skills compared to those children who were placed in foster care after they turned 2 years old. Their skills of the Foster Care children were more similar to those children who had never been institutionalised (Windsor, Glaze, Koga, & the BEIP Core Group, 2007). Experience-dependent mechanisms of brain network formation and maturation may be responsible for such changes when children are placed in a stimulating environment (Fox et al., 2010). Therefore, enrichment may lead to a restoration of typical development through the use of a growth-facilitating interpersonal environment.

In conclusion, when early experiences are nurturing, stable, and predictable, healthy brain development is promoted, and other organ regulatory systems are facilitated. When, on the other hand, early experiences are fraught with threat, uncertainty, neglect or abuse, the developing brain circuitry is disrupted, with a consequently greater level of vulnerability in the child's physical and mental health.

This thesis focuses on infants and their parents who experience a disruption in their biological and relational primary environment caused by preterm labour. The project studies the effects of the Kangaroo Care (KC) procedure in this context (Charpak, Ruiz-Pelaez, Figueroa de, & Charkap, 1997). KC is considered in this study an *enriched environment* for the preterm infant, since it provides physical and emotional contact at a time when the preterm infant is removed from the environment of the maternal womb and separated from his/her parents. In this piece of research the effects of KC are studied at the behavioural and psychological level and some explanatory models about the impact of early experiences are formulated within the previously explained framework (Grossmann & Johnson, 2007; Fox et al., 2010). In the following two sections, the ordinary developmental path of a not yet born child in the last trimester of pregnancy is contrasted with the developmental path of a child born preterm.

1.3 Development in the typical environment

In the context of this thesis, knowledge on how a foetus develops in its primary environment - the maternal womb - is essential in order to understand how both its developmental path and the mother's pregnancy experiences are disrupted by the event of preterm birth. This knowledge is also important to comprehend the potential benefit of an early intervention for preterm infants and their family, such as KC; an intervention which intervenes within the preterm infant environment and the maternal postnatal experiences.

In the following paragraphs, the prenatal development of the foetus is addressed in terms of its sensory, motor and neurobehavioural development, with a focus on the primary environment's influence on the foetus' growth and development.

1.3.1 Prenatal development

In Figure 1.1 the anatomic development of the embryo is presented, indicating the sensitive periods during which major congenital anomalies as well as functional defects for each major organ system can arise. This anatomic development proceeds at a rapid pace. By 8-10 weeks post-conception, most of the major organ systems are already formed, and foetal heartbeat, movement and reflexes can already be detected (Hooker, 1954; Streeter, 1942). By 14 weeks post-conception, the entire surface of the body is sensitive to cutaneous stimulation.

Central to the preterm population is the fact that it is only by the 6th month of pregnancy that the foetus achieves the capacity to maintain regular breathing, although the lungs and the digestive system still remain immature. From the 7th month of gestation breathing is self-regulated, as the lungs and the digestive system are properly developed. At this time, the brain continues to grow and increases rapidly in size. It is the last organ to develop, and it is completed near the end of the third trimester. During this period, the brain's development is still sensitive if it is exposed to teratogen factors, such as drugs, maternal psychological status or a maternal disease, with potential implications for its functional development (Kinsella & Monk, 2009).

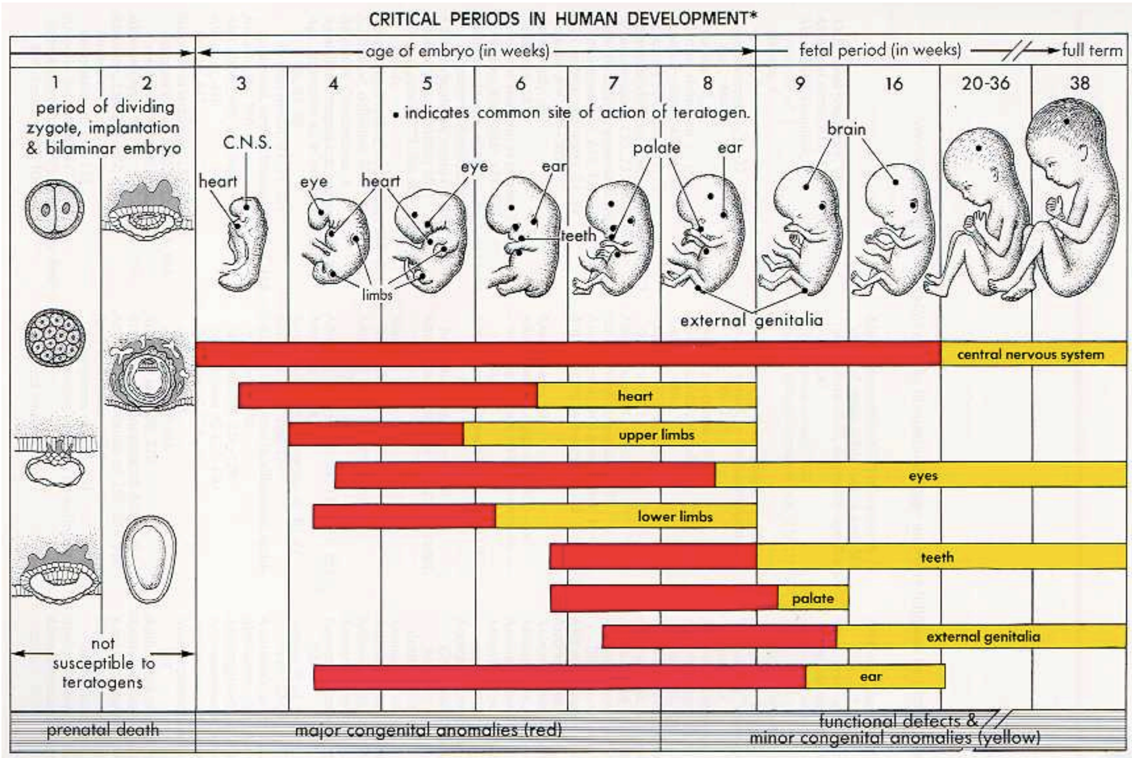


Figure 1.1 Prenatal development. Adapted from *Prenatal Development* by L. L. Solmonson, W. Mullener, & D. G. Eckstein (2008).www.shsu.edu/~lls014/index.html

Foetal sensory development

The basic structures of the eyes, ears, and olfactory bulb develop early in gestation. However, the building of the initial neural architecture of each sensory system occurs between the 22nd and 40th week of gestation. By the second trimester of pregnancy, foetal sensory functions are fully developed and the foetus is able to respond to tactile, pressory, kinaesthetic, thermic, vestibular, gustatory and painful stimuli (Lecanuet & Schaal, 1996). Sensory systems develop at their own pace and sequence, and this pace is critical for the creation of the basic neural architecture of each system.

The sense of touch is the first to develop. During pregnancy, the foetus has varied opportunities for tactile contact and stimulation with the uterine environment and with different parts of its own body (Lecanuet, Granier-Deferre, & Busnel, 1989). The foetus is responsive to pressure and touch very early after conception. In fact, just before 8 weeks gestational age, the first sensitivity to touch manifests itself in a set of protective movements. From this early date, experiments that involve hair stroking of various parts of the embryonic body illustrate that skin sensitivity quickly extends to the genital area (10 weeks), palms (11 weeks), and soles (12 weeks); these areas are the ones which will end up having the greatest number and variety of sensory receptors in adults. By 32 weeks, the mean age at birth of this research's population, nearly every part of the foetal body is sensitive (Montagu, 1978).

The foetus' response to acoustic stimulation can be observed from the 22nd - 24th week of gestation; such responses involve acceleration in foetal heart rate and in motor activity. The foetus is surrounded by rich acoustic stimulation deriving from the inside of the mother's body, through her eating, drinking, breathing and cardiovascular and gastrointestinal activity, but also through her vocalisations and through the environmental noise attenuated by the placenta (Busnel, Granier-Deferre, & Lecanuet 1992; Walker, Grimwade, & Wood, 1971). Within the foetus' primary environment, the pulsation of the womb's main artery (Salk, 1973) and the mother's voice are the most familiar sounds experienced (Busnel et al., 1992).

The influence of the foetus' primary environment on its development is demonstrated by research which proves that foetuses exhibit auditory discriminative capacities for maternal and paternal voices (Busnel et al., 1992), demonstrating a prenatal preference for specific sounds. Such prenatal auditory experiences are considered to have an ontogenetic relevance during the postnatal period (DeCasper & Fifer, 1980; DeCasper & Sigafoos, 1983). Indeed, DeCasper et al. have shown that in the postnatal period the infant displays the same preferences shown in the womb. Interestingly, and relevant to the early intervention for preterm infants such as the one investigated in this thesis, it has been shown that the familiar voice of the mother, the sound of the mother's heartbeat and the inclination for listening to familiar stories read by the mother before birth, have a soothing effect on the newborn (DeCasper & Fifer, 1980; DeCasper & Sigafoos, 1983).

In the same way, from the 22nd week of gestation, taste (Bradley & Stern, 1967; Pritchard, 1965) and olfaction (Pedersen, Stewart, Greer & Shepherd, 1983; Schaal, Orgeur, & Rogan, 1995) in the uterus are relevant to the infant's postnatal capacity to recognise maternal odour. Olfactory recognition can be detected in the early stages of the mother-infant bonding process, when the newborn learns to recognise his/her own mother's unique odour signature (Winberg & Porter, 1998). This early stage of mother-infant bonding is delayed in the case of preterm birth. Indeed, depending at which gestational age a preterm infant is born, he/she is separated from the mother at birth, missing out on these early experiences.

During pregnancy, the foetus maintains a stable body temperature by means of heat exchange with the mother's blood circulation. It can perceive the ordinary maternal body temperature variations, but the mother's body protects it from the changes in external temperature (Gluckman et al., 1983).

Studies of sensory capacities demonstrate the sensitivity and reactivity of the foetus to its environment, by showing an almost immediate response to changes in the maternal environment, such as maternal postural changes (Lecaneut & Jacquet, 2002).

Foetal movements

A foetus is able to move spontaneously within its environment from a very early age. According to Prechtl (1989), the first visible movements appear at about 7.5 weeks of gestation. The repertoire of movements expands rapidly with the advance of gestational age, reaching its full repertoire around the 15th week of gestation. Prenatal motor movement facilitates the normal muscular, skeletal, neural and behavioural development (Moessinger, Bassi, Ballantyne, Collins, et al., 1983). The ordinary variations in these movements reflect ontogenetic adaptation to the intrauterine environment, as revealed by data generated from animal models (Smotherman & Robinson, 1987).

At the end of the third trimester of gestation, the foetus becomes very active and responsive to stimuli. It has been shown, through 24-hour ultrasonographic observations, that between the 24th and 28th week of gestation the foetus is active 14% of the time. After 32 weeks, each foetal movement is associated with foetal heart rate acceleration, and nearly every significant acceleration is associated with foetal movements (Hon & Quilligant, 1968; Sorokin, Dierker, Pillay, et al., 1982; Rabinowitz, Persitz, & Sadowsky, 1983). At birth, the neonate presents the full repertoire of movements developed during foetal life. Individual differences in the behaviour of foetuses can be observed in the quantity of movements, which vary from one foetus to another. Even if different foetuses of the same gestational age demonstrate identical behavioural patterns, each foetus shows individual initiative and choice of movements (de Vries, Visser, & Prechtl, 1988), which have been found to be consistent throughout pregnancy (Prechtl, 1989).

In humans, prenatal motor activity prepares the foetus for postnatal life (DiPietro, Kivlighhan, Costigan, Rubin, Shiffler, Henderson, et al., 2010; Prechtl, 1984). The prenatal development of certain motor skills and activities has been shown to facilitate foetal and infant organ development and the neuromuscular action needed after birth. For example, the periodic swallowing and expulsion of amniotic fluid has been found to be related to the lung's normal development (Vyas, Milner, & Hopkins, 1982) and to the regulation of the quantity of fluid inside the womb (Prechtl, 1984). Moreover, the development of the capacity for prenatal breathing facilitates the performance of the complex neuromuscular action needed after birth. Finally, variation in motor activity has also been significantly associated with activity levels in early childhood and has been shown to be predictive of a range of regulatory temperament characteristics (DiPietro, Bornstein, Costigan, Pressman, Hahn, Painter, et al., 2002). For example, DiPietro et al. (2002) have found that foetal movements were consistently and negatively predictive of distress to limitations at 1 year and of behavioural inhibition at 2 years, accounting for 21 to 43% of the variance in these measures. Indeed, infants who were more active in utero, displayed less distress to frustration and restraint at 1 year. They were also more likely to interact with toys and with the experimenter independently from their mothers at 2 years. This underlines the continuity of certain motor patterns, which develop in uterus, from foetus to infant (Almli, Ball, & Wheeler, 2001).

Foetal behavioural states and neurobehaviours

Foetal behavioural states refer to temporary stable conditions of neural and autonomic functions known as sleep and wakefulness, characterised by eye movements, heart rate patterns, breathing patterns, EEG patterns and motor activity (Prechtl, 1985; Nijhuis, Prechtl, Martin, & Bots, 1982). The association between foetal heart rate and motor activity has been attributed to centrally mediated co-activation of cardiac and somatomotor processes (Johnson, Besinger, Thomas, Strobino, & Niebyl, 1992; Vintzileos, Campbell, & Nochinson, 1986). Studies of the normative development of this association reveal a predictable progression during gestation. With the advance of gestational age, the level of correspondence between these two parameters increases and their latency diminishes (DiPietro, Hodgson, Costigan, Hilton, & Johnson, 1996; DiPietro et al., 2001; DiPietro et al., 2004).

Heart rate and heart variability, motor activity, as well as foetal sleep-wake activity are parameters of the foetal neurobehaviour and neurological development, which can be measured from the 24th week of gestation (DiPietro et al., 2010). Research has shown continuity between the prenatal and the postnatal periods in relation to neurobehaviours and neurological development (Amiel-Tison, Gosselin, & Kurjak, 2006; Kinsella & Monk, 2009). For instance, foetal heart rate and the measurement of its variability are pivotal indicators of the developing balance between parasympathetic and sympathetic innervation (DiPietro, Bornstein, Hahn, Costigan, & Achy-Brou, 2007). Higher variability in heart rate is an indicator of parasympathetic maturation in both the prenatal and postnatal period (DiPietro et al., 2010). Their measurements from 28 weeks of gestation onwards are linked to later mental, psychomotor, and language development in the third year of life (DiPietro, et al., 2007). Research has shown, for example, that heart rate variability reflects emerging individual differences in the development of the autonomic and central nervous systems, related to the style of future emotional regulation. Higher rates of this parameter are associated with a less adaptive response to emotional cues. For example, during social attention tasks, children with high heart rate variability have been shown to experience difficulties in developing appropriate social interactions that require reciprocal engagement and disengagement strategies (Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). High heart rate variability is one of the problems reported in the preterm infant's postnatal life in the NICU, which is indeed highly monitored.

In relation to motor activity, despite the profound changes in environmental conditions between pre and postnatal life, there are hardly any changes in the form and pattern of infant movements in the first weeks after birth (Einspieler, Prechtl, & Bos, 2004). The foetus' spontaneous motility is considered of great clinical significance as an indicator of normal brain development. In postnatal life, and up to the third month, infant abnormal motility has been shown to be an important indicator for later brain dysfunction (Prechtl, 2001). For preterm infants, in particular for children below 32 weeks of GA, their capacity to respond to environmental stimuli through their motor activity develops in different environmental conditions compared to the maternal womb. They are exposed to the stimuli of the NICU, which often involve painful medical procedures, as will be illustrated in the third part of this Chapter. Therefore, from 32 weeks, which is the time that the association between each motor activity and heart rate is established, in preterm infants the nature of this association is often linked to noxious stimulation.

1.3.2 The intrauterine environment: foetus and mother bi-directional interaction

A new area of research focuses on the study of the intrauterine environment, in order to investigate the interplay between foetal behaviours and maternal emotions (DiPietro, 2010). Moreover, studies have been carried out to test the hypothesis that prenatal environmental exposures, such as alterations in 'in utero' physiology due to maternal psychological state, can have a sustained effect on the foetus and child throughout its lifespan (Kinsella & Monk, 2009).

However, research aiming to understand the complex interaction between the foetus and the pregnant woman is still scarce. As stated by DiPietro (2010) "*while the uterus is the developmental niche of the foetus, the foetus is also an active inhabitant of that niche*" (p. 35) and the *"prenatal environment exposure – including maternal psychological state-based alterations in in utero physiology – can have sustained effects across the life span"* (p. 34).

The understanding of how changes in the maternal psychological state can generate a foetal response is still unclear, due to the controversial findings in this field of research. Foetal responsiveness to the maternal psychological state, such as to episodes of maternal alarm and maternal distress, has been documented in terms of both foetal heart rate and motor responsiveness (Ianniruberto & Tajani, 1981; Yoles, Hod, Kaplan, & Ovadia, 1993). As seen in the previous section, foetal heart rate and motor responsiveness both reflect neurological development.

During the second half of gestation, higher levels of foetal motor activity (DiPietro, Hilton, Hawkins, Costingan, & Pressman, 2002) and variability in foetal heart rate (DiPietro et al., 2002; Monk, Fifer, Mayers, Sloan, Trien, & Hurtado, 2000; Monk, Sloan, Mayers, Ellman, Werner, Jeon, et al., 2004) are induced by self-reported maternal indicators of anxiety and stress. In relation to the foetal variability in heart rate, a similar association has been demonstrated as a result of high traits of maternal depression (Monk et al., 2000; Monk et al., 2004). Controversially, DiPietro et al. (2010) have observed that both induced maternal arousal (DiPietro, Costigan, & Gurewitsch, 2003) and relaxation (DiPietro, Costigan, Nelson, Gurewitsch & Laudenlager, 2008; DiPietro, Ghera & Costigan, 2008) are associated with the same response in foetal neurobehaviours, such as suppression of motor activity. They have interpreted these results as a capacity the foetus has to detect and react to maternal psycho-physiological changes (DiPietro et al., 2010).

A recent literature review (Talge, Neal & Glover, 2007) reports on the relevance the maternal psychological state during pregnancy has on postnatal child neurodevelopmental outcomes. Symptoms of anxiety and depression occur frequently during pregnancy, and, unexpectedly, are reported to be more common in late pregnancy than in the postpartum period (Heron, O'Connor, Evans, Golding, & Glover, 2004). There is now reliable evidence deriving from many studies showing that antenatal stress is associated with adverse neurobehavioural outcomes in the postnatal period (Talge, et al. 2007). Mothers with high prenatal levels of anxiety had newborns who spent more time in deep sleep, less time in quiet and active alert states, and who showed more state changes and less optimal performance on the Neonatal Behavioural Assessment Scale (NBAS), a standard neurobehavioural assessment of motor maturity and autonomic stability during the neonatal period (Field, Diego, Hernandez-Reif, Schanberg, Kun, Yando, et al., 2003). In the same way, stressful antenatal life events predict lower scores on the Prechtl scale, as well as smaller head circumference and lower birth weight (Lou, Hansen, Nordentoft, Pryds, Jensen, Nim, et al., 1994). However, antenatal anxiety and depression have been associated both negatively (LaPlante, Barr, Brunet, Galbaud Du Fort, Meany, Saucier, et al., 2004) and positively (DiPietro, Novak, Costigan, Atella, & Reusing, 2006) with child development, measured by the Bayley II scale at 24 months. The authors have suggested that a small to moderate amount of antenatal stress may actually be helpful to the child's development, and that perhaps the association between prenatal stress or arousal and child outcomes is best represented by a u-shaped curve (Talge et al., 2009).

This new field of research highlights the inter-relationship between the maternal psychological status and the infant's growth and activities even during the prenatal period, with consequences on his/her postnatal development. In the context of the population of this study, as will be explained in detail in the following sections, mothers are highly at risk of feelings of anxiety, symptoms of depression and experiences of parenting stress.

1.4 Development in atypical environment: disruption caused by preterm birth

In the following sections the disruptions in the typical infant's developmental path caused by preterm birth are addressed. Firstly, the changes that exist due to an atypical environment- the neonatal intensive care unit (NICU) are compared to the typical environment (the maternal womb). Secondly, the preterm-infant's growth and development under such circumstances are delineated. Lastly, the impact of this process on the formation of the parent-infant relationship during the first year of life is explored.

An understanding of the environmental changes that occur in the transition from in-utero to the NICU and of the subsequent preterm infant's development outside the womb is essential to address issues that a parent needs to deal with at the time of preterm birth. Moreover, it is important to understand this process because these environmental changes influence the parental psychological status, the parents' bonding with and perception of the infant, the mother-infant interaction, the quality of the infant's proximal environment, and the infant's development during the first postnatal year, all areas investigated in this thesis. Finally, an understanding of the complications of prematurity is relevant in order to comprehend the effectiveness of early intervention, such as the one investigated in this thesis, KC. Such early intervention aims to promote the optimal development of medically vulnerable infants and to support their families during prolonged periods of intense stress.

A preterm birth is defined as any delivery that occurs before 37 completed weeks of gestation, regardless of birth weight. According to the degree of prematurity, a birth is considered very preterm (VPT) when the infant is born before 32 weeks' gestation, as were most of the participants taking part in this research, and extremely preterm (EPT) before 28 weeks' gestation (Macfarlane & Mugford, 2000).

Preterm birth is associated with 70% to 80% of neonatal mortality and increased morbidity in both developed and developing countries, and is a major public health concern (Berkowitz & Papiernik, 1993). In recent decades, the preterm birth rate has increased from 9.5% in 1981 to 12% in 2006 worldwide (Goldenberg, Culhane, Iams, & Romero, 2008); it impacts approximately between 5% and 11% of births throughout the industrialised world

(Wen, Smith, Yang et al., 2004). In the United Kingdom, approximately 7% of births are preterm (Macfarlane & Mugford, 2000). Indeed, since the use of assisted ventilation in the 1970s, the introduction of advanced technology (Doyle, Rogerson, Chuang, James, Bowman & Davis, 1999; Saigal & Doyle, 2008) and changing attitudes towards intensive care (Soll, 1998), survival rates have improved (Spitzer, 1996). It is important to consider that preterm births at 32-36 weeks' gestation are five times more common than preterm births before 32 weeks' gestation (Davidoff, Dias, Damus, et al., 2002; Saigal & Doyle, 2008).

Several factors are commonly associated with preterm birth, although in many instances a definitive cause cannot be identified. A number of epidemiological factors have been positively correlated with preterm delivery, such as socio-economic disadvantage, non-white ethnic background, substance misuse, maternal nutritional status, smoking and extremes in maternal age, with both teenage and older mothers at an increased risk, (Slattery & Morrison, 2002; Moutquin, 2003). Furthermore, multiple gestation, previous preterm labour, diabetes, uterine anomalies and intrauterine infection have all been associated with a higher risk for preterm labour (Moutquin, 2003).

When infants are born preterm, they experience the extra-uterine environment before they are developmentally prepared to do so. It is now recognised that the development of foetuses and infants is a reflection of the dynamic relationship between individual endowment and environment. Preterm infants experience a very different beginning to life, compared to full-term infants. For example, separation between the infant and the parents is often necessary for the survival of preterm infants and in order to administer normal routine care following preterm birth, sometimes including painful medical procedures. The neonatal care unit thus becomes the initial environment in which the majority of preterm infants are raised, for a period of time that depends on the degree of prematurity and health.

1.4.1 The Neonatal Care Environment

The first neonatal intensive care unit (NICU) was established by Stahlman at Vanderbilt University in early 1960. The NICU environment has changed over time, taking into account the recent knowledge of the interrelationship between infant development and environment. Yet, the NICU environment is still characterised by both sensory deprivation, compared to the variety of stimuli experienced in the womb, and at the same time by sensory bombardment. Indeed, NICUs are characterised by constant noise, bright light, tactile stimulations, invasive procedures, disturbance of sleep-wake cycles and multiple caregivers. Most of the time, in this environment the preterm infant receives inappropriate patterns of stimulation, which are non-contingent, non-reciprocal, often painful and characterised by multiple stimuli (Gorski, Davidson & Brazelton, 1979; Gottfried & Gaiter, 1985).

The preterm infant's immature CNS is over-stimulated by the NICU environment. For example, the preterm infant's response to the NICU can be confusion, distress and irritability, causing apnoea, bradycardia and other physiological instability, which severely compromise neonatal health (Eyler, Courtway-Meyers, Edens, Hellrung, Nelson, Eitzman, et al., 1989; Gunderson & Kenner, 1987; Lester & Tronick, 1990; Volpe, 1997).

Nowadays, the NICU culture has started to change by being more aware of the long term consequences that the stimuli present in a NICU may have for the preterm infant's development. Indeed, research has demonstrated the immediate and long-lasting physiological and developmental benefits of individualised developmental intervention (Als, Lawhon, Duffy, MacAnulty, Gibes-Grossmann, & Blickman, 1994) during the preterm infant's hospital stay. It has been shown that the most beneficial interventions are the ones that are contingent with the infant's responses, protecting the infant from sensory overload, and promoting the active involvement of parents in the infant's care (Als et al., 1994;

Gardner & Goldston, 2002; Gorski, 1991; McGrath & Conliffe-Torres, 1996).

In the context of the early intervention investigated in this thesis, of great relevance is the research that has shown how the consistency of caregiving enables newborns to adapt to the postnatal environment. This is achieved by the infant's regulation of their biorhythms to those of the caregiver, allowing time to develop synchrony and expectations of the primary environment (Hofer, 1994). A sensitive and responsive NICU environment enhances the establishment of the preterm infant's biorhythmic balance and physiological homeostasis, both necessary for survival. Moreover, the reduction from multiple caregivers to one or two people, improves the establishment of biorhythms for sleep-wake cycles, feeding, and visual attentiveness; consistent cues soon elicit, as a result, a consistency of response from the infant. A predictable and responsive environment enables the infant to progress with his/her communication skills (Hofer, 1994; Als et al., 1994).

1.4.2 Preterm infant: psychological and behavioural development before term age

Physiological health status following a preterm birth

At birth, all preterm infants' organs are biologically immature; as discussed previously, the brain and lungs are especially susceptible to the consequences of preterm birth, leading to higher rates of long-term neurological and health problems (Saigal & Doyle, 2008). The disruption caused by preterm labour on infant development is confirmed by the increasing evidence that suggests that features of brain structure (Hüppi, Warfield, Kikinis, Barnes, Zientara, Jolesz, et al., 1998) and function (Duffy, Als, McAnulty, 2003) are different between medically healthy preterm infants and their full-term counterparts when assessed at the same gestational age (Als, Duffy, MacAnulty, Rivkin, Vajapeyam, Mulkern, et al., 2004).

For instance, preterm infants at term age - 40 weeks of post-conceptional age – show a structural as well as a functional delay in brain development when compared with full-term infants (Huppi et al., 1996). Although some of these differences can be explained by the cumulative effect of minor medical complications associated with premature birth, the infant's sensory experience in the NICU environment - including exposure to bright lights, high sound levels, and frequent noxious interventions - may exert deleterious effects on the immature brain and alter its subsequent development (Als et al., 2004).

Physiologically, compared with infants born at term, preterm infants born between 32 to 36 weeks' gestation have higher rates of temperature instability, respiratory distress, apnoea, hypoglycaemia, seizures, jaundice, feeding difficulties, periventricular leucomalacia and re-hospitalisations (Wang, Dorer, Fleming & Catlin, 2004; Kinney, 2006; Escobar, McCormick, Zupancic et al., 2006). Extremely preterm infants are, in addition, at increased risk of a range of further adverse neonatal outcomes (Lorenz, Paneth, Jetton, den Oudent & Tyson, 2001) such as chronic lung disease (Lefebvre, Glorieux & St-Laurent-Gagnon, 1996), severe brain injury (O'Shea, Klinepeter, Goldstein, Jackson, & Dillard, 1997), retinopathy of prematurity (Allen, Donohue & Dusman, 1993), necrotising enterocolitis (Kilpatrick, Schlueter, Piecuch, Leonard, Rogido, & Sola, 1997) and neonatal sepsis (Hack, Friedman & Fanaroff, 1996). Therefore, short and long-term complications are common in preterm infants, and are mainly due to their degree of physiological immaturity.

Behavioural Development

Preterm infant behavioural development depends upon several parameters, including gestational age, regulation of sleep-wake cycle, feeding schedule and maternal influences. In contrast with full term neonates, they do not begin their extra-uterine life equipped with the ability to communicate through a complex repertoire of behaviours and to attend to their environment through their sensory capabilities (Gardner & Goldston, 2002). Preterm infants are, compared to term infants, more reactive, showing a lower ability to control their level of excitation, and less able to self-regulate, showing lower ability to modulate reactivity, habituation rate and self-soothing capacities (Eckerman, Oehler, Hannan, & Molitor, 1995; Morris, Philbin & Bose, 2000). Thus, the preterm infant is easily over-stimulated and less able to deal with multiple sources of stimuli.

The abilities to be a social partner and to respond through social interaction are developmentally determined by the infant's physical condition. The infant's interaction with the environment and care providers can result in their physiological stability being put at risk (Tronick, Scanlon & Scanlon, 1990). This depends on the degree of prematurity at which the infants are born. At younger gestational age, i.e. before 32 weeks' gestation that is the mean age of the preterm infants who received the KC intervention in this study, the newborns seem to respond with distress, such as closing of the eyes, to all forms of social stimulation (Eckerman et al., 1995). From approximately the 33rd week to 34th weeks, a more differentiated responsiveness emerges, as infants begin to respond to another person talking in *motherese* with increased attention. However, at this stage of development, they continue to show distress when tactile stimulation is combined with talking (Eckerman et al., 1995). Instead, from approximately 35 to 36 weeks, they are able to pay more attention to social stimulations such as touching, eye contact, being talked to. Nonetheless, regardless of gestational age, preterm infants with higher medical risk present more difficulties in attending to and modulating their responses to social interaction compared to healthy preterm infants (Eckerman et al., 1995), displaying increased reactivity and decreased ability to self-regulate (Eckerman et al., 1995; Tronick, Scanlon & Scanlon, 1990). In fact, unhealthy preterm infants switch more quickly from attention to distress during social interaction than equally preterm infants but with lower biological risk (Eckerman et al., 1995).

Therefore, the interactive capacity of preterm infants is dependent upon both their advances in developmental organisation and upon their biological risk in the postnatal period. The growing process in preterm infants is however "uneven" as the preterm infants advance in one area of development, but may become more vulnerable in other areas. For instance, advances in their social development may destabilise their achieved physiological state, such as the exposure to contact for extremely preterm infants can lead to an increase in bradycardia and heart rate (Gorski, Davidson & Brazelton, 1979).

Gorski et al. (1979) have identified three stages and characteristics of behavioural organisation development. The first stage, concerning preterm infants of less than 32 weeks' gestation, is characterised by a physiological stage of mere survival with autonomic nervous system responses to stimuli, little or no direct response to social stimulation, inability to arouse self spontaneously and jerky movements. They are asleep 97% of the time in order to protect the central nervous system (CNS) from sensory overload. The second stage is distinguished by the first active response to the environment, which can be seen at around 34 weeks' gestation, once some level of physiological stability has been achieved. In this stage, the preterm infant is capable of direct response to social stimulation for short periods of time, of being aroused spontaneously and of maintaining arousal once the stimulus has ceased. In cases in which he/she is in interaction during an alert state, there is the ability to maintain the interaction for 5-10 minutes, to track animate and inanimate stimuli. During this stage, he/she is in an alert state 10% to 15% of the time, displaying predictable interaction patterns. Finally, from 36 weeks' gestation, the infant in the third stage is capable of active interaction and reciprocity with the environment, of arousing and consoling her/himself, of maintaining alertness, of interacting with animate/inanimate objects and of coping with external stress such as that related to his/her routine care. Therefore, the preterm infant's ability to elicit and respond to the care provider depends on the level of neurophysiological development and maturity reached by the CNS (Brazelton, 1984; McGehee & Eckerman, 1983).

Sleep-wake cycles

Maturation of sleep architecture follows a well-described course, with a gradual decrease in rapid eye movement (REM) or active sleep and a simultaneous increase in quiet sleep. The development of the circadian rhythm is influenced by genetic factors and brain maturation. It is also influenced, to a smaller degree, by the environment (Fielder & Moseley, 2000; McCarton, Brookes-Gunn, Wallace et al., 1997; Rivkees & Hao, 2000). In the case of preterm infants, active and quiet sleep cycles are less well organised and of shorter duration than those of full-term infants.

In preterm infants, active sleep, which is lighter than quiet sleep, is the predominant state (Dreyfus-Brisac, 1974). Spontaneous movements are often irregular, tremulous and jerky, and are more prominent during active sleep. In the youngest premature infants (below 28 weeks) stimulation by light, temperature changes and feeding can produce transient arousal. A third and predominant sleep state has been identified in preterm infants called "transitional sleep" (Parmelee, Wenner, Akiyama, Schultz, & Stern, E. 1967). It is characterised by periods of eyes being closed, regular periodic respiration, no body movements and no REM. It is only by approximately the 36 weeks' gestation that quiet sleep becomes the predominant state.

In relation to the alert state, periods of wakefulness gradually increase in duration between 28 to 32 weeks of gestation; by that time, there should be periods of sustained arousal without outside stimulation. During the waking state, it is more common to see random stretching, which may appear asynchronous or bilateral and which may spread to include head, neck and trunk. Before 30 weeks of gestation, even when there is no papillary response, the preterm infant at 28 weeks will blink at bright light. By 31 to 32 weeks visual fixation on bright, large objects can be demonstrated, as the papillary light reflex is fully mature. By 36 weeks, there is active tracking with the head turning towards the light and forceful eye closure to bright light (Booth, Leonard, & Thoman, 1980). Preterm infants at 40 weeks of gestation are similar to newborn full term infants, with periods of sustained arousal and reactivity to a variety of sensory stimuli that include visual, auditory and tactile modalities (Booth, Leonard, & Thoman, 1980).

Sensory Development

The preterm infant's sensory development proceeds in the same specific order compared to that of full term infants: from tactile to vestibular, from olfactory to gustatory and from auditory to visual (Gardner & Golston, 2002). A preterm infant's experience of his/her mother and father's voices or of the sounds made within his/her environment will depend on the degree of prematurity; as explained in the first section of this chapter, from the 22^{nd} to the 24^{th} week of gestation, the infant/foetus is able to hear and remember such acoustic stimuli (Abrams & Gerhardt, 2000; Bauer, Gerhardt, Abrams, Huang, & Bauer, 2001; Hall, 2000). However, a preterm infant displays lower habituation capacity to sound than full term infants do. This is particularly noteworthy, considering that they are exposed to a very different array of acoustic stimulations due to the NICU environment. For instance, they appear to be more vulnerable to sounds by displaying larger heart rate changes (Gardner & Golston, 2002).

Of great relevance, touch is the first sense to develop in uterus (Montagu, 1978) and is indeed the main method of communication in postnatal life (Gardner & Golston, 2002). In fact, at birth the senses of touch, temperature and pressure are all well developed and the relevant receptors lie in the skin, mainly in the face, lips and hands. Importantly, newborns pick up most environmental messages through the manner in which they are held and handled (Gardner & Golston, 2002).

The ontogenetic importance of sensory experiences and the impact of sensory deprivation on infant development are widely reported in the literature concerning both preterm and full term infants. Tactile contact and vestibular stimulation are essential for the organisation and sorting of stimuli, coordination of sensorimotor skills, normal neurophysiological and emotional development and temperament (Bolwby, 1973; Prescott, 1975). A lack of appropriate stimulation can have long-term consequences. Stimulus deprivation results in impairment, retardation, or deviancy in the development of skills, the severity of which depends on the severity of the restrictions and limitations encountered. It has been reported that infants are able to overcome mental and nutritional deprivation as long as they are not deprived of tactile stimulation (Montagu, 1978). In fact, it has been well established in the literature, based on studies of a population of full-term infants, that infants who were well cared for physically but who did not receive tactile and kinaesthetic stimulation either died or were seriously impaired mentally, emotionally and socially (Bolwby, 1973; Gardner, 1982; Spitz, 1945).

Preterm infant self-regulatory capacities

The primary task of newborns is to ensure their own survival via the re-establishment of their biorhythmic balance. This is achieved by stabilising the functions of sleep-wake cycle, blood chemistry levels, metabolic processes, eating patterns, respiratory and heart rates (Gardner & Goldston, 2002). As a foetus in uterus, an infant depends on the mother to regulate its own systems; even if the biorhythmic balance is internally determined, after birth it is facilitated by contact with familiar surroundings, such as the mother's body. It is critical to state again that in preterm infants, such immediate contact is not possible for the majority of time due to their physiological immaturity or due to maternal illness. In these situations, the primary mothering role necessary for re-establishing the preterm infant's biorhythmic balance is not present as the caregiving is temporarily transferred to medical staff.

1.4.3 Transition to parenthood in the NICU: Parents' response to preterm birth

Pregnancy and birth constitute a major life event for expectant parents, which involve complex psychological changes (Goldberg & DiVitto, 1995). The period of pregnancy allows time to prepare for the parenting role, to form expectations about the new infant and to actively engage in preparation for infant care. However, when the pregnancy fails to deliver a full-term and healthy newborn, as is the case with prematurity, parents need to grieve the loss of their expectations (Gardner & Goldston, 2002). Thus, their ability to achieve an optimal adaptation to parenthood is placed at risk. The most common feelings are helplessness, isolation, failure, emptiness and an absence of control over the situation (Klauss & Kennell, 1982). Parents face a period of psychological disorganisation during which they might feel that they are not able to cope (Caplan, Mason, & Klapan, 2000).

Psychological processes in parents

The psychological processes that parents must deal with after a preterm birth can be understood through looking at the different stages of their experience: these are the time of delivery, the admission to NICU and the period of hospitalisation. The emotional investment in the infant may be delayed due to medical problems that can arise during pregnancy and delivery, which threaten the health of both mother and infant. Moreover, parents of preterm infants are deprived of the time necessary to psychologically prepare for the birth. Parents are not prepared for the shock, stress, and anxiety that occur when their infant is born extremely early or sick enough as to require critical care. There is an overwhelming sense of losing control of the events of the labour and delivery and their timing (Taylor & Hall, 1979). As a result, parents can either feel not yet ready to invest in the infant (Taylor & Hall, 1979) or they may feel that the infant is not really theirs, with a consequent feeling of rejection towards the infant (Bialoskurski, Cox & Hayes, 1999). Mothers usually experience feelings of inadequacy due to being unable to deliver a healthy term infant and at the same time may feel shocked, frightened, anxious and helpless (Oehler, Hannan & Catlett, 1993). These emotions may interfere with the initial processes of bonding between parents and infant.

After labour and delivery, when the infant is admitted to a NICU, parents have limited access to their infant because of the acute medical nature of their infant's condition. Separation has been described as the worst and most painful aspect of this experience (Redshaw, Harris & Ingram, 1996). Parents have to come to term with feelings of grief and sadness over the loss of the expected idealised child that they had wished for during the pregnancy (Wallerstedt & Higgins, 1996). They may find themselves in a very stressful position, trying to balance the painful reality of a possible loss against their hope for the intact survival of the infant. This leads them to emotionally withdraw from the infant and to undertake anticipatory grieving processes in order to cope with this highly emotional situation (Oehler, Hannan & Catlett, 1993; Miles, 1989). Such psychological processes are considered important and necessary for the parents in order to accept the reality of their infants' condition (Solnit & Stark, 1961).

During the infant's hospitalisation, parents need to establish a relationship with the infant and initiate their caregiving role, something that has been delayed by events (Redshaw et al., 1996). This implies a shift in their level of involvement from that of passive participants to that of active primary caregivers (Kenner & Lott, 1990; Singer, Davillier, Bruening, Hawkins, & Yamashita, 1996). This shift is influenced by the stability or liability of the infant's health condition, the physical health of the mother, the level of both partner and social support available and the staff expectations (Miles & Holditch-Davis, 1997). In fact, instead of the expected child, their child is a small, frail and often unattractive infant who is mainly in the care of a complex array of NICU staff (Sammons & Lewis, 1985). The care of preterm infants is always appropriate to their physical and medical difficulties but their psychological and relational needs necessary for the essential formation of the parent-infant bonding and relationship are rarely addressed.

Impact of the NICU environment on the parents

The above reported parental reactions are often heightened when parents attempt to adapt to the unfamiliar environment of the NICU (De Chateau & Wiberg 1977; Doering, Dracup & Moser, 1999; Miles et al., 1999; Siegel, 1982). Indeed, when faced with a NICU admission, parents struggle with the unfamiliar and potentially threatening environment of an intensive care unit. Parents must learn a new language related to their infant's health. They also need to learn to trust the medical staff and to adapt their parental role to this environment. They often encounter challenges to the development of their parental role (Fenwick, Barclay, & Schmied, 2001a, 2002b; Heerman, Wilson & Wilhelm, 2005; Lupton & Fenwick, 2001) and to their identity as parents (Redshaw & Harris, 1995). Moreover, the appearance of a high-risk nursery may frighten parents, increasing their feelings of helplessness and anxiety. The most common sources of stress experienced by parents during their infant's hospital stay have been identified as follows: prenatal and perinatal experiences, infant illness, treatment and appearance of the infant, concerns about the infant's development, and temporary loss of the parental role (Siegel, Gardner, & Merenstein, 2002).

The most recent literature review addressing parenting in the NICU (Cleveland, 2008) identified six primary needs of such parents: receiving accurate information about the infant's health and being included in the infant's care and in relevant decision making (Higgins & Dullow, 2003), vigilant watching-over and protecting the infant from danger such as poor continuity of care and lack of attention for the baby (Hurst, 2001), physical contact with the infant (Erlandsson & Fagerberg, 2005; Higgins & Dullow, 2003; Joseph, Mackley, Davis, Spear & Locke, 2007; Lupton & Fenwick, 2001; Orapiriyakul, Jirapaet, & Rodcumdee, 2007; Ward, 2001), being positively perceived by the nursing staff, because of their fear of losing access to their infant (Lupton & Fenwick, 2001; Hurst, 2001; Fenwick et al., 2001), individualised care and finally, reassurance in the therapeutic relationship with the nursing staff (Cleveland, 2008).

In summary, the parental experience of the NICU environment may adversely disrupt the initiation of parenting processes, parent-infant bonding and parental involvement, all essential for the child's long-term development (Mangelsdorf, Plunkett, Dedrick, Berlinet al., 1996; Redshaw, 2005). The principal characteristics of such an environment, which renders the family bonding a very difficult process, are the separation of parents and child in the postnatal period, the uncertainty about their child's well being and the immaturity of the infant's behaviours. In the following sections, the psychological impact of all these characteristics on mothers and fathers is explored.

Psychological impact on the mother and father

The relevant literature shows that mothers of infants admitted to a Neonatal Intensive Care Unit (NICU) experience a rise in distress, anxiety (Carter, Mulder, Bartram, & Darlow, 2005; Garel, Bahuaud, & Blondel, 2004; McGrath, Boukydis, & Lester, 1993; Meyer, Garcia, Seifer, Ramos, Kilis, & William, 1995; Singer, Salvator, Guo, Collin, Lilien, & Baley, 1999) and depression levels (Carter et al. 2005; Brooten, Gennaro, Brown, 1988; Doering, Moser & Dracup, 2000; O'Brien, Heron Asay & McCluskey-Fawcett, 1999) compared to mothers of healthy full-term infants.

Anxiety and depression have been the most investigated variables related to the maternal experience following a preterm birth. Only recently has the experience of having a preterm birth been recognised as a cause of post-traumatic stress disorder, which affects in greater proportion mothers of high risk preterm infants, with symptoms that sometimes persist long after the infant's discharge from hospital (Holditch-Davis, Bartlett, Blickman & Miles, 2003; DeMier, Hynan, Harris & Maniello, 1996; Forcada-Guex, Borghini, Pierrehumbert, Ansermet, & Muller-Nix, 2011; Jotzo & Poets, 2005; Kersting, Dorsch, Wesselmann, Ludorff, Witthault, Ohrmann et al., 2004; Muller-Nix, Forcada-Guex, Pierrehumbert, Jaunin, Borghini, & Ansermet, 2004; Pierrehumbert, Nicole, Muller-Nix, Forcada-Guex & Ansermet, 2003).

Few studies have reported on the experiences of the preterm infant's father during the postnatal period. The existing literature indicates that fathers face unique challenges too: they are often required to undertake both physical and emotional responsibilities ranging from being worried about the hospitalised infant, providing support to their partner, communicating with concerned family and friends, caring for other children, and, in many cases, returning to work within a few days after the infant's birth (Miles et al., 1996; Lee, Miles & Holditch-Davis, 2006). These fathers strive to achieve a balance between work and family life (Pohlman, 2005; Miles et al., 1996). Initially, fathers report having more concern for their partner than for their infant, a concern that might make early bonding with the infant more difficult compared to fathers of full term infants (Arockiasamy, Holsti & Albersheim, 2008; Lundqvist & Jakobsson, 2003; Koppel & Kaiser, 2001). Fathers also express a need for information in order to be more focused on their infant (Lundqvist & Jakobsson, 2003). Such experiences are not that different from the processes described in full-term transition to fatherhood (Genesoni & Tallandini, 2009).

Fathers are reported to experience higher levels of stress in the first week of their infant's hospitalisation due to their dual role of supporting both the mother and the infant (Mackley, Locke, Spear, & Joseph, 2010). They often experience stress (Dudek-Shriber, 2004; Mackley, Locke, Spear, & Joseph, 2010; Miles et al., 1996; Pinelli, 2000; Spear, Leef, Epps & Locke, 2002; Shields-Poe & Pinelli, 1997) and depressive symptomatology (Mackley, Locke, Spear, & Joseph, 2010). However, their psychosocial adjustment differs in distress severity from that of mothers; fathers have been reported to experience lower levels of distress than mothers (Affleck et al., 1991; Miles, Funk, & Kasper et al., 1992). Interestingly, Mackley et al. (2010) have shown that both stress and depression are independent from infant illness and while paternal stress remains unchanged during the infant's hospitalisation, depressive symptomatology decreases over time. Postpartum depressive symptoms in fathers have been associated with less positive interaction with the infant during the first year of the infant's life (Lee et al., 2006).

Sullivan (1999) investigates the development of attachment between fathers and premature infants. In this study, the major factor influencing the process of attachment has to do with the opportunity to establish physical contact with the infant; fathers who held their infants shortly after birth showed more attachment behaviours than fathers who delayed such contact, which indicates that such contact helps to establish their "fathering" role (Arockiasamy et al., 2008; Lundqvist & Jakobsson, 2003; Jackson, Ternestedt & Skollin, 2003).

1.4.4 From hospital discharge to the first year of the preterm infant's life

The impact of having a preterm infant is not only limited to the period during which the child is hospitalised. It has long lasting implications on the parental psychological state, on the parents' attachment towards the child, on parental perception of the child, on the parent-infant dyadic interaction, and on the quality of the environment provided to the child. Importantly, all these dimensions, together with the prematurity, have potential implications on the infant's development post-discharge.

The transition from NICU to life with the infant at home can be indeed overwhelming for parents. This is because at this stage they assume full responsibility for an infant who, for weeks or months, was regarded as medically fragile (Easterbrooks, 1988; Miles & Holditch-Davis, 1997). Parents have reported feelings of being unprepared to take on their parental responsibilities (Brooten, Gennaro, Knapp, Brown & York, 1989; Butts, Brooten, Brown, Bakewell-Sachs, Gibbons, Finkler, et al., 1988; Kenner & Lott, 1990). Even so, many mothers recall the first few months at home with their infant as a satisfying time compared to what they had faced during the hospitalisation or what they had feared might happen once they took the infant home (Affleck et al., 1991).

The major parental concern following discharge is the uncertainty regarding the infant's long-term development (Affleck et al., 1991; McKim, 1993; Wereszczak, Miles, & Holditch-Davis, 1997), which mainly depends on the infant's medical fragility. In the first few months at home, parents may encounter problems because some preterm infants are still dependent on medical technology such as oxygen therapy (Affleck et al., 1991). Other sources of stress reported by parents have to do with the need for medication, poor weight gain, recurrent illness (Affleck et al., 1991; Blackburn, 1995) and frequent re-hospitalisation (McCormick, Workman-Daniels, Brooks-Gunn, & Peckham, 1993).

Mothers of preterm infants find caregiving issues, such as lack of sleep due to the unpredictability of the infant's sleep patterns, particularly challenging. They often feel frustration over feeding problems and over their inability to soothe the infant's distress (Hughes, Shults, McGrath, & Medoff-Cooper, 2002). During the first year of life, preterm infants are more difficult than full-term infants (Gennaro, Tulman, & Fawcett, 1990; Langkamp, Kim & Pascoe, 1998), with behavioural and temperament patterns that render them less responsive to their caregiver (Crnic, Ragozin, Greenberg, Robinson, & Basham et al., 1983; Field, 1977; Landry, Chapieski, Richardson, Palmer, & Hall, 1990).

Another issue to consider is the parents' common perception that their preterm infant is fragile and in need of special protection, which raises their stress level in terms of whether or not the infant may still be in danger of dying unexpectedly (Affleck & Tennen, 1991). For this reason, many mothers keep their infant at home for fear of infection and they tend not to leave the infant in the care of others (Affleck & Tennen, 1991).

The parents' experiences after their infant has been discharged from hospital are mixed. Some studies report that the addition of a preterm infant to the family has a negative long lasting impact, adding more strain, with an adverse effect on parental emotional health, something that can increase the possibility of parental separation (Cronic, Shapiro, Casiro & Cheang, 1995; Saigal, Burrows, Stoskopf, Rosenbaum & Streiner, 2000; Taylor, Klein, Minich & Hack, 2001). Other studies indicate that any adverse consequences dissipate over time (Singer, Salvator, Guo, Collin, Lilien & Bailey, 1999; Lee, Penner & Cox, 1991; Tommiska, Ostberg, Fellman, 2002).

Mothers' psychological distress following their preterm infant's discharge

At the time of discharge, mothers of preterm infant still experience high levels of depression and anxiety (Blumberg, 1980; Singer, Davillier, Bruening, Hawkins & Yamashita, 1996; Pederson, Bento, Graham, Chance, Evans & Fox, 1987). Muller-Nix et al. (2004) have retrospectively measured the presence of symptoms of perinatal posttraumatic stress disorder in mothers, at 18 months after birth. In their sample, they reported that high posttraumatic stress disorder was found in 73.3% of mothers of high-risk preterm infants and 23.6% in mothers of low-risk preterm infants. The incidence of post-traumatic stress disorder reported among the full-term sample was 4%, while among the low-risk preterm infant sample it was 21%. Finally, among the high-risk preterm infant sample it was 39%.

Maternal stress beyond the neonatal period has been the subject of only a few controlled studies (Carter et al., 2007; Muller-Nix et al., 2004; Singer et al., 1999; Tallandini, Rink Sugar, & Lis, 1982). The majority of these studies indicate that after hospital discharge, maternal anxiety is not related to the severity of neonatal conditions, but to the infant's present health status and the degree of support received (Zelkowitz et al., 2007; Garel, Bahuaud, & Blondl, 2004). Moreover, the mothers' post-traumatic stress is linked to the prematurity itself regardless of the infant's perinatal risk (Gamba Szijarto, Forcada-Guex, Borghini, Pierrehumbert, Ansermet & Muller-Nix, 2009).

One of the first longitudinal studies of parental distress (Singer et al., 1999) indicates that after discharge from hospital, the psychological impact due to preterm delivery depends on the infant's medical risk status, gestational age at birth and the infant's developmental outcomes. However, at 8 and 12 months after birth, mothers demonstrated similar symptoms of anxiety, depression and parental stress compared to mothers of full term infants, regardless of the infant's medical risk. Carter et al. (2007) replicated these results when examining the psychological status, in terms of anxiety and depression symptoms, of parents of NICU and parents of full term infants. These researchers showed that the initial differences found at birth dissipate in the first nine months following discharge; parents of preterm infants made large symptomatic improvements with a decrease in anxiety and depression symptoms over a nine-month follow-up period, whereas the functioning of parents of full term infants remained relatively stable. In particular, mothers' improvement in anxiety and depression symptoms was related to the degree of satisfaction within and to the quality of life with the child's father at nine months. In contrast to the time when the infant was born, parental psychological status at nine months was not related to the infant's gestational age at birth (Carter et al., 2007).

In conclusion, beyond the perinatal period, the latest studies seem to indicate that mothers' psychological experience of having a premature child is more influenced by the event of preterm birth itself than by the degree of prematurity and medical risk with which their child is born. The mothers' psychological experience is also influenced by other variables that may have a cumulative effect, such as relational and environmental factors.

Mothers-preterm infant relationship

Parent-infant interaction behaviours and parental mental representations are the building blocks for the parent-infant relationship (Stern-Brushweiler & Stern, 1989). Preterm birth constitutes a risk for the early establishment and evolution of the mother-infant relationship (Forcada-Guex, Pierrehumbert, Borghini, Moessinger & Muller-Nix, 2006;

Minde, Perrotta & Marton, 1985; Muller-Nix et al., 2004). The psychological well-being of mothers during the perinatal period represents one of the most important factors influencing the development of the mother-infant relationship, having an impact on both interaction behaviour and mental representations (Korja, Savonlahti, Ahlqvist-Bjorkroth, Stolt, Haataja, Lapinleimu, 2008; Murray, Fiori-Cowley, Hooper, & Cooper, 1996).

The last trimester of pregnancy, from the 24th to the 32nd week of gestation, is the crucial period for the development of maternal representations of the infant. The representation of the idealised infant gradually shifts towards the real infant; this development is important because it prepares the mother for separation from her infant (Ammaniti, Baumgartner, Candelori, Perucchini, Pola, Tambelli, et al., 1992; Cohen & Slade, 2000). Also, during this period, attachment representations regarding the infant begin to form (Benoit, Parker, & Zeanah, 1997; Stern, 1995; Zeanah & Benoit, 1995). These representations are reported to guide the mother's postnatal behaviour in her caregiving relationship (Stern, 1995). The development of such maternal representations during the prenatal and postnatal periods is interrupted by preterm labour. Indeed, it has been reported that consequently to preterm birth there is a discrepancy between the mother's mental representation of the real infant and her representation of the idealised infant (Levy-Shiff, Sharir, & Mogilner, 1989; Korja, Savonlahti, Haataja, Lapinleimu, Manninen, Piha, Lehtonen et al., 2009; Korja, Ahlqvist-Bjork, Savonlahti, Stolt, Haataja, Lapinleimu, Piha, Lehtonen et al., 2010).

When trying to understand the long term impact of prematurity on parents, of great relevance is the research which has highlighted that during the early postnatal period the maternal recollection of the first contact with the child has been linked to the maternal capacity to represent the infant's internal states; mothers who remember positive emotional reactions are less likely to misinterpret their infant's internal states (Meins, Fernyhough, Arnott, Turner & Leekam, 2011). In the case of preterm infants, the early birth and the immediate separation interrupt these processes.

The literature on mothers' attachment representations of their preterm infants belongs to a recent field of research (Borghini, Pierrehumbert, Miljkovitch, Muller-Nix, Forcada-Guex & Ansermet, 2006; Korja et al., 2009; 2010; Forcada-Guex, Borghini, Pierrehumbert, Ansermet & Muller-Nix, 2011). Maternal attachment representations have been explored in relation to the severity of prematurity, fear of potential loss, separation after birth and maternal psychological well-being. It has been found that mothers of both healthy preterm infants, who experience prolonged post natal separation, and mothers of sick preterm infants, who in addition to separation have also feared losing their infants, had less secure attachment behaviours and representations than mothers of full term infants. The quality of the maternal attachment representations was found to be negatively influenced by the duration of mother-infant separation after birth (Feldman, Weller, Leckman, Kuint & Eidelman, 1999). In the same way, Borghini et al. (2006) found that preterm birth and perinatal risk have an impact on the mother's attachment representations as measured by the Working Model of Child Interview (WMCI). At 6 and 18 months corrected age, only 20% of mothers of a premature born infants had secure attachment representations compared to 53% of mothers of full-term born infants. Importantly, both mothers of low and high-risk preterm infants are affected, showing similar proportions of insecure attachment representations. However, mothers in the high and low-risk groups displayed different patterns of behaviours. Mothers of low-risk infants had more disengaged representations, characterised by coldness and emotional distance, than mothers of high-risk infants did; whereas mothers of high-risk premature infants had distorted attachment representations, characterised by high emotional involvement and confusion, anxiety and distortion of the infant's needs. This confirms that the parental behavioural response to a premature birth is linked to the severity of perinatal risk. However, prematurity itself, regardless of the severity of perinatal risk, exposes mothers to develop insecure attachment representations. A further investigation within the same cohort (Forcada-Guex et al., 2011) confirmed that prematurity has an impact on the quality of maternal attachment representations and on the dyadic quality of mother-infant interaction at 6 months corrected age. The effect of preterm mothers' posttraumatic stress was also investigated, showing that the maternal psychological status was also responsible for the mother's distorted representation of the infant and to a controlling pattern of interaction (Forcada-Guex et al., 2011).

Another group of researchers (Korja et al., 2009; 2010) demonstrated that, at 12 months, higher amounts of depression symptoms in mothers of preterm infants were associated with the formation of distorted attachment representations. However, in contrast with previous studies, these researchers did not find any differences in maternal attachment representations when comparing mothers of term and preterm infants, showing an equal number of balanced attachment representations in both groups (Korja et al., 2009). Furthermore, preterm birth does not seem to affect the positive association between maternal attachment representations and mother-infant interactive behaviours (Korja et al., 2010). Therefore, these findings seem to further establish the influence of the maternal psychological status on the maternal attachment representations. Yet, the relationship among preterm birth, maternal attachment representation and mother-infant interaction remains unclear.

A number of early investigations have documented differences in the communicative style between preterm infants and full term infants with their mothers. While preterm infants have been described as less alert, attentive and responsive (Eckerman & Oehler, 1992; Hughes & McCollum, 1994) and more avoidant (Crnic, Ragozin et al., 1983; Greenspan, 1992) than full term infants, the mothers of preterm infants have been described as more active, stimulating, intrusive and, at the same time, more distant in mother-infant interaction when compared to the mothers of full term infants (Barnard, Bee & Hammond, 1984; Brown & Bakeman, 1980; Crinc, Ragozin, Greenberg, Robinson & Bashman, 1983; Goldberg & DiVitto, 1995; Field, 1977; Minde, Perrotta & Marton, 1985). Such differences appear to persist in the long term (Macey, Harmon & Eastbrooks, 1987). Indeed, the stress related to infant hospitalisation and to the immature and irregular behaviours of the preterm infant have an adverse influence on parenting and on parent-infant interactions during the first year of life (Crnic, Ragozin et al., 1983; Field, 1977; Minde, Whitelaw, Brown, & Fitzhardinge, 1983).

Evidence from numerous studies underlines the fact that parents of preterm infants face unique challenges beyond those involved in parenting a full-term infant (Goldberg & DiVitto, 1995). Preterm infants with greater medical and neurobiological risks may be expected to present a greater challenge to caregivers because of the immaturity of the infant's behavioural organisation. Moreover, high maternal stress, found in preterm mothers during the perinatal period, is recognised to be a major factor influencing mother-infant interaction (Murray, Fiori-Cowley, Hooper & Cooper, 1996).

Conversely, preterm infants and their mothers are described as competent in their interactive behaviours (Schermann-Eizirik, Hagekull, Bohlin, Persson & Sedin, 1997), particularly after the first year of life (Greenberg, Carmichael-Olson & Crnic, 1992). These differences in results may be related to the fact that preterm infants are a heterogeneous group, with considerable variation in medical and neurological histories, which makes it difficult to generalise from the results. Another explanation may have to do with the recent change in attitude resulting from an increase in parental presence and involvement with the infant's care in the neonatal unit.

Recently, Forcada-Guex et al. (Forcada-Guex, Pierrehumbert, Borghini, Moessinger & Muller-Nix, 2006; Forcada-Guex et al., 2011) have identified two specific mother-preterm infant dyadic patterns of interaction, at 6 months corrected age, in a sample of preterm infants born below 34 weeks of gestational age, comparing them to a full term sample. The first pattern was defined as a "cooperative pattern" between sensitive mothers and cooperative-responsive infants, and the second was defined as a "controlling pattern" between controlling mothers and compulsive-compliant infants. The controlling pattern of interaction significantly identified preterm dyads formed by infants with high perinatal risk and mothers with elevated post-traumatic stress and distorted attachment representations (Muller-Nix et al., 2004). At 18 months, these preterm infants displayed more behavioural problematic symptoms, such as eating problems and lower developmental social skills (Forcada-Guex, et al. 2006; 2011). Interestingly, the relationship between the mother's post-traumatic stress and the mother's interactive behaviour was found to be independent of the infant's perinatal risk factors and behaviour, as well as independent of the family's socioeconomic background (Forcada-Guex, et al. 2006).

The relationship between infant risk status, maternal psychological distress and the quality of maternal-infant interaction has been the subject of a recent large longitudinal study (Singer, Fulton, Daviller, Koshy, Salvator & Baley, 2003) on a very preterm mother-infant sample during the first year after discharge. The mother-infant interaction was here assessed during feeding times using the NCAF (Barnard, 1975), in order to be able to investigate a familiar and frequent interaction between parent and child. The authors found that maternal and infant interactive behaviours were negatively affected by infant risk status. However, these effects diminished with time. Indeed, in the neonatal period, mothers of both high and low risk infants provided more socio-emotional growth fostering during feeding than mothers of term infants, in line with previous studies (Field, 1977; Singer et al., 1996). Socio-emotional growth fostering behaviours include paying attention to the child during feeding, making eye contact, engaging in social forms of interaction and using positive statements when talking to the child during feeding. By 8 and 12 months such differences between preterm and full-term mothers had dissipated. Mothers of preterm infants showed more active interactive behaviour at 12 months compared than at 1 month, as previously found (Crnic et al., 1983). On the infant's side, the very preterm infants' interactive behaviour was less clear and less responsive to maternal stimulation compared to that of full-term infants, in line again with previous findings. Maternal distress symptoms, which were measured as a compounding of several adverse psychiatric symptoms, such as depression and anxiety, did not differentially affect mothers of high and low risk infants beyond the perinatal period. For all mothers, higher levels of psychological distress were related to maternal interactive behaviours in terms of lower frequency of cognitive growth fostering at 8 and 12 months. During feeding, cognitive growth-fostering maternal behaviours include encouraging the child to explore the breast, bottle, cup and food, describing some aspect of the feeding situation to the child, and responding to the child's vocalisations. The relationship between maternal psychological distress, measured in terms of states of anxiety, and interaction has been further confirmed by two later studies within a similar population of very preterm infants (Feeley, Gottlieb & Zelkowitz, 2005; Schmücker, Brisch, Köhntop, Betzler, Österle, Pohlandt, et al., 2005). Moreover, they highlighted the impact of maternal state anxiety early in the NICU, which was associated with less optimal interactive behaviour at 3 months (Schmücker, et al., 2005).

In summary, these findings further establish the influence of the maternal psychological status on mother-preterm infant dyadic interaction, regardless of the infant's medical risk at birth.

Fathers' experience of preterm birth after hospital discharge

After hospital discharge, fathers of preterm infants compared with fathers of full-term infants are reported to have greater stress levels (Beckman & Pokorni, 1988; Lee, Penner & Cox, 1991; Parke & Tinsley, 1981; Rimmerman & Sheran, 2001) and more symptoms of depression (Carter, Mulder, & Darlow, 2007; Lee, Penner & Cox, 1991; Parke & Tinsley, 1981; Rimmerman & Sheran, 2001). The improvement of the fathers' anxiety and depression symptoms has been associated with the degree of satisfaction within the current couple relationship, when their psychological status was no longer related to the infant's gestational age at birth (Carter et al., 2007).

The findings that have been reported in relation to fathers' involvement are not conclusive. Lower involvement rates with their infant have been reported after discharge from hospital (Rimmerman & Sheran, 2001), while previous studies showed that fathers of premature infants are more involved in their care compared to fathers of full term infants (Yongman, 1984; 1987). For example, in a longitudinal study, Yongman Kindlon and Earls (1995) showed that the involvement of fathers was positively related to the infant's illness at 3 months after discharge. Involvement was negatively influenced if they were young fathers, partners of teenage mothers, fathers from low-income families and black fathers, highlighting the influence that socio-economic status may have. Furthermore, Yongman (1984, 1985; Yongman et al., 1995) indicates that premature infant development is influenced by the father's involvement, showing a significant association between the father's ability to engage his premature infant in play at 5 months and the infant's developmental outcomes at 9 and 18 months post-term (Yongman, 1984). Similarly, the early involvement of fathers, in terms of how frequently they visit their hospitalised infant, has been linked to better social and adaptive development of the preterm infants at 18 months of age, with more extensive and positive patterns of fathering and better perceptions of the infant at 8 and 18 months of age (Levy-Shiff, Hoffman, Mogilner, Levinger & Mogilner, 1990).

1.4.5 Preterm infant development

A growing body of research indicates that biological and environmental risks interact over time, influencing development (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987; Spiker, Ferguson, & Brooks- Gunn, 1993). Preterm infants are likely to present adverse neuro-developmental outcomes, covering motor, sensory, cognitive and behavioural domains. In preterm infant populations, 75% is composed of late preterm infants born after the 34th week of GA; however, literature on preterm infant development has mainly focused on very preterm infants.

The most recent review of preterm birth developmental outcomes (Arpino, Compagnone, Montanaro, Cacciatore, De Luca, Cerulli, Girolamo & Curatolo, 2010) reports cognitive impairment to be the most common and severe disability in preterm infants. The authors report that when infants are born below the 32nd week of gestation (very preterm infants) there is a linear relationship between gestational age and cognitive development (Bhutta, Cleves, Casey, Cradock & Anand, 2002; Wolke, Schultz & Meyer, 2001; Marlow, Wolke, Bracewell & Samara, 2005). However, in cases of infants born beyond the 33rd weeks of gestation, such a relationship was not found (Wolke, Schultz & Meyer, 2001). Disruption to a critical stage of brain development in children born below 33 weeks has been reported as the major cause of such findings (Peterson, Vohr, Staib, Cannistraci, Dolberg et al., 2000).

Many studies have also reported the impact of both medical and social factors (Johnson, 2007). Research examining the cumulative risk to children's development has found that as the number of biological and psychosocial risks increases, cognitive outcomes decline (Liaw & Brooks-Gunn, 1993; Sameroff, Bartko, Baldwin, Baldwin, & Seifer, 1998). A recent review of cognitive development of very preterm infants showed that poorer cognitive outcomes have been associated with perinatal factors such as cerebral ultrasound abnormalities, chronic lung disease, subnormal head circumference, retinopathy of prematurity, IVH, PVL and use of antenatal steroids (Johnson, 2007). Moreover, it was also strongly related to socio-economic status, as previously found for term population (Johnson, 2007). On the other hand, improvements in cognitive development are related to positive mother-infant interactions during the first years of life (Beckwith & Rodning, 1996; Forcada-Guex et al., 2006; Crnic et al., 1983).

Therefore, biological and environmental factors seem to have a double effect. However, in the case of severe biological risk, the potential impact of positive environmental factors loses its compensatory effects (Wolke, 1998). Predictive factors of later cognitive development are preterm infant motor development at 1 year (Burns, O'Callaghan, McDonell, & Rogers, 2004; Jeyaseelan, O'Callaghan, Neulinger, Shum, & Burns, 2006) and previous cognitive outcomes (Johnson et al., 2007).

Very preterm infants are also at risk of greater long term behavioural and emotional disorders (Achenbach, 1991), such as inattention and hyperactivity (Bhutta et al., 2002; Aarnoudse-Moens, Weisglas-Kuperus, van Goudoever, & Oosterlaan, 2009; Hayes & Sharif, 2009; Stein, Siegel & Bauman, 2006). Environmental risk factors related to behavioural and emotional disorders are maternal distress, duration of hospitalisation and disturbance in parent-infant interaction (Arpino, Compagnone, E., Montanaro, M. L., Cacciatore, D., De Luca, A., Cerulli, A., et al., 2010).

Maternal characteristics including dimensions of emotional involvement, warmth, and sensitivity to the infant's cues have all been positively related to accelerations in infant development (Forcada-Guex et al., 2006). Importantly, maternal sensitivity and responsiveness were found to be powerful predictors of later social and linguistic competence (Beckwith & Rodning, 1996; Cusson, 2003). This is of particular relevance because problems in language development are difficult to detect in preterm infants before the pre-school years (Anderson & Doyle, 2003; Largo, Molinari, Comenale Pinto, Weber, & Duc, 1986; Luoma, Martikainen, & Ahonen, 1998; Sansavini, Rizzardi, Alessandroni, & Giovanelli, 1996; Wolke & Meyer, 1999).

1.5 Conclusions

From the above literature it is clear that preterm birth puts the infant's development at risk and disrupts the parental bonding processes (Kennel & Klauss, 1998; Klauss & Kennel, 1982; Saigal & Doyle, 2008). Preterm infants and their parents experience a deviation from the typical environment, which for the infant would have been the maternal womb and for the mother the continuation of her pregnancy. Developmental psychology and neuroscientific literature recognise the direct link between very early relational experiences and bonding on the infant's development (Grossmann & Johnson, 2007; Sameroff, 2010; Schore, 2001; Shonkoff, 2010), as development depends upon the dynamic interaction between genetic factors and environmental stimulations (Shonkoff, 2010). In accordance with this perspective, a preterm infant's development is highly influenced by the abrupt change in primal environment and by the disruption of the growth that takes place during the last trimester of gestation. These disruptions heavily impinge on the preterm infant's capacities to initiate, promote and reciprocate social and emotional interactions with his/her caregivers. Taking into account the different stages of maturation of the foetus in terms of sensory, motor, and neurobehavioural development, a preterm infant is born with a repertoire of capacities that derives from the gestational age at birth. During the postnatal period, the preterm child's developmental competences are dependent upon infant physiological status (Arpino et al., 2010; Johnson, 2007) and socio-economic background (Johnson, 2007), and are fostered through the establishment of the experiences of reciprocal interactions with the parents (Beckwith & Rodning, 1996; Forcada-Guex et al., 2006; Crnic et al., 1983).

Based on the literature presented, some elements are outstanding and seem to demand a deeper investigation, in terms of research that can be carried out to explore the long term psychological and developmental influences on preterm infants and their parents. The main areas which are affected by preterm birth are: maternal psychological status (Affleck et al., 1991; Thomson et al., 1993; McGrath et al., 1993; Meyer et al., 1995; Singer et al., 1999; O'Brien et al., 1999; Doering et al., 2000; Brooten et al., 1988); mother-infant relationship in terms of maternal representation of the child, bonding, and interaction (Forcada-Guex, et al., 2006; Muller-Nix, et al., 2004; Feldman & Weller, 1999); paternal psychological well-being (Lee et al., 1991; Parke & Tinsley, 1982; Rimmerman & Sheran, 2001); and father-infant relationship (Rimmerman & Sheran, 2001) and bonding (Sullivan, 1999). These areas are all implicated in the parental-infant ties affected by the preterm infant's medical difficulties, by the separation between parents and preterm infant, and by the NICU environment.

Indeed, throughout the first years of the infant's life, the literature reports the negative consequences of the psychological components quoted above on the parent-infant's ties.

However, the causes of these negative consequences are still disputed and are in need of further investigation. For instance, central to this discussion, the findings are equivocal in establishing what is the contribution of the infant’s medical risk at birth to the parents' distress and to the difficulties in parent-infant interaction (Carter et al., 2005; Feeley et al., 2005; Zelkowitz et al., 2007). Conversely, during the postnatal period, the maternal psychological status is related to the fact of having experienced a preterm birth regardless of the gestational age of her newborn, to the actual infant’s post discharge health (Carter et al., 1997; Gamba et al., 2009; Garrel, 1993; Singer et al., 1999), to the degree of support available and to the quality of the couple relationship (Carter et al., 2007; Garrel et al., 2004). The mother-infant relationship instead seems to be mainly affected by the mother's interrupted prenatal attachment representation process, early separation, and fear of losing the infant (Feldman et al., 1999; Forcada-Guex et al., 2006; 2011; Muller-Nix et al., 2004).

Chapter 2

Literature review on the Kangaroo Care procedure and its impact on preterm infant, mother and father

2.1 Introduction

The evidence found regarding the effects of the Kangaroo Care (KC) intervention in the preterm infant and his/her mother and father is reviewed in this Chapter. The aim is to provide an analysis of the existing literature regarding the effect of KC on maternal psychological status, on the mother-infant dyadic relationship, and on the preterm infant's development during the first year of life. Background information in terms of how the KC procedure was developed from its origins to its more recent applications, as well as in terms of its impact on the preterm infant's health, is provided in the first section. Lastly, the existing evidence on the influence of KC on fathers is presented.

2.2 Kangaroo Care procedure

KC intervention for preterm and low birth-weight (LBW) infants and their families was initially developed by Edgar Rey in 1978, in order to address the lack of incubators, cross-infection, overcrowding, scarcity of resources and infant abandonment that were all commonplace at the time in Colombia. Preterm infants, once they had reached a stable medical condition, were placed naked on their mother's chest, between the breasts in order to facilitate nursing, while the heat of the maternal body regulated the temperature. In this way, the mother and other family members could act as natural incubators, 24 hours a day.

Three randomised controlled trials (Charpak, Ruiz, de Calume, & Charpak, 1997;

Sloan, Comacho, Rojas, & Stern, 1994; Whitelaw & Sleath, 1985) were conducted in Colombia to assess morbidity and mortality rates when the KC procedure was undertaken. It was shown that the KC intervention is a safe procedure, which does not increase morbidity or mortality rates of preterm infants as compared to infants in standard incubator care.

Since KC was developed, two modalities in its application have emerged, related mainly to the setting and the resources available, as this technique is now practised in developing as well as in developed countries (Charpak, Ruiz-Pelaez, Charpak & Rey-Martinez, 1994; Sloan, Camacho, Rojas, & Stern, 1994). The first modality is applied in developing countries with limited available medical resources, in which the original KC model is implemented. This consists of continuous (24h/day, 7 day/week) parent-infant skin-to-skin contact, early discharge from hospital with the infant in the kangaroo position, ideally exclusive breastfeeding and daily outpatient follow-up. It is recommended for all preterm infants from about 32 weeks of gestational age (Charpak et al., 1994; Sloan et al., 1994). It has been adopted as a part of health care policy in Colombia, Brazil, South Africa and Vietnam, and large health care centres in 25 developing countries now deliver KC (Ruiz-Pelaez, Charpak, & Cuervo, 2004).

The second modality emerged after the Kangaroo method spread to developed countries where advanced technologies are available. In this setting, intermittent KC with sessions of different lengths of skin-to-skin contact for a limited period per day is common (Nyqvist, & an Expert Group of the International Network on Kangaroo Mother: Anderson, Bergman, Cattaneo, Charpak, et al., 2010a). It is a recommended procedure for preterm infants of any weight, from 28 weeks of gestational age, in addition to standard neonatal care. The timing and duration of KC sessions are dependent on individual infant and parental physiological and behavioural responses; however, a minimum duration of one hour of KC per session is strongly recommended. This is because the transfer to / from KC position may be stressful for the infant (Cattaneo, Davanzo, Uxa, & Tamburlini, 1998; Charpak, Ruiz, Zupan, Cattaneo, Figueroa, Tessier, et al., 2005; Gale, Franck, & Lund, 1993; Nyqvist, Anderson, Bergman, Cattaneo, Charpak, Davanzo, et al., 2010b). KC in these settings is used to control stress in both mothers and infants, to promote physiological maturation and early bonding, and to facilitate breastfeeding (Charpak et al., 2005).

2.3 Effects of Kangaroo Care on preterm infants

Studies that have addressed the impact of the KC procedure on the preterm infant's health have covered a wide range of outcomes. In high-technology settings, the main physiological advantages of infants receiving intermittent KC during their hospital stay are a lower and more stable heart rate (Ludington-Hoe & Swinth, 1996), a decrease in apnoea and bradycardia (Bosque, Brady, Affonso, & Wahlberg, 1995; Fohe, Kropf, & Avenarius, 2000), a maintenance in body temperature and an improvement in oxygenation and gas exchange (Fischer, Sontheimer, Scheffer, Bauer, & Linderkamp, 1998; Fohe et al., 2000; Ludington-Hoe & Golant, 1993). These studies have demonstrated that preterm infants, even at a low gestational age, benefit from the fact that KC helps to improve and maintain their physiological stability. A Cochrane review (McCall et al., 2008) concluded that skin-to-skin contact is superior to routine practice for preventing hypothermia. Moreover, infants cared for with KC improve in arousal regulation and stress reactivity (Michelsson, Christenson, Rothganger, & Winberg, 1996; Mooncey, Giannakoulopoulos, Glober, Acolet, & Modi, 1997), have lower cortisol levels (Törnhage, Serenious, Uvnas-Moberg & Linberg, 1998) and show a more organised sleep-wake cycle, spending more time in quiet sleep, alert wakefulness and less time in active sleep (Acolet, Sleath, & Whitelaw, 1989; Feldman, Weller, Sirota, & Eidelman, 2002a; Feldman & Eidelman, 2003). Therefore, KC helps preterm infants in their difficulties during the transition from one stage of sleep to another, allowing more time in quiet sleep, which has a protective function in relation to environmental stimuli. Being held in the KC position also fosters motor organisation by minimising purposeless movements and by reducing the infant's reactions to loud noises or environmental changes which cause them to flail their arms, extend their legs, heave their chests and move their heads, using up oxygen and calories which need to be used for growth and development (Ludington-Hoe & Swinth, 1996). In addition, KC infants achieve a more mature neuro-developmental profile at term age, in particular in relation to their capacity to orientate their attention and to become accustomed to environmental stimuli. This shows KC's impact on autonomic system maturation (Feldman & Eidelman, 2003).

Finally, infants receiving KC present a faster growth rate in weight (Hann, Malan, Kronson, Bergman, Huskisson, 1999; Kambarami, Chidede, & Kowo, 1999; Tallandini & Scalembra, 2006; Wahlberg, 1991), and are discharged earlier from hospital, which points to the positive effect of skin-to-skin contact on the infant's physiological maturation (Acolet et al., 1989; Bosque et al., 1995; Ludington-Hoe, 1990).

Following discharge from hospital, KC infants are breastfed for longer periods when compared to infants cared for with standard incubator care (Bier, Ferguson, Morales, Liebling, Archer, Oh, et al., 1996; Ramanathan, Paul, Deorari, Taneja, & George, 2001; Whitelaw, Heisterkamp, Sleath, Acolet, & Richards, 1988). They present longer alert states, less crying (Whitelaw et al., 1988) and a better ability to modulate arousal in accordance with the presentation and termination of external stimulation at three months (Feldman et al., 2002a). The latter results indicate that KC before term age has a lasting effect on preterm infants as they achieve a more organised sleep-wake cycle, and as they become more adept at regulating negative emotions, modulating arousal, sharing engagement with the mother and objects, and sustaining effortful exploration (Feldman et al., 2002a).

As illustrated by Table 2.1, the long-term influence, up to 24 months, of KC on the preterm infant's psychomotor development has been investigated by only three studies. One was on continuous KC (Tessier, Cristo, Velz, Giron, Nadeau, Figuera de Calume, et al., 2003) and two were on intermittent KC (Feldman, 2004; Miles, Cowan, Glover, Stevenson, & Modi, 2006), and they have applied different procedures in the implementation of KC in relation to its setting and recommended duration.

In low-technology hospital settings, through a large randomised controlled trial, Tessier et al. (2003) demonstrated the benefit of continuous KC on the preterm infant's cognitive score at 12 months (CA), as measured by the Griffith Scale of Mental Development. They showed that the infants who benefit most from KC were those with a higher medical risk at birth and a doubtful neurological status at 6 months. The domains in which there was the most benefit were hearing-speech, personal-social and performance; the latter domain includes the ability to plan and coordinate complex hand and eye skills, such as manipulating different objects at the same time.

Table 2.1: Literature on the Impact of KC on Infant Psychomotor Development

Authors	Participants	KC Intervention	Measures	Results	Limits
Continuous KC					
Tessier et al., 2003 (Colombia)	N = 336 < 1801 g BW Mean GA 30	RCT 183 infants on 24hours/7days KC discharged from hospital 153 infants on TC	6 months: Neurological status (Infanib) 12 months: Griffiths Mental Developmental Scales	At 12 months: KC children had higher scores on the Mental scale	Randomisation prior to consent
Intermittent KC					
Feldman et al., 2004 (Israel)	N = 146 Mean BW 1270 g Mean GA 31 weeks	73 mother-infant KC at 31-34 weeks GA in stable medical condition – at least 1 hour a day for 14 days matched to 73 mother infant TC from another hospital	At 6, 12 & 24 months: Bayley II Mental and Motor Developmental Scales	At 6 months only: KC children presented better Motor skills At 6, 12 & 24 months: KC children had a higher scores on the Mental scale	Convenient grouping dependent on hospital at birth
Miles et al., 2005 (UK)	N = 78 < 32 weeks GA Mean BW 1100 g Mean GA 28	RCT 46 mother-infant KC covered with blanket for at least 20 min. a day for 4 weeks 32 mother-infant TC	12 months: Hammersmith Infant Neurological Examination; Fagan Test of Intelligence; Griffiths Mental Developmental Scales & ITSEA; GHQ-28; PSI – child domain; MPAQ	At 12 months: No between groups significant differences were found	Randomisation prior to consent

In high-technology hospital settings, Feldman, Eidelman, Sirota and Weller (2002b; Feldman, 2004) reached similar conclusions, through the implementation of regular intermittent KC during the infant's hospitalisation, with daily sessions lasting at least one hour for at least 14 days (Feldman et al., 2002b, Feldman, 2004). At 6 months (CA) infants who received such intermittent KC scored significantly higher on motor and cognitive development on the Bayley II Scales, and such results were maintained on their cognitive development at 12 and 24 months (CA) (Feldman, 2004). On the other hand, a later study conducted in the UK by Miles et al. (2006) did not find any beneficial effects of intermittent KC on extremely preterm infant development at 12 months (CA) using the Griffith Scale of Mental Development. Differently from the aforementioned study, in the Miles et al. (2006) study, it was recommended that mothers provide skin-to-skin contact, starting within the first week after the infants' birth regardless of their physiological stabilisation, for a minimum of 20 minutes a day for four weeks.

2.4 Effects of Kangaroo Care on mother-infant dyads

2.4.1 Short-term effects: from hospitalisation to discharge

In the early nineties, researchers began investigating the impact of the KC procedure on psychological variables related to maternal well-being and on mother-preterm infant dyads. All the studies conducted up to now are illustrated in Table 2.2 below. At the time of this thesis' development in 2006, in comparison with the infant's physiology and medical health, this area of study was less well researched.

The initial studies on this topic were based on qualitative research, aiming to describe the maternal experience of practising intermittent KC during hospitalisation. Such studies showed that KC mothers were more focused and confident in meeting the needs of their infants, felt more comfortable with the surroundings and had greater self-esteem (Affonso, Bosque, Wahlberg & Brandy 1993; Gale et al, 1993) compared to mothers who did not experience KC with their infant. More recently, there has been evidence on some of the ways the KC procedure facilitates maternal behaviours and mother-infant bonding as well as the ways it helps restore the mother-infant relationship within the neonatal intensive care environment (Johnson, 2007, Roller, 2003; Neu, 2004). In particular, one recent study (Johnson, 2007) reported how, with KC, mothers' confidence increases regardless of the infant's health status, from a state of feeling nervous and scared to feelings of "being needed" by the child and the nursing staff. Through the close bodily contact achieved by KC, mothers were shown to be more able to focus on their infant, displaying nurturing behaviours. KC holding was experienced as qualitatively different from other types of holding such as holding the infant fully dressed or wrapped in a blanket; it triggered maternal feelings and allowed mother-infant mutual exploration (Johnson, 2007). This highlights the role of KC in initiating mother-infant acquaintance, which facilitates the development of the mother's identity, in a situation and environment that potentially inhibits such a process (Roller, 2003).

These studies have contributed to our understanding of the maternal experience within the NICU setting. However, they have relied on very small samples and have not been based on an experimental design, lacking a control group.

The first extensive investigation on KC's psychological impact was carried out in low-technology hospitals settings, where the original KC model was implemented (24h/day, 7 day/week). This was part of a large randomised controlled study reported in the previous section (Tessier et al., 2003) by Tessier, Cristo, Velez, Giron, de Calume, & Ruiz-Palaez, (1998). The authors investigated mothers' feelings and perceptions of their preterm delivery experience, and the responsivity of mother and child to each other during breastfeeding at 41 weeks of GA. KC was performed for 24 hours a day until the infant demonstrated, through his/her behaviour, that he/she was ready for more independent interaction. Tessier et al. (1998) found that mothers in the KC group felt more confident and less stressed, especially when the intervention started 1 to 2 days after birth, as well as in the cases when the infant needed intensive care. They were also more sensitive to and cognitively stimulated their infant more than mothers using traditional care, in the context of a longer hospital stay. However, with high-risk infants, both mothers in KC and standard care groups showed behavioural patterns that were adapted to a child's health status.

In high-technology settings, only four studies were published at the time of this project's development. Specifically, the psychological effect of KC was investigated in Israel (Feldman et al., 2002b; Feldman, Weller, Sirota, & Eidelman, 2003), Italy (Tallandini & Scalembra, 2006) and the UK (Miles et al., 2005; Whitelaw et al., 1988).

The results deriving from these studies did not agree on the beneficial psychological effect of intermittent KC on the mothers. Two studies conducted in the UK showed that skin-to-skin contact resulted in neither beneficial nor adverse consequences on psychological maternal outcomes (Whitelaw et al., 1988; Miles et al., 2006). The first study was a randomised controlled trial conducted by Whitelaw et al. in the late 1980s. The effect of KC was studied on preterm infants below 1500 grams at birth. Skin-to-skin contact was performed for an average of 30 minutes each day. Mothers in both groups were asked to answer a non-standardised questionnaire on depression and on their feelings and confidence in looking after their infant. Upon the infant's discharge from hospital, no psychological advantage for mothers who performed skin-to-skin contact with their infant was found. Similarly, Miles et al. (2006) conducted a pragmatic randomised controlled trial on preterm infants born below 32 weeks gestation. Mothers were asked to provide skin-to-skin contact, starting within the first week after the infant's birth, for at least 20 minutes a day for 4 weeks. Upon discharge, the authors did not find any differences between the control and skin-to-skin groups in terms of maternal depression, anxiety, and parental stress.

On the other hand, Feldman et al. (Feldman, et al. 2002b) demonstrated a positive impact of the KC intervention on the parenting process. Differently from the above studies, KC was implemented for a longer daily session of at least one hour per day, for 14 consecutive days, and it was only implemented after the physiological stabilisation of the infant and the mother. In this context, the authors found that once the preterm infant reached 37 weeks of GA, KC mothers were less depressed, perceived their infants as less abnormal and showed more positive affect, touch, and adaptation to the infant's cues. Their infants showed more alertness and less gaze aversion. Such results are in line with what has been successively found by Tallandini and Scalembra in Italy (2006). There, KC was also provided for sessions of at least 1 hour per day until the infant reached a satisfactory degree of physical maturity. The authors assessed parental stress before the beginning of KC and at discharge, as well as mother-infant interaction at discharge. They showed that, at discharge, mothers who had experienced KC had a significant decrease in maternal emotional stress. Moreover, the KC intervention produced a better mother-infant interactive style; in particular, KC infants displayed a higher capacity to respond to their parents than non-KC infants.

In support of these results, a further recent study (Ahn, Lee, & Shin, 2010) confirms partially the positive effect of KC on maternal outcome variables as previously found by Feldman et al. and Tallandini and Scalembra. Indeed, Ahn et al. showed that, following 3 weeks of KC intervention with daily sessions of 1 hour a day, mothers bonded better to their infant than mothers who had not experienced KC. No differences were found in this study on symptoms of maternal depression.

2.4.2 Long-term effects during the first year following discharge

Mother-infant interaction

Prior to the present study, Feldman et al. (2002b; 2003) were the only group who investigated KC's impact starting from after hospital discharge up to 6 months (CA) of the infant's life in comparison with standard incubator infant care. In their first study (Feldman et al., 2002b), they showed that at 3 months (CA) KC parents provided their infants with a better home environment. At 6 months (CA), during dyadic interaction, KC mothers were more sensitive, adaptive, warm and resourceful than mothers in the control group, who did not provide KC. In a further publication on the same cohort, Feldman et al. (Feldman et al., 2003) also demonstrated that at 3 and 6 months (CA) KC infants showed lower negative emotionality during their interaction with their mother, compared to control infants. Finally, they found that the entire family benefited from the mother-infant experience of KC, reporting a more cohesive relationship among family members, compared to families in the control group.

In the last 2 years, further research has been conducted to broaden the understanding of intermittent KC's effects on later mother-infant interaction; in all the following studies, KC daily sessions were of at least 1 hour a day or even more (Bigelow, Littlejohn, Bergman & McDonald, 2010; Neu & Robinson, 2010; Chiu & Anderson, 2009). However, the findings have been inconclusive so far. For instance, Chiu and Anderson (2009) studied the long-term influence of KC on mother-infant interaction at 6, 12 and 18 months of age. They conducted a randomised controlled trial comparing mother-infant dyads practising KC with dyads receiving routine care. In the KC intervention group, mothers were encouraged and supported to begin KC as early and as often as possible, with a mean group duration of 1 hour a day for 11 days. The authors used the same scale that this thesis uses, as well as Tessier et al. (1998), Tallandini & Scalembra (2006), (the NCAF) in order to measure mother-preterm infant dyadic interaction. They reported that KC mothers had higher scores on maternal sensitivity to infant cues, in response to distress and social and cognitive growth fostering, but the differences between the two groups were not statistically significant. Surprisingly, in this study, KC infants at 6 months were significantly less likely to respond to their caregivers' cues compared to infants in the routine care group; such a difference was no longer present at 12 and 18 months. Another study carried out by Bigelow et al. (2010), revealed a more positive impact of KC on maternal interactive style at a mean infant's age of 8 months. They demonstrated that the amount of skin-to-skin contact that a mother provided in the first 24 hours of her infant's life was directly linked to her maternal sensitivity, as measured by the NCAF again. This indicates that the amount of early mother-infant skin-to-skin contact predicted subsequent maternal sensitivity. This study was conducted on a South-African sample of LBW infants and their mothers as part of the follow-up of mother-infant dyads participating in a randomised controlled study (Bergman, Linley, & Fawcus, 2004) investigating physiological stabilisation in the first six hours of life in LBW infants receiving KC versus incubator care. The results of this study, however, cannot be directly compared with research on this topic because the randomisation between KC and control infants was applied only during the first six hours of the infants' life. After this initial period, all mothers were allowed to provide KC to their infant. As a result, the follow-up sample consisted of mother-infant dyads that had experienced different amounts of KC during hospitalisation, without a proper control group.

Another recent study (Neu & Robinson, 2010) provided stronger evidence than the previously cited studies regarding the long-term benefits of KC at six months of age, on a sample of healthy preterm infants and their mothers. The focus of this study was on co-regulation between mother and infant. The term *"co-regulation"* indicates an aspect of the mother-child interaction *"during which the dyad functions as an integrated entity to regulate* *each other's behaviour"* (p. 401). The researchers compared a KC group who were required to provide 1 hour skin-to-skin daily session for 8 weeks, to a group who held their dressed infant wrapped in a blanket for the same amount of time, and to a control group who did not have holding constraints. The Still-Face Paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978) was used to measure dyadic co-regulation during mother-infant interaction and the infant's response to the mother's sudden and unexpected change in facial expression, displaying a neutral face. The authors demonstrated that mother-infant dyads supported in practising KC in the early weeks of life developed more symmetrical behaviours than mothers in the other two groups. The neutral face was a novel experience for most dyads, and mothers and infants in the kangaroo group responded to this novelty with co-regulatory skills that allowed them to have a rewarding experience even after the stress of the neutral face episode. In fact, infants in the kangaroo group displayed more positive behaviour compared to infants in the other two groups. The authors suggested that the infants had a higher ability to arouse the mothers' positive affect and to contribute to the interaction by actively smiling and vocalising because they were more self-regulated than other infants. Indeed, as previously reported (Feldman et al., 2002a), KC enhances the infants' physiological regulation.

Maternal psychological well-being and maternal bonding towards the infant

At the time of this research project's development, only the initial longitudinal results on maternal psychological status and on maternal bonding towards the infant were provided by Miles et al. (2006). The results are part of the randomised controlled trial discussed in the previous sections. The authors did not find differences between the control and KC groups on maternal psychological distress in terms of depression and anxiety at 4 months (CA) and on parenting stress at 4 and 12 months of the infant's age (CA). Moreover, they did not find differences in maternal bonding towards the infant at 12 months (CA). As highlighted in the previous sections, in this study the amount of skin-to-skin contact was quite limited with a mean duration of 20 minutes a day for four weeks.

After the development of this PhD project, a study in which the KC group was required to be provided with skin-to-skin contact for at least 6 hours per day starting as soon as possible after birth, showed (Gathwala et al., 2008) that 3 months after hospital discharge, KC mothers developed a stronger bond with their infants. This was shown by their increased involvement in caregiving activities and in time providing care, compared to mothers who did not do KC. However, the results from this study were obtained from a non-standardised questionnaire and are therefore difficult to evaluate.

Therefore, KC's longitudinal impact in this area reports data that are highly equivocal and difficult to compare, due to methodological differences and due to the different implementation of KC.

2.5 Effects of Kangaroo Care on the premature father-infant dyads

Literature on the influence of KC performed by fathers is almost totally absent. Ludington-Hoe, Hashemi, Argote, Medellin and Rey (1992) studied the cardiorespiratory, thermal and behavioural responses of 11 healthy premature infants to two hours of paternal skin-to-skin contact within the first 17 hours of birth. They concluded that fathers could be a source of warmth and comfort to premature infants as an alternative to mothers. However, Gale et al. (1993) reported that fathers have more difficulties than mothers in providing KC to their preterm infant. They observed the behaviour of a sample of 25 high-risk mechanically ventilated preterm infants and their parents, in response to the offer of KC procedure. Fathers were more unwilling than mothers to hold their infants skin-to-skin. 29% of fathers held the infant only once and 71% of them for less than 5 hours.

At present, the only published study reporting direct evidence of KC's psychological impact on fathers is provided by Tessier, Charpak, Giron, Cristo, de Calume and Ruiz-Pelaez (2009), as part of the follow-up to a randomised controlled trial conducted on continuous KC. In this setting, fathers and mothers shared the provision of KC with their preterm infants; however, the authors do not specify the quantity of skin-to-skin contact provided by fathers. Through a maternal report on their partner's involvement, KC fathers were reported to participate more in the care of their preterm infant at 12 months (CA) than fathers who did not provide KC. This was positively correlated to the infant's psychomotor development.

Two studies, presented during the last international workshop on KC (2010), reported further evidence of KC's beneficial effect on fathers. Johnston, Campbell-Yeo, Filion, Nyut, Bourgault, & Duhn (2010) showed that fathers who provided KC to their preterm infants expressed similar feelings to those of mothers during the heel-stick procedure. Indeed, KC helped them in promoting bonding with the infant, in feeling more involved and in decreasing their parental stress. A further study using qualitative methodology in a sample of Indian fathers (Varela, Muñoz, Plata, & Moreno, 2010) indicated that KC has a positive effect on increasing paternal sensitivity in the infants' care. They also reported that fatherhood perceptions were enriched by the experience of KC thanks to early involvement and a larger sense of care responsibility towards the infant.

In the same way, the study conducted by Feldman, Weller & Sirota (2003) demonstrated the indirect impact of KC provided by mothers on fathers. KC mothers had partners who established better interaction with their preterm infant at 3 and 6 months (CA). This suggests that the KC intervention helps to create and to enhance the quality of the family as a developmental context for the preterm infant, which is further confirmed by the reported provision of a better home environment in KC groups (Feldman et al., 2003; Tessier et al., 2009).

QUANTATIVE STUDIES

Studies on maternal psychological distress and mother-infant interaction

Authors	Participants	KC Intervention	Measures	Results	Limits
Continuous KC					
Tessier et al., 1998 (Colombia)	N = 488 < 2001 g BW Mean BW 1698 g Mean GA 33 weeks	RCT 246 mother-infant on 24/7 KC with early discharge 242 mother-infant TC	Second day after delivery & 41 weeks GA: Mother's Perception of Preterm Birth Questionnaire 41 weeks GA: mother-infant feeding interaction (NCAF)	41 weeks GA: KC mothers: - more confident - less stressed - more sensitive to the infant - better capacity to foster the infant social and cognitive growth With high-risk infants, KC and Control mothers did not differ	Randomisation prior to consent Use of non standardized questionnaire
Intermittent KC					
Chiu & Anderson, 2009 (USA)	N = 95 Mean BW 2250 Mean GA 34 weeks	RCT 50 mother-infant KC at 33-35 weeks GA x an average of 90 min (range: 30-150 min) x an average of 11 days (range: 1-25 days) 45 mother-infant TC	6 months: mother-infant feeding and teaching interaction (NCATS) 12 & 18 months: mother-infant teaching interaction (NCATS)	6 months KC infants were less responsive to to their caregivers' cues compared to infants in the routine care group 12 & 18 months mother-infant dyads in KC and control group did not differ in their interactive capacities	Only one measure considered

Continuation 2/6

Authors	Participants	KC Intervention	Measures	Results	Limits
Feldman et al., 2002b (Israel)	N = 146 Mean BW 1270 g Mean GA 31 weeks	73 mother-infant KC at 31-34 weeks GA in stable medical condition – at least 1 hour a day for 14 days matched to 73 mother-infant TC from another hospital	<u>At birth</u>: CRIB II <u>At 37 GA</u>: BDI; NPI; Mother-Newborn Coding System for dyadic interaction <u>At 3 moths</u>: HOME <u>At 6 months</u>: Bayley II Mental and Motor Developmental Scales & Mother-Newborn Coding System for dyadic interaction	<u>At 37 GA</u> KC mothers had: - a better perception of the infant - less symptoms of depression - showed more positive affect, touch, and adaptation to infant cues KC infants: - more alertness and less gaze aversion <u>At 3 months</u> KC families provided a better home environment <u>At 6 months</u> KC infant had a better mental and motor development KC mothers were more sensitive, adaptive, warm and resourceful.	Convenient grouping
Neu & Robinson, 2010 (USA)	N = 65 Mean GA 33 weeks	RCT 22 mother-infant KC holding for at least 1 hour a day for 8 weeks 23 mother-infant blanket holding for at least 1 hour a day for 8 weeks 20 mother-infant TC no instruction on holding	<u>1st week after birth:</u> STAI & CES-D <u>6 months:</u> mother-infant interaction with Still Face Paradigm	<u>6 months:</u> KC group developed: - more symmetrical behaviours - mothers-infants dyads displayed co-regulatory skills to the novelty of the still face experience - mother-infant dyad were able to have a rewarding experience after the stress of the neutral face episode	Loss of 25% of sample at 6 months follow-up 2 out of 4 coders no blind to study design Holding in the three group started at different postnatal age of the child

Continuation 3/6

Authors	Participants	KC Intervention	Measures	Results	Limits
Tallandini & Scalembra, 2006 (Italy)	N = 40 < 1800 g BW Mean BW 1200 g Mean GA 30 weeks	19 mother-infant KC at 32-34 weeks GA in stable medical condition – at least 1 hour a day until infant physiological maturity 21 mother infant TC from another hospital	First week after birth: PSI-SF At 38 weeks GA: PSI-SF & mother-infant feeding interaction (NCAF)	At 38 weeks GA: KC mothers were less stressed and KC group mother-infant dyadic interaction: - better infant ability to make requests and to respond to parental interactive style - enhanced mother capacity to foster the infant social and cognitive growth	Convenient grouping
Miles et al., 2005 (UK)	N = 78 Below 32 weeks GA Mean GA 28 Mean BW 1100 g	RCT 46 mother-infant KC for at least 20 min. a day for 4 weeks 32 mother-infant TC	During hospital: infant plasma cortisol level Discharge: Parental Stressor Scale: NICU MABS; EPDS & STAI At 4 months: EPDS; STAI At 4 and 12 months: infant salivary cortisol level Behavioural Pain Scale on infant vocal distress latency and duration and maternal soothing 12 months: Hammersmith Infant Neurological Examination; Fagan Test of Intelligence; Griffiths Mental Developmental Scales & ITSEA; GHQ-28; PSI – child domain; MPAQ	No differences between KC and TC groups	Randomisation prior to consent KC performed less than 1 hour per session

Continuation 4/6

Studies on maternal bonding and feelings towards the infant

Intermittent KC

Authors	Participants	KC Intervention	Measures	Results	Limits
Ahn et al., 2010 (South Korea)	N = 20 < 1800 g BW Mean BW 1500 g Mean GA 32 weeks	10 mother-infant KC in stable medical condition – x 10 session of 60 min x 3 weeks 10 mother-infant TC from same hospital	Pre-post Intervention: infant's body weight, height and head circumference, Mother's EPDS and Mother-to-Infant Attachment Inventory	After 3 weeks of KC Mothers bonded better to their infant than mothers who had not experienced KC. No differences in depression symptoms between KC and TC mothers	Small sample size Non specified methodology No control group.
Gathwala et al., 2008 (India)	N = 100 Mean BW 1690 g Mean GA 35	RCT 50 mother-infant + 50 mother-infant control group KC initiated 1st-2nd day after delivery for at least 6 hours a day	3 months: structural maternal interview on attachment	At 3 months KC mothers had: - a stronger bond with their infants – higher involvement in caregiving compared to mothers who did not do KC	Use of non standardized questionnaire
Whitelaw et al., 1988 (UK)	N = 71 < 1500 g BW Mean BW 1140 g Mean GA 29 weeks	RCT 35 mother-infant on KC for 36 min on average x day 36 mother-infant on normal handling	Before discharge and at 6 months: 6 point scale questionnaire on maternal feelings for the baby At 6 months: diary on infant's behaviours	No differences between KC and Control mothers	Randomisation prior to consent Use of non standardized questionnaire KC performed less than 1 hour per session

Continuation 5/6

Studies on KC performed by fathers

Continuous KC

Authors	Participants	KC Intervention	Measures	Results	Limits
Tessier et al., 2009 (Colombia)	N = 338 < 2001 g BW	RCT 194 families on 24/7 KC with early discharge 144 families TC	<u>9-12 months:</u> HOME <u>12 months:</u> Griffith Scale of Mental Development. Father involvement measured by one item of the Mother's Perception of Preterm Birth Questionnaire	<u>12 months:</u> KC mothers reported that: - fathers had higher participation to their infant 's care This was positively correlated to the infant's development.	Randomisation prior to consent Use of non standardized questionnaire Father involvement measured through partner's perception

QUALITATIVE STUDIES

Continuous KC

Authors	Participants	KC Intervention	Measures	Results	Limits
Blomqvist & Nyqvist, 2010 (Sweden)	N = 23 Mean BW 2535 Mean GA 35	23 mother-infant 24/7 KC after birth	<u>5 to 3 years after hospital discharge:</u> likert scale questionnaire on mother's experience of continuous KC with one open question	Mothers showed good acceptance of providing their infants with 24/7 KC during hospitalization. Negative comments on: - lack of information about practical application of KC - feeling exhausted after caring for their infant in the hospital during the night	Retrospective design Non standardised measure
Affonso et al., 1993 (USA)	N = 8 Mean BW 1061 g Mean GA 28 weeks	8 mother-infant KC for 4 hours a day x 3 consecutive weeks	Weekly semi-structured interviews over a period of 3 weeks on mother's emotional reaction	KC was reported to: - help mother in be more confident in meeting the needs of their infants - improve mothers' self-esteem	Small sample size Different age at follow-up

Continuation 6/6

Intermittent KC

Authors	Participants	KC Intervention	Measures	Results	Limits
Johnson, 2007 (USA)	N = 18 Mean BW 1410 g Mean GA 29	Naturalistic inquiry design 18 mother-infant KC initiated in the first 2 weeks with 1h session for at least 3 days	First two weeks after birth: semi-structured interview on maternal experience of holding	KC was experienced as qualitatively different from other types of holding KC was reported to: - help the transition from being scared to feelings of "being needed" by the child and the nursing staff. - concentrate on their infant, with nurturing behaviours - trigger maternal feelings - allowed mother-infant mutual exploration	Small sample size Only one interview conducted
Roller, 2003 (USA)	N = 10 1500 -3000 g BW 32 - 36 weeks GA	Qualitative design 10 mother-infant KC began within the first 24h after birth	At 1 and 4 weeks after discharge: qualitative semi-structured interview main topic: "What was like to provide KC for your preterm infant while you were in the hospital?"	KC helps in: - initiating mother-infant acquaintance - restoring mother-infant relationship and bonding - facilitating the development of the mother identity	Small sample size No details of KC application length No control group Inclusion of 4 adolescent mothers and majority of African American

2.6 Conclusions

The KC method, which emerged out of necessity, has become a form of support for the preterm infant and his/her parents. In high-technology setting, skin-to-skin contact between parents and infant through KC promotes the physiological growth of the preterm infant and his/her autonomic nervous system maturation. Specifically, KC seems to address the preterm infant areas of main difficulties during his/her postnatal period at the NICU, due to his/her immature state, as explained in Chapter 1. Indeed, it improves arousal regulation, it increases the infant's capacity to habituate to and to cope with external stimulation, it stabilises the heart rate and it fosters the motor organisation by minimising purposeless movements.

In the context of a high-tech NICU, the knowledge available on the short and long-term psychological, behavioural and developmental impact of KC at the time of this research project was limited to four studies (Feldman et al., 2002b, 2003; Miles et al., 2006; Tallandini & Scalembra, 2006; Whitelaw, 1989). These studies, as has been extensively reported, did not obtain the same results on maternal psychological stress at the time of the infant's discharge (Feldman et al., 2002b, 2003; Miles et al., 2006; Tallandini & Scalembra, 2006; Whitelaw et al., 1988) and on preterm infant development at 12 months (Feldman et al., 2002b, 2004; Miles et al., 2006). Studies that showed a positive effect of KC (Feldman et al., 2002b, 2003; Tallandini & Scalembra, 2006) also demonstrated its positive outcome on mother-infant dyadic interaction (Feldman et al., 2002b, 2003; Tallandini & Scalembra, 2006) and on the quality on the home environment (Feldman, 2003), establishing the role of KC on producing in mothers a more sensitive parenting style. On the other hand, the sole longitudinal study on maternal psychological status and on maternal bonding towards the infant (Miles et al., 2006) has shown neither beneficial nor adverse effects of KC.

Two major differences among these studies were evident: a difference in research design and in the modality of KC application. The results deriving from the two RCTs did not show any positive effect of KC (Miles et al., 2006; Whitelaw et al., 1988). It could be argued that the positive effects found by Feldman et al. and Tallandini and Scalembra were due to a non-random assignment of KC intervention (Feldman et al., 2002b, 2003; Tallandini & Scalembra, 2006). However, potential pre-existing group differences were excluded by Feldman et al. by matching each child in the KC and Control groups in terms of the infant birth and medical characteristics and family demographic variables. Instead, Tallandini & Scalembra used a pre-post intervention design with infant medical characteristics and family demographic variables controlled between KC and Control groups.

The second among studies divergence is due to the disparity in the duration of the daily KC sessions. Whitelaw et al. (1988) reports a mean daily duration of 30 minutes of KC session and Miles et al.'s (2006) procedure prescribed the initiation of KC within a week after birth in a population of newborns with an average GA of 28 weeks at birth. In the latter, the recommended minimum duration was 20 minutes per day; the amount of contact provided by mothers ranged from 0 to 27 days (mean days 11.26) for a total average of 507 min. (range 0-3350 min.).

Conversely, in Israel (Feldman et al., 2002b) and Italy (Tallandini & Scalembra, 2006) KC was applied following a different procedure that proved to be efficacious for both mother and infant. In these two studies, KC was applied only when the physiological stability of both mother and infant were established (at an average GA of 31-33 weeks) with sessions that lasted at least 1 hour. Tallandini and Scalembra (2006) in their study did not establish a minimum number of days of intervention: KC was discontinued when the infant reached a satisfactory degree of physical maturity. Very recently, it has been specifically stated that sessions of KC of less than 1 hour can be stressful for both pre-term infants and mothers, more so in the case of very and extremely pre-term infants (Nyvisq et al., 2010b). This is particularly true for children at a low gestational age, such as in Miles et al. study. In fact, the child and the mother need to be allowed enough time to establish intimate contact and to recover from the delicate procedure of taking the child out of the incubator.

Since the end of the data collection of this research, further longitudinal studies have been published; three on the effect of KC on mother-infant dyadic interaction (Bigelow, Littlejohn, Bergman & McDonald, 2010; Neu & Robinson, 2010; Chiu & Anderson, 2009) and two on the maternal bonding towards the child during the hospital period (Ahn et al., 2010) and 3 months after the infant's hospital discharge (Gathwala et al., 2008). Common to all studies is the application of a KC daily session starting from 1 hour. The study of Neu and Robison is particularly relevant for the establishment of the efficacy of the impact of KC on the mother-infant relationship because it compares KC intervention to the holding of a dressed infant wrapped in a blanket, for the same amount of time. This points out that it is not only the closeness and contact between mother and infant - also achieved through the blanket holding - which leads to a beneficial effect of KC. KC must have specific characteristics that facilitates the development of the relational capacities of the dyads. Indeed, during KC, the mother's skin-to-skin contact with her preterm infant provides a more sensitive environment for the immature infant with multi-sensory stimulation including emotional, tactile, proprioceptive, vestibular, olfactory, auditory, visual, and thermal stimulation in a unique interactive style.

Nevertheless, the positive effect of KC previously found appears in the majority of the latest studies weakened by results based on very small sample sizes (Bigelow et al., 2010; Neu & Robinson, 2010), different research methodologies and application of KC (Bigelow et al., 2010) and the use of non-standardised measures (Gathwala et al., 2008), which lead to difficulties in generalising on the basis of the results obtained.

Research on the effect of KC on fathers is extremely limited and no studies so far have investigated the way that, in the context of KC, maternal and paternal variables relate to the outcomes found on the preterm infant development.

Chapter 3

The research project

3.1 Introduction

This chapter sets out the objectives of this research project and describes the methodology used.

3.2 Objectives and hypotheses

The effects of early parent-infant contact, in the form of the Kangaroo Care (KC) intervention, are investigated longitudinally throughout the infant's first year of life. The population under investigation consists of preterm infants and their mothers who experience a deviation from the typical primary environment - the maternal womb for the infant and the continuation of pregnancy for the mother - due to preterm birth.

In the event of preterm birth, both infants and mothers undergo a highly traumatic experience, as seen in Chapter 1. KC is an early intervention that aims to provide a "*growth facilitating interpersonal environment*" (Fox, 2010). It offers the parents a unique opportunity for bodily contact with their newborn infant. It also allows the immature preterm infant to recover at least some aspects of the prenatal environment. Through KC, the parent-infant relationship is characterised by multi-sensory exchanges, including emotional, tactile (skin-to skin contact), proprioceptive (gradual adjustment of the child's body on his/her mother's chest), vestibular (change of position from horizontal to vertical), olfactory (maternal and infant odour), auditory (sound of each other's heartbeat and hearing the parent's familiar voice) visual (maternal breast and the infant's face), and thermal stimulation (warmth of the parent and infant's skin) in a unique interactive style.

At the time in which this research project began, the studies that had already been published, offering psychological and developmental data based on comparisons of KC to routine incubator care in developed countries were very few (Feldman et al., 2002; Miles et al., 2006; Tallandini & Scalembra, 2006; Whitelaw et al., 1988) and they reported differing results, as seen in Chapter 2. The aim of this study was to investigate whether the previously reported beneficial effects of KC could also be observed in the present study on the following areas: the short-term psychological distress of the mother in terms of depression (Feldman et al., 2002b) and parenting stress (Tallandini & Scalembra, 2006); the maternal perception of her preterm infant (Feldman et al., 2002b); the mother-infant dyadic interaction at discharge (Tallandini & Scalembra, 2006) and at 6 months (Feldman et al., 2002b; 2003); the quality of home environment at 3 months (CA) (Feldman et al., 2003); and on effects on the preterm infant's development at 6 (Feldman et al., 2002b) and 12 months (CA) (Feldman, 2004).

The new points that this project aimed to achieve were to investigate the impact of structured KC intervention, longitudinally, on: maternal psychological distress at 3, 6, 9 and 12 months (CA); the mother-infant dyadic interaction at 12 months; the maternal bonding towards the infant at 6 and 12 months; and the impact on the quality of the proximal infant's environment in terms of the couple relationship and in terms of the social level of support available for the family. At the time that this research project was developed, two studies had shown no short or longitudinal effects of KC on maternal psychological distress at discharge (Miles et al., 2006) at 4 and 12 months (CA) in terms of anxiety, depression and parenting stress (Miles et al., 2006); on maternal bonding towards the infant at 12 months and on infant development at 12 months (CA). The reason of these null-results is believed to be due to the provision of a fragmented KC intervention, characterised by a short daily duration, a high variability in the length of intervention, and a pre-established beginning of intervention, defined as within a week after the birth of preterm infants born at 28 weeks of GA, regardless of their physiological stability.

The objective was to achieve the implementation of a well-defined structured KC intervention and to verify whether this would lead to clearer results in the areas mentioned above. As explained in Chapter 2, the KC intervention can be carried out as a continuous KC procedure 24-hours per day (Charpack et al., 1997) or as an intermittent KC procedure in which the time requested varies widely (i.e. Feldman et al., 2002b; 2003; Miles et al., 2006; Tallandini & Scalembra, 2006; Whitelaw, 1988). Continuous KC application, as suggested by Charpack et al. (1997), was not considered feasible in the context of UK hospitals where this project was carried out. This was due to the hospitals' organisational limits, the impossibility of the mothers to remain in hospital as inpatients during the full duration of their infants' hospitalisation, and the available space in the Unit. Continuous KC application was also seen as not feasible because of the mothers' personal constraints, for example when they had other children in the family or when there was no wider family context on which to depend, aspects that can be considered as culturally determined. As explained previously, in the research carried out on intermittent KC, different procedures have been used, mostly in terms of the length of time of each KC session per day and in terms of the minimum number of days KC is applied (Feldman et al., 2002; Miles et al., 2006; Tallandini & Scalembra, 2006; Whitelaw et al., 1988). It is here held that this is the major difference among studies, that can explain the difference in results. For the present clinical trial, Feldman's (2002b; 2003; 2004) procedure was selected; a minimum of at least one hour per day, which is also the recommended minimum daily duration for a KC session in high-tech settings (Nyvisq et al.

2010b), for at least 14 consecutive days.

The impact of this type of KC intervention was studied along the developmental paths of the preterm infant, of the mother-preterm infant's relationship and of the maternal psychological state. In this, the present study differs from previous studies published on this topic, in which KC effects on the outcome variables were not investigated comparing them across times but only at a single point of the infant's development. In this study, the selected longitudinal assessment times, after the infant's discharge, were decided on the basis of specific developmental milestones and changes, each of which enables the infant to implement different modes of communication in the interaction with his/her environment. Specifically, one of these selected times is at 3 months (CA) which is when the infant develops the capacity to pre-reach an object in his/her environment (Trevarthen, 1974), to use social smile for communication (Trevarthen, 1982) and to discriminate social/emotional cues in human faces (Nelson, de Hann, & Thomas, 2006). The next selected time is at 6 months (CA), when a shift occurs from a dyadic mother-infant context to a triadic mother-infant-object context (Carpenter, Nagell, & Tomasello, 1998; Striano & Bertin, 2005). It is also the time that the infant achieves the sitting alone position (Rochat & Goubet, 1995), starts to actively explore objects, starts to babble, begins displaying differential smiles (Polak, Emde, & Spitz, 1964) and starts to differentiate self from other (Butterworth & Harris, 1994) and to respond to facial and vocal expressions of emotions such as happiness, surprise and fear (Flom & Bahrick, 2007). Another such time is 9 months (CA), when independent mobility is partially achieved through crawling (Butterworth & Harris, 1994), when either visual or proprioceptive information are used to control the infants' posture in the environment (Berthental & Bai 1989), when the capacity of joint attention is established (Olafsen, Rønning, Kaaresen, Ulvund, & Handegård, 2006) and when the infant displays distress due to separation from the caregiver and due to fear of strangers, forming clear attachments to specific people (Ainsworth & Bell, 1970; Bowlby, 1969). The final selected time is at 12 months (CA), which is the time when the infant uses gestures and sounds meaningfully to communicate socially, produces the first words, is able to stand and begins the first independent steps (Butterworth & Harris, 1994).

In conclusion, the present study's objective was to verify whether a structured KC intervention, on the one hand, reduces the mothers' distress caused by preterm birth, and on the other hand, whether it fosters the mother-infant relationship. It also aimed to verify whether KC has long term effects on: the maternal bonding and perception of the infant, the mother-preterm infant dyadic interaction, the quality of the environment provided to the infant and the preterm infant development. All these areas have been investigated in order to verify whether the influence of KC was maintained across the first year of the preterm infant's life, selecting as checking time points relevant steps in child's development. These dimensions under investigation were chosen, firstly, because they are those areas in which mother and preterm infant experience the majority of difficulties. Secondly, because they are of pivotal importance to the preterm infant's healthy development and to the parent-infant relationship, as widely addressed in Chapter 1. Moreover, they also provide data comparable with previous KC research. The investigated dimensions were addressed longitudinally and in combination, which has been done for the first time in a study on KC.

The dimensions investigated were grouped in the areas of: 1) maternal psychological distress (addressing parenting stress, general anxiety and depression), 2) maternal bonding with and maternal representation of the infant, 3) development of mother-preterm infant dyadic interaction, and finally 4) the preterm infant's development (addressing cognitive, language, motor, socio-emotional and adaptive behavioural skills).

3.2.1 Research Questions

This research project aims to answer two main questions. First, whether KC, when applied as a well-defined structured intervention (of 1 hour a day for 14 consecutive days) alongside incubator care in high-tech NICU, promotes the formation of the parent-infant relationship and of bonding. Secondly, whether the KC intervention has a longitudinal impact on the specific areas investigated across the first year of the infant's life.

3.2.2 Hypotheses

The following hypotheses were developed:

1) The KC intervention will be efficacious in lowering parental stress (Tallandini & Scalembra, 2006), anxiety (Affonso et al., 1993) and depression (Feldman et al., 2002b) at discharge from hospital, helping parents to cope with the trauma of preterm birth. Going beyond the work of the previous studies, it is expected that such an effect will present itself throughout the whole first year of the infant's life among parents who experience KC.

2) The increased opportunity for physical closeness and affectionate behaviour between parents and infant, such as touch, gaze and contact exchanges will result in the development of a better quality of maternal bonding towards the preterm infant. As already found by Feldman et al. (2002b), it will also have a positive impact on ameliorating the mothers' representation of their infants.

3) The provision of an available, predictable and appropriate environment through the KC procedure will then facilitate the interactive style of the mother-infant dyads (Feldman et al., 2002b; Tallandini & Scalembra, 2006). During their interaction with the infant, KC mothers will be more sensitive and alert to their infants' cues, more responsive to their infant's distress, and better able to foster their infant in his/her emotional and cognitive

development. Moreover, KC infants will demonstrate a higher capacity to make demands towards their parents and respond to them, compared to the control group, from discharge to 12 months (CA).

4) In line with Feldman et al. (2003), who have shown that KC has an impact on the whole family, it is expected that the infant's proximal environment will benefit from KC intervention. Specifically, the parents will have a better parenting alliance, an increase in marital satisfaction and an improvement in the quality of stimulation they offer to the infant within the home environment.

5) Considering that infant development is directly related to early experiences and relationships (Samenorff, 2010), it is assumed that the KC intervention, which integrates rhythmic, sensory, and tactile stimulations into the mother-infant context (Kangaroo position), will promote the immature preterm infant's ex-utero maturation and as a result will produce better long-term developmental outcomes. The KC intervention will diminish the negative impact of prematurity on the infant’s development on cognitive (Feldman et al., 2002b; Tessier et al., 2003), communication, motor (Feldman et al., 2002b; Tessier et al., 2003), socio-emotional and adaptive behavioural skills. This will be tested at 6 and at 12 months (CA).

3.3 Methodology

3.3.1 Research Design

The research design is a pre-post clinical control study, where the experimental treatment is compared longitudinally to standard-of-care therapy at 6 points in time during the first year of the infant’s life (corrected age for prematurity, CA). Randomisation was precluded because KC is a care option available to parents, therefore it would have been unethical to apply a randomised design.

This was originally designed to be a prospective single site study, with recruitment of both control and experimental groups planned within the same hospital. The control group was recruited before the implementation of the intervention in the target hospital. However, the research design was converted from a single to a multi-site study because of the limited number of eligible children born in the targeted hospital and a simultaneous change in the NHS system. The latter involved the creation of collaborating networks of hospitals across London and the UK called Perinatal Networks, within which infants were frequently transferred on the basis of their health condition and of the geographical catchment area in which their families live. Therefore, the expansion of the research to other hospitals that were part of the same network was essential in order to monitor the infants' hospital stay, to implement and supervise each intervention across all hospitals involved, and to follow the infants up after discharge.

The multi-site design covered the North Central London Perinatal Network and the hospitals involved in the study were the UCLH as well as the Whittington, Barnet and Royal Free Hospitals. The network coordinates and delivers intensive and special care provision as a unique neonatal service in all units, sharing clinical guidelines and information concerning babies moved between hospitals. It covers newborn infants in the London Boroughs of Barnet, Enfield, Haringey, Camden, and Islington.

3.3.2 Ethics and R&D Processes

The research project was approved by the UCLH/UCL Ethics Committee and by the local Ethics Committee and Research and Development offices for the project's on-site suitability regarding each hospital involved.

Participation was voluntary. If at any time the participating families decided not to continue participating in the study, they were free to withdraw without further comment, penalty or alteration to mother and infant care. Each participating family was given an identification number and only the investigator could access the names and questionnaire data. With the video material, while it was recognised that complete anonymity would not be possible as the participants would be visually identified on tape, the participants were informed of steps that would be taken to ensure confidentiality. Videotapes were not used for any purpose other than for coding in order to answer the research hypotheses. Copies of the videotaped interaction were each given an identification number, coded by independent coders blind to the research aims, and securely stored in a locked cabinet. Videotapes will be kept securely for five years and then destroyed in accordance with the Ethics guidelines. Data were analysed and stored on two password protected computers in order to securely back up the information. Finally, no information about the project will be published in any form that will allow any individual to be recognised, without the direct consent of the participants' families.

3.3.3 Participants

Preterm infants and their parents were recruited in the selected hospitals between June 2006 and August 2008. Infants born at less than 37 gestational weeks (GA) and 2000 grams, who reached physiological stability, as decided by the medical team, were eligible for recruitment. Infants with major congenital malformations were excluded from the study, as were cases with any parental psychopathological history and/or any ongoing family social issues. The latter could in fact impinge on the psychological and behavioural variables investigated.

A power analysis calculated a sample size of 125 subjects, in order to detect differences between groups in relation to our primary outcomes with an alpha of .05 and a beta of .08, estimating an effect size of medium magnitude equivalent to ω^2_A of .05 (Keppel, Saufley, & Tokunaga, 2001).

Five hundred and sixty six (566) children of less than 2000 grams and less than 37 weeks of gestation were born during this period. Of these 267 (47%) were eligible to be approached. Two hundred and thirty eight (238) were approached and a total of 135 were recruited following consecutive admission to the NICU. The remaining 109 refused to take part in the research (see Figure 3.1). Twenty-nine (29) families were not approached even when eligible due to logistical problems.

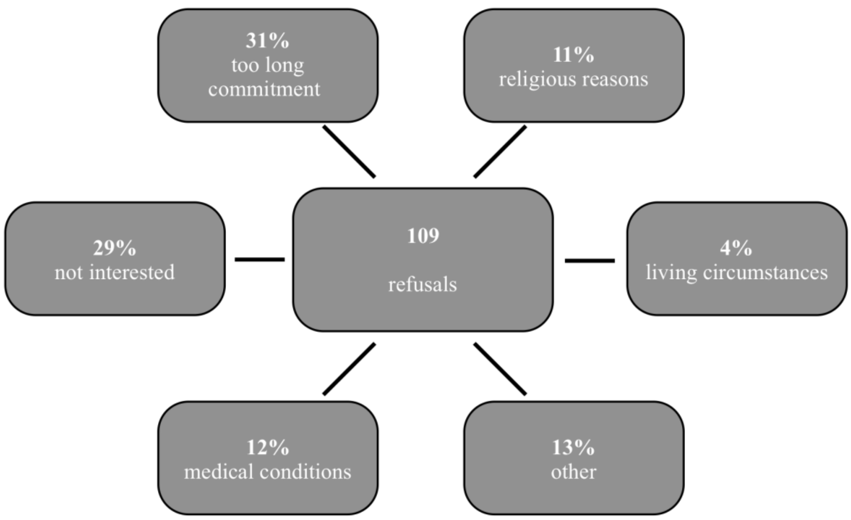


Figure 3.1 Percentage of Refusal to Take Part in the Study and Reasons Given by the Eligible Families

One hundred and thirty five (135) mothers agreed initially to take part in the research. However, of this sample, four children had to be subsequently excluded due to late diagnosis of severe cerebral palsy. These four families have been followed up, even though not considered part of the sample.

After the infants' discharge from hospital, the sample had an attrition of 30% since forty-one (41) families dropped out of the research. The reasons given were due to the health condition of the mothers and/or the infants, due to housing problems or due to a feeling that there was too much going on in their lives for them to be able to give time to the research.

The final sample consisted of 90 preterm infants and their mothers, of whom 56 infants experienced the KC procedure. The Control group consisted of 34 mother-preterm infant dyads with infants receiving traditional hospital care (TC). However, during the 12 months follow-up, 10 more families dropped out (see Table 3.1), four of which were between time 3 and time 4, four at time 5. Finally, at time 6, a family with twins dropped out because the children were re-hospitalised.

Table 3.1.Number of Participants Excluded and Dropped-out from the Research at Each Follow-up Time

Research Times	Dropped-out	Exclusion	In research
After birth	0	0	135
Discharge	41	4	90
3 months (CA)	2	0	88
6 months (CA)	2	0	86
9 months (CA)	4	0	82
12 months(CA)	2	0	80

3.3.4. Control variables

The following between-group variables were controlled for infants: gestational age (GA), birth weight, gender, parity, twins, and medical risk (CRIB II).

Family between-group control variables were: maternal and paternal age at infant birth, education, ethnicity, occupation, socio-economic status, number of children and mothers' personality characteristics. The latter control variable was necessary in order to exclude any personal characteristic bias in the mother's choice to provide Kangaroo Care to their newborn. Participants were assessed using a questionnaire to collect parental demographic information and infant medical characteristics (see Appendix 1). Moreover, parental personality characteristics were evaluated administering a standardised questionnaire (GPP-I, Gordon, 1993; see the measure section below for a full description). Socio-economic status was computed using the UK *National Statistic Socio-Economic Classification (NS-SEC, 2001).* Finally, infant neonatal risk was evaluated using the Clinical Risk Index for Babies (CRIB II) (Parry, 2003), which is calculated by compounding the influence of GA, birth weight, birth temperature, worst base excess in the first 12 hours of life, and gender.

Homogeneity test on the control variables between participants and drop-outs

The homogeneity between the group of families who dropped out of the research at the infant's discharge from hospital (at Time 2) and the families who participated in the remaining research times has been investigated through an examination of the families' demographic characteristics and the infants' medical condition at birth.

Chi-square analyses for participant characteristics expressed in nominal data (see Table 3.2) and one-way analyses of variance (ANOVA) for continuous variables (see Table 3.3) were performed. The dependent variables were participant characteristics, and the independent variable was group type.

The results show that the infants' health status did not influence the family's participation: no significant differences existed between the two groups in relation to the infants' birth gestational age, weight, Apgar score at 5 minutes and medical risk (CRIB II) at the entry of the trial. However, the following differences were found in relation to demographic variables: maternal age, $F\,(1, 134) = 9.23$; $p = .003$, marital status, $\chi^2\,(2, 134) = 10.65$; $p = .005$, mother's occupation, $\chi^2\,(3, 134) = 16.16$; $p = .001$, and family socio-economic status, $\chi^2\,(7, 134) = 27.78$; $p < .001$. As illustrated in Table 3.2 and 3.3, the results indicate that those mothers who dropped out of the research group tended to be younger, single, with a higher percentage of unemployment and lower economic status than the mothers who participated.

Table 3.2: Univariate Analyses of Infant Characteristics and Family Demographics Between Participant Families and Drop-out Families

	In Research		Drop-out		F	P
	Mean	SD	Mean	SD		
Infants' characteristics at birth:						
Gestational Age (days)	219.48	23.23	214.02	21.43	1.74	Ns
Weight (grams)	1443.64	442.51	1392.38	416.144	.42	Ns
CRIB	4.02	4.36	5.14	4.33	1.44	Ns
Apgar	9.07	1.08	8.70	1.27	2.94	Ns
Demographic Characteristics:						
Maternal age	34.77	5.02	31.76	6.39	8.97	.003
Paternal age	36.85	5.56	35.61	6.73	1.21	Ns

Table 3.3: Pearson Chi-square Analyses of Infant Characteristics and Family Demographics Between Participant Families and Drop-out Families

	In Research %	Dropt-out %	Chi-sq	P
Infants' characteristics at birth:				
Male	58.9%	60.0%	.150	Ns
Twins	42.2%	28.9%	2.269	Ns
First child	64.4%	47.4%	3.230	Ns
Ethnicity:				
Caucasian	60.0%	51.1%	1.085	Ns
Black	14.4%	17.8%		
Asian	7.8%	11.1%		
Other	17.8%	20.0%		
Demographic Characteristics:				
Marital status				
Married/co-habiting	95.6%	84.1%	10.65	.005
Single parent	0.0%	11.4%		
Other	4.4%	4.5%		
Mother's education				
Left school before 16	1.1%	2.3%	.551	Ns
Left school after 16	98.9%	97.7%		
Father's education				
Left school before 16	1.1%	2.5%	.522	Ns
Left school after 16	98.9%	97.5%		
Mother occupation				
Employed	95.6%	72.7%	16.16	.001
Housewife	4.4%	18.2%		
Going to school	0%	4.5%		
Unemployed	0%	4.5%		
Father occupation				
Employed	98.9%	95.0%	4.99	Ns
Unemployed	0.0%	5.0%		
Other	1.1%	0.0%		
Family's SES				
High managerial-1	50.0%	27.3%	27.78	.000
Lower managerial-2	30.0%	22.7%		
Intermediate occupation-3	6.7%	6.8%		
Small employers-4	1.1%	9.1%		
Lower technical-5	3.3%	6.8%		
Semi-routine occupation-6	7.8%	4.5%		
Routine occupation-7	1.1%	9.1%		
Never worked/unemployed-8	0.0%	13.6%		

3.4 Procedure

Participants' recruitment

As stated before, the Control group was recruited at a time when the KC procedure had not yet been implemented in the ward. Children in the Control group did not receive the KC procedure; however, the parents were free to visit the infant at the NICU at any time of the day and to hold the infant once it became feasible in terms of the infant's health. The same standard hospital procedure was followed for all pre-term infants recruited during the research.

A number of eligible children were identified and a list was collated from the unit admission data on a daily basis. In consultation with the nurse in charge of the identified child, each child was screened in relation to the inclusion and exclusion criteria. Once both mother and child reached physiological stability, the child's parents were approached for recruitment. A participant information statement (see Appendix 4) was given to all eligible parents and the full research plan was explained in detail. Both parents were invited to take part in the research. Data from mothers are reported here; in terms of data from fathers, see Chapter 5.

Approaching subjects for consent, the researcher emphasised that participation was voluntary. Potential participants were given at least 24 hours to consider their decision of participation in the study. Before written consent was obtained, the researcher ascertained that the parents had understood the extent of their involvement in the study.

During the infants' hospital stay, informal contact was maintained between the researcher and the families. Once the infant was discharged from hospital, the family was reminded of the next step of the research and its timing.

KC procedure - preliminary stage

The KC implementation was sustained by a UCLH Neonatal Consultant, Dr Angela Huertas-Ceballos, responsible for all on-site research activities. She actively supported the spreading of knowledge, the implementation and the practice of KC among medical and nursing staff and parents.

Three major issues were identified in the literature in relation to the NICU staff. The first had to do with the pre-conceptions of considering KC a sub-standard form of care, even if supported by sound scientific principles, as it does not involve technology and is a low-cost procedure (Charpak & Ruiz-Pelaez, 2006; Johnson, 2007b). The second issue was that KC might be perceived as extra work for nursing staff operating in busy high-tech environments. In such settings, the high frequency of inappropriate nurse-to-infant ratios can potentially make it difficult for nurses to support parents during the initiation of KC. However, after a few sessions, the main provider of the infant's basic needs and the front-line monitor of the baby's condition becomes the mother, who progressively relieves the health professional of many routine activities (Charpak & Ruiz-Pelaez, 2006). The nursing staff might also feel uncertain in assessing the infant's readiness for KC and may have concerns regarding the infant's safety and his/her physiological stability (Johnson, 2007b). Lastly, in relation to the parents, in some cases there have been reports that they may disregard the opportunity to offer KC to their pre-term infant due to potential cultural issues, which might arise in contexts where skin-to-skin contact between KC providers and the baby is considered inappropriate. This could be because of an inadequate level of privacy during the teaching of KC and it also might have to do with the presence of cultural barriers that prevent paternal participation (Charpak & Ruiz-Pelaez, 2006).

In order to address these issues and to attain a consistent KC method, appropriate medical staff guidelines were developed (see Appendix 2). The guidelines were based on the WHO guidelines for 24-hour application of KC. All medical staff had easy access to the guidelines and to the scientific papers supporting KC. Moreover, posters were hung on the walls of the NICU wards and an information booklet was placed in the staff teaching library. In addition, an information sheet describing KC was created for the parents (see Appendix 3).

The following procedural steps were applied before the implementation: 1) the achievement of a mutual medical team agreement to implement KC in the wards, which was obviously indispensable and was in particular highly supported by the consultant pediatrician (Angela Huertas-Ceballos); 2) the introduction of a KC-trained nurse in charge of the technical aspects of the procedure (that transpired to be very successful in alleviating the initially perceived burden by the nursing staff); 3) the training of nurses on KC and parental support; 4) the provision of regular teaching sessions for the Nursing Staff; 5) the teaching of parents through the provision of instruction on the practicality and safety of KC (i.e. how to position, hold, and transfer the infants in and out of incubators); 6) the provision of continuous support to parents during KC sessions, if required and 8) the provision of continuous training with regular verification of implementation strategies and meetings with parents.

KC procedure - practical implementation

KC was implemented in the wards during the second year of data collection, after the recruitment of the Control group.

As previously reported, for the present clinical trial KC was recommended to mothers following the well-defined procedure carried out previously by Feldman et al. (200a, 2002b, 2003, 2004), which prescribes a minimum of 1 hour per day for at least 14 consecutive days.

The KC procedure was offered to all mothers, regardless of their willingness to participate in the research project. Each preterm infant's readiness was medically evaluated, the major requirement being that the baby and the mother needed to both be physiologically stable. Decisions about KC suitability were made by the clinical team and major attention was given to the willingness of the mothers. The adoption of KC was therefore the result of an informed decision reached by parents.

The KC procedure consisted in placing the infant naked - except for a nappy, socks, and cap - on their parent's chest in an upright position (see Figure 3.2 and Appendix 2 pages 7-9). Parents carried out KC seated in a comfortable chair located beside the infant's incubator. They were provided with a personal pack with a support binder to secure the baby on their chest and also with a mirror to see their baby's face. Additionally, they were given a diary in which they had to indicate the time at which each session began and finished and to note who had provided KC to the infant. In the diary, they could also write any observations or comments they wanted to.

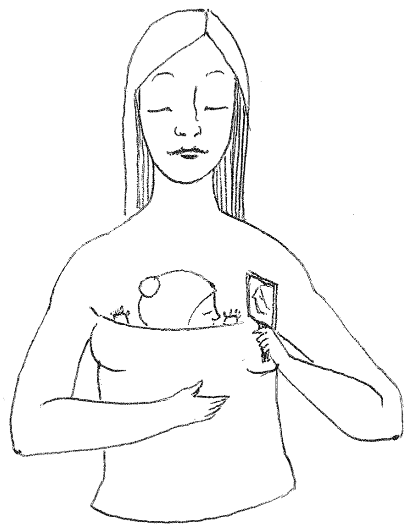


Figure 3.2 KC Position - Adapted from *Kangaroo Care Guidelines* by M. A. Tallandini, A. Huertas-Ceballos, L. Genesoni & L. Curran (2006) in Appendix 2.

In the current study, KC was initiated between the infants' 28th and 36th gestational week (Mean = 32 weeks GA), which depended upon the time of infant physiological stabilisation and gestational age at birth. Mean infant postnatal age at entry in the KC group was 15 days (SD = 10.86; range: 2-55).

KC intervention was recommended for at least 1 hour per day for 14 consecutive days. All mothers provided sessions of KC which lasted at least 1 hour; however, not all mothers completed the full recommended length of 14 days of intervention. The full implementation of the intervention was provided by 33 mothers (Mean = 2158.17 minutes; range 880-5625). The other 23 mothers provided less than the recommended KC time (Mean = 478.8 minutes; range 60-820). As we aimed to test the efficacy of a specific application of KC, the KC group was subdivided into two groups, which were considered separately for the analyses. The group providing the required amount of KC was termed "Intervention KC" and the other, "Limited KC".

Follow-up stage

Each follow-up visit was arranged by telephone contact and was organised at the family home during one of the infant's feeding times in order to observe mother-infant interaction. The researcher video-recorded mother and infant during a feeding session at the place where the mother usually fed her infant. A small digital video camera with a built-in microphone was used and the researcher positioned herself in such a way as to minimise the effect of her presence on the mother-infant daily routine. The mother was asked to feed her infant as usual. The full feeding session was recorded.

3.4.1 Data collection

The research consists of six assessments done at distinct times: 1) before starting KC; 2) at hospital discharge – within two weeks after the infant's discharge; 3) at 3 months; 4) at 6 months; 5) at 9 months and 6) at 12 months (CA), as illustrated in Table 3.5.

Time 1 data collection provided the first psychological assessment of parents before the application of KC procedure. Completion of the questionnaire occurred in a quiet area of the NICU at a time convenient for the participants. Parents who had agreed to participate were asked to give demographic details, to complete the questionnaire on personality, GPP-I, and also to fill in, for the first time, the questionnaires (see Table 3.5). In relation to the measure of parenting distress, PSI-SF, parents were asked to complete only the sub-scale of Parental Distress because the items of the other two sub-scales are not age appropriate at this specific time of the child's development (see the next section for a full explanation of each questionnaire). The child's medical data were retrieved from hospital medical notes.

Time 2 data collection was carried out within the first two weeks after the child was discharged from hospital. A specific time frame was established in order to allow the same period of time for each family to settle at home with their preterm infant. At the time of the visit, all mothers were asked to fill in a set of questionnaires (see Table 3.5), and a video of the mother-infant interaction during feeding was registered.

The subsequent data collections were all carried out at the homes of the participating families and the set of measures carried out are presented in the section below and in Table 3.4. Their administration at each point of the research is outlined in Table 3.5.

Data coding

Self-report questionnaires were coded by myself and re-coded by another independent coder, unaware of group assignment.

The videos on interaction were analysed by independent judges, unaware of the group assignment of each dyad. The judges were trained in the coding system used (NCAFS, see next section for instrument description), which requires inter-observer reliability of 85% (Barnard, 1975). The 85% inter-observer reliability must be achieved with a partner on at least five cases using the NCAF scale. The judges' codings were compared using Cohen's coefficient, and an inter-observer reliability equal or above 0.85 was always achieved.

Table 3.4: Summary Table of the Areas Investigated and the Measures Administered

Areas	**Explanatory variables**	**Measure**
Parental psychological stress	Parenting stress	*Parenting Stress Index, PSI/SF, (Abidin, 1995)*
	Anxiety	*Beck Anxiety Inventory, BAI (Beck & Steer, 1993)*
	Depression	*Beck Depression Inventory, BDI (Beck, 1978)*
Maternal bonding and infant's representation	Perception of the infant's behaviours	*Neonatal Perception Inventory, NPI-I & II (Broussard & Hartner, 1970)*
	Parental bonding	*Maternal Post-natal Attachment Questionnaire, MPAQ & Paternal Post-natal Attachment Questionnaire, PPAQ, (Codon & Corkindale, 1998)*
Mother-preterm infant dyadic interaction	Interaction	*Nursing Child Assessment Feeding Scale (NCAFS; Barnard, 1975)*
Proximal environment	Quality of the home environment	*The Home Observation of the Measurement of Environment (HOME, Infant/Toddler version) (Caldwell & Bradley, 1984)*
	Parental relationship	*ENRICH Marital Satisfaction Scale, EMS Scale (Fower & Olson, 1993) & Parenting Alliance inventory, PAI, (Abidin & Bruner, 1995)*
	Social support	*The Family Support Scale (FSS) (Dunst, Trivette & Hamby, 1994)*
Preterm infant development	Cognitive, language, motor, socio-emotional and adaptive behaviours development	*The Bayley Scales of Infant Development III (BSID-III) (Bayley, 2006)*

Table 3.5: Measures Administered to Participants at Each of the Research Time Point

RESEARCH TIMES	**ASSESSMENTS*** Self-report measures	Observational measures	Developmenal Scale
Time 1 After physiological stability as been reached	Demographic questionnaire; Infant medical characteristics; GPP-I; BAI; BDI; Parental Distress Sub-scale of the PSI-SF; NPI; FSS; PAI; EMS		
Time 2 At discharge	BAI; BDI; PSI-SF; NPI; M/PPAQ; FSS; PAI; EMS;	15 minutes videotaped mother-infant interaction during feeding (NCAF)	
Time 3 3 months (CA)	BAI; BDI; PSI-SF; FSS; PAI; EMS; NPI	15 minutes videotaped mother-infant interaction during feeding (NCAF) Home	
Time 4 6 months (CA)	BAI; BDI; PSI-SF; M/PPAQ	15 minutes videotaped mother-infant interaction during feeding (NCAF)	BSID-III
Time 5 9 months (CA)	BAI; BDI; PSI-SF; FSS	15 minutes videotaped mother-infant interaction during feeding (NCAF)	
Time 6 12 months (CA)	BAI; BDI; PSI-SF; M/PPAQ; FSS; PAI; EMS	15 minutes videotaped mother-infant interaction during feeding (NCAF)	BSID-III

**Measure abbreviations are reported in Table 3.4 above*

3.5 Measures

The measures selected are summarised in Table 3.5, described below and included in Appendix 5. They addressed the areas investigated in this study and also provided data comparable to the results obtained by studies on KC in high tech environments conducted prior to this study (Feldman et al., 2002b, 2003; Miles et al., 2005; Tallandini & Scalembra, 2006).

Measures comprise the combination of standardized parent self-report questionnaires, observational scales and developmental scales. Due to the number of measures requested from mothers to be completed at each data collection, parental self-report standardised questionnaires were mainly chosen as the form of assessment. They were carefully selected as those questionnaires that are most widely used in the preterm population (Farel, Freeman, Keenan, & Huber, 1991; Harrison & Magill-Evans, 1996; Magill-Evans & Harrison, 1999; Singer et al., 2003), and/or validated against observational forms of assessments (Feldstein, Hane, Morrison, & Huang, 2004).

In relation to the mother-infant dyadic interaction, it was decided that it should be assessed during feeding times, in order to be able to investigate a familiar and frequent interaction between parent and child, in which the observer's presence would be less likely to interfere with the natural pattern of interaction, compared to an observation of a structured interaction. Moreover, because of the limited capabilities and interactional skills of the preterm infants at the time of discharge, it was decided that this would constitute the least stressful situation for both mothers and preterm infants.

All specifications for each measure used are detailed below.

Parental personality characteristics

Gordon Personal Profile Inventory, GPP-I, (Gordon, 1993)

This inventory combines the Gordon Personal Profile (GPP) and the Gordon Personal Inventory (GPI). It measures eight traits: ascendancy, responsibility, emotional stability, sociability, cautiousness, original thinking, personal relations, and vigour. The first 4 traits are also compounded to yield a measure of self-esteem. The test requires participants to self-score 38 sets of personal characteristics. Each set is composed of 4 descriptions. Participants are asked to examine each set and to select the description that is the "*most like*" them and then the one that is the "*least like*" them. Results are interpreted in percentile terms for each of the eight areas of personality assessed. Correlations with other personality measures (Guilford-Zimmerman Temperament Survey, Thurstone Temperament Schedule, Adult Opinion Survey, the Eysenk Personality Inventory, and 16 Personality Factor) support the construct validity of the eight scales. For example, GPP-I correlations with the Guilford-Zimmerman Temperament Survey (GZTS) are as follows: the GPP-I-Ascendancy scale and GZTS-Ascendance (.58); GPP-I-Sociability and GZTS-Sociability (.65); GPP-I-Vigor and GZTS-General Activity (.66); and GPP-I Cautiousness and GZTS-Restrain (.63). Good split-half reliability coefficients of nearly comparable magnitude are reported for each scale as follows: ascendancy .86, responsibility .88, emotional stability .89, sociability .88, cautiousness .83, original thinking .83, personal relations .83, and vigour .80.

Parental psychological stress

Three different measures were used to address specifically the stress related to the experience of being a parent, the general state of anxiety and depression.

Parenting Stress Index, PSI/SF (Abidin, 1995)

The PSI-SF was previously used in KC studies by Tallandini & Scalembra (2006), Feldman et al. (2003) and Miles et al. (2006). It is composed of 36 items divided into three sub-scales of 12 items each. The first sub-scale, *Parental Distress (PD)*, measures the distress the parent is experiencing in his or her role as a parent, on the basis of personal factors directly related to parenting. Its associated components are: impaired sense of parenting competence, restrictions placed by parenting on other life roles, conflict with the child's other parent, lack of social support and the presence of depression. The second sub-scale is *Parent-Child Dysfunctional Interaction (PCDI),* which focuses on the parent's perception that the child does not meet his or her expectations and that interactions with the child are not reinforcing him/her as a parent. The third sub-scale is *Difficult Child (DC),* which evaluates the basic behavioural characteristics of children that make them easy or difficult to manage. These characteristics are either rooted in the child's temperament or can also include learned patterns of defiant, non-compliant and demanding behaviours. This instrument also includes a *Defensive Responding Scale (DR)*, which assesses the extent to which the respondent approaches the questionnaire with a strong bias to present the most favourable picture of him or herself and to minimise indications of problems or stress in the parent-child relationship. The items are derived from specific questions of the *Parental Distress Sub-Scale.*

Each item of the sub-scales is scored on a 5-point Likert scale, ranging from 1 "strongly agree" to 5 "strongly disagree". A total raw score of >90 (or above the 90th percentile) indicates a clinically significant level of stress. The PSI has been extensively used to assess stress and parenting behaviour. It has a total score internal consistency-of .91; .87 for the PD sub-scale; .80 for the P-CDI; and .85 for DC. The total score test-retest reliability is .84, .85 for PD, .68 for P-CDI, and.78 for DC. The PSI/SF has a correlation of .94 with the full-length of the PSI.

Beck Anxiety Inventory, BAI (Beck & Steer, 1993)

The BAI assesses anxiety levels in adults and is composed of 21 items. Each item is descriptive of subjective, somatic, and/or panic-related symptoms of anxiety. It is a self-report measure, which asks respondents to rate the extent to which they have been bothered by each symptom over the past week on a 4-point scale ranging from 0 to 3. The total score is obtained from the sum of the items and can range from 0 to 63. Minimal anxiety ranges from 0 to 7, mild from 8 to 15, moderate from 16 to 25 and severe from 26 to 63. The scale is reported to have an internal consistency of .92 and a test-retest reliability of .75.

Beck Depression Inventory, BDI (Beck, 1978)

The BDI measures the presence and degree of depression in adults. It has also been widely used to detect post-natal depression amongst women (Affonso, De, Horowitz & Maybery, 2000) and it has also previously been used to study KC by Feldman et al. (2002b). It is composed of 21 items presented in a multiple-choice format. Each of the 21 items corresponds to a specific category of depressive symptom and/or attitude. Each category describes a specific behavioural manifestation of depression and consists of a graded series of four self-evaluative statements, to which a numerical value from zero to three is assigned. The BDI total score is the sum of the item scores and can range from 0 to 63; minimal depression ranges from 0 to 13, mild from 14 to 19, moderate from 20 to 28 and severe from 29 to 63. The test-retest reliability indicates a consistent relationship between BDI scores and the patient's clinical state of > .90. Internal consistency for the test items is .86.

Parents' bonding towards and representation of the infant

The Neonatal Perception Inventory, NPI-I & II (Broussard & Hartner, 1970)

The NPI questionnaire measures parental perceptions of their infant as compared to their idea of an average infant. It was previously applied in KC and researched by Feldman et al. (2002b). The parents are asked to assess their infant (Your Baby) and the average infant (Average Baby) in terms of physical and behavioural predictability. The six items of both the Your Baby and Average Baby sections are scored on a five-step scale ranging from 1 (none) to 5 (a great deal). The sum score varies between 6 and 30 for both sections. The NPI score is obtained by subtracting the Your Baby from the Average Baby sum score. The NPI score is categorised into better than average (positive) if the mother reports fewer problems in her baby than in the average baby, and not better than average (negative), when the mother reports as many or even more problems in her baby than in an average baby. Higher negative scores indicate that the parents perceive the child as being more difficult. A positive NPI score indicates that the parents perceive their baby as being less difficult than the average baby.

The Maternal and Paternal Post-natal Attachment Questionnaire, MPAQ (Condon & Corkindale, 1998), PPAQ (Condon, Corkindale, & Boyce 2008)

After a careful investigation, this measure of parental/maternal bonding with the infant was chosen because it is a well standardised questionnaire that positively correlates to the Attachment Q-Sort, a measure of infant to parent attachment (Feldstein, Hane, Morrison, & Huang, 2004). It was also selected based on its previous use by Miles et al. (2006). The MPAQ and PPAQ assess the mother's and father's feelings toward the infant, in terms of parental attachment indicators. They consist of a total of 19 items, each of which describes the frequency and intensity of the parent's responses to her/his infant on a five point Likert scale. The score for each item ranges from 1 (low attachment) to 5 (attachment). The questionnaire comprises three dimensions: Quality of attachment (QA), Absence of hostility (AH) and Pleasure in interaction (PI). The Internal consistency is .79 for MPAQ and .80 for the PPAQ and the test-retest reliability is .86. The criterion validity was established showing that MPAQ and PPAQ are both significantly positively related to the Attachment Q-Sort, a measure of infant to parent attachment (Feldstein, Hane, Morrison, & Huang, 2004).

Mother-infant dyadic interaction

The Nursing Child Assessment Feeding Scale (NCAFS; Barnard, 1975)

The NCAF was created to assess infants at high risk (Zeanah, 2009). It is a well validated and frequently used method of assessing mother-infant interactions, which has been used extensively in clinical practice in populations of preterm and very low birth weight infants during their first year of life (Farel, Freeman, Keenan, & Huber, 1991; Harrison & Magill-Evans, 1996; Magill-Evans & Harrison, 1999; Singer et al., 2003). Moreover, it has also been used in previous KC studies (Tallandini & Scalembra, 2006; Tessier et al., 1998).

The NCAFS assesses the quality of mother–newborn interaction during feeding. It is part of The Nursing Child Assessment Satellite Training (NCAST), composed by the NCAF and the Nursing Child Assessment Teaching Scale (NCAT), which is used during a novel situation. They are both based on the Barnard conceptual model (1976). This model assumes that caregivers and infants both have responsibilities in maintaining positive interactions. In the interaction between caregiver and infant, each responds and reacts to the other, adapting his/her behaviour to accommodate to or modify the other's behaviour. In cases where there is interference in the adaptive behaviour, either on the part of the caregiver or of the infant, the interaction is likely to be maladaptive, putting the infant at risk for infant mental health disorders.

The NCAF scale consists of 76 binary items structured into six conceptual sub-scales. Four of these sub-scales assess the mother's behaviour towards her infant, and look particularly at: S*ensitivity to Cues*, *Response to Distress*, *Social-Emotional Growth Fostering* and *Cognitive Growth Fostering*. The remaining two sub-scales examine the infant's behaviour towards his/her mother and focus on: *Clarity of Cues* and *Responsiveness to Parents*. This scale has been proven to have good internal consistency with a total score of 86, based on a sample of 845 feeding observations.

The internal consistency of the sub-scales that measure parental behaviour is: .60 for the Sensitivity to Cues sub-scale, .69 for the Response to Distress sub-scale, .63 for the sub-scale assessing Social-Emotional Growth Fostering, and .69 for the sub-scale assessing Cognitive Growth Fostering. The overall internal consistency of the Total Parent Score is .83. The following values refer to the internal consistency of the two sub-scales that assess infant behaviour: .56 for Clarity of Cues and .58 for Responsiveness to Parents. The overall internal consistency for the total score assessing infant characteristics is .73. The test-retest reliability of the NCAFS was calculated by administering the measure to a group of 30 mother–infant dyads, at intervals of 4 months each, a total of four times, showing a test-retest reliability of .75 for the sub-scales that describe parents' interactive behaviour, and .51 for the two sub-scales assessing infant interactive characteristics. The authors of the scale considered that there is a sizeable stability of scores over time, with greater stability for parent interactive behaviour and less stability for infant behaviour. The lower stability of the infants' scores was judged acceptable, in light of the developmental changes small infants inevitably undergo during their first months of life. Moreover, inter-rater reliability estimates are reported as 0.89 to 0.92 for NCAST scales (NCAF and NCAT) and internal consistency reliability estimates as 0.80 to 0.82 (Britton et al., 2001).

Infant's proximal environment

ENRICH Marital Satisfaction Scale, EMS Scale (Fower & Olson, 1993)

This questionnaire assesses the couple's marital quality. It consists of two sub-scales from the ENRICH Inventory and is composed of 15 items consisting of the Marital Satisfaction scale (10 items) and the Idealistic Distortion scale (5 items). Items are scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The score on the Idealistic Distortion Scale is used to correct the Marital Satisfaction scale score on the basis of the degree to which the respondent portrays the marriage in an unrealistically positive way. The score is derived by first scoring the Marital Satisfaction and Idealistic Distortion scales, then correcting the marital satisfaction score downwards on the basis of the respondent's Idealistic Distortion score. The scale has an internal consistency of .86 and test-retest reliability of .86. Moreover, it has a .73 correlation with the Locke-Wallace Marital Adjustment Test (MAT, Lock & Wallace, 1959) and a .66 correlation with the Family satisfaction scale (Olson & Wilson, 1982).

<u>The Parenting Alliance inventory, PAI (Abidin & Bruner, 1995)</u>

The PAI measures the degree of commitment and cooperation between mothers and fathers in childrearing. It is based on the definition of the four positive parenting alliance dimensions identified by Weissman and Cohen (1985, page 31): "(a) each parent is invested in the child, (b) each parent values the other parent's involvement with the child, (c) each parent respects the judgments of the other parent and (d) each parent desires to communicate with the other". Therefore, it relates to parents' ability to cooperate with each other by nurturing the child and meeting his/her developmental needs. It consists of 20 items on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). The PAI has an internal consistency of .97 and test-retest reliability after a 4 to 6 week period of .80.

<u>The Home Observation of the Measurement of Environment (HOME, Infant/Toddler version) (Caldwell & Bradley, 1984)</u>

In KC studies, Feldman et al. (2002b) also used the HOME as a measure of home environment. The HOME was developed to measure the quality and quantity of stimulation and support available to children in their home environment from birth to age 3. It is composed of 45 items clustered into 6 sub-scales: 1) Parental Responsivity, 2) Acceptance of the Child, 3) Organization of the Environment, 4) Learning Materials, 5) Parental Involvement and 6) Variety in Experience. The inventory is administered at the child's home.

The assessment consists of an observation of the parent-infant interaction and of an interview with the parents. The interview with the parents focuses on day-to-day life, discussing toys that are available to the child, ways in which the family arranges the daily routine and chosen methods of discipline. A binary-choice (yes/no) format is used to score HOME items. The Birth to Three total HOME score has an internal consistency of .89 and test-retest stability of .62 (6 months versus 12 months), .64 (6 months versus 24 months) and .77 (12 months versus 24 months).

The Family Support Scale (FSS) (Dunst, Trivette & Hamby, 1994)

The FSS is a multidimensional assessment tool designed to evaluate the degree to which different sources of support are helpful in rearing a young child. It comprises 18 items divided into 5 sub-scales, each of which pertains to one aspect of family life: partner/spouse, informal kinship, formal kinship, social organisations and professional services. Parents are asked to rate the helpfulness of different sources of support that may be available to them. A single question is asked: "How helpful has each of the following been to you in terms of raising your child"; and then a series of sources of assistance is listed. The parents are requested to indicate the amount of help received from each of these sources on a five-point scale, from 1 (Not at all helpful) to 5 (Extremely helpful). The measure can be scored based on: total help received (total number of sources of support); the average amount received for each sub-scale; or the total average amount of help received. Higher scores indicate greater levels of help received. The scale has an internal consistency of .79 and test-retest reliability of .91 for the total score, and .75 for the separate items.

Infant development

The Bayley Scales of Infant Development III (BSID-III) (Bayley, 2006)

BSID-III is an individually administered examination that assesses the developmental functioning of infants and children from age 1 to 42 months. It presents infants with situations and tasks designed to produce an observable set of behavioural responses. Additionally, the caregiver of each child is also asked to complete a questionnaire. It is composed of five scales: the cognitive, the language, the motor, the socio-emotional and the adaptive behaviours scales. The language scale is composed of expressive and receptive sub-scales and the motor scale is composed of fine end gross motor sub-scales.

A questionnaire, completed by the child's principal caregiver, measures the socio-emotional and adaptive behavioural development. The Social-Emotional portion of the Social-Emotional and Adaptive Behaviour Questionnaire measures development in infants and young children by identifying social-emotional milestones that are normally achieved by certain ages. The Adaptive Behaviour portion of the Questionnaire asks caregivers to respond to items that assess their child’s ability to adapt to various demands of normal daily living. Depending on the child’s age, children are measured on some or all of the following areas: Communication (Com): speech, language, listening and nonverbal communication skills; Functional Pre-Academics (FA): skills such as letter recognition and counting; Self-Direction (SD): skills such as self-control, following directions and making choices; Leisure (LS): activities such as playing and following rules; Social (Soc): getting along with other people, including skills such as using manners, assisting others and recognising emotions;

Community Use (CU): interest in activities outside the home; Home Living (HL): helping adults with household tasks and taking care of personal possessions; Health and Safety (HS): knowledge of basic health activities and physical dangers; Self-Care (SC): activities such as eating, toileting and bathing; and finally Motor (MO): locomotion and manipulation of objects.

Each scale of the BSDI-III presents good internal consistency reliability coefficients: cognitive scale .87, receptive communication .81, expressive communication .81, fine motor .82, gross motor .89, language .90 and motor .90, socio emotional scale .83 and adaptive behaviour .94.

Chapter 4

Results

Section 1: Mothers' and the preterm infants' outcomes

4.1 Introduction

This chapter provides a description of the statistical analyses carried out. Firstly, the analyses on the homogeneity among Control, Intervention KC and Limited KC are reported. Secondly, the plan of the statistics used to investigate the hypothesised effect of KC is explained. Finally, results are illustrated separately for each of the domains investigated: 1) maternal psychological distress, 2) mother's attachment toward the infant and representation of the infant, 3) mother-preterm infant dyadic interaction, 4) preterm infants' proximal environment and 5) infant's development.

4.2 Analysis of the homogeneity among the Intervention KC, Limited KC and Control group

The homogeneity among the research participants in the three groups was verified by analysing the infants' and families' baseline variables of the demographic characteristics among Intervention KC, Limited KC and Control groups. One-way analyses of variance (ANOVA) were performed to compare the control variables of infant medical information at birth, demographic variables, and maternal personality characteristics (GPP-I) across groups.

Chi-square analyses were used when participant characteristics were nominal**.** Family demographics and infant information for the three groups are summarised in Table 4.1 (ANOVA) and Table 4.2 (Chi-square), while maternal personality characteristics are summarised in Table 4.3.

Parental education, occupation, socio-economic status, ethnicity, marital status and distribution of twins, parity and mother's personality characteristics were homogeneous among the three groups. However, mothers in the three groups differed with respect to age, F (2, 90) = 3.52, p = .034. Inspection of Table 4.2 reveals that the proportions of male and female infants differed across the three groups, χ^2 (1, N=90) = 10.65, p = .005, as did gestational age, F (2, 90) = 18.98, p < .001, birth weight, F (2, 90) = 13.94, p < .001, and CRIB II score, F (2, 90) = 14.22, p < .001. Post-hoc comparisons showed that infants in the Intervention KC group were more premature, presented higher CRIB II scores (indicating a higher medical risk at birth) and had older mothers than the Control and Limited KC groups. The latter presented a greater number of boys than the other two groups. The Intervention and Control groups, however, did not significantly differ with respect to gender.

Table 4.1: Univariate Analyses of variance on Infants' Characteristics and Families' Demographics Between Intervention KC, Limited KC and Control Groups: statistical homogeneity among groups

	Intervention KC		Limited KC		Control		F	P
	Mean	SD	Mean	SD	Mean	SD		
Infants' characteristics at birth:								
Gestational Age (days)	203.12	22.41	224.83	18.64	231.74	17.18	18.98	<.001
Weight (grams)	1161.39	366.24	1562.04	387.25	1637.50	412.20	13.94	<.001
CRIB	6.72	4.50	3.43	2.97	1.79	3.64	14.22	<.001
Apgar	8.79	1.24	9.05	1.05	9.36	.859	2.42	Ns
Demographic Characteristics:								
Maternal age	36.48	5.43	33.17	3.22	34.18	5.21	3.52	.034
Paternal age	37.43	6.11	34.52	3.88	36.93	5.86	1.84	Ns

Table 4.2: Chi-square Analyses of Infants' Characteristics and Families' Demographics between Intervention KC, Limited KC and Control groups: statistical homogeneity among groups

	Intervention KC	Limited KC	Control	Chi-sq	p
	%	%	%		
Infants' characteristics at birth:					
Male	39.4%	82.6%	61.8%	10.64	.005
Female	60.6%	17.4%	38.2%		
Singleton	27.3%	52.2%	50%	4.80	ns
Twins	72.7%	47.8%	50%		
First child	63.6%	60.9%	67.7%	.290	ns
No first child	36.4%	39.1%	32.4%		
Ethnicity:					
Caucasian	48.5%	73.9%	61.8%	7.42	ns
Black	18.2%	4.4%	17.7%		
Asian	12.1%	0.0%	8.8%		
Other	21.2%	21.7%	11.8%		
Demographic:					
Marital status					
Married/co-habiting	96.9%	100%	91.2%	2.76	ns
Other	3.1%	0%	8.8%		
Mother's education					
Left school before 16	0.0%	0.0%	2.9%	1.66	ns
Left school after 16	100%	100%	97.1%		
Father's education					
Left school before 16	3.1%	0.0%	0.0%	.424	ns
Left school after 16	96.9%	100%	100%		
Mother occupation					
Employed	100%	95.7%	91.2%	3.07	ns
Housewife	0%	4.3%	8.8%		
Father occupation					
Employed	100%	100%	100%	.441	ns
Family's SES					
High managerial-1	60.6%	47.8%	41.2%	.402	ns
Lower managerial-2	26.5%	43.5%	26.5%		
Intermediate occupation-3	11.8%	0%	11.8%		
Small employers-4	0%	0%	0%		
Lower technical-5	5.9%	0%	5.9%		
Semi-routine occupation-6	11.8%	8.7%	11.8%		
Routine occupation-7	2.9%	0%	2.9%		
Unemployed-8	0%	0%	0%		

Table 4.3: Univariate Analyses of Variance on Mothers' Personality Characteristics Between Intervention KC, Limited KC and Control Groups: statistical homogeneity among groups

	Intervention KC		Limited KC		Control		F	P
	Mean	SD	Mean	SD	Mean	SD		
Ascendancy	21.94	6.09	24.00	3.97	22.07	5.56	1.047	Ns
Responsibility	26.26	5.08	26.48	4.09	26.22	5.37	.114	Ns
Emotional Stability	25.26	4.60	24.71	7.13	22.56	5.69	1.061	Ns
Sociability	21.10	4.58	23.38	4.53	22.22	6.64	1.526	Ns
Self Esteem	95.36	12.46	98.57	9.06	93.07	16.35	.963	Ns
Cautiousness	24.45	4.20	23.52	5.44	24.74	6.83	.345	Ns
Original Thinking	27.00	4.40	27.76	3.94	24.37	5.75	2.936	Ns
Personal Relation	23.61	5.90	21.76	6.63	22.85	5.17	1.336	Ns
Vigor	29.32	5.90	29.52	3.40	26.96	5.58	1.969	Ns

Given the differences in the amount of KC provided in the Intervention KC and the Limited KC groups and taking into account the aforementioned differences in infants' characteristics, Pearson's *r* correlations were computed between total amount of KC provided and: CRIB II, GA at birth, birth weight, postnatal age and GA at which KC was started, and total hospital stay. As shown in Table 4.4, the total amount of KC given to the infant was negatively correlated to CRIB II, GA at birth, birth weight, GA at which KC was started, and total hospital stay, and positively correlated to the postnatal age at which KC was started. These relationships indicate that the more immature preterm infants, those with greater medical risk, with lower birth weight, who had longer hospitalisation, who started KC at a lower GA but consequently at an older post-natal age, were the infants who received more KC. All relations were large size effects (Cohen, 1988).

Table 4.4: Correlations (Pearson's r) Between Amount of KC and Infants' Characteristics, Age at the Intervention's Start and Duration of Hospitalisation

	CRIB II	GA at birth	BW	Age at the start of KC	GA at the start of KC	Duration of hospitalisation
Total duration of KC	,47**	-,52**	-,45**	,40**	-,47**	,50**

Notes. GA = gestational age; BW = birth weight; CRIB II = infants' medical risk at birth

** Correlation is significant at $p < 0.001$ (2-tailed)

4.3 Statistical analyses

Given the statistically significant differences observed in the control variables among Intervention KC, Limited KC and Control groups, the CRIB II score was introduced as a covariate in the statistical analyses. The CRIB II score was chosen as covariate because it is a medical risk measure obtained compounding, among others risk indicators, the infant's GA at birth, birth weight and gender (see Chapter 3), Therefore, it takes into account all the variables which significantly differ among the considered groups. Indeed, as illustrated by Table 4.5, CRIB II, GA, birth weight are highly correlated.

Table 4.5 Pearson Correlations on the Preterm Infants' Variables at Birth of CRIB II Score, Gestational Age and Birth Weight.

	Birth weight (grams)	GA at birth (days)
GA at birth (days)	,806**	
CRIB II	-,806**	-,896**

** Correlation is significant at the 0.01 level (2-tailed)

GA = Gestational Age

Preliminary analyses on data distribution of the dependent variables showed that the data were positively skewed (skew values were equal or below 1) for the following measures: PSI-SF at 3 months (CA) in the Limited KC and Control groups and at 9 months (CA) in the Intervention KC group; NPI score at time 1 for the Intervention KC only; BDI and BAI in all groups; and finally Socio-emotional Scale for the Intervention and Control groups at 12 months. Conversely, they were negatively skewed (all skew values were equal or below -1.5) for: MPAQ at discharge in the Control and Limited KC groups and at 6 months for the Limited KC only; Cognitive Scale in the Control at 6 months and in the Limited KC group at 6 and 12 months; and Language Scale at 6 months in the Limited KC group and at 12 months in the Control group. Mean, standard deviation, range, degree of freedom are reported in the results section for each measure in the relevant Table. F-test is robust to violation of assumption of normality due to skewness as long as there are at least 20 degrees of freedom of error (Tabachnick & Fidell, 2007).

Therefore, repeated measures mixed-model analyses of variance and covariance (ANCOVAs) were used as statistical analyses. They were computed in order to test the effects of KC on the areas investigated longitudinally across the time laps considered and in order to ascertain whether participants had a different pattern of change over time, depending on which group they are associated with.

These analyses were based on the total number of participants who completed the follow-up assessments for each outcome variable (see Table 3.5, Chapter 3 page 114). The total number of mothers who remained in the study from time 1 to time 6 is 80. However, across testing times, few missing data were present due to mothers failing to respond to all questions in the self-report questionnaires and also due to mothers' unavailability at one of the times of data collection. With respect to PSI-SF, BDI, BAI and Bayley III, developmental assessment data were available for 75 mothers and infants (5 missing data). Scores on the NCAF and on the MPAQ were completed for 68 participants (12 missing data). Seventy-seven (77) mothers were scored in relation to the NPI (4 missing data). The PAI was filled by 63 (17 data missing) and the ENRICH by 61 mothers (19 data missing). In total, 19 mothers had at least one missing data point. In the analyses, missing data were dealt with using pairwise deletion.

In the repeated measures mixed-model analyses of variance (ANCOVAs) the within-participants independent variable was time (time point 1 through to time point 6, depending on the measure analysed), the between-participants independent variable was group (Intervention KC, Limited KC and Control group) and the covariate CRIB II score. The dependent variables were each of the total score of the outcome variables investigated. Results are reported in terms of time, time x group and group effects.

In case of either time or time x group effect, follow-up analyses using univariate analyses of variance and covariance (ANCOVAs) among the three groups were conducted for each measure at each time point. This was carried out to establish: 1) whether KC impacted on the dependent variable at a specific developmental stage of the child and 2) in case of measures of separate sub-scales (i.e. PSI-SF, MPAQ, and NCAF), whether KC acted upon precise components of the dependent variables. Multivariate analyses of variance and covariance (MANCOVAs) were carried out when a particular measure had several components measured separately; this was the case for parenting stress (PSI-SF), maternal attachment (MPAQ), and mother-infant dyadic interaction (NCAFS). The potential presence of interaction between the covariate and the independent variable was always examined. Sidak post hoc comparisons (with á = .05) were calculated when a KC main effect was present.

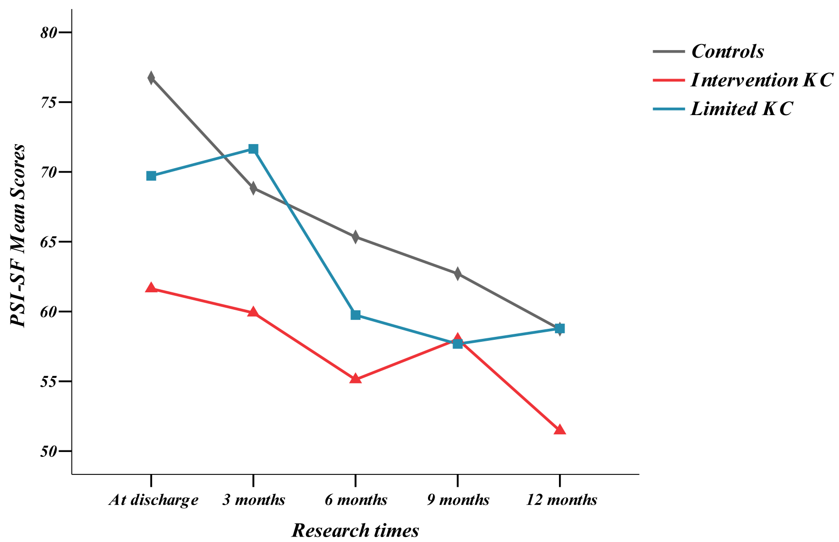
For the analysis of infant development (BSDI-III), both the longitudinal analysis with repeated measures mixed-model analyses of variance (ANOVAs) and when necessary the follow-up analysis with one-way analyses of variance at each scale and sub-scale at 6 (time 4) and 12 months (CA) (time 6) corrected for age, were performed without CRIB II as covariate. This is because BSID-III adjusts the child's score in relation to the degree of prematurity, by comparing the child to the normative results of children of his/her corrected age. Therefore, performance is already adjusted to the level of the child's prematurity. Group was the independent variable and the dependent variables were each of the BSID-III scales and sub-scales. In addition, chi-square analyses were performed among groups to test differences between the percentage of children who scored below and within the normal standardised range for each developmental skill area (cognitive, language, motor, socio-emotional and adaptive behaviour).

The measure of home environment (HOME) was analysed through univariate analyses of variance and covariance (ANCOVAs) and multivariate analyses of variance and covariance (MANCOVAs) for its sub-scales among the three groups at time 3. As before, the potential presence of interaction between the covariate and the independent variable was always examined. Sidak post hoc comparisons (with á = .05) were calculated when a KC main effect was present.

4.4 Maternal distress

4.4.1 Parenting Stress

Longitudinal analysis



Note: PSI-SF total was measured between time 2 to time 6.

At time 1 only the Parental Stress Sub-scale was administered

Figure 4.1: Total PSI-SF Scores Across the Research Time Points

A total number of 75 mothers were included in this analysis, out of which 29 were part of the Intervention KC group, 20 of the Limited KC group, and 26 of the Control group. The mean total parenting stress was measured from discharge (Time 2) to 12 months (CA) (Time

6) of the infant. Time 1 total parenting stress was not considered in this analysis, because only the sub-scale of *Parental Stress* was administered after the child's birth (see Chapter 3).

As illustrated in Figure 4.1, the total parenting stress of the three groups changed over the research times, F (4, 247) = 6.79, p < .001, showing a significant linear downward trend for time F (1, 71) = 18.90, p < .001. Differences in the parenting stress scores among the three groups was detected, as showed by a significant main effect of group, F (2, 71) = 4.32, p = .017. An indication of time x group interaction was shown; however, it did not reach a statistically significant level, F (8, 247) = 1.94, p = .065.

Follow-up analyses: time point evaluation

Given the above results on the longitudinal analyses, follow up analyses were conducted at each research point on both the total score of the parenting stress (PSI-SF) and on its sub-scales (*Parental Distress, Parent-Child Dysfunctional Interaction, Difficult Child and Defensive Responding*). Table 4.6 illustrates all the results.

Table 4.6 Univariate Analyses of Variance on Maternal Parenting Stress Between Intervention KC, Limited KC and Control Groups at Each Research Time

Measures*	Intervention KC			Limited KC			Control			df	F	P
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth												
PD	23.46	6.33	13-35	24.43	4.95	12-33	25.69	6.60	13-38	2, 84	2.36	Ns
DR	13.59	3.64	7-20	13.32	3.13	7-20	15.90	4.26	8-23	2, 84	3.52	.034
At discharge												
PSI-SF Total	63.60	17.89	35-94	69.71	16.28	46-107	79.09	17.58	49-115	2, 84	5.30	.006
PD	24.52	7.07	13-42	25.14	6.14	12-45	27.90	8.15	16-54	2, 84	1.43	Ns
P-CDI	19.30	4.76	12-29	21.01	6.50	12-34	24.82	6.84	12-36	2, 84	5.32	.007
DC	20.28	5.87	12-33	23.53	7.15	12-43	26.17	6.99	15-43	2, 84	4.91	.010
DR	13.54	4.06	7-24	12.78	3.36	7-21	15.09	5.20	7-32	2, 84	1.91	Ns
3 months CA												
PSI-SF Total	62.27	13.29	39-91	68.83	21.77	43-130	68.39	16.44	42-115	2, 80	.88	Ns
PD	24.30	5.74	12-38	25.55	9.24	12-43	25.38	7.55	12-44	2, 80	.16	Ns
P-CDI	17.44	3.94	13-26	18.07	6.06	12-35	20.21	5.29	12-35	2, 80	1.70	Ns
DC	20.17	4.94	13-31	22.39	7.93	12-57	22.16	6.43	13-40	2, 80	1.28	Ns
DR	13.53	3.90	7-23	14.99	3.88	7-24	14.53	5.26	7-29	2, 80	.58	Ns
6 months CA												
PSI-SF Total	57.54	11.30	36-77	59.34	14.73	39-92	69.28	13.88	41-92	2, 82	5.02	.009
PD	22.61	6.31	12-38	22.84	8.25	12-39	27.45	7.45	13-39	2, 82	2.93	.06
P-CDI	15.80	3.47	12-23	15.29	3.74	12-24	20.18	4.87	12-29	2, 82	8.08	.001
DC	19.66	4.97	12-30	21.21	6.32	13-33	21.68	5.01	13-31	2, 82	.67	Ns
DR	11.47	3.93	7-23	12.81	4.57	7-23	15.14	4.78	7-24	2, 82	4.37	.016
9 months CA												
PSI-SF Total	57.28	10.26	44-86	56.03	11.67	41-84	62.99	11.29	45-86	2, 70	2.18	Ns
PD	21.63	6.31	15-38	21.23	6.03	13-33	25.54	6.50	15-40	2, 70	2.91	Ns
P-CDI	16.10	3.02	12-22	14.91	3.36	12-22	17.01	4.41	12-27	2, 70	1.79	Ns
DC	19.77	4.72	13-37	19.82	5.98	12-37	20.70	4.93	13-33	2, 70	.80	Ns
DR	12.08	4.62	7-26	12.34	3.36	8-18	14.32	3.56	8-22	2, 70	1.95	Ns
12 months CA												
PSI-SF Total	51.47	11.20	37-73	57.04	14.34	39-87	59.23	15.99	43-87	2, 74	1.66	Ns
PD	19.12	6.41	12-39	19.78	6.08	12-33	22.99	6.70	13-37	2, 74	2.09	Ns
P-CDI	14.14	3.08	12-22	15.37	3.75	12-25	18.11	4.93	12-27	2, 74	5.26	.007
DC	20.41	4.73	13-27	21.74	7.63	12-38	20.41	5.17	13-30	2, 74	1.94	Ns
DR	10.80	3.68	37-73	11.39	3.61	7-18	13.39	4.33	8-22	2, 74	1.85	Ns

** Measures captions: PD = PSI-SF Total = Total Parenting Stress; Parental Distress Sub-scale; P-CDI = Parent-Child Dysfunctional Interaction Sub-scale; DC = Difficult Child Sub-scale; DR = Defensive Responding Sub-scales*

Before the beginning of the KC intervention, the mothers' parental stress did not differ significantly among the three groups, *F* (2, 84) = 2.36, *p* = .10. However, at this time point there was a significant difference between the groups on the *Defensive Responding sub-scale*, *F* (2, 84) = 3.52, *p* = .034. This sub-scale does not contribute to the PSI-SF total score and is a separate value, which is not an indication of stress (see Chapter 3). It showed that Control mothers displayed a significantly higher defensive response in answering to the PSI-SF items than Limited KC mothers but not than Intervention KC mothers.

At the time of the infants' hospital discharge, a significant difference among the three groups was found for the total PSI-SF score, F (2, 84) = 5.3, p = .006. Intervention KC mothers were significantly less stressed than Control mothers. The parenting stress of Limited KC mothers was not significantly different from either of the other groups. The MANCOVA on PSI-SF sub-scales revealed a significant between group difference on the PSI-SF sub-scales, *Wilks' Lambda F* (6, 156) = 2.35, p = .034. Analysis of each dependent variable showed that there was contribution from the *Parent-child Dysfunctional Interaction sub-scale*, F (2, 84) = 5.32, p = .007, and the *Difficult Child sub-scale*, F (2, 84) = 4.91, p = .01. In both sub-scales Intervention KC mothers presented lower stress scores than did Control mothers. Limited KC mothers did not differ significantly from the other two groups.

Even if at 3 months (CA) no statistically significant differences were found between the three groups, F (2, 80) = .88, p =.419, the results presented the same trend as at the previous time point and at 6 months (CA) a KC main effect was found for total parenting stress, F (2, 82) = 5.02, p = .009. Indeed, as previously reported, intervention KC mothers were significantly less stressed than Control mothers and again, Limited KC mothers were midway between but not significantly different from the other two groups. The subsequent analysis on the sub-scales showed significant difference, *Wilks' Lambda F* (6, 152) = 3.28, p = .005. The *Parent-Child Dysfunctional Interaction sub-scale, F* (2, 82) = 8.08, p = .001, significantly contributed with Intervention KC mothers and Limited KC mothers perceiving a less dysfunctional interaction with their child than did Control mothers. There was also a marginally significant contribution from the *Parental Distress sub-scale*, F (2, 82) = 2.93, p =

.06, with Intervention KC mothers and Limited KC mothers experiencing less parental distress than Control mothers. Finally, a significant difference among the three groups was also shown on the *Defensive Responding sub-scale*, F (2, 82) = 4.37, p = .016. Intervention KC mothers had a less defensive response in answering the PSI-SF items than Control mothers, but not significantly less than Limited KC mothers.

Again at 9 months (CA), the parenting stress mean scores followed the same pattern as at the previous research time points, with the Intervention KC group presenting the lowest scores, although the results were not statistically significant, F (2, 70) = 2.18, p = .121.

Finally, at 12 months (CA), as clearly illustrated in Table 4.5, the Intervention KC group presented a lower score in the total of parenting stress compared to the other two groups, but the difference among the three groups for the total score did not differ, F (2, 74) = 1.66, p =.198. Differently, the MANCOVA showed a significant between group difference, *Wilks' Lambda* F (6, 140) = 2.38, p = .032. Analysis on the single sub-scales indicated a significant contribution only for the *Parent-Child Dysfunctional Interaction sub-scale*. This revealed a long-term KC main effect, F (2, 74) = 5.261, p = .007, with Intervention KC mothers perceiving to have a less dysfunctional interaction with their child than Control mothers. Limited KC mothers did not differ significantly from the other two groups.

4.4.2 General anxiety

Longitudinal analysis

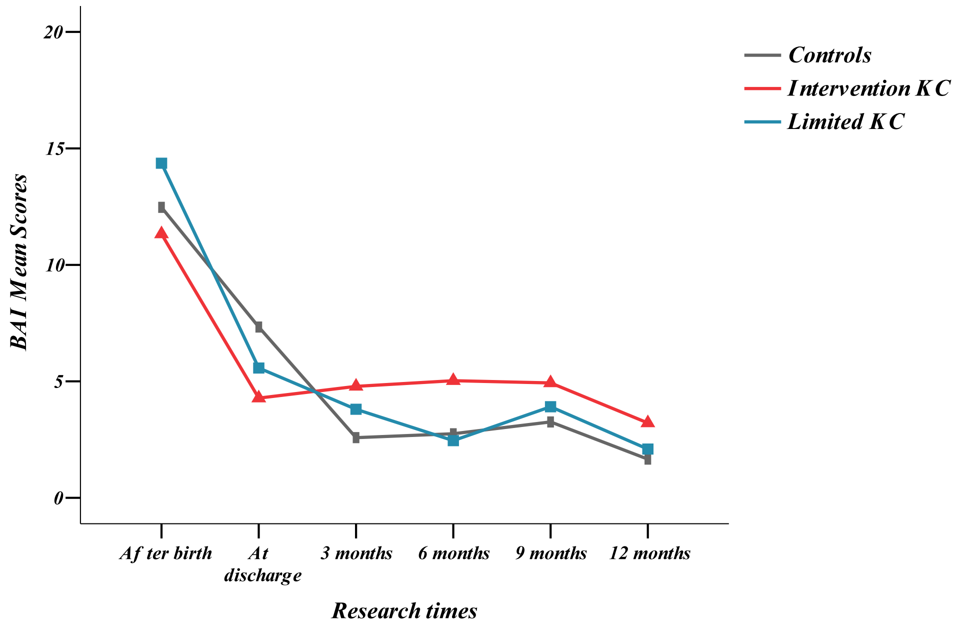


Figure 4.2: BAI Scores Across the Research Time Points

Seventy-five (75) mothers completed the full research schedule (from Time 1 to Time 6) for this measure and were included in this analysis, out of which 29 were part of the Intervention KC group, 20 of the Limited KC group, and 26 of the Control group.

Figure 4.2 illustrates the anxiety level in each group; for all groups, the anxiety level went from mild at time 1 to minimal at the other research times, and this decrease was similar in all three groups. This shows a significant effect of time, F (5, 250) = 25.78, $p < .001$ and a significant linear trend for time, F (1, 74) = 40.20, $p < .001$. No main effect of group, F (2, 74) = .179, $p = .837$ and no time x group interaction, F (10, 250) = 1.88, $p = .106$ were found, demonstrating that the mothers' personal anxiety levels did not statistically differ among the three groups.

Follow-up analysis: time point evaluation

Table 4.7 Univariate Analyses of Variance on Maternal Anxiety Levels Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
Anxiety	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth	11.65	6.89	0-27	14.33	11.67	1-47	14.63	9.99	0-38	2, 88	.02	Ns
At discharge	4.82	3.50	0-14	5.56	4.19	0-13	7.15	5.55	0-22	2, 88	1.78	Ns
3 months CA	4.79	3.35	0-17	3.73	3.88	0-11	2.15	2.39	0-18	2, 84	2.73	Ns
6 months CA	5.08	4.57	0-19	2.43	3.42	0-13	2.62	3.23	0-10	2, 83	3.50	.035
9 months CA	4.46	5.72	0-23	4.01	4.28	0-13	3.45	3.32	0-13	2, 70	.23	Ns
12 months CA	3.19	3.15	0-13	2.07	4.42	0-13	2.31	2.91	0-20	2, 74	.58	Ns

Table 4.7 summarises the full list of the results on mothers' personal anxiety levels in the three groups. As can be observed, anxiety levels did not statistically differ among the three groups in all research times with the exception of time 4, at 6 months (CA). Indeed at 6 months (CA), a significant difference, F (2, 83) = 3.50, p = .035 among groups was detected. Surprisingly, Intervention KC mothers had a borderline significant (p = .056) higher anxiety level than mothers in the Limited KC Group. Control mother did not differ from the other two groups. However, it should be noted that the anxiety levels of the mothers remained within the 'minimal' range of anxiety, as defined by the BAI.

4.4.3 Symptoms of depression

Longitudinal analysis

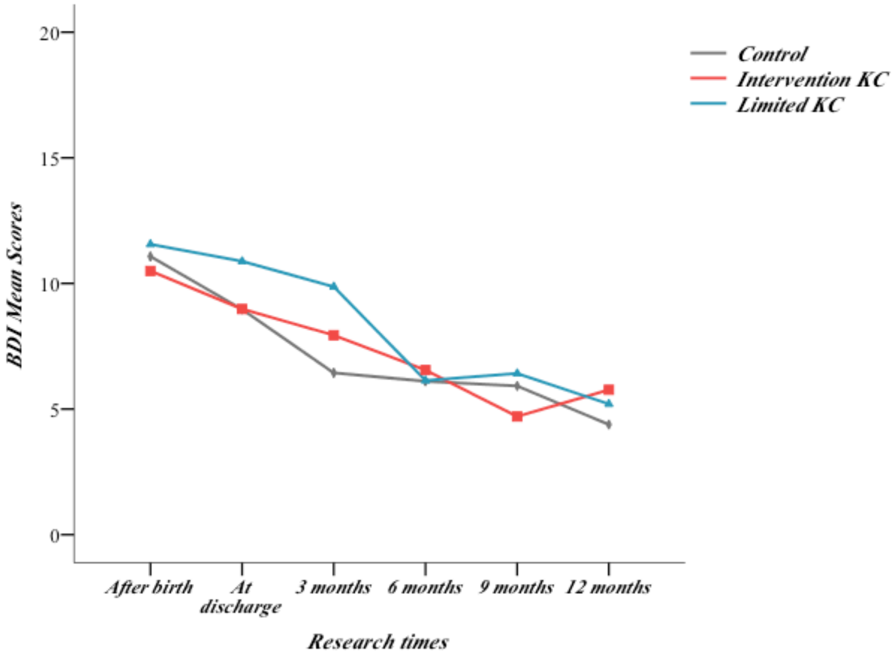


Figure 4.3: BDI Scores Across the Research Time Points

A total of 75 mothers were included in the analyses. As illustrated in Figure 4.3, the three groups presented similar symptoms of depression across the research times that stayed within the 'minimal' range, according to BDI manual classification. As illustrated by Figure 4.3, the results showed a significant downwards effect of time, F (5, 250) = 7.886, $p < .001$, with a significant linear trend, F (5, 75) = 20.915, $p < .001$. No main effect of group, F (2, 75) = .728, $p = .488$ and no time x group interaction, F (5, 250) = .681, $p = .741$, were found.

Follow-up analyses: time point evaluation

Table 4.8 Univariate Analyses of Variance on Maternal Depression Symptoms Between Intervention KC, Limited KC and Control Groups at Each Research Time

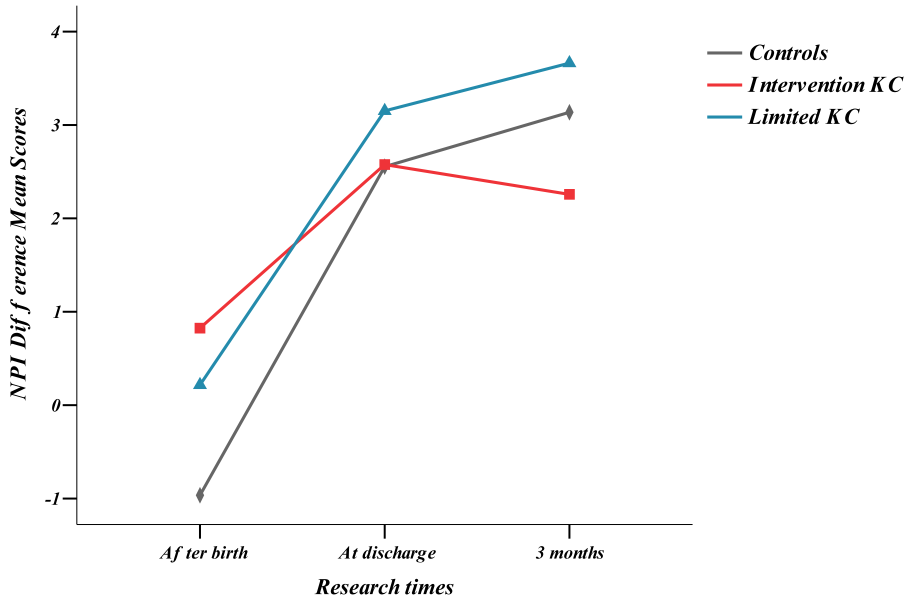
	Intervention KC			Limited KC			Control			df	F	P
Depression	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth	10.30	6.34	1-35	14.18	7.79	3-28	12.85	4.64	3-20	2, 88	2.64	Ns
At discharge	9.60	5.61	0-20	10.65	5.76	2-25	9.70	5.23	3-25	2, 88	.27	Ns
3 months CA	8.34	5.62	1-23	9.35	8.97	0-34	7.07	4.19	1-20	2, 84	.79	Ns
6 months CA	7.63	5.71	1-26	5.94	4.51	0-17	6.33	4.41	0-19	2, 83	.745	Ns
9 months CA	5.88	5.97	0-23	6.18	4.25	0-16	6.58	4.10	1-14	2, 70	.09	Ns
12 months CA	5.55	4.72	0-21	5.59	3.94	0-17	5.22	4.15	0-16	2, 74	.05	Ns

Table 4.8 reports all results for each of the research times on symptoms of depression among the three groups. As clearly illustrated, Intervention KC, Limited and Control groups did not differ significantly at any of the six research time points, Depression symptoms stayed within the ‘minimal’ range, according to BDI manual classification.

4.5 Mother's bonding and infant's representation

4.5.1 Maternal representation of the infant

Longitudinal analysis



Note: NPI was measured between time 1 to time 3 only.

Figure 4.4 NPI Difference Scores Across the Research Time Points

Changes over time from time 1 to time 3 were investigated for 77 mothers of whom 28 were in the Intervention KC group, 23 in the Limited KC group and 26 in the Control group.

In all three groups, the mothers experienced an increase in the discrepancy between their perception of their own infant in comparison to an average infant across the first three months following the infant's discharge, showing an upwards time effect, F (2, 146) = 8.11, p

$< .001$. Inspection of Figure 4.4 reveals that the mothers' discrepancy increased from after birth until discharge, but did not significantly change at the last assessment (time 3 - 3 months CA), showing a significant linear time effect, $F\ (1, 73) = 13.20$, $p = .001$. No time x group, $F\ (4, 146) = .81$, $p = .521$, and main effect of group, $F\ (2, 73) = .664$, $p = .518$, were found.

The discrepancy was due to a significant upwards time effect on the *Average Infant scale*, $F\ (2, 146) = 4.162$, $p = .017$, indicating that their perception of the average infant became worst over time – and in an opposite trend to a significant decrease on the *My Baby scale* from time 1 to time 3, with a significant downwards time effect, $F\ (2, 146) = 4.08$; $p = .019$- indicating that the mothers' perception of their own baby improved over time. No time x group effect was shown for either the *Average Infant scale*, $F\ (4, 146) = 1.61$, $p = .175$, or the *My Baby scale*, $F\ (2, 146) = .251$, $p = .909$. A main effect of group was detected for the *Average Infant scale*, $F\ (2, 73) = 4.24$, $p = .018$, but not for the *My Baby scale*, $F\ (2, 73) = 1.03$, $p = .363$.

Follow-up analyses: time point evaluation

Table 4.9 Univariate Analyses of Variance on Maternal Representation of the Infant Between Intervention KC, Limited KC and Control Groups at Each Research Time

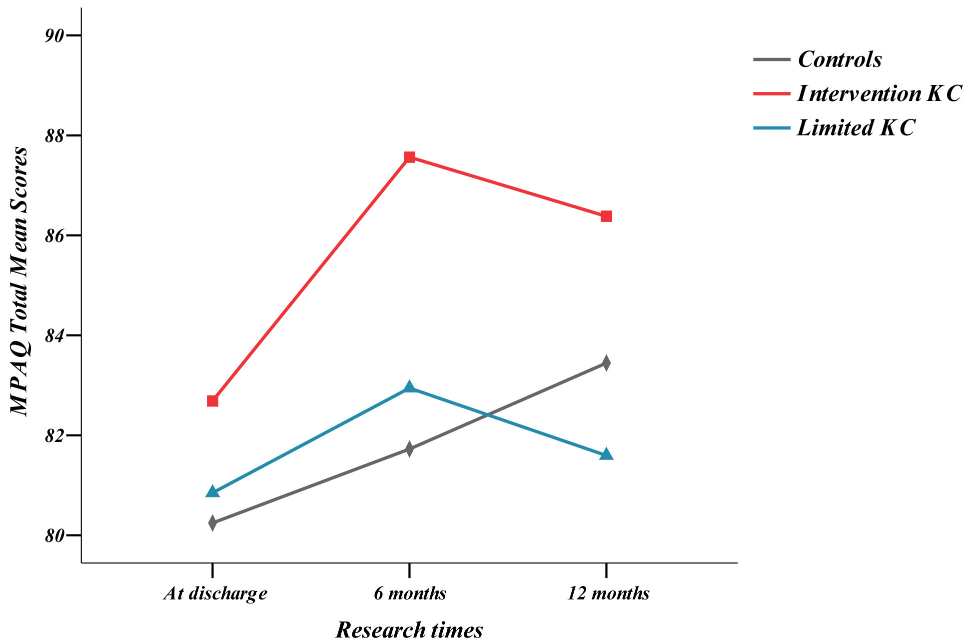
Maternal representation	Intervention KC			Limited KC			Control			df	F	P
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth												
Average Baby	19.20	2.75	15-27	19.01	2.73	15-25	17.34	2.61	12-22	2,88	3.62	.031
My Baby will be	17.16	3.34	9-23	18.85	3.99	11-27	18.46	3.34	10-24	2,88	1.53	Ns
Difference	2.11	4.11	-4-14	.17	2.50	-6-4	-1.11	3.11	-6-7	2,88	5.50	.006
At discharge												
Average Baby	19.07	3.00	11-26	20.61	3.35	15-28	19.17	2.49	15-24	2,88	2.19	Ns
My Baby is	15.82	3.79	10-23	17.48	4.04	11-28	16.69	4.36	8-26	2,88	1.04	Ns
Difference	3.29	3.80	-5-12	3.12	3.19	-3-10	2.38	4.52	-5-15	2,88	.39	Ns
3 months (CA)												
Average Baby	18.21	2.83	10-23	21.39	3.01	11-30	17.24	3.07	9-22	2,73	5.84	.001
My Baby is	16.31	3.04	10-24	17.35	4.64	10-27	15.29	3.39	9-25	2,73	1.86	Ns
Difference	2.40	3.76	-4-11	3.68	3.69	-6-9	2.97	3.59	-4-10	2,73	.63	Ns

Table 4.9 above reports the findings relating to maternal representation of her own child in comparison to her perception of an average child. As can be seen from the mean scores in the table, before the KC procedure implementation no significant differences were found between the groups with respect to the maternal perception of what their baby will be like (NPI-I *My Baby* scale). However, the analysis showed a significant difference between the groups of mothers in how they perceived an "average" baby (NPI-I *Average Baby* scale), F (2, 88) = 3.62, p = .031. A borderline significant difference (p=.056) indicated that Intervention KC mothers had a worse perception of an "average child" than Control mothers did. The Limited KC mothers did not differ from the other two groups. As a consequence, the difference between the maternal perception of their own infant in comparison to an average infant differed between the three groups, F (2, 88) = 5.5, p = .006, with Intervention KC mothers perceiving their own infants as being better than an average infant, whereas Control

mothers perceived their infants as being worse than an average infant. Limited KC mothers perceived their infants as very similar to the average infant.

At discharge from hospital and at 3 months (CA), mothers in the three groups did not differ significantly in how they perceived their own baby in comparison to an average baby, all results are reported in Table 4.8 above.

4.5.2 Maternal bonding to the infant



Note: MPAQ was measured between at time 2, time 4 and time 6.

Figure 4.5 Total MPAQ scores across the research times

A total of 68 mothers were included in the analyses of which 25 were in the Intervention KC group, 22 in the Limited KC group and 21 in the Control group. As illustrated in Figure 4.5, the Intervention KC mothers' bonding to their infant (total MPAQ) remained higher than in the other two groups, but they presented the same trend of change across the research time, F (2, 128) = 9.68, p < .001, showing a significant increase on maternal bonding to the infant from discharge to 6 months (CA) and a significant linear trend for time, F (1, 64) = 9,48, p = .003. No main effect of group, F (2, 64) = 2.38, p = .101, and no time x group interaction, F (4, 128) = 1.46, p = .223, were found.

Follow-up analyses: time point evaluation

Table 4.10 Univariate Analyses of Variance on Maternal Bonding to the Infant Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
Measures*	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
At discharge												
Total MPAQ	81.89	6.00	72-94	80.95	7.63	60-91	81.34	10.12	51-98	2,82	.08	Ns
QA	40.67	3.14	33-45	39.55	3.03	32-44	39.15	5.67	24-50	2,82	.55	Ns
AH	20.63	2.10	16-25	19.95	2.48	14-23	19.85	3.42	12-25	2,82	.09	Ns
PI	21.84	5.77	15-48	21.39	3.74	11-25	21.92	3.67	11-25	2,82	.08	Ns
6 months CA												
Total MPAQ	86.64	5.19	76-94	83.06	8.17	60-93	81.33	7.07	69-94	2,84	3.72	.029
QA	42.58	1.98	38-45	41.21	3.46	34-45	40.55	3.01	36-45	2,84	3.12	.05
AH	21.62	2.25	15-25	20.57	3.38	11-25	19.69	3.46	10-25	2,84	2.35	Ns
PI	22.62	2.42	17-27	21.29	3.10	12-25	21.16	3.14	15-25	2,84	1.84	Ns
12 months CA												
Total MPAQ	86.45	4.73	75-94	81.60	9.11	62-93	83.21	7.03	67-94	2,72	2.60	Ns
QA	42.59	1.65	38-45	41.30	3.88	33-45	40.82	3.68	35-45	2,72	1.63	Ns
AH	21.87	2.37	16-25	19.53	3.64	11-24	20.79	2.56	16-25	2,72	3.65	.031
PI	21.92	2.25	17-25	21.80	6.34	11-45	21.34	3.28	11-25	2,72	.10	Ns

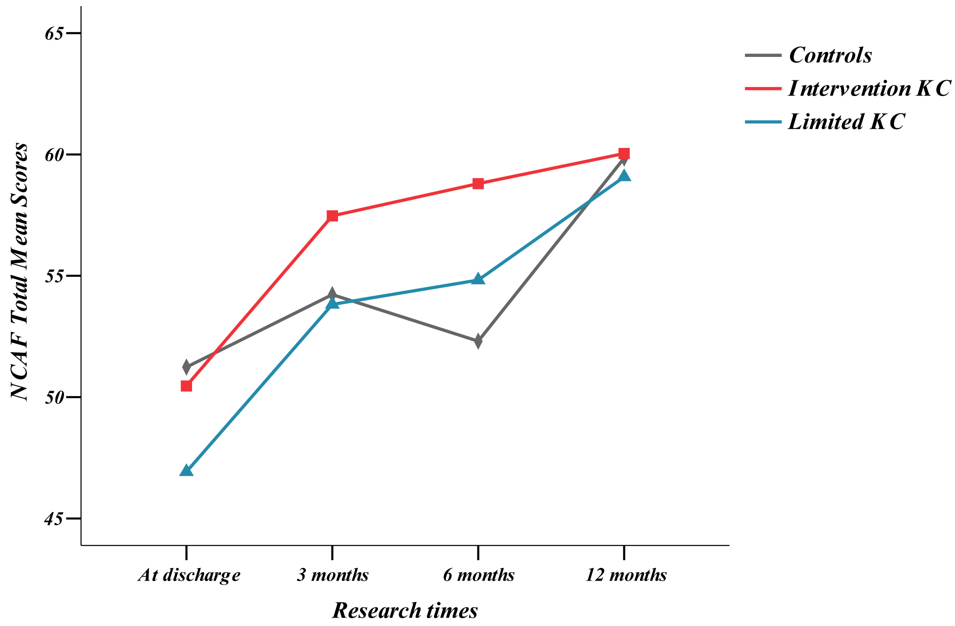
** Measures captions: MPAQ – Maternal Post-natal Attachment Questionnaire; QA – Quality of Attachment Sub-Scale; AB - Absence of Hostility Sub-Scale; & PI – Pleasure in Interaction Sub-Scale*

At discharge from hospital, the three groups did not differ with respect to the measure of maternal bonding (MPAQ). At 6 months (CA), however, a difference in the MPAQ – Total scores between the three groups was evident, F (2, 82) = 3.72, p = .029. As illustrated by the mean scores reported in Table 4.10 above, Intervention KC mothers had a higher bonding score than Control mothers, but the mean for Limited KC mothers did not differ significantly from that of the other two groups. The MANCOVA on the MPAQ sub-scales did not show a significant difference between the three groups, *Wilks' Lambda F* (4, 152) = 1.41, *p* = .216. However, the analysis on the single sub-scales indicated a significant group difference for *Quality of Attachment sub-scale*, *F* (2, 84) = 3.12, *p* = .05, with Intervention KC mothers demonstrating a better quality of bonding than Control mothers. Once again, Limited KC mothers did not significantly differ from the other two groups.

At 12 months (CA), mothers in the Intervention group maintained a higher score on the *Absence of Hostility sub-scale* of the MPAQ in comparison to the other two groups, *F* (2, 72) = 3.65, *p* = .031, even if no between group difference was found on the overall MANCOVA *Wilks' Lambda F* (4, 140) = .669, *p* = .615. In this sub-scale, Intervention KC mothers had significantly higher scores compared to Limited KC mothers. However, Control mothers did not differ significantly from the other two groups.

4.6 Mother-preterm infant dyadic interaction

Longitudinal analysis



Note: NCAF was measured at time 2, time 3, time 4 and time 6.

Figure 4.6 Mother-infant Dyadic Interaction Total Scores Across the Research Time Points

The longitudinal variation along the research time was investigated for mother-preterm infant interactive scores as measured by the NCAF scale. A total of 68 mother-infant dyads completed all the assessment times for the NCAF variable; 26 were part of the Intervention KC group, 22 of the Limited KC group and 20 of the Control group.

The overall score on the NCAF on mother-preterm infant dyadic interaction significantly changed from discharge to 12 months (CA), as a main effect of time was found,

F (3, 192) = 38.78; $p < .001$ for all groups, showing a significant linear trend, F (1, 64= 118.26; $p < .001$. Moreover, the group x time interaction was significant, F (6, 192) = 2.75; p = .014, revealing that the means in the three groups changed differently across the research time. As can be seen from Figure 4.6, the dyadic interactive capacities increased in all groups in the first 3 months at the infant's discharge. However, differently from the other two groups, Intervention KC dyads did not experience a decrease at the child's 6 months of age (CA). By the end of the first year of the infant life, mothers in the Control and Limited KC groups reached the same quality of dyadic interaction that was achieved at 6 months (CA) by the Intervention KC mother-infant dyads. Finally, a main effect of group was found in these analyses, F (2, 64) = 3.79; p = .028.

Follow-up analysis: time point evaluation

Table 4.11 Univariate Analyses of Variance on Mother-Infant dyadic Interaction Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
At discharge												
NCAF Total	51.13	5.70	37-60	46.86	5.13	37-54	49.93	6.63	34-58	2,80	3.37	.039
Mother's:												
SC	11.91	1.59	9-15	11.19	1.40	9-14	11.79	1.45	9-14	2,80	1.62	Ns
RD	10.41	.98	8-11	10.57	.75	8-11	10.39	1.17	7-11	2,80	.35	Ns
S-EGF	10.03	1.60	8-13	9.67	1.77	6-12	11.00	1.94	6-13	2,80	4.54	.014
CGF	5.47	1.46	2-8	4.52	1.47	2-7	5.14	1.67	2-8	2,80	2.22	Ns
Child's:												
CC	8.93	2.27	3-13	7.86	1.62	5-11	8.50	2.44	1-12	2,80	1.06	Ns
RC	3.37	1.21	2-6	3.05	1.20	1-6	3.10	1.42	1-6	2,80	.13	Ns
3 months												
NCAF Total	57.46	7.29	42-69	53.65	6.84	42-69	53.85	7.51	40-66	2,79	2.07	Ns
Mother's:												
SC	11.93	2.15	9-16	11.91	1.88	8-15	12.11	1.99	8-15	2,79	.40	Ns
RD	10.59	.87	8-11	9.91	1.31	8-11	9.67	1.27	7-11	2,79	4.78	.011
S-EGF	12.41	1.94	7-14	11.04	1.74	7-14	11.81	1.84	7-14	2,79	3.52	.035
CGF	6.34	1.78	2-9	5.65	1.50	2-8	5.81	1.84	2-9	2,79	1.20	Ns
Child's:												
CC	10.57	2.75	6-14	10.78	1.70	9-14	10.41	2.21	5-14	2,79	.27	Ns
RC	4.90	2.14	1-9	4.90	1.85	1-8	4.04	1.95	1-9	2,79	1.17	Ns
6 months												
NCAF Total	59.16	6.28	47-72	54.73	6.51	41-66	52.84	8.77	35-67	2,73	4.91	.01
Mother's:												
SC	12.27	1.99	7-15	11.82	1.84	8-15	11.32	2.70	7-16	2,73	1.16	Ns
RD	10.23	1.14	8-11	10.14	1.32	7-11	9.88	1.27	7-11	2,73	.54	Ns
S-EGF	12.62	1.33	8-14	11.55	1.82	7-14	11.6	2.57	4-14	2,73	2.34	Ns
CGF	7.19	1.60	3-9	5.86	1.89	2-8	5.48	1.83	1-8	2,73	6.56	.002
Child's:												
CC	10.96	1.46	8-14	10.68	1.70	7-14	10.48	1.64	8-14	2,73	.57	Ns
RC	5.80	2.12	3-10	4.91	1.97	1-9	4.32	1.70	1-8	2,73	3.70	.03
12 months												
NCAF Total	59.33	4.71	50-67	59.13	6.59	39-70	60.33	5.48	43-66	2,70	.233	Ns
Mother's:												
SC	11.04	1.72	7-15	11.00	1.17	8-14	11.00	1.41	7-13	2,70	.01	Ns
RD	10.59	.93	8-11	10.04	1.43	6-11	10.86	.48	9-11	2,70	3.63	.032
S-EGF	13.19	.78	11-14	12.73	1.39	8-14	13.14	1.35	10-14	2,70	1.02	Ns
CGF	7.78	1.12	5-9	8.21	.85	6-9	7.81	1.25	5-9	2,70	1.21	Ns
Child's:												
CC	9.96	1.51	7-13	10.61	2.10	4-14	10.52	1.89	5-13	2,70	.93	Ns
RC	6.78	1.48	4-9	6.52	2.13	2-10	7.00	1.76	1-9	2,70	.39	Ns

* *Measures captions: SC* = Sensibility of cues; RD = Response to Distress; S-EGF = Socio-emotional Growth Fostering; CGF = Cognitive Growth Fostering; CC = Clarity of Cues; RC = Responsiveness to Caregivers

Table 4.11 reports all the results of the NCAF Sub-scales. At discharge from hospital, a significant difference among the three groups was found for the NCAF total score, F (2, 80) = 3.37, p = .039, with Intervention KC mothers-infant dyads presenting a better overall interaction style than the dyads in the Limited KC group. Control mother-infant dyads did not statistically differ from the other two groups. The MANCOVA on the NCAF sub-scales did not reveal any significant differences, *Wilks Lambda* F(12, 146) = .889, p = .56. However, the analyses on the single sub-scales indicated a significant difference on the maternal sub-scale of *Socio-Emotional Growth Fostering*, F (2, 80) = 4.54, p = .014. Surprisingly, both Intervention and Control group mothers had better interactive capacity in fostering their child socio-emotional growth at discharge than Limited KC mothers.

At 3 months (CA), no among groups' differences were found on the total interaction score on the NCAF. However, the MANCOVA on the sub-scales showed a significant between groups difference, *Wilks Lambda* F (12, 140) = 1.83, p = .049. Univariate comparisons on the sub-scales revealed that the three groups differed on mother's *Socio-Emotional Growth Fostering*, F (2, 79) = 3.52, p = .035, and *Response to Distress*, F (2, 79) = 4.78, p = .011, sub-scales. Intervention KC mothers provided a better response to their infants' distress than Control and Limited KC mothers did, although the difference was not statistically significant. Regarding the *Socio-Emotional Growth Fostering,* Intervention KC mothers had better interactive capacity in fostering their child socio-emotional growth than Limited KC mothers had. However, Control mothers did not differ from the other two groups.

At 6 months (CA), mother-infant dyads presented significant differences in their interactive capacities (NCAF Total), F (2, 73) = 4.9, p = .01, showing that Intervention KC mother-infant dyads developed a better reciprocal interaction than the Control group dyads.

As clearly illustrated by the mean scores reported in Table 4.10, the global interactive scores of the limited KC group dyads were midway between the other two groups but did not statistically differ. Even if the overall MANCOVA on the sub-scales did not show significant between groups differences, F (12, 128) = 1.42, p = .167, the analysis on the single sub-scales revealed significant differences on the mother's sub-scale of *Cognitive Growth Fostering*, F (2, 73) = 6.56; p = .002, and on the infant's sub-scale of *Responsiveness to Caregiver sub-scale*, F (2, 73) = 3.69; p = .03. Subsequent analyses proved that KC Intervention mothers were more able to stimulate their child's cognitive growth then Control and Limited KC mothers. Moreover, on the other side, Intervention KC children by 6 months of corrected age developed a better response to their mother than Control children did. Limited KC children did not differ from the other two groups.

Finally, at 12 months (CA), the quality of the mother-infant dyadic interaction (NCAF-total) did not differ among the three groups. Also the MANCOVA on the sub-scale did not indicate any differences between groups, F (12, 126) = 1.57, p = .108. However, the subsequent analyses on the single sub-scales indicate that only for the sub-scale of the mothers' *Response to Distress*, F (2, 70) = 3.85, p = .032, mothers in the Control group had a better response than Limited KC mothers. Intervention KC mothers, instead, had a midway but not statistically different score than mothers in the other two groups.

4.7 Infants' proximal environment

4.7.1 Marital satisfaction

Longitudinal analysis

A total of 61 mothers completed each of the four time points (see Table 3.5 in Chapter 3) in which marital satisfaction was evaluated. Of these, 19 were part of the Control group, 21 of the Intervention KC group and 21 of the Limited KC group.

Mothers in the three groups presented very similar marital satisfaction, which was maintained stable across the research time. The results indeed show no time, F (3, 171) = 1.387, p = .248, no time x group, F (6, 171) = 1,854, p = .091, and no group effect, F (2, 57) = .679, p = .51. Table 4.12 shows the mean scores and standard deviation for the three groups at each of the research times.

Table 4.12 Means, Range and Standard Deviations on Marital Satisfaction Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control		
Marital satisfaction	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
After birth	55.55	7.87	41-75	57.91	6.25	45-68	58.84	10.87	40-95
At discharge	56.40	16.52	25-95	55.62	7.40	39-68	58.94	12.99	41-95
3 months CA	54.02	13.53	23-95	56.25	10.39	20-67	62.40	15.75	45-95
12 months CA	58.41	15.72	20-95	59.62	12.87	39-90	54.05	14.93	40-95

4.7.2 Parenting alliance

Longitudinal analysis

Sixty-three (63) mothers were included in the analysis, of which 20 were part of the Control group, 20 of the Intervention KC group and 23 of the Limited KC group.

As found for marital satisfaction and as illustrated by Table 4.13, mothers did not differ in their perception of parenting alliance established with their partner in looking after their child. The results indeed show no time, F (3, 177) = .773, p = .51, no time x group, F (6, 177) = .490, p = .815, and no group effect, F (2, 59) = .773, p = .461.

Table 4.13 Means, Range and Standard Deviations on Parenting Alliance Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control		
Parenting alliance	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
After birth	89.59	9.99	60-100	92.24	10.27	63-100	90.10	6.75	70-100
At discharge	89.59	11.38	55-100	92.20	8.14	70-100	90.05	8.45	71-100
3 months CA	89.07	11.74	47-100	88.51	9.20	69-100	88.08	6.77	75-100
12 months CA	91.95	12.05	42-100	90.04	12.98	52-100	91.45	8.95	68-100

4.7.3 Level of social support

Longitudinal analysis

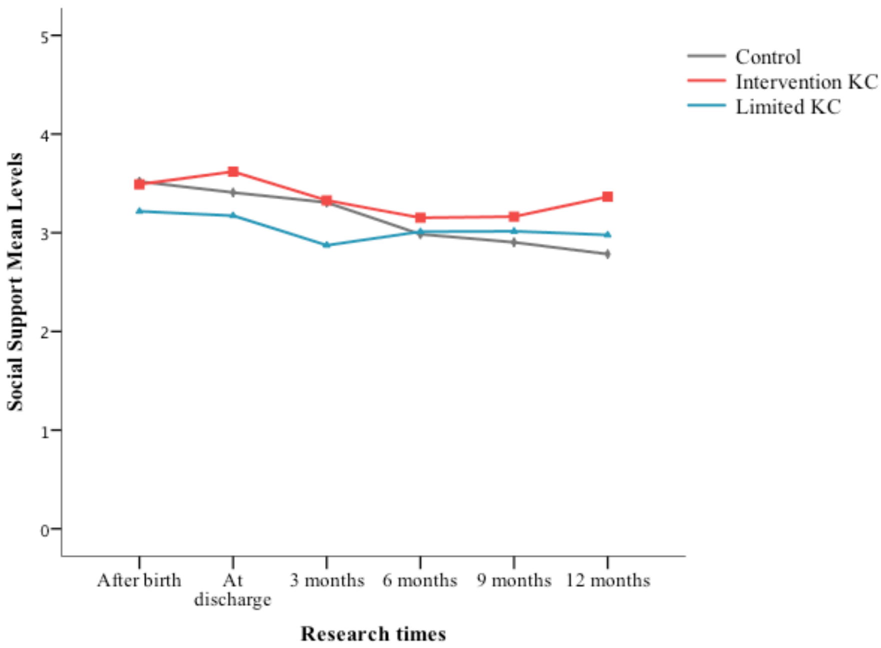


Figure 4.7 Social Support Levels Across the Research Time Points

The level of social support perceived by mothers in the three groups did not differ, as the results show no effect of either group, F (2, 49) = 1.17, p = .32, or time x group, F (10, 245) = 1.742, p = .072. Even if Figure 4.7 seems to indicate that the mean scores in the three groups were constant across time, the level of social support presented a significant effect of time, F (5, 245) = 6.157, p < .001, with a significant linear trend, F (1, 49) = 13,526, p = .001.

Follow-up analyses: time point evaluation

Table 4.14: Univariate Analyses of Variance on Maternal Perception of Social Support Levels Between Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
Social support	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth	3.49	.64	2-5	3.39	.58	2-5	3.39	.72	2-5	2, 88	.17	Ns
At discharge	3.26	.71	2-5	3.21	.53	2-4	3.46	.71	2-5	2, 88	.98	Ns
3 months CA	3.17	.70	2-4	3.07	.80	2-4	3.02	.65	2-4	2, 84	.25	Ns
6 months CA	3.04	.73	2-4	3.02	.82	2-5	3.05	.68	2-5	2, 83	.01	Ns
9 months CA	3.10	.55	2-4	3.07	.60	2-4	3.05	.65	2-4	2, 70	.02	Ns
12 months CA	3.27	.56	2-4	3.05	.75	2-5	2.85	.60	2-4	2, 74	2.18	Ns

The full list of results is reported in Table 4.14 above. Follow-up analysis on the level of social support at each of the research times revealed that groups did not statistically differ.

4.7.4 Home environment at 3 months: time point evaluation

Table 4.15 Univariate Analyses of Variance on Quality of Home Environment Provided by Mothers on Intervention KC, Limited KC and Control Groups at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
HOME Total Score	36.88	3.44	29-40	36.37	2.98	30-42	34.76	4.29	25-42	2,73	1.80	Ns
Responsivity	10.80	.37	10-11	10.92	.29	10-11	10.76	.68	8-11	2,73	.72	Ns
Acceptance	6.75	.78	5-8	6.67	.72	6-8	6.46	.65	6-8	2,73	.81	Ns
Organization	5.42	.75	4-6	4.99	.69	4-6	5.13	1.11	2-6	2,73	1.24	Ns
Learning Materials	6.77	1.09	3-8	6.74	1.23	5-8	5.91	1.41	3-8	2,73	3.12	.05
Involvement	4.32	1.18	2-6	4.20	1.19	2-6	4.17	1.30	2-6	2,73	.07	Ns
Variety	2.82	1.08	2-4	2.84	.89	1-4	2.33	.91	1-4	2,73	1.84	Ns

As reported in Table 4.15, at three months (CA), the total HOME means scores indicated that both Intervention KC mothers and Limited KC mothers offered a better home environment to their children than Control mothers did. Yet, the differences among groups did not reach statistical significance, *F* (2, 73) =1.80*, p* =.174. In addition, the MANCOVA on the sub-scales did not reveal a significant difference among the three groups, *Wilks' Lambda F* (12, 124) = .994, *p* = .458. Nevertheless, the analyses on the single sub-scales showed a significant between group difference for the *Learning Materials Sub-scale*, *F* (2, 73) = 3.12; *p* = .05. As illustrated by the means scores reported in Table 4.15, post hoc analysis indicated that Intervention KC and Limited KC mothers offered more learning materials than Control mothers did.

4.8 Infant development: Bayley III

The analyses were based on a total of 75 children who were assessed at both 6 and 12 months (CA). Of this sample, 26 were in the Intervention KC group, 23 in the Limited KC group and 26 in the Control group.

Results show a positive effect of KC intervention; in fact, significant group x time interaction was detected in the children's global language skills, *F* (2, 72) = 3.04, *p* = .054, gross motor skills, *F* (2, 72) = 4.23, *p* = .018, and leisure skills, *F* (2, 64) = 6.77, *p* = .002.

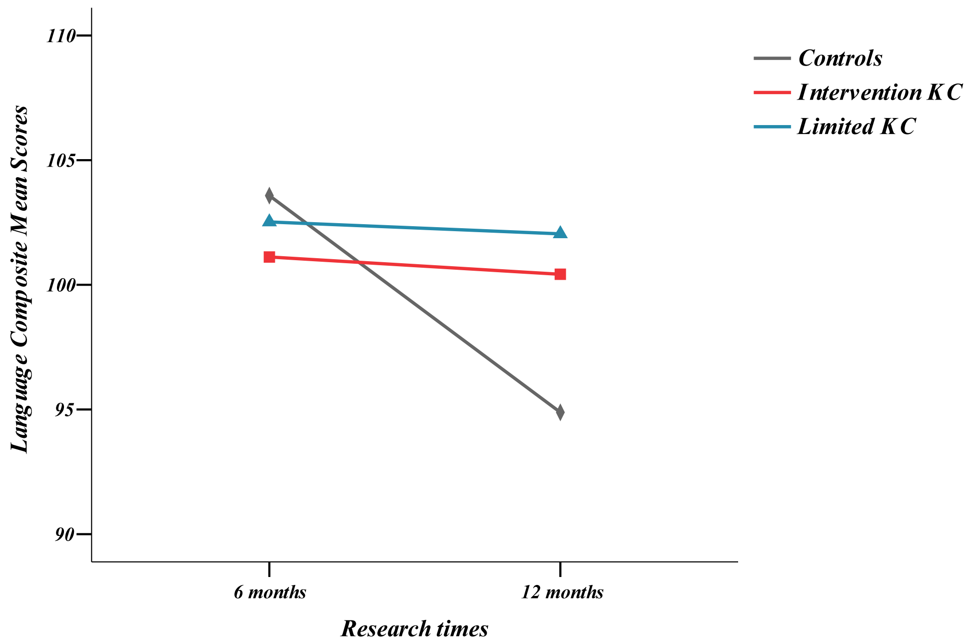


Figure 4.8 Language developmental scores from 6 to 12 months CA

As illustrated in Figure 4.8, along the research time, Intervention KC and Limited KC children's scores on language skills remained above the mean population score as opposed to children in the Control group who decreased in performance from 6 to 12 months (CA), showing a significant main effect of time, F (1, 72) = 4.40, p = .039, but not a main effect of group, F (2, 72) = 1.02, p = .364.

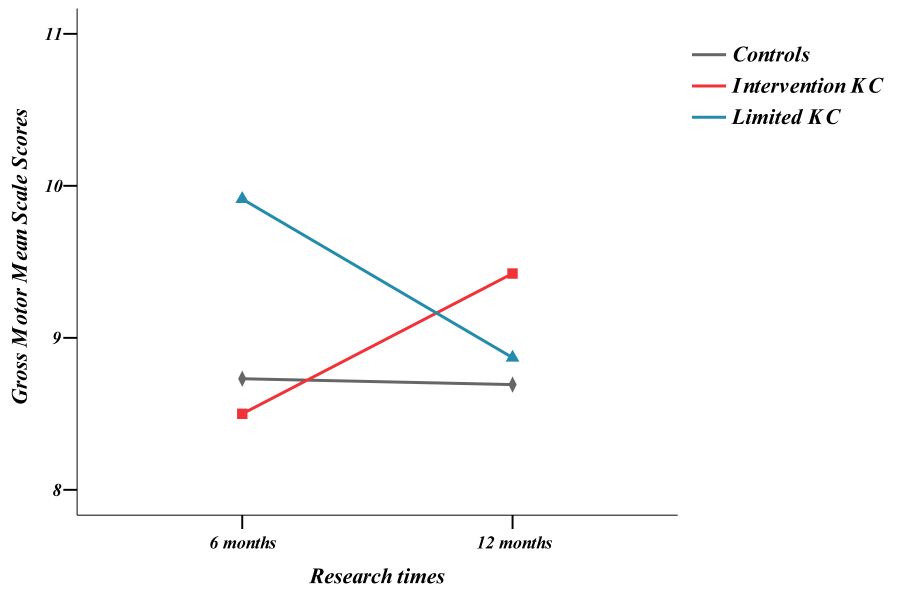


Figure 4.9 Gross motor developmental scores from 6 to 12 months CA

In relation to gross motor skills, Intervention KC children presented an improvement, reaching the average population performance by 12 months of age (CA). With an opposite trend, Limited KC children's gross motor competency decreased over time, even if remaining within the normal range. The gross motor competency of the Control children remained stable from 6 to 12 months (CA), with mean scores in the low end of the range of the normal population, as seen in Figure 4.9 above. For this sub-scale, no main effect of either time, F (1, 72) = .038, p = .847, or group, F (2, 72) = .812, p = .448, was detected.

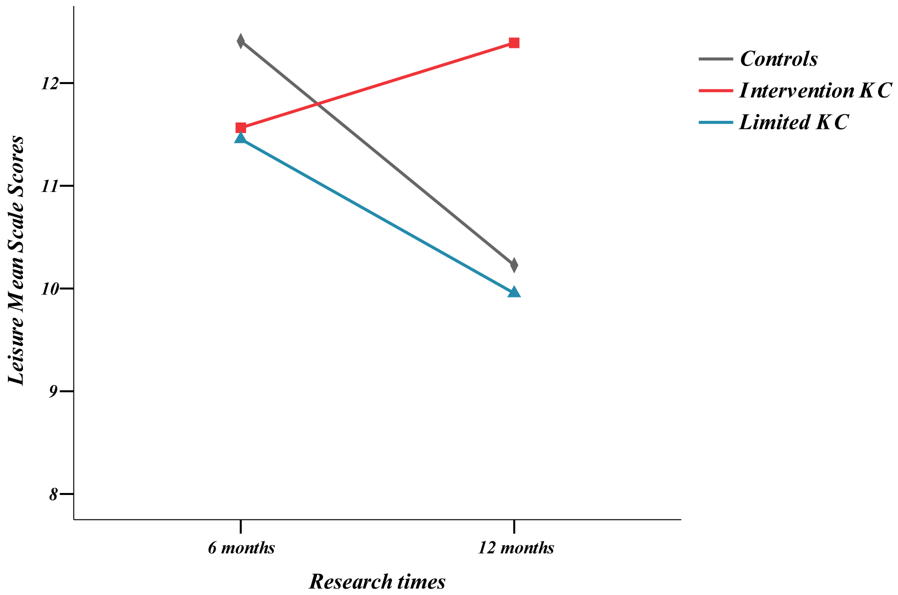


Figure 4.10 Leisure Skills development from 6 to 12 months CA

Finally, as illustrated in Figure 4.10, Intervention KC children improved their play ability from 6 to 12 months (CA) while both Limited KC and Control group children experienced a decrease in their performance over time, showing a main effect of time, F (1, 64) = 7.30, p = .009 and of group, F (2, 72) = 3.18, p = .048.

Children in all three groups had an improvement with time on the cognitive, F (1, 72) = 19.05, p < .001, and socio-emotional skills, F (1, 64) = 9.77, p = .003, where however no main effect of either group x time (cognitive, F (2, 72) = .575, p = .565, and socio-emotional scales, F (2, 64) = 1.68, p = .194) and of group (cognitive, F (2, 72) = .793, p = .456, and socio-emotional scales, F(2, 64) = 1.20, p = .307) were found. Conversely, children showed decreased performance from 6 to 12 months (CA) on fine motor skills, F (1, 72) = 5.89; p = .018, with no main effect of either group x time, F (2, 64) = 1.20; p = .307 or group, F (2, 64)

= 1.20; *p* = .307. The same result was found on the children's expressive communication skills, showing a significant downward main effect of time, *F* (1, 72) = 12.83; *p* = .001 and no main effect of either group x time, *F* (2, 72) = 1.88; *p* = .160, or group, *F* (2, 64) = .549; *p* = .580. Similarly, in relation to the children's global adaptive behaviour skills, a significant effect of time, *F* (1, 63) = 7.96; *p* = .006, was shown with a downwards trend and with no group x time interaction, *F* (1, 63) = 1.23; *p* = .229, detected. Nevertheless, a main effect of group was observed *F* (1, 63) = 3.35; *p* = .041.

Follow-up analysis: time point evaluation

Cognitive development

Table 4.16 Univariate Analyses of Variance on the Preterm Infants' Cognitive Development Between Intervention KC, Limited KC and Control Groups at 6 and 12 Months (CA)

	Intervention KC		Limited KC		Control		df	F	P
Cognitive Scale Score	Mean	SD	Mean	SD	Mean	SD			
6 months CA	10.61	1.63	10.96	1.52	10.39	1.52	2,84	.88	Ns
12 months CA	11.38	2.04	12.22	1.59	11.81	2.51	2,74	.97	Ns

At 6 and 12 months (CA) assessment, children in the three groups did not differ in their cognitive skill scores, as illustrated in Table 4.16 (the ranges are reported in the text below).

In comparison with the standardised mean population score for children of comparable age (Scale score population mean = 10; SD = 2; range = 7-13), the children in the Intervention KC group and Limited KC group obtained scores within the normal range both at 6 (Intervention KC Scale Score Mean = 10.61; SD = 1.63; range = 7-13 – Limited KC Scale Score Mean = 10.96; SD = 1.52; range = 7-13) and 12 months (CA) (Intervention KC

Scale Score Mean = 11.38; SD = 2.04; range = 7-16 – Limited KC Scale Score Mean = 12.22; SD = 1.59; range = 7-14). Only in the control group, 3.2 % at 6 months (CA) and 3.8 % at 12 months (CA) of the children scored below the normal range. However, the mean scale score of the Control group was within the normal range both at 6 (Scale Score Mean = 10.39; SD = 1.52; range = 5-13) and at 12 months (CA) (Scale Score Mean = 11.81; SD = 2.51; range = 6-16). The Chi-square analysis did not show any significant statistical difference among the groups on the percentage of children who scored below and within the normal standardised age.

<u>Language development</u>

Table 4.17 Univariate Analyses of Variance on the Preterm Infants' Language Development Between Intervention KC, Limited KC and Control Groups at 6 and 12 Months (CA)

	Intervention KC		Limited KC		Control		df	F	P
	Mean	SD	Mean	SD	Mean	SD			
6 months (CA)									
Total Language Composite	102.19	11.37	102.52	8.62	103.10	10.13	2,84	.06	Ns
Receptive Com. Scale Score	9.87	2.68	9.83	1.99	10.10	2.37	2,84	.10	Ns
Expressive Com. Scale Score	10.81	1.97	10.96	1.80	10.90	1.94	2,84	.04	Ns
12 months (CA)									
Total Language Composite	100.42	10.89	102.04	8.12	94.88	10.61	2,74	3.52	.035
Receptive Com. Scale Score	10.08	2.15	10.52	1.90	8.96	1.93	2,74	4.02	.022
Expressive Com. Scale Score	10.00	2.04	10.13	1.42	9.23	2.05	2,74	1.68	Ns

At 6 months (CA) no significant among groups differences were found in the language scale and sub-scales, as shown in Table 4.17 (the ranges are reported in the text below). A different picture was revealed at 12 months (CA) in relation to the *Receptive Communication sub-scale*, F (2, 74) = 4.017; p = .022, where a significant difference among the groups was found. In this sub-scale, Limited KC children had a better receptive communication than

Control children had. Children in the Intervention KC group obtained a mean score very similar to the Limited KC children however, not statistically different from the other two groups. This result is also reflected on the overall composite score of the language scale, F (2, 74) = 3.52; p = .035, where again Limited KC children had a better total language score than Control children had. As before, Intervention KC children's total language composite score did not significantly differ from Limited KC and Control group.

In relation to the standardised mean population score for children of comparable age (Composite score mean = 100; SD = 15; range = 85-115), all groups presented a small percentage of children who performed below the normal range at both 6 and 12 months (CA) of age. The differences in the percentage of children who score below or within the normal range were not significant. The percentage of children who scored below the normal range were: in the Intervention KC group 6.5% at 6 (Intervention KC Composite Score Mean = 102.19; SD = 11.37; range = 83-124) and 7.7% at 12 months (CA) (Intervention KC Composite Score Mean = 110.42; SD = 10.89; range = 77-118); in the Limited KC group 4.3% at both 6 (Limited KC Composite Score Mean = 102.62; SD = 8.62; range = 77-118) and 12 months (CA) (Limited KC Composite Score Mean = 102.04; SD = 8.12; range = 83-115); and in the Control group 3.2% at 6 (Control Composite Score Mean = 103.10; SD = 10.13; range = 83-124) and 11.5% at 12 months (CA) (Control Composite Score Mean = 94.88; SD = 10.61; range = 62-112). From this description, it can be noted that only Control group children had a relevant rise in the percentage of children who scored below the normal range from 6 to 12 months (CA).

Motor development

Table 4.18 Univariate Analyses of Variance on the Preterm Infants' Motor Development Between Intervention KC, Limited KC and Control Groups at 6 and 12 Months (CA)

	Intervention KC		Limited KC		Control		df	F	P
	Mean	SD	Mean	SD	Mean	SD			
6 months (CA)									
Total Motor Composite	103.06	12.58	105.09	11.61	101.03	10.35	2,84	.82	Ns
Fine Motor Scale Score	12.10	2.66	12.70	4.27	11.87	1.99	2,84	.52	Ns
Gross Motor Scale Score	8.58	2.11	9.91	2.63	8.35	2.54	2,84	3.08	.05
12 months (CA)									
Total Motor Composite	101.42	10.94	101.87	9.67	98.77	11.12	2,74	.627	Ns
Fine Motor Scale Score	10.96	2.57	11.74	2.40	10.81	2.77	2,74	.89	Ns
Gross Motor Scale Score	9.42	2.28	8.87	1.80	8.69	2.28	2,74	.82	Ns

Table 4.17 reports on the results on the infant's motor skills (the ranges are reported below). As can be seen, at 6 months (CA), the gross motor skills development, F (2, 84) = 3.08; p = .05, was significantly different among the three groups, with Limited KC children having a higher scale score than Control children did. Intervention KC children did not significantly differ from the other two groups. No differences were found in fine motor and global motor development. At 12 months, (CA) children in the three groups did not differ in motor development.

The global motor skills development of our sample, in comparison with the standardised mean population score for children of comparable age (Composite score mean = 100; SD = 15; range = 85-115), had a smaller percentage of children who performed below the normal range at both 6 and 12 months (CA), which was not different among groups in a statistically significant way. The percentage of children that scored below the normal range were: in the Intervention KC group 6.5% at 6 months (CA) (Mean = 103.06; SD = 12.58; range = 73-133) and 3.8% at 12 months (CA) (Mean = 101.42; SD = 10.94; range = 79-124);

in the Limited KC group 8.7% at 6 months (CA) only (Mean = 105.09; SD = 11.61; range = 82-127); and in the Control group 3.2% at 6 (Mean = 101.03; SD = 10.35; range = 76-121) and 7.7% at 12 months (CA) (Mean = 98.77; SD = 11.12; range = 73-115). Thus, from 6 to 12 months (CA), the percentage of children who scored below the normal range decreased in the Intervention KC group in contrast to the Control group.

Socio-emotional development

Table 4.19 Univariate Analyses of Variance on the Preterm Infants' Socio-Emotional Development Between Intervention KC, Limited KC and Control Groups at 6 and 12 Months (CA)

	Intervention KC		Limited KC		Control		df	F	P
Socio-emotional Scale Score	Mean	SD	Mean	SD	Mean	SD			
6 months CA	9.54	2.59	9.35	2.52	8.93	2.56	2,84	.42	Ns
12 months CA	10.63	2.56	11.23	2.47	9.48	2.40	2,74	2.92	Ns

The children's socio-emotional development did not change among the groups at either 6 or 12 months (CA), as illustrated by the results reported in Table 4.19 (the ranges are reported below).

In comparison with the standardised population norms for children of comparable age (Scale score mean = 10; SD = 2; range = 7-13), at 6 months (CA) a small percentage of children for each group scored just below the normal range, in the Intervention KC the 8.7% (Mean = 9.54; SD = 2.59; range = 6-15), in the Limited KC the 6.1% (Mean = 9.35; SD = 2.52; range = 6-15) and in the Control group the 13.8% (Mean = 8.93; SD = 2.56; range = 4-15). At 12 months, all children scored within the normal range for their corrected age. The difference between the percentage of children who scored below and within the normal range did not significantly statistically differ amongst the three groups.

Adaptive behaviours development

Table 4.20 Univariate Analyses of Variance on the Preterm Infants' Adaptive Behaviours Development Between Intervention KC, Limited KC and Control Groups at 6 and 12 Months (CA)

	Intervention KC		Limited KC		Control		df	F	P
	Mean	SD	Mean	SD	Mean	SD			
6 months CA									
Total Adaptive Behaviour Composite	104.79	11.26	96.45	8.82	97.21	10.02	2,80	5.60	.005
Communication	10.45	2.13	9.17	2.37	10.10	2.08	2,80	2.28	Ns
Health and Safety	10.55	1.84	10.35	.98	9.90	1.17	2,80	1.63	Ns
Leisure	11.86	2.29	11.52	1.83	12.07	1.60	2,80	.51	Ns
Self-Care	10.00	1.41	8.74	1.94	8.55	1.80	2,80	5.97	.004
Self-Direction	11.07	2.95	9.74	2.70	9.97	2.15	2,80	2.02	Ns
Social	10.83	1.69	9.87	1.77	9.83	2.11	2,80	2.57	Ns
Motor	9.66	1.67	8.91	1.78	8.17	2.04	2,80	4.70	.012
12 months CA									
Total Adaptive Behaviour Composite	97.64	12.45	89.68	10.73	91.08	15.61	2,70	2.51	Ns
Communication	10.60	2.06	9.77	2.07	8.96	2.14	2,70	3.78	.028
Community Use	9.72	1.79	9.35	1.53	10.04	1.52	2,70	.99	Ns
Functional Pre-Academics	9.96	3.25	10.25	2.55	9.38	2.46	2,70	.57	Ns
Home Living	9.72	1.24	9.20	1.44	8.63	1.34	2,70	4.11	.021
Health and Safety	9.04	2.20	9.09	1.80	8.67	1.71	2,70	.34	Ns
Leisure	12.24	2.54	9.95	2.90	10.25	2.09	2,70	5.87	.004
Self-Care	7.64	1.47	7.77	1.60	7.38	1.95	2,70	.33	Ns
Self-Direction	9.64	1.60	9.41	1.40	9.50	1.79	2,70	.12	Ns
Social	9.64	2.67	8.82	2.11	8.25	2.29	2,70	2.11	Ns
Motor	9.68	2.87	8.68	1.98	8.88	2.25	2,70	1.15	Ns

The full list of results is reported in Table 4.20 above (the ranges are reported below).

At 6 months (CA), the *Adaptive Behaviours* total composite score differed among the three groups, F (2, 80) = 5.60; p = .005. Intervention KC mothers indicated that their children had better adaptive behaviours than mothers in the Limited KC and Control groups did. The MANCOVA on the sub-scales revealed significant differences on the *Self-Care sub-scale*, F (2, 80) = 5.97; p = .004, where Intervention KC children had a significantly higher scale score than Limited KC and Control children had. The three groups also significantly differed on *motor sub-scale*, *F* (2, 80) = 4.70; *p* = .012, revealing that mothers indicated that Intervention KC children had better motor development than Control children did. Limited KC children did not differ from the other two groups.

At 12 months (CA), the three groups had a significant difference on the *Communication sub-scale*, *F* (2, 70) = 3.78, *p* = .028. Intervention KC children had better communication skills than Control children did. As previously seen, Limited KC children did not differ from the other two groups. Moreover, the three groups differed on the *Home Living sub-scale*, *F* (2, 70) = 4.11, *p* = .021, where Intervention KC children performed better than Control children did. Limited KC children did not differ from the other two groups. Lastly, the *Leisure sub-scale*, *F* (2, 80) = 6.57; *p* = .002, was significantly different among the three groups. Intervention KC children had a significantly higher scale score than Control and Limited KC children.

The differences between the percentage of children below and within the normal range among groups were not statistically significant. A small percentage of children in all groups performed below the normal range at both 6 and 12 months (CA). Such percentages were: in the Intervention KC group 3.4% at 6 (Mean = 104.79; SD = 11.26; range = 75-122) and 4% at 12 months (CA) (Mean = 97.64; SD = 12.45; range = 78-126); in the Limited KC group 9.1% at 6 (Mean = 96.45; SD = 8.82; range = 73-107) and 13.6% at 12 months (CA) (Mean = 89.68; SD = 10.73; range = 78-108); and in the Control group 13.8% at 6 (Control Composite Score Mean = 97.21; SD = 10.02; range = 64-134) and 20.8% at 12 months (CA) (Control Composite Score Mean = 91.08; SD = 15.61; range = 76-114).

Summary of results on infant's development

In summary, in relation to preterm infant development, between 6 to 12 months (CA) the KC procedure had a positive impact on the language, gross motor skills and on adaptive behaviour development, specifically on the preterm infant's leisure capacities. Follow-up analyses have revealed that Limited KC children where the ones presenting a better performance on gross motor skills at 6 months (CA) and on language development at 12 months (CA) compared to Control group children. In reference to language development, the intervention KC children presented very similar scores to the Limited KC children at 12 months; however, not statistically significantly different from the children in the Control group. This could indicate that both Limited and Intervention KC children benefited from the intervention received during the NICU period, enhancing their communicative skills. Indeed, the lower scores in the Intervention KC children could be due to the fact that they presented a higher degree of infant medical risk and prematurity compared to the children in the Limited KC group. In the following section of this Chapter, this will be further explored.

Finally, in relation to adaptive behaviour development, follow-up analyses demonstrated that at 6 months (CA) mothers of children in the full intervention KC reported that their children presented better global adaptive development and at 12 months (CA) better communication compared to children in the Control group and better leisure abilities compared to children in both the Control and Limited groups.

From 6 to 12 months (CA) all children in the three groups presented an improvement in cognitive and socio-emotional development. Conversely, they also presented a decrease in fine motor, expressive communication and adaptive behaviour skills.

Section 2:

KC effect on mother's attachment, mother-infant dyadic interaction, parenting distress and infant's development. An exploration on the contributing factors

4.9 Introduction

This section will explore the long-term impact of the KC on maternal bonding and mother-infant dyadic interaction at 6 months (CA), and on maternal parenting stress and infant language development at 12 months (CA). The other significant KC effects found at previous research times are investigated as explanations for the long-term differences found among groups.

4.10 Background and hypotheses

Results from this research (see Section 1) proved the long-term efficacy of the KC intervention in enhancing the quality of mother-infant interaction and of maternal bonding at 6 months (CA) and in lowering maternal stress; specifically, at 12 months (CA) KC was efficacious in lessening the maternal worry of having a dysfunctional interaction with the child. Moreover, KC in the limited KC procedure improved infants' language development at 12 months (CA).

At previous times of data collection, the positive impact of KC intervention was found in relation to the following three areas: 1) maternal parenting stress (at discharge and 6 months (CA)), 2) mother-infant dyadic interaction (at 3 months (CA)), having to do with the maternal capacity of fostering the infant's socio-emotional growth and of responding to the infant's distress and 3) when KC was carried out as both a limited and a full intervention, on the infant's proximal environment, improving the quality of learning materials made available to the preterm infant at 3 months (CA).

In the wider literature concerning preterm infants and their mothers, these three areas (maternal parenting stress, mother-infant dyadic interaction, and the infant proximal environment) are recognised to be the ones in which major difficulties are reported due to preterm birth in mothers and in mother-infant dyads. Moreover, as will be explained below, they are reported to play a major influential role in the subsequent mother bonding to the preterm infant, mother-infant interaction, maternal parenting stress, and on preterm infant development, where long-term effects of KC have been here found.

The investigation of the potential contribution of parenting stress on the long-term results obtained by the practice of KC could shed light on the underlying processes involved. Indeed, as seen in Chapter 1, maternal stress is considered one of the most powerful factors that adversely influences the development of the mother-infant relationship, as it has an impact on both mother-infant interaction and on the maternal representations of her bonding with the child (Forcada-Guex et al., 2011; Korja et al., 2008; Murray et al., 1996).

In relation to mother-infant dyadic interaction, maternal parenting stress is identified as a major contributor, adversely influencing mother-infant interactive styles (Feeley et al., 2005; Forcada et al., 2011; Schmucker et al., 2005; Singer et al., 2003). In the preterm population, at 6 months post discharge, infant perinatal risk is still reported to negatively influence the mother-infant dyadic interaction (Muller-Nix et al., 2004; Singer et al., 2003). In this context, the positive effect of the KC intervention found at 6 months could have been the result of the contribution of its earlier positive effect on maternal parenting stress at discharge, accounting for the infant perinatal risk.

With respect to the outcome variables of maternal bonding representation and maternal parenting stress itself, both are influenced by: their interrelationship to each other (Korja et al., 2009; 2010; Forcada-Guex et al., 2011; Murray et al., 1996), the infant medical risk (Borghini et al., 2006; Muller-Nix et al., 2004) and the length of mother-infant separation (Feldman et al., 1999). When looking at the long-term effect of KC on maternal bonding to the child, it was important to establish whether the KC Intervention, which had helped reduce the separation between mother and infant, acted together with its previous positive effect on maternal parenting stress (at discharge) in enhancing the maternal quality of bonding with the preterm infant, as found at 6 months (CA).

Conversely, when looking at the effect of KC on the maternal worry of having a dysfunctional interaction with her child (sub-scale of the PSI-SF) at 12 months (CA), it was here important to investigate whether there were potential contributions of both the quality of maternal bonding representation and the mother-infant dyadic interaction, on which a KC effect was previously established at 6 months (CA).

Finally, concerning language development, the most recent literature on preterm infant development (Arpino et al., 2010; Johnson, 2007) recognises that the child's development is equally linked to biological (Arpino et al., 2010; Johnson, 2007) and environmental factors (Aylward, Verhulst, & Bell, 1989; Lee & Barratt, 1993; Liaw & Brooks-Gunn, 1993). More specifically, in relation to the language development of preterm infants, it is established that social and environmental factors have a greater impact on developmental outcomes than do perinatal complications (Lukeman & Melvin, 1993; Magill-Evans & Harrison, 2010). The most relevant social and environmental factors implicated on preterm infant language development are: mother-infant dyadic interaction (Beckwith & Rodning, 1996; Cusson, 2003; Forcada-Guez et al., 2006), maternal parenting stress (Magill-Evans & Harrison, 2010) and the quality of home environment and family socio-economic background (Arpino et al., 2010). At 12 months (CA), however, the biological factor which is still reported to be influential is infant perinatal risk. Thus, when exploring the here found impact of the KC procedure on language development at 12 months (CA), it was important to take into consideration its previous effect on maternal parenting stress, mother-infant interaction and home environment. It was also relevant to account for the potential influence of infant perinatal risk and of the family socio-economic background.

The repeated measures design of the present study allowed investigation of the impact of KC effect found at previous research times on the long-term results obtained. The aim of this section was to explore whether the positive KC long-term effects were also due to the positive KC impacts on specific outcome variables measured at previous research times. In this PhD project, long-term KC effects are found in the areas just mentioned above: maternal bonding and mother-infant dyadic interaction at 6 months (CA), and maternal parenting stress and infant language development at 12 months (CA). The selection of contributor variables on the KC long-term effects was made on the consideration that such outcome variables are established as being of pivotal importance for their influence on maternal psychological status and on the child's healthy development, as detailed above (see also Chapter 1). Consequently, the following hypotheses were tested:

1. The better quality of maternal bonding at 6 months (CA) found on the KC intervention group could have been influenced by the reduction of maternal stress after the preterm infant's discharge; the maternal interactive skills at 3 months was also due to KC intervention.

2. The lower maternal stress found on the KC group at discharge could have played a role on the improvement of the mother-infant dyadic interaction at 6 months (CA), both in terms of maternal and infant interactive skills.
3. The positive effect of KC on the level of maternal parenting stress at 12 months (CA) could be due to its positive earlier influence on mother-infant dyadic interaction and maternal bonding at 6 months (CA).
4. The positive effect of the KC procedure on language development at 12 months could be the result of a combined influence of KC together with the home environment's quality, in terms of learning materials available to the child at 3 months (CA), mother-infant dyadic interaction and maternal parenting stress at 6 months (CA), socio-economic background and finally, infant medical risk.

4.11 Analyses and results

Three statistical approaches were investigated in order to inspect the independent contribution made by the KC intervention and the potential contributions of the identified variables on: 1) maternal bonding towards the preterm infant at 6 months (CA), 2) mother-infant interaction at 6 months (CA), 3) parenting stress at 12 months (CA), and 4) infant language development at 12 months (CA).

Firstly, repeated measures mixed-model analyses of variance ((M)ANCOVAs) were planned. In this type of statistical analyses, the within-participants independent variable was time (time point 1 through to time point 6, depending on the measure analysed) and the between-participants independent variable was group (Intervention KC, Limited KC and

Control group). The dependent variables were each of the four variables reported above, measured across time points. The covariates considered were CRIB II and, depending on the dependent variable investigated, the ones identified as being potential contributors as reported above. However, in order not to increase the degree of errors, the number of covariates that was possible to introduce was limited due to the small sample size. The sample size indeed was reduced by the fact that there were different missing values for each measure to be inserted into the model, as reported in Section 1. Therefore, the possibility was considered of creating composite scores with the covariates identified. However, the inspection of their concordance and internal reliability across time did not give acceptable results. A reason for this could be due to the fact that the measurements relate to different stages of the child's development, and to a different situation with respect to the preterm birth. In fact, the variables under scrutiny presented different correlations over time and therefore this approach was considered not viable.

In the second approach, four different hierarchical regression models were computed using the maternal outcome variables identified in the first half-year, in order to predict maternal bonding towards the preterm infant at 6 months (CA), mother-infant interaction at 6 months (CA), parenting stress at 12 months (CA) and infant language development at 12 months (CA). The predictor variables were entered in three blocks, in a predetermined order, to respectively account for: 1) the variance of the control measure CRIB II in order to partial out the variance among groups related to the infant's biological risk, 2) the variance of the mentioned maternal outcome variables with expected predictive power, and lastly 3) to account for the variability of groups (Intervention KC, Limited KC and Control), above and beyond all other variables in the model. Two dummy variables were created to account for the three groups. All regressions were screened for departures from the assumption of independence of errors (Durbin-Watson test) and multicollinearity (collinearity diagnostic). The latter indicates whether the predictor variables in the model are highly correlated. The presence of multicollinearity does not reduce the predictive power or reliability of the model as a whole, but it affects calculations regarding individual predictors, not giving a valid result about any individual predictor. None were found. However, through hierarchical regression it was not possible to establish whether there were any interactions among the inserted predictor variables and group.

Finally, a third approach was applied in order to also take into consideration potential interactions among the variables inserted into the model and group in the statistical model. Four different univariate analyses of variance and covariance (ANCOVAs) with group (Intervention KC, Limited KC and Control) as between subject factor were conducted for each of the following dependent variables: maternal bonding towards the preterm infant at 6 months (CA), mother-infant interaction at 6 months (CA), parenting stress at 12 months (CA) and infant language development at 12 months (CA). The potential presence of interaction between the covariates and the independent variable was always examined. In case of significant interaction, the covariate was centred and the ANCOVA re-run. Sidak post hoc comparisons (with $\alpha = .05$) were always calculated to establish the unique contribution of the KC intervention.

In the first ANCOVA model, the dependent variable considered was the mother-infant dyadic interaction (NCAF Total) at 6 months (CA). The covariates inserted into the model were: CRIB II, to partial out the variance related to the infant's biological risk, and maternal parenting stress (PSI-SF Total) at discharge. Two further ANCOVAs were carried out with the same covariates because the same positive effect of KC at 6 months (CA) was found on two specific sub-scales, one accounting for the maternal contribution to the interaction

(*Cognitive growth fostering Sub-scale*) and the other accounting for the infant's contribution to the dyadic interaction (*Responsiveness to caregiver*).

In the second ANCOVA model, investigating maternal bonding towards the preterm infant at 6 months (CA), the following covariates were entered in the model: CRIB II, maternal stress at discharge (PSI-SF Total) and maternal interactive behaviours (*Socio-emotional growth fostering Sub-scale and Responsiveness to the infant's distress Sub-scale*), in order to investigate any shared variability they might have with the KC intervention in the positive KC result found on the MPAQ Total (DV). Moreover, in order to explore the contribution of KC on parenting stress at 12 months (CA), above and beyond all other variables in the model, a third ANCOVA was computed with *Parent-Child Dysfunctional Interaction Sub-Scale* as dependent variable, and, as covariates, CRIB II, maternal bonding (MPAQ total) and mother-infant dyadic interaction (NCAF), both at 6 months (CA).

A final ANCOVA model was computed in order to explore the presence of any shared contribution of KC with the following covariates on the infants' language development at 12 months (CA): CRIB II, family's socio-economic status (SES) (to partial out variance related to family background), *Learning material sub-scale* (HOME) at 3 months (CA), mother-infant dyadic interaction (NCAF) total score at 6 months (CA) and Parenting stress (PSI-SF) total score at 6 months (CA).

ANCOVAs and hierarchical regressions led to similar results. It was then decided to report on the results obtained by the ANCOVAs analyses as information about interactions was given using this approach.

Results are presented in terms of the main effect of group and of each covariate in the model. Their contribution on the dependent variable is reported as partial eta square (η^2). The overall significance of the model accounting for group and covariates together is indicated and the percentage of variance (R^2) on the dependent variable for which it accounts for is provided.

The results are reported below separately for each of the dependent variables investigated.

4.11.1 Investigation on mother-preterm infant dyadic interaction at 6 months (CA)

Table 4.21: Results of Analyses of Covariance for Relations between Mother-Infant Dyadic Interaction at 6 Months (CA) and Infant Medical Risk and Maternal Parenting Stress at Discharge

	df	*F*	p
Corrected Model	4,62	2.66	.041
CRIB II	1,62	.378	.541
PSI-SF at discharge	1,62	.035	.852
Groups	2,62	1.99	.145

Table 4.22: Mother-Infant dyadic Interaction Adjusted means for Infant Medical Risk and Maternal Parenting Stress at Discharge

	NCAF total		95% Confidence Interval	
	Mean	SD	Lower Bound	Upper Bound
Control	52.79[a]	1.81	49.18	56.41
Intervention KC	58.52[a]	1.80	54.93	62.15
Limited KC	55.13[a]	1.71	51.71	58.54

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 4 and PSI/SF total at discharge = 72,67

A significant model resulted from the ANCOVA on the NCAF total score at 6 months (CA), *F Corrected Model* (4, 62) = 2.66, $p = .041$, $\eta^2 = .146$, accounting for 14.6% of the variance on mother-infant dyadic interaction (*R squared* = .146). The covariates in the model

CRIB II, F (1, 62) = .378, p = .541, η^2 = .006, and maternal parenting stress at discharge, F (1, 62) = .035, p = .852, η^2 = .001, did not significantly contribute on the variance of the NCAF total, as shown in Table 4.21. No effect of group was found, F (2, 62) = 1.99, p = .145, η^2 = .06. However, Sidak comparisons revealed an almost significant effect of Intervention KC in comparison to Control (p = .053) but not in comparison with Limited KC (p = .175); the adjusted means are reported in Table 4.22 above.

Table 4.23: Results of Analyses of Covariance for Relations between Maternal Interactive Capacity of Cognitive Growth Fostering of the Infant at 6 Months (CA) and Infant Medical Risk and Maternal Parenting Stress at Discharge

	df	F	P
Corrected Model	4, 68	3.03	.024
CRIB II	1, 68	.041	.840
PSI-SF at discharge	1, 68	.019	.891
Groups	2, 68	3.35	.041

Table 4.24: Cognitive Growth Fostering Adjusted Means for Infant Medical Risk and Maternal Parenting Stress at Discharge

	NCAF Cognitive Growth Fostering Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Control	5.48[a]	.444	4.59	6.37
Intervention KC	7.17[a]	.429	6.34	8.03
Limited KC	5.90[a]	.420	5.06	6.74

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 3.98, PSI/SF total at discharge = 72.5

Table 4.23 reports on the results regarding the maternal contribution to the dyadic interaction. As illustrated in relation to the mother's capacity to cognitively foster the preterm infant's cognitive growth, the ANCOVA reported again a statistically significant model, *F Corrected Model* (4, 67) = 3.03, $p = .024$, $\eta^2 = .161$, accounting for 16% of the variance on maternal interactive capacities (*R squared* = .161). As can be seen in Table 4.24, which reports the adjusted means, a significant group effect was found, $F(2, 68) = 2.46$, $p = .041$, $\eta^2 = .096$, with Intervention KC having better scores than Control ($p = .038$) and Limited KC ($p = .018$). As found for the other two models, the other covariates CRIB II, $F(1, 68) = .041$, $p = .84$, $\eta^2 = .001$, and PSI-SF at discharge, $F(1, 68) = 0.19$, $p = .89$, $\eta^2 = .001$, were not statistically significant. No interactions were found between group and covariates.

Table 4.25: Results of Analyses of Covariance for Relations between Infant Responsiveness to Caregiver 6 Months (CA) and Infant Medical Risk and Maternal Parenting Stress at discharge

	df	F	p
Corrected Model	4,62	2.75	.036
CRIB II	1,62	.194	.661
PSI-SF at discharge	1,62	1.53	.220
Groups	2,62	2.46	.094

Table 4.26: Infant Responsiveness to Caregiver Adjusted Means for Infant Medical Risk and Maternal Parenting Stress at Discharge

	NCAF Infant Responsiveness Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Control	4.12[a]	.473	3.17	5.06
Intervention KC	5.79[a]	.470	4.85	6.73
Limited KC	4.85[a]	.447	3.96	5.74

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 4 and PSI/SF total at discharge = 72.67

Similar results were obtained in relation to the preterm infant's responsiveness to the mother, as illustrated in Table 4.25 above. Indeed, a significant model was found from the ANCOVA, *F Corrected Model* (4, 62) = 2.76, p = .036, η^2 = .151, accounting for 15% of the variance on the infant interactive capacities (*R squared* = .151). However, no effect of group was found, *F* (2, 62) = 2.46, *p* = .094, η^2 = .074. Nevertheless, as illustrated in adjusted means reported in Table 4.26, Sidak comparisons revealed a significant effect of Intervention KC in comparison to Control (*p* = .031) but not in comparison to Limited KC (*p* = .152). The other covariates in the model, CRIB II, *F* (1, 62) = .194, *p* = .661, η^2 = .003, and PSI-SF, *F* (1, 62) = 1.53, *p* = .22, η^2 = .024, at discharge again were not statistically significant. No interactions were found between group and covariates.

4.11.2 Investigation on maternal attachment at 6 months (CA)

Table 4.27: Results of Analyses of Covariance for Relations between Maternal Bonding to the Infant at 6 Months (CA) and Infant Medical Risk and Maternal Parenting Stress at discharge and Maternal Interactive Capacities with the Infant at 3 Months (CA)

	df	F	p
Corrected Model	6, 69	3.18	.009
CRIB II	1, 69	.005	.944
PSI-SF at discharge	1, 69	14.56	<.001
NCAF responding to distress (3 months)	1, 69	.583	.448
NCAF socio-emotional growth (3 months)	1, 69	.037	.847
Groups	2, 69	.380	.686

Table 4.28: Maternal Bonding to the Infant Adjusted Means for Infant Medical Risk and Maternal Parenting Stress at discharge and Maternal Interactive Capacities with the Infant at 3 Months (CA)

	MPAQ Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Control	83.48[a]	1.55	80.39	86.58
Intervention KC	84.64[a]	1.58	81.49	87.79
Limited KC	82.70[a]	1.47	79.76	85.65

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 4.27, PSI/SF Total at discharge = 72.59, NCAF Sub-scale Maternal Response to distress (3 months) = 10.04, NCAF Sub-scale Maternal Social-emotional growth fostering (3 months) = 11.87

As illustrated in Table 4.27, the ANCOVA on the total of MPAQ resulted in a statistical significant model, *F Corrected Model* (6, 69) = 3.18, $p = .009$, η^2 .235, which accounted for 23.5% (*R squared* = .235) of the variance in the maternal bonding scores at 6 months. However, no effect of group was found, F (2, 69) = 38, $p = .686$, $\eta^2 = .012$; Intervention KC mothers did not significantly differ from Control ($p = .804$) and Limited KC mothers ($p = .618$). The only covariate contributing to the positive effect on the model was maternal parenting stress at discharge, F (1, 69) = 14.56, $p < .001$, $\eta^2 = .19$, which was highly significant. The maternal interactive capacities in terms of responding to the infants' distress, F (2, 69) = .583, $p = .448$, $\eta^2 = .009$, and in terms of socio-emotional growth fostering, F (2, 69) = .037, $p = .847$, $\eta^2 = .001$, did not result in significantly accounting for maternal bonding to the infant at 6 months of age. No interactions were found among the covariates and group type. Table 4.28 reports the adjusted means for maternal bonding when accounting for CRIB II, PSI-SF at discharge and NCAF at 3 months (CA).

4.11.3 Investigation on maternal parenting stress at 12 months (CA)

The positive effect of Intervention KC found on the PSI-SF sub-scale of Parent-child Dysfunctional Interaction at 12 months (CA) was further investigated to establish whether other positive effects of the KC intervention on maternal bonding (MPAQ Total), maternal capacity to foster the child's cognitive growth (mother sub-scale, NCAF) and on the infant's responsiveness towards the mother (infant sub-scale, NCAF), also contributed to it. A significant interaction between group and the MPAQ score was found, (3, 61) = 4.37, p = .008. The MPAQ scores were recoded by centring them in relation to the overall mean of the sample. No other significant interactions were observed. The same ANCOVAs with the centred MPAQ scores were re-computed.

Table 4.29: Results of Analyses of Covariance for Relations between Maternal Parenting Stress (Parent-Child Dysfunctional Interaction, PSI-SF Subscale) at 12 Months (CA) and Infant Medical Risk and Maternal Bonding to the Child and Mother-Infant Dyadic Interaction at 6 months (CA)

	df	F	p
Corrected Model	6, 61	4.61	.001
CRIB II	1, 61	.126	.724
MAPQ Centred 6 months	1, 61	11.17	.002
NCAF Mother Cognitive Growth Fostering (6 months)	1, 61	.001	.973
NCAF Infant Responsiveness (6 months)	1, 61	.046	.831
Group	2, 61	3.73	.031

Table 4.30: PSI-SF Sub-scale of Parent-Child Dysfunctional Interaction (CA) Adjusted Means for Infant Medical Risk and Maternal Bonding to the Child and Mother-Infant Dyadic Interaction at 6 months (CA)

	PSI-SF Parent-Child Dysfunctional Interaction		95% Confidence Interval	
	Mean	Std. Error	Lower Bound	Upper Bound
Control	18.02[a]	.946	16.12	19.95
Intervention KC	14.26[a]	.983	12.29	16.23
Limited KC	15.20[a]	.788	13.62	16.78

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 3.97, Centred MAPQ 6m = .388, NCAFS Sub-scale Cognitive Growth Fostering (6 months) = 6.21, NCAFS Sub-scale Responsiveness to Caregiver (6 months) = 5.02

Table 4.29 illustrates the final ANCOVA, indicating a significant model, *F Corrected Model* (6, 67) = 24.61, p = .001, η^2 = .339, which accounts for 40% of the variance on the Parent-child Dysfunctional Interaction scores (*R squared* = .339). No influence was found from CRIB II, *F* (1, 61) = .126, *p* = .724, η^2 = .002. A significant effect of group was established, *F* (3, 61) = 3.73, *p* = .031, η^2 = .121. Indeed, as illustrated by the adjusted means scores reported in Table 4.30, Intervention KC had significantly lower scores compared to Control (*p* = .05) but not compared to Limited KC (*p* = .858). Moreover, a highly significant contribution of MPAQ at 6 months, *F* (1, 61) = 11.17, *p* = .002, η^2 = .171, was found. Neither the NCAF sub-scales *Cognitive Growth Fostering,* related to the mother, *F* (1, 61) = .001, *p* = .973, η^2 = .001, nor *Responsiveness to Caregiver,* related to the infant, *F* (1, 61) = .046, *p* = .831, η^2 = .001, were statistically significant contributors in the model.

4.11.4 Investigation of infants' language development at 12 months (CA)

Results in Section 1 showed that both Intervention and Limited KC preterm infants at

12 months (CA) presented better global language capacities than children in the Control group. A further ANCOVA was carried out to investigate the contribution of the learning materials available to the child at 3 months (CA), mother-infant dyadic interaction at 6 months (CA) and maternal parenting stress at 6 months (CA). Both infant medical risk and the socio-economic background were accounted for in the model. A significant interaction between group and NCAF was found, F (1, 51) = 3.49, p = .042. As in the previous model, the NCAF scores were centred and the ANCOVA was then re-run. No other interactions were found.

Table 4.31: Results of Analyses of Covariance for Relations between Infant Language Development at 12 Months (CA) and Infant Medical Risk, Socio-Economic Status, Learning Materials Available to the Child (HOME Sub-Scale) at 3 months (CA), Maternal Parenting Stress, and Mother-Infant Dyadic Interaction at 6 months (CA)

	df	F	p
Corrected Model	7	2.25	.048
CRIB II	1	1.27	.265
SES	1	3.32	.075
HOME Learning Material Sub-scale (3 months)	1	3.12	.085
PSI-SF Total (6 months)	1	.768	.386
Centred NCAF Total (6 months)	1	1.36	.249
Group	2	3.21	.050

Table 4.32: Language Composite Adjusted Means for Infant Medical Risk, Socio-Economic Status, Learning Materials Available to the Child (HOME Sub-Scale) at 3 months (CA), Maternal Parenting Stress, and Mother-Infant Dyadic Interaction at 6 months (CA)

	Language Composite Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Control	94.61[a]	2.735	89.10	100.13
Intervention KC	104.41[a]	2.859	98.64	110.17
Limited KC	102.46[a]	1.997	98.43	106.49

a. Covariates appearing in the model are evaluated at the following values: CRIB II = 4.06, SES = 1.88, HOME Learning materials (3 months) = 6.80, PSI/SF total (6 months) = 58.33 and Centred NCAF Total 6 months = -.198

The ANCOVA revealed a significant model, *F Corrected Model* (7, 51) = 2.25, *p* = .04, η^2 = .268, which accounts for the 26.8 % of the variance on the infant language composite scores (*R squared* = .268), as illustrated in Table 4.31. The only significant contributor in the model was group, *F* (2, 51) = 3.21, *p* = .05, η^2 = .13. As can be seen by the adjusted means reported in Table 4.32, a statistically significant difference was shown for both Intervention KC (*p* = .035) and Limited KC (*p* = .023) when compared to the Control group. An indication, even if not significant, of a contribution of Family SES, *F* (1, 51) = 3.32, *p* = .075, η^2 = .072, and the HOME learning material sub-scale, *F* (1, 51) = 3.12, *p* = .085, η^2= .068, was found. CRIB II, *F* (1, 51) = 1.27, *p* = .265, η^2 = .029, mother-preterm infant dyadic interaction (NCAF), *F* (1, 51) = 1.36, *p* = .249, η^2 = .031, and maternal parenting stress (PSI-SF), *F* (1, 51) = .768, *p* = .386, η^2 = .018, were not significant covariates in the model.

These results on infant language development further confirm the results previously found in the repeated measure design: the KC procedure, regardless of whether it is carried out as a limited or as a full intervention, has been found to be the unique contributor. In the ANCOVA model it was not possible to account for the elements distinctive of KC, such as gestational age and postnatal age of the child at the beginning of KC, and total duration of KC, because, as shown in Table 4.4, in Section 1, these variables were highly correlated to infant medical risk (CRIB II). In order to verify whether a particular component of the KC intervention played a role in both Intervention and Limited KC, Pearson r correlations were computed between the infant language composite score at 12 months (CA) and gestational age and postnatal age in days of the child at the beginning of KC, and total duration of KC among limited and Intervention KC groups. As illustrated in Table 4.33, results show a negative correlation between infant language development and the gestational age of the infant at the beginning of the intervention r (75) = -.338, p = .008, showing a medium effect size. This indicates that preterm infants at a lower gestational age at the intervention's beginning are the ones who benefit most from the effects of KC on language development.

Table 4.33: Correlations (Pearson's r) Between Infant Language Composite Score and Gestational Age and Post-Natal Age at the Beginning of the Intervention and Total Duration of KC on Days and Minutes

	GA at the beginning of KC	Post-natal age at the beginning of KC	Total days of KC	Total duration in minutes of KC
Language Score	-,181	-,383**	,005	-,039

** Correlation is significant at the 0.01 level (2-tailed)

GA = gestational age

4.12 Discussion of the results reported in Section 1 and Section 2

The results reported in Section 1 and Section 2 have demonstrated that the KC intervention has a clear effect on the following investigated areas: 1) maternal psychological distress, in terms of parenting stress but not in terms of anxiety and depression; 2) maternal bonding to her preterm infant but not on her perception of him/her; and 3) mother-infant dyadic interaction. Less stronger effects were reported in the area of the infant's proximal environment. In this area, KC when applied as both full intervention (1 hour a day for 14 consecutive days) and limited intervention produced a better home environment in terms of the quality of learning materials available to child, but did not influence the couple relationship and the perception of the level of social support available. The results in the area of child development proved the efficacy of the KC intervention on the mothers' reports of their child's adaptive development. Moreover, KC when applied as both full and limited intervention was shown to promote the preterm infant's language development. Gross motor development, instead, was enhanced in the children of the limited KC group only.

In relation to maternal psychological distress, it was hypothesised that the KC intervention would have a beneficial effect, by helping mothers to cope with the impact of a preterm birth and by ameliorating their psychological distress. The results confirm this hypothesis. They have shown that the KC intervention (carried out for 1 hour a day for 14 consecutive days) was efficacious in lowering the parenting stress experienced by mothers at discharge from hospital. Thus, these results confirm the earlier ones obtained by Tallandini & Scalembra (2006). Moreover, differently from what was previously found by Miles et al. (2006), the results proved KC's long-term effects on parenting stress, which were maintained until 12 months (CA). This provides new evidence on the efficacy of KC when applied as a well defined and structured intervention. Indeed, KC, when carried out for a shorter amount of time, was not found to be efficacious in significantly lessening parenting stress. In relation to the distress experienced by mothers, KC appears to have a specific effect, acting precisely on the stress that can arise from caregiving. Indeed, in contrast with our hypothesis and also in contrast with previous findings (Affonso, 1998; Feldman et al., 2002b), no influence of KC on the mothers' depressive symptoms or personal anxiety was observed at the time of hospital discharge. With respect to the mothers' personal anxiety levels, the KC Intervention group presented a higher level of anxiety at 6 months (CA). However, these anxiety levels followed the same path for the three groups, going from mild (just after birth) to minimal. A possible explanation for this finding is that the KC intervention group contained more immature infants at birth, with higher medical risk than the other two groups. It is possible that the KC mothers may have developed a higher state of alertness and reactivity in order to cope with unexpected negative events related to their infant's health (Barlow, 2002).

In relation to the long-term effects of KC, the results from section 2 showed that the lowering of maternal parenting stress at 12 months (CA) was the result of the contributions of both the KC intervention itself and also of the quality of maternal bonding to the infant established by 6 months (CA), above and beyond the quality of mother-infant interaction and of infant medical risk. Conversely, the quality of maternal bonding to the preterm infant at 6 months (CA) was found to be due to the maternal parenting stress at discharge, which was found to be the only contributor to the positive results found. The mother-infant interaction was directly associated with neither the bonding processes nor with parental distress. Such results further confirm the interrelationship between parenting stress and maternal bonding, validating the findings from the wider preterm infant literature. Indeed, the presence of high maternal stress influences the bonding processes negatively (Korja et al., 2009; 2010; Forcada-Guex et al., 2011).

Subsequently, in relation to the prediction that KC would have a positive impact on the mothers' bonding to their preterm infants, findings further support that the provision of a structured KC intervention heightens the mother's quality of bonding at 6 months (CA). Moreover, it reduces the mother's hostility towards her child at 12 months (CA). However, the KC effect seems to be not direct but the end result of the interrelationship between maternal bonding and maternal parenting stress. Interestingly, as if such interrelationship was in the process of development, the present results show that KC mothers reached a better quality of bonding than the other two groups only by the second semester of the first year (CA) of the infant's life. This is the time in the infant's development in which the child becomes more socially responsive to his/her caregivers' babbling and displaying of social smiles, and more active within the proximal environment through a shift from a dyadic mother-infant context to a triadic mother-infant-object context (Carpenter et al., 1998; Striano & Bertin, 2005).

The previous study on the impact of KC on maternal bonding (Miles et al., 2006) found no effect of the KC procedure at 12 months (CA). In line with the results of this research, two recent studies - carried out after the development of this PhD project - demonstrated that at the time of discharge from hospital and at 3 months (CA), KC mothers bonded better with their infants compared to Control mothers did (Ahn et al., 2010; Gathwala, Singh & Bharti, 2008). Similarly to our research and differently from Miles et al. (2006), KC was here applied for daily sessions of at least for 1 hour a day. As extensively reported in Chapter 2 and discussed in Chapter 3, Miles et al. (2006) applied a KC procedure that required a very limited amount of skin-to-skin contact compared to the one applied in the present study, which could explain the differences in the studies' results.

Even if the quality of bonding was found to be different among groups, the maternal perception of the child in the first 3 months (CA) of the preterm infant's life was not influenced by the provision of KC, differently from what was hypothesised. This latter finding is in contrast to Feldman et al.'s (2002b) results who reported that KC mothers had a less abnormal perception of their child than did Control mothers.

With respect to the mother-infant dyadic interaction, results from this research demonstrate that the KC intervention facilitated the interactive style of the mother-infant dyads, as hypothesised. In particular, stronger KC effects were found on the maternal side of the interaction along the research time. Indeed, KC intervention mothers developed a better interactive style in fostering their infants' cognitive and socio-emotional development and in responding to their infants' distress. Only by 6 months (CA) Intervention KC infants demonstrated a higher capacity to respond to their parents' interactive style, contributing to the interaction by actively smiling and vocalising. The analyses in section 2 demonstrated that the long-term results on maternal interactive style at 6 months (CA) was due to the main contribution of the provision of KC for at least 1 hour a day for 14 days, above and beyond infant medical risk and maternal parenting stress. Differently from our hypotheses and from previous findings (Forcada et al., 2011; Singer et al., 2003; Feeley et al., 2005; Schmucker et al., 2005), the mothers' parenting stress did not exert any influence in conjunction with the effect of KC on the subsequent mother-infant interaction at 6 months (CA).

These results are in line with previous KC research, which has shown the short-term (Tessier et al., 1998; Feldman et al., 2002b; Tallandini & Scalembra, 2006) and long-term (Feldman et al., 2003) efficacy of KC in mother-infant dyadic interaction. Moreover, recent studies (Bigelow, Bergmand & McDonald, 2010; Neu & Robinson, 2010) have also found similar positive KC effects. It should be noted that in our sample, by the time the infants reached 12 months (CA), mother-infant dyads in all groups reached the same level of quality of interaction, suggesting that the KC intervention can be considered a positive supplement in addressing the initial interactive difficulties reported with preterm infants (Crinc et al., 1983; Minde et al., 1983; Muller-Nix et al., 2004).

It was further hypothesised that the positive effect of KC would influence the whole family, impacting on the infant’s proximal environment. Our results have only partially supported these hypotheses on the variables taken into consideration for this dimension. As already supported by Feldman et al. (2003), our results seem to denote that all KC mothers provided a better home environment in terms of making more learning materials available to their infants than Control mothers did. This could be an indication that, through KC, mothers became more engaged in their children’s play activities and were better able to recognise the benefits of providing many and diverse learning materials to their children. However, when the parental couple and the perception of social support were investigated, no among group differences were found. In fact, these dimensions remained stable in all groups across the research times and no statistically significant results emerged. Previous research (Carter et al., 2007) indicated that the relationship between parents and the social support available were important factors in affecting the quality of the preterm infants’ family life in the year following discharge from hospital.

In respect to the last area investigated in this research, preterm infant development, the results have clearly demonstrated that KC impacted on the report given by mothers on their child’s adaptive behaviour development at 6 months (CA). This was found in terms of social skills, such as the ability to get along with other people and to recognise emotions; self-care skills such as eating and sleeping; and motor skills in terms of locomotion and manipulation of objects. These positive impacts of KC on adaptive development were maintained at 12 months (CA) but on different dimensions, that is, on infant communication, home living and leisure skills, affecting thus mainly social areas.

A more complex KC effect was found in relation to the other developmental scales of motor and language development. When the differences on the longitudinal analysis of these measures were investigated between 6 to 12 months (CA), the KC Intervention children's' gross motor development significantly improved, differently to that of the children in the Limited KC and Control group. Moreover, both Intervention KC and Limited KC language development remained above the mean population score as opposed to the children in the Control group who decreased in their performance. However, follow-up analyses showed that the provision of KC during the postnatal period improved gross motor development at 6 months (CA) for the Limited KC group only compared to the Control group, and at 12 months (CA) no statistically significant group differences were found. Conversely, in the infant's global language development significant differences were found only between the communicative skills of Limited KC children and Control group children, particularly impacting the infants' receptive communication skills. However, Intervention KC children's language developmental mean score was very similar to the Limited KC group. The further investigation reported in section 2 revealed the effect of both the Limited and Intervention KC on language development. Indeed, when taking into account the potential contributions of mother-infant interaction, maternal parenting stress, the provision of appropriate play materials and socio-economic background, the KC procedure, both as a Limited and a Full Intervention, was independently the unique contributor for the preterm infant's language development. Language development was here not linked to the mother-infant dyadic interaction, which is in contrast with the wider literature on preterm infants (Arpino et al., 2010; Siegel et al., 1982).

The results on infant development only partially proved our hypotheses and supported previous research findings (Feldman, 2004; Tessier et al., 2003) in which a positive impact was also found on the cognitive development of the child. The clearer effect of KC on the Limited KC group and not on the Intervention KC group could be due to the fact that, even if statistically controlled, the more severe prematurity of the target group might have played an intervening role on the infant developmental variables. Infant development is highly influenced by the disruption to a critical stage of growth that takes place during the last trimester of gestation (Kinsella & Monk, 2009). Therefore, the higher medical risk and the lower gestational age at birth could counteract the potential KC effects. Indeed, in relation to language development, the results indicate that the younger the gestational age of the child was at the time of the KC's procedure start, the better the children's language score was at 12 months (CA). Obviously, the gestational age at which KC was started in each child was dependent upon their physiological and medical situation strictly linked to the infants' medical risk.

In summary, this PhD project has duplicated previous research findings on parenting stress at discharge, mother-infant dyadic interaction until 6 months (CA), and preterm infant motor development at 6 months (CA). It has provided new data on KC's positive long-term impact on parenting stress, which was maintained until 12 months (CA), language at 12 months (CA) and adaptive behaviour developments at 6 and 12 months (CA). The results have also proven that the KC procedure is most efficacious when applied as a well defined structured intervention, characterised by regularity, consistency, contingency of daily care and contact. These results are further augmented in relation to the wider literature on preterm infants in the general discussion in Chapter 6, where the underlying and possible causal processes involved are introduced, in order to explain the found KC effects.

Chapter 5

Notes on paternal outcomes: an initial study.

5.1 Introduction

This Chapter presents the outcome of an initial study that investigated the impact of Kangaroo Care (KC) procedure on the formation of bonding between fathers and preterm infants. Moreover, this Chapter explores the way that maternal and paternal parenting stress and bonding variables might affect one another as well as child development. Due to the limited sample size of this study, the findings can only be considered as an indication for further investigations.

5.2 Aim and Hypotheses

The aim of this study was to investigate whether the fathers of those children who had received KC by their mothers benefited on their part from the positive impact found when studying the mothers, as seen in Chapter 4. The variables considered for the investigation were the parenting stress of fathers and their bonding to their children. Furthermore, this study also aimed at establishing whether the maternal psychological status and the mother-infant relationship influence the parenting stress of the fathers as well as their bonding to the child, and vice versa. Finally, the fathers’ contribution to their child’s development was also explored.

Previous research has demonstrated that interventions that target one relationship, in this case the mother-preterm infant dyad, can also affect other individuals and relationships present in the same family. Particular gains achieved in one dyadic system should persist when the same two individuals interact within a triad (Belsky, 1981; McHale & Cowan, 1996). Previous research has shown that the impact of intermittent KC intervention on the mother-infant dyad can also positively affect the father-infant system and the interactions of the entire family (Feldman et al., 2003). Specifically, following the mother-infant Kangaroo intervention, it was observed that an improvement exists in the fathers' sensitivity towards the infant. It was also observed that there exists a reduction in the father's intrusiveness towards the infant during the father-infant interaction. These were the same areas in which a KC effect was found in mothers. This, in turn, produced better family cohesiveness, with harmonious and synchronised relationships among members (Feldman et. al, 2003). Similarly, continuous KC was found to promote a climate in the family in which parents become progressively more aware of the child's needs and thus more sensitive in their caregiving (Tessier et al., 2009). Moreover, fathers who have directly experienced KC with their infants have reported a feeling of being more involved, less stressed (Johnston et al., 2010) and more sensitive in the caring of their infant (Varela et al., 2010). Therefore, in accordance with these results, a positive effect of KC on fatherhood could be hypothesised. It was expected that fathers with partners experiencing KC would have a response similar to the one found in mothers (see Chapter 4, Section 1).

The second part of this Chapter looked at the relationship between the fathers' parenting stress and bonding to their infant and the mothers' parenting stress and bonding, in the context of KC intervention. The most recent literature review on fatherhood (Genesoni & Tallandini, 2009) reported the importance of the role of mothers in helping their partners construct their identity as fathers and their relationship with the child (Belsky, Youngblade, Rovine, & Volling, 1991; Bouchard & Lee, 2000; Carter et al., 2007; McBride & Rane, 1998). Knowing the positive effect of KC on mothers in terms of their relationship with the child and in terms of parenting stress, this study investigated whether such positive outcomes play a role in the fathers' parenting stress and bonding with their child. The positive effect of KC on these maternal variables has been found concurrently at 6 months (CA); therefore, the potential influence of KC at this stage of the infant's development is investigated on the correspondent paternal variables at 12 months (CA). On the mothers' side, it was also investigated here whether the formation of the fathers' bonding to their infants and the fathers' parenting stress at discharge from hospital were contributing factors of the positive effect of KC intervention on maternal parenting stress, maternal bonding to the infant and mother-infant interaction at 6 months (CA).

Finally, the third section aimed at investigating the role the fathers' parenting stress and bonding to their child has on the on the development of the preterm infants. Very limited research has examined the role of fathers as contributors to infant preterm development. Yongman (1984, 1985; Yongman et al., 1995) indicates that premature infant development is influenced by the father's involvement, showing a significant positive association between the father's ability to engage his premature infant in play at 5 months and the infant's developmental outcomes at 9 and 18 months post-term (Yongman, 1984). Similarly, language skills at 18 months were shown to be predicted by the father–child relationship at 3 months of age (Magill-Evans & Harrison, 1999). It is well established that child development is influenced by the interplay between the child, the family, and other aspects of the environment (Fox et al., 2010, Grossman & Johnson, 2009). Through supporting the mother emotionally, fathers may enable the mothers to be responsive caregivers to their child. But fathers may also directly influence child development more directly through their own relationship with the child.

Therefore, the following hypotheses were tested:

1) As a result of the KC effect found in mothers, fathers of children in the Intervention KC group would have less parental stress and would have an experience of a better relationship with their infants, compared to the fathers of the children in the Limited KC and Control groups.

2) Maternal parenting stress, bonding to the child and mother-infant interaction, which have been found to benefit from KC intervention concurrently at 6 months (CA), would influence paternal parenting stress and fathers' bonding to their preterm infant at 12 months (CA).

3) KC's positive effects at 6 months (CA) on maternal parenting stress, on maternal bonding to the child and on mother-infant interaction could also work in concomitance with the emotional support received by their partner in terms of the level of stress in the father when looking after the preterm infant and in terms of the quality of the father's bonding to the child, following discharge from hospital.

4) Fathers' parenting stress and bonding would contribute to the preterm infants' development at 6 months and 12 months (CA) as measured by Bayley III scale.

5.3 Participants

A total of 44 fathers agreed to take part in the research together with their partners. Sixteen fathers were partners of mothers in the Control group; the other 28 belonged to the Intervention KC group (N = 11) and to the Limited KC group (N = 17).

5.3.1 Homogeneity between groups

The homogeneity of the fathers' groups was tested with the same analysis used to test the mothers' groups (see Chapter 3).

Fathers in the three groups differed for age, F (2, 43) = 4.41, p = .02. The limited KC father group had younger fathers (Mean = 33.63; SD = 3.67) compared to the other two groups (Intervention KC Mean = 37.11; SD = 6.17 - Control Mean = 38.83; SD = 5.70). Intervention and Control group fathers did not significantly differ for age.

Similarly, as found in the homogeneity of mothers' group, infants differed for GA, F (2, 43) = 5.62, p = .007, birth weight, F (2, 48) = 3.95, p = .026, and CRIB II, F (2, 48) = 4.59, p = .015. Post-hoc comparisons showed that infants in the Intervention KC group had a lower GA (Mean = 29 weeks; SD = 3.75) compared to Limited KC (Mean = 31.76 weeks; SD = 2.75) and Control groups (Mean = 32.98 weeks; SD = 2.60). They also presented higher CRIB II scores (Mean = 6.18; SD = 5.49) than Control (Mean = 1.57; SD = 3.88) and Limited KC (Mean = 3.52; SD = 3.40) groups. Therefore the father groups' composition followed the same pattern observed for the mothers.

5.4 Measures and procedure

Only the PSI-SF and the version for fathers of the MPAQ (named PPAQ) were fully completed by the fathers (see Chapter 3 for the measures description).

The PSI-SF was collected at each of the six time points as before. The PPAQ was measured at the infants' hospital discharge, and when infants were 6 and 12 months old (CA).

The number of fathers who participated at each of the research times varied as shown in Table 5.1 and the justification given was their work commitments.

Table 5.1: Number of Participants' Fathers at Each Follow-up Time

Research Times	Intervention KC	Limited KC	Control	Total
After birth	11	17	16	44
Discharge	11	17	16	44
3 months (CA)	8	16	10	34
6 months (CA)	10	16	12	38
9 months (CA)	7	11	11	28
12 months (CA)	8	13	11	32

5.5 Data analysis and results

Given the initial small sample size and the attrition across the data collection points (see Table 5.1), only time point evaluation analyses were performed. In order to test the presence of differences among Intervention KC, Limited KC and Control group fathers, as described in Chapter 4, univariate analyses of variance and covariance (ANCOVAs) among the three groups were conducted for each measure at each time point. The between-participants independent variable was group (Intervention KC, Limited KC and Control group) and the covariate CRIB II score. The dependent variables were father parenting stress (PSI-SF) and bonding (PPAQ) outcome variables. Multivariate analyses of variance and covariance (MANCOVAs) were carried out to test the different sub-scales of the PSI-SF and of the PPAQ. The potential presence of interaction between the covariate and the independent variable was always examined. Sidak post hoc comparisons (with á = .05) were calculated when a group main effect was present. Moreover, because of the already established of the contribution of parenting stress on the quality of maternal bonding, the relationship between these two variables was tested in fathers using Pearson bivariate correlations.

The second set of analyses was then performed to explore the interrelationship between maternal outcome variables and fathers' variables of parenting stress (PSI-SF) and bonding with the child (PPAQ). Two different models of ANCOVAs were computed. In the first model, two ANCOVAs were carried out with group as between-participants independent variable (Intervention KC, Limited KC and Control group) and maternal parenting stress (PSI-SF), maternal bonding to the child (MPAQ), mother-infant dyadic interaction at 6 months (CA) and CRIB II score as covariates. The dependent variables were fathers' parenting stress (PSI-SF) and paternal bonding (PPAQ) at 12 months (CA). In the second model of ANCOVAs, the between-participants independent variable was group (Intervention KC, Limited KC and Control group) and the covariates were the fathers' parenting stress (PSI-SF) and bonding to the child at (PPAQ) discharge, and CRIB II score. The dependent variables were maternal parenting stress (PSI-SF), maternal bonding to the child (MPAQ) and mother-infant dyadic interaction at 6 months (CA). Results are presented in terms of the main effect of group and of each covariate in the model. Their contribution is reported as partial eta square and as overall significance of the model in terms of percentage of variance on the dependent variable for which it account for (R^2).

Finally, the last set of analyses were then carried out to investigate the influence on infant development at 6 and 12 months (CA) of the fathers' parenting stress and bonding to the child. Two models of ANCOVAs were computed with group as between-participants independent variable (Intervention KC, Limited KC and Control group). Fathers' parenting stress and bonding to the child at discharge were the covariates in the first model, in which the dependent variable was each of the infant areas of development measured at 6 months (CA): cognitive, language (receptive and expressive), motor (fine and gross), socio-emotional and adaptive behaviours development. In the second model, the covariate were again the fathers' parenting stress and bonding to the child but at 6 months (CA) and the dependent variable was each of the infant areas of development measured at 12 months (CA). CRIB II was always inserted as a covariate in both models. As in the second set of analyses, the results are presented in terms of the main effect of group and the main effect of covariates, of partial eta square and of the overall significance of the model.

The covariates inserted in the ANCOVAs model, presented above, had good internal reliability across the research times considered. Specifically, fathers' and mothers' PSI-SF total at discharge, 3 moths, 6 months, 9 months and 12 months (mothers: $r(44) = .61$; $r(44) = .56$; $r(44) = .74$; $r(40) = .49$; $r(43) = .53$ all significant at p , .001 - fathers: $r(44) = .84$; $r(43) = .89$; $r(36) = .84$; $r(28) = .67$ and $r(31) = .81$, all significant at p , .001 respectively), mothers' MPAQ and fathers' PPAQ at discharge, 6 months and 12 months (mothers: $r(44) = .68$; $r(43) = .62$; $r(41) = .63$, all significant at p , .001 - fathers: $r(36) = .86$; $r(29) = .55$; $r(28) = .57$, all significant at p , .001 respectively) were stable across time.

5.5.1 Parenting stress

Table 5.2: Univariate Analyses of Variance on Paternal Parenting Stress Levels Between Intervention KC, Limited KC and Control Groups at Each Research Time on Fathers' PSI-SF at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
Measures*	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
After birth												
PD	19.65	6.77	13-34	26.13	4.23	19-32	23.51	3.38	17-29	2,43	6.17	.005
DR	10.98	3.56	8-18	15.47	2.90	10-19	13.95	2.11	9-16	2,43	9.14	.001
At discharge												
Total PSI-SF	58.23	17.37	38-83	75.17	17.60	43-98	76.16	16.91	38-93	2,43	4.44	.018
PD	18.93	6.55	13-34	26.05	8.09	14-33	25.06	9.22	12-35	2,43	3.06	.058
P-CDI	19.34	6.02	12-28	23.56	4.85	12-33	24.17	5.70	12-31	2,43	2.58	Ns
DC	20.24	6.57	13-32	25.36	6.86	15-34	26.75	5.82	13-34	2,43	2.84	Ns
DR	9.87	3.01	8-17	14.19	4.93	8-21	13.76	5.36	7-20	2,43	3.54	.038
3 months (CA)												
Total PSI-SF	56.00	11.00	48-79	69.55	19.10	47-105	63.31	16.81	37-88	2,34	1.54	Ns
PD	19.08	4.62	15-27	27.46	8.02	12-42	23.68	6.88	12-33	2,34	3.41	.046
P-CDI	16.32	4.28	12-23	19.51	5.61	12-33	17.32	5.47	12-28	2,34	1.06	Ns
DC	20.60	4.78	17-31	22.58	7.40	13-37	22.29	6.62	13-29	2,34	.18	Ns
DR	10.61	3.01	8-17	15.90	5.00	7-26	14.67	5.74	7-26	2,34	2.61	Ns
6 months (CA)												
Total PSI-SF	46.57	14.14	31-71	63.46	15.01	43-91	65.98	16.13	38-90	2,38	5.03	.012
PD	16.44	4.46	13-25	25.13	8.20	16-43	25.29	6.71	12-36	2,38	5.68	.007
P-CDI	15.18	3.37	12-22	16.34	2.94	12-21	18.40	5.22	12-29	2,38	1.72	Ns
DC	17.50	4.87	14-26	22.09	6.17	12-34	22.04	5.38	13-30	2,38	2.18	Ns
DR	9.54	2.80	7-15	14.15	5.17	8-25	14.63	4.00	7-21	2,38	4.82	.014
9 months (CA)												
Total PSI-SF	46.89	7.39	40-61	61.12	14.73	40-81	59.32	11.63	42-78	2,32	1.93	Ns
PD	15.56	4.85	13-26	22.90	5.02	14-31	22.02	5.39	14-30	2,32	3.23	.057
P-CDI	13.75	2.63	12-19	16.37	3.12	12-20	16.69	3.93	12-23	2,32	.982	Ns
DC	17.57	2.27	14-21	21.84	8.33	14-35	20.61	3.96	14-27	2,32	.726	Ns
DR	7.82	2.19	7-13	12.68	2.57	8-17	12.71	3.12	7-17	2,32	5.85	.008
12 months (CA)												
Total PSI-SF	47.87	11.33	37-69	62.02	14.23	43-85	67.88	14.71	49-91	2,32	4.26	.024
PD	15.66	5.15	12-25	23.18	6.15	12-33	25.03	6.22	13-33	2,32	5.48	.010
P-CDI	14.17	2.97	12-20	16.98	3.75	12-23	19.81	6.03	12-30	2,32	3.12	Ns
DC	18.06	4.39	13-26	22.32	5.52	14-29	23.03	4.80	15-31	2,32	2.11	Ns
DR	9.51	2.98	7-15	13.13	4.51	7-23	14.11	3.36	8-19	2,32	3.13	Ns

** Measures captions: PD = PSI-SF Total = Total Parenting Stress; Parental Distress Sub-scale; P-CDI = Parent-Child Dysfunctional Interaction Sub-scale; DC = Difficult Child Sub-scale; DR = Defensive Responding Sub-scales*

Unexpected results emerged when the comparison between groups on the *Parental Stress* sub-scale was analysed before the beginning of KC. The *Parental Stress* sub-scale was found to differ among groups, F (2, 43) = 4.24, p = .02. As shown by the means reported in Table 5.2, the score obtained by the Control group did not differ from the fathers in the Intervention KC group, but Limited KC fathers were significantly more stressed than fathers in the Intervention KC group.

At discharge, a significant overall effect was found for group on the PSI-SF total score, F (2, 43) = 4.44, p = .02, revealing that this time Intervention KC fathers presented significantly lower parenting stress than Control fathers and also than Limited KC fathers, modifying the initial trend in which Intervention KC fathers' stress was not statistically different compared to Control fathers. No significant difference was found on the overall MANCOVA between the three groups on the subscales, *Wilks' Lambda F* (6, 76) = 1.304, p = .266. As illustrated in Table 5.2, in comparison with the previous assessment, the Intervention KC group presented a smaller decrease in its stress scores in parental distress level, Limited KC stayed at the same level and the Control group slightly increased its stress scores. The difference between groups was only statistically different at a borderline level F (2, 43) = 3.06, p = .058. In addition, a significant overall effect was found on the *Defensive Responding Sub-scale, F* (2, 43) = 3.54, p = .04 (see Chapter 3). Intervention KC fathers displayed a significantly lower response than Limited KC fathers. Control fathers did not differ from the other two groups in this sub-scale.

As illustrated in Table 5.2 above, the results followed the same pattern at all data collection times.

At 3 month (CA), a significant overall effect was found for group on *Parental Stress Sub-scale*, F (2, 34) = 3.41, p = .05. Intervention KC fathers scored lower than Control and

Limited KC groups of fathers. However, post-hoc comparisons did not show any significant differences, as shown in Table 5.2.

With 6 months old infants (CA), a significant group difference was again established for group on the PSI-SF total score, F (2, 38) = 5.03, p = .01. Intervention KC fathers, as before, had lower total parenting stress levels compared to Control fathers and Limited KC fathers. The MANCOVA revealed a significant difference on the PSI-SF sub-scales between groups, *Wilks' Lambda F* (6, 64) = 2.37, p = .04. There was a significant difference on the *Parental Stress Sub-scale*, F (2, 38) = 5.68, p = .007, where Intervention KC fathers obtained significantly lower scores than Control and Limited KC fathers.

These results were maintained with 12 month old infants (CA) on the PSI-SF total score, F (2, 32) = 4.26, p = .02. Again, Table 5.2 illustrates that Intervention KC fathers had lower parenting stress than the Control group, and Limited KC fathers did not significantly differ from the other two groups. The subsequent analysis on the sub-scales showed an almost significant difference, *Wilks' Lambda F*(6, 52) = 2.13, p = .065, and the analysis on the single sub-scales revealed that the three groups differed again in the *Parental Stress Sub-scale*, F (2, 32) = 5.45, p = .01; Intervention KC fathers obtained significantly lower scores than Control and Limited KC fathers did.

5.5.2 Paternal bonding

Table 5.3 Univariate Analyses of Variance on Paternal Bonding to the Infant Between Intervention KC, Limited KC and Control Groups at Each Research Time on Fathers' PSI-SF at Each Research Time

	Intervention KC			Limited KC			Control			df	F	P
Measures*	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range			
At discharge												
Total PPAQ	84.95	5.89	72-90	78.72	5.18	69-86	78.91	7.02	63-91	2,43	4.24	.021
QA	24.25	1.45	21-25	22.72	1.27	21-25	22.71	1.81	19-25	2,43	3.93	.028
AH	19.88	1.78	17-22	22.93	2.12	14-23	21.38	2.69	15-25	2,43	.49	Ns
PI	39.72	3.11	34-43	35.83	3.28	30-41	35.55	4.18	26-43	2,43	4.60	.016
6 months CA												
Total PPAQ	84.39	5.94	72-90	78.31	6.04	69-89	77.69	7.00	64-93	2,36	3.31	.078
QA	23.69	2.32	18-25	23.15	1.57	21-25	23.10	.90	22-25	2,36	.35	Ns
AH	23.21	1.69	20-25	19.34	1.76	15-21	18.66	4.06	10-24	2,36	8.89	.001
PI	37.55	2.61	33-41	35.96	4.20	29-44	35.97	2.94	33-44	2,36	.63	Ns
12 months CA												
Total PPAQ	88.07	6.48	76-94	74.11	13.18	50-86	70.83	8.66	50-82	2,29	6.03	.007
QA	24.64	1.16	22-25	23.02	1.61	21-25	22.46	.98	21-24	2,29	6.48	.005
AH	23.22	1.23	20-24	20.24	2.99	16-25	17.96	2.31	15-23	2,29	9.97	.001
PI	39.03	5.03	32-45	34.35	3.23	26-38	33.51	2.86	28-37	2,29	4.61	.020

** Measures captions: PPAQ – Paternal Post-natal Attachment Questionnaire; QA – Quality of Attachment Sub-Scale; AB - Absence of Hostility Sub-Scale; & PI – Pleasure in Interaction Sub-Scale*

The PPAQ total score, at the infants' discharge from hospital, presented a significant overall effect for group, F (2, 43) = 4.24, p = .02. As presented in Table 5.3, Intervention KC fathers had a higher bonding score than both Control fathers and Limited KC fathers. The MANCOVA on PPAQ sub-scales did not reveal a significant difference between the three groups, *Wilks' Lambda F* (6, 76) = 1.84, p = .102. However, the *Quality of Attachment Sub-scale*, F (2, 43) = 3.93, p = .03, and the *Pleasure in Interaction Sub-scale, F* (2, 43) = 3.54, p = .04, significantly differed between groups. As reported in the Table 5.3, Intervention KC fathers had a better quality of bonding than Control fathers and Limited KC fathers and obtained more pleasure interacting with their children than Control fathers and Limited KC fathers did.

At 6 months (CA), a significant effect was found for group on the *Paternal Postnatal Attachment* total score, F (2, 36) = 3.31, p = .05. The group of Intervention KC fathers had a higher mean score than the other two groups as presented in Table 5.3; however, post-hoc comparisons did not show any significant differences.

Finally, at 12 months (CA) the above results were maintained for *Paternal Postnatal Attachment* total score, F (2, 29) = 6.03, p = .007, showing that Intervention KC fathers had a better quality of bonding than Control fathers and Limited KC fathers. The MANCOVA on the sub-scales revealed a significant group difference, *Wilks' Lambda F* (6, 46) = 4.09, p = .002, with an overall group effect for *Quality of Attachment, F* (2, 29) = 6.48, p = .005, *Absence of hostility*, F (2, 29) = 9.97, p = .001, and *Pleasure in Interaction*, F (2, 29) = 4.61, p = .02. As illustrated by the means reported in Table 5.3, this indicates that the fathers belonging to the Intervention KC group developed a better quality of bonding, were less hostile towards and expressed more pleasure in interacting with their infants than the other two groups.

5.5.3 Correlation between fathers' parenting stress and bonding to the infant

Given the initial group difference in the *Parental Stress* sub-scale, in order to examine the relationship between parenting stress and bonding, Pearson bivariate correlations were computed with these two measures. Significantly high correlations were found: at discharge r (42) -.571, $p < .001$, at 6 months (CA) r (34) -.659, $p < .001$ and at 12 months (CA) r (30) -.440, p = .017. These showed that the fathers' parenting stress score was inversely correlated to the quality of bonding.

5.5.4 Influence of mothers' parenting stress and mother-infant interaction and bonding to the child at 6 months (CA) on fathers' parenting stress and bonding to the child at 12 months (CA)

The ANCOVA on paternal parenting stress at 12 months (CA) showed a significant model, F (6, 22) = 5.24, p = .002, η^2 .588, in which however, no effect of group was found, F (2, 22) = 1.11, p = .347, η^2 .092. The covariate of maternal parenting stress at 6 months (CA) was found to be highly significant in the model, F (1, 22) = 14.67, p < .001, η^2 .4. No influence of maternal bonding with the child, F (1, 22) = .927, p = .346, η^2 .04, or of mother-infant dyadic interaction, F (1, 22) = 2.03, p = .168, η^2 .085, and of CRIB II, F (1, 22) = .41, p = .529, η^2 .018, was found.

Very similar results were found in relation to paternal bonding to the child at 12 months (CA), with a significant model, F(6, 22) = 3.93, p = .01, η^2 .55, but no effect of group, F(2, 19) = 2.58, p = .102, η^2 .213. The covariates of maternal bonding with the child, F (1, 19) = .493, p = .491, η^2 .025, of mother-infant dyadic interaction, F(1, 19) = 2.03, p = .168, η^2 .064, and of CRIB II, F(1, 19) = 1.57, p = .226, η^2 .076, were not significant. But, as before, maternal parenting stress at 6 months (CA) was found to significantly influence the fathers' score, F(1, 22) = 5.95, p = .025, η^2 .239.

The results in both models suggest a potential influence of maternal parenting stress on fathers. The differences found among groups were not due to the KC intervention itself but to the maternal psychological status in relation to the child.

5.5.5 Influence of fathers' parenting stress and bonding at discharge on mothers' parenting stress, bonding to the child and mother-infant interaction and at 6 months (CA)

The results on mother's parenting stress at 6 months (CA) show that there was a main effect of paternal parenting stress (fathers' PSI-SF at discharge), $F(1, 34) = 10.86$, $p = .002$, η^2 .242, and an almost significant effect of group, $F(2, 34) = 2.90$, $p = .06$, η^2 .146. No main effect of father bonding (PPAQ), F (1, 34) = 1.96, $p = .17$, η^2 .055, and of CRIB II were detected. The overall model accounted for 54% of variance ($R^2 = .54$) on the maternal PSI-SF scores, being statistically significant, F (5, 34) = 8.12, $p < .001$, η^2 .544.

In relation to maternal bonding, no significant main effect of the paternal variables of parenting stress (fathers' PSI-SF at discharge), F (1, 34) = .531, $p = .471$, η^2 .015, and fathers' bonding (PPAQ), F (1, 34) = .330, $p = .569$, η^2 .01, was found. CRIB II was also not significant, F (1, 34) = 2.19, $p = .148$, η^2 .061. Again, group effect was almost significant, $F(2, 34) = 2.90$, $p = .06$, η^2 .146. The overall model was significant, F (5, 34) = 2.69, $p =$ .038, η^2 .283, accounting for 28% ($R^2 = .283$) of the variance on MPAQ scores at 6 months (CA).

Finally, the mother-infant dyadic interaction was not found to be influenced by the fathers' parenting stress, F (1, 32) = .132, $p = .718$, η^2 .004, and bonding, F (1, 34) = .700, p = .409, η^2 .021, and by the CRIB II, F (1, 34) = .282, $p = .599$, η^2 .009. The model was not statistically significant, F (1, 34) = 2.90, $p = .06$, η^2 .146.

These results are an indication that the paternal variables considered have different effects in relation to the mother-preterm infant relationship, maternal parenting stress and mother-infant dyadic interaction in the context of KC.

5.5.6 Influence of fathers' parenting stress and bonding at 6 months (CA) on preterm infant development at 12 months (CA)

Infant development at 6 months (CA) was found to be influenced by fathers' parenting stress and bonding at discharge in two areas. Specifically, main effects of fathers' parenting stress, F (1, 35) = 3.98, p = .05, η^2 .102, and of paternal bonding, F (1, 35) = 4.55, p = .04, η^2 .181, were found on infant global language development. No main effect of group, F (2, 35) = .621, p = .543, η^2 .034, and of CRIB II, F (2, 35) = .543, p = .466, η^2 .015, were found. However, the overall model was not significant, F (5, 35) = 1.68, p = .164, η^2 .194. From the results, the main domain of language development that was affected by fathers' parenting stress, F (1, 35) = 7.74, p = .009, η^2 .181 and bonding, F (1, 35) = 7.74, p = .009, η^2 .181, had to do with the child's expressive skills. In this domain, the overall significant model, F (5, 35) = 2.62, p = .041, η^2 .273 accounted for the 27% (R^2 = .273) of the variance on language expressive development.

Interestingly, fathers' parenting stress was only found to have a significant main effect, F (1, 35) = 12.77, p < .001, η^2 .267, on the preterm infant's fine motor development. No main effect of paternal bonding, F (1, 35) = .758, p = .39, η^2 .021, group, F (2, 35) = .805, p = .455, η^2 .044, and CRIB II, F (1, 35) = .152, p = .699, η^2 .004, was found. The overall model was significant, F (5, 35) = 2.912, p = .027, η^2 .294, accounting for the 29% (R^2 = .294) of variance on the preterm infant's fine motor skills.

At 12 moths (CA) the preterm infant's development was not related to the fathers' variables that were investigated.

5.7 Discussion

The results from this study are not conclusive in relation to a positive effect of KC on fathers, when KC is applied by mothers. However, the results indicate that maternal parenting stress contributed to the paternal parenting stress and paternal bonding to the infant. On the other hand, paternal parenting stress at discharge contributed to maternal parenting stress only at 6 months (CA) in relation to the mother's variables. In relation to the preterm infant's development at 6 months (CA), paternal parenting stress at discharge contributed to infant motor development. Finally, together with paternal bonding, it contributed on expressive language development.

Before the initiation of the intervention in the target group, the fathers of children in the Intervention KC group presented lower parental stress compared to fathers of children in the Limited KC group but not of the Control groups. When looking at the means in Table 5.2, it can be noted that the parental stress did not decrease from after the birth of the infant to the discharge at home, after KC intervention was applied by mothers. Therefore, the subsequent among groups differences cannot be completely ascribed to the provision of KC. Moreover, paternal bonding was highly correlated to the fathers' parenting stress at each of the research times. The between groups differences on the fathers' quality of bonding towards their children seems not to be due to KC effect, but possibly, to the level of parenting stress experienced by them.

The analyses carried out consequently highlight the key role of maternal parenting stress on the fathers' parenting stress and bonding to the child. However, the results in Chapter 4 established the positive role of KC in lowering the maternal parenting stress. Therefore, it could be argued that the KC intervention, when applied following the full recommended procedure, diminishes parenting stress in mothers and could have a consequent effect on fathers' parenting stress and on father's bonding to the child. These results would support the literature claims on fathers of preterm infants (Carter et al., 2007) and on fathers in general (Belsky, Youngblade, Rovine, & Volling, 1991; Bouchard & Lee, 2000; Genesoni & Tallandini, 2009; McBride & Rane, 1998), which established the key role of female partners in helping men to construct the relationship with their child and their identity as fathers.

On the other side, fathers' parenting stress, at the difficult time of the infant's discharge form hospital has been found here to play a role in concomitance with the KC intervention on maternal parenting stress at 6 months (CA). No effect of paternal variables was found on maternal bonding to the infant and on mother-infant interaction.

The final set of results of this Chapter indicates the role of the infant's proximal environment on development. Particularly, this was found in relation to fathers' parenting stress and bonding which had a contributing role on the preterm infants' expressive skills (sub-scale of language scale in the Bayley III) at 6 months (CA), regardless of their medical risk. This is in agreement with the literature on preterm infant language development, where the area of expressive language skill was shown to be more influenced by social environmental factors than by biological factors (Magill-Evans & Harrison, 2010). Moreover, only paternal parenting stress appeared to contribute to infant fine motor skills development. Unfortunately, probably due to the attrition of the fathers' sample size from 6 to 12 months (CA) and due to the consequent reduction of the analyses' power, no indication of the potential influence of fathers' parenting stress or bonding to their infant was found on any of the preterm infant developmental areas at 12 months.

Results deriving from this Chapter need to be considered as an indication. They need to be further verified with a bigger sample size. Further research is indeed necessary on the indication found here of interrelationships between the practice of KC during the perinatal period, of maternal parenting stress and of paternal parenting stress. With an appropriate sample size, the relationship among these variables should be investigated, for example, through a path analysis, in order to investigate both their direct and indirect effects.

In conclusion, the results of this study can be considered within the realm of what was previously found by Feldman et al. (2003), who indicate that KC has an influence on the father-infant relationship through the mediating effect of the partner's experience. The main contributor effect in play in the present research seems to be due to maternal parenting stress, which acts upon the fathers' parenting stress. In this research, the most relevant variable at play in terms of the fathers was indeed their level of parenting stress, which was also relevant to infant language development and fine motor skills at 6 months (CA). Obviously, no conclusive considerations can be made given the restricted number of fathers participating in the research.

Chapter 6

General discussion

This study has examined the effects of an early intervention for preterm infants and their parents, which provides skin-to-skin contact through the Kangaroo Care (KC) procedure during the infant's hospitalisation in high-tech NICUs. The implications of this procedure have been explored, looking at the following areas: 1) parental psychological distress, 2) parental bonding to and representation of their own infant, 3) mother-preterm infant dyadic interaction, 4) infants' proximal environment and 5) infant development.

The aim was to answer two specific questions: first, whether KC, when applied as a well-defined structured intervention (of 1 hour a day for 14 consecutive days) alongside standard incubator care in high-tech NICU, promotes the formation of the parent-infant relationship and of bonding. Second, whether the KC intervention has a longitudinal impact on specific areas that have been investigated across the first year of the infant's life. Three groups were compared: Intervention KC, in which mothers provided skin-to-skin contact to their infant. Limited KC, in which a lower amount of KC was provided. And finally, the Control group, in which mothers did not provide skin-to-skin contact. Preterm infants in all groups received the same medical and routine care within the NICUs.

This study has clearly demonstrated the positive impact on maternal outcome variables of the structured KC intervention that consists of 1 hour a day for 14 consecutive days. These results are the first to demonstrate KC's long-term effects on maternal parenting stress and on the mothers' bonding to their infants. The results have also confirmed KC's short and long-term effects on maternal interactive capacity. A smaller KC intervention effect was found on the home environment and on the preterm infants' interactive capacity.

Conversely, a limited amount of KC – KC carried out for at least 1 hour a day for less than 14 consecutive days - was not efficacious on the maternal interactive behaviour and on maternal bonding to the infant. An effect of a limited KC was only found on the quality of home environment at 3 months (CA) and on the level of parenting stress at 6 months (CA).

Finally, in relation to KC's influence on the preterm infant's development, a complex effect was found. KC, when carried out for a daily session of at least 1 hour a day, regardless of its total duration (referring to both Limited and Full Intervention) was found to reduce the negative impact of prematurity on the infants' gross motor and language development but not on cognitive and socio-emotional development. Instead, the preterm infant's adaptive behaviour development was positively influenced only when the preterm infant received the recommended full KC intervention. These results on language and adaptive behaviour are new findings with respect to the efficacy of KC on the preterm infant. Finally, of great theoretical and clinical relevance, this study is among the first to demonstrate that the efficacy of KC was stronger when mothers followed the recommended structured implementation (Intervention KC group: at least 1 hour per day for 14 consecutive days), compared to when the implementation was of a shorter and less coherent application (Limited KC group: sessions of 1 hour per day for less than 14 consecutive days).

In the following paragraphs, the results are discussed in relation to the literature on KC and in relation to the wider literature on preterm infants and their mothers. The results are not conclusive in terms of the underlying processes that take place during KC procedure. However, potential causal processes are suggested regarding both the mothers and the infants. The implications of these results are then interpreted in terms of the clinical application of KC in NICUs, taking into account how care is currently delivered to preterm infants. Finally, the limits of this research and some suggested future directions are discussed.

In the area of maternal parenting stress, the KC intervention was efficacious in lowering the parenting stress experienced by mothers at discharge from hospital, thus confirming Tallandini & Scalembra's results (2006). The present study is the first to prove the long-term consistent effect of KC on maternal stress. This is a different result from the one obtained by Miles et al. (2006). In fact, at 12 months (CA), in the KC Intervention group, maternal expectations were better fulfilled within the dyadic interaction, reinforcing thus the mother-infant relationship. In this context, the length and consistency of intervention played a major role. This is due to the fact that, as was shown by the different results obtained by Intervention KC and Limited KC mothers, a positive impact can only be reached when the mother regularly applies the required amount of KC. Such differences were evident at three particular times: at the infant's discharge from hospital, which can be overwhelming for parents as they assume full responsibility of their infant (Easterbrooks, 1988; Miles & Holditch-Davis, 1997); when the infant reaches 6 months (CA), which is the time when the infant becomes a more active social partner through, for instance, the capacity of babbling and the ability of smiling differentially; and finally at 12 months (CA) of age, when the infant starts to independently explore the environment.

These results are a clear indication that KC helps mothers to cope with the impact of a preterm birth, by addressing two major causes of reported distress during hospitalisation: the lack of physical contact with the infant (Erlandsson & Fagerberg, 2005; Higgins & Dullow, 2003; Joseph et al., 2007; Lupton & Fenwick, 2001; Orapiriyakul et al., 2007; Ward, 2001) and of the establishment of the parental role (Fenwick et al., 2001a, 2002b; Heerman et al., 2005; Lupton & Febwick, 2001; Redshaw et al., 1996; Siegel et al., 2002).

In relation to the mothers' level of anxiety and depression, no influences of KC were found. This result differs from what was previously found by Feldman et al. (2002b) and also differs from what was hypothesised in this study. However, recent results from Ahn et al. (2010) give support to the present findings when depression is investigated; indeed, they have also found a moderate level of depression in all mothers after premature birth before the KC implementation, which decreases over time for all mothers. Thus it appears that KC acts specifically on the distress that arises from the demands related to the parenting process.

The maternal bonding to the infant at 6 months (CA) and the regular and constant provision of KC ended up being the major contributors to diminish the mothers' parenting stress at 12 months (CA). Conversely, parenting stress was here found to be highly implicated in maternal bonding processes. Indeed, the level of parenting stress that mothers presented at discharge from hospital was the major contributor on the quality of maternal bonding to the preterm infant at 6 months (CA), a result which is in agreement with the relevant literature (Korja et al., 2009, 2010; Forcada-Guex et al., 2011). This is also in line with Laganiére, Tessier, & Nadeau's (2003) findings in a sample of premature infants, showing that high maternal parenting stress is linked to insecure attachment development. Importantly, it seems that parenting stress has a central role in the processes through which KC acts, favouring the mother-infant relationship; KC reduces parenting stress, which in turn enhances maternal bonding to her child at 6 months (CA). In fact, between groups differences were found in the area of maternal bonding, in agreement with what was hypothesised. Differently from Miles et al. (2006), only mothers who followed the KC intervention, had developed by the 6th month a better quality of bonding and by the 12th month (CA) presented with decreased hostile feelings towards him/her. These results offer new data supporting the positive impact of KC on maternal bonding that was recently found by Gathwala et al. (2008) and Ahn et al. (2010) for infants aged only 3 months (CA).

Hence, the provision of KC can result in being a key psychological element in resolving the problems linked to mothers' parenting stress and bonding processes. This can occur despite the well-documented difficulties that arise with preterm infants as, for example, the infants' lack of inter-relational capacities (Kennel & Klauss, 1998; Forcada-Guex et al., 2006; Muller-Nix et al., 2004) and the parents' experience of a high level of parenting stress (Holditch-Davis et al., 2003; DeMier et al., 1996; Forcada-Guex et al., 2011; Jotzo & Poets, 2005; Kersting et al., 2004; Muller-Nix et al., 2004; Pierrehumbert et al., 2003). In agreement with the literature (Korja et al., 2009, 2010; Forcada-Guex et al., 2011), the link between KC, parenting stress and bonding is of great relevance, considering that mothers' psychological well-being during the perinatal period is one of the most important factors influencing the development of the mother-infant relationship (Korja et al., 2008; Murray et al., 1996) as well as infant development (Beckwith & Rodning, 1996; Forcada-Guex et al., 2006; Crnic et al., 1983).

The results on mother-infant dyadic interaction further established that the KC Intervention promotes an earlier development of the dyadic relationship. The KC intervention in the postnatal period was found to be the only contributor of the later mother-infant dyadic interaction at 6 months (CA). However, unexpectedly, and differently from previous findings (Forcada-Guex et al., 2011; Singer et al., 2003; Feeley et al., 2005; Schmucker et al., 2005), maternal parenting stress did not play a role in the mother-infant dyadic interactive behaviours at 6 months (CA). This indicates that parenting stress is a different component. Even if it is involved in the mother-infant bonding processes, it does not relate to the mother and the infant's capacities to interact with each other.

In this area of investigation, the hypothesised positive effect on the mother-infant dyadic interaction was confirmed, in line with the rest of the KC literature on this topic (Tessier et al., 1998; Feldman et al., 2002b; Tallandini & Scalembra, 2006; Bigelow et al., 2010; Feldman et al., 2003; Neu & Robinson, 2010). The results show that, during the first 6 months (CA), the interactive behaviours of the mother-infant dyads in the KC intervention group were characterised by a better maternal capacity to foster their infants' cognitive and socio-emotional development and to respond to their infant's distress, compared to mothers in the Limited and Control groups. The children in the KC intervention group demonstrated a better capacity in responding to their parents' interactive style compared to children in the Limited and Control groups. Conversely, as previously found (Tallandini and Scalembra, 2006), the three groups of mothers were not significantly different in their parental sensitivity towards the children's cues and in their capacity to read the infants' signals. This could be explained by the fact that the preterm infant does not have a fully developed capacity of expressing his/her needs, such as requesting food, or of being in an alert state. In fact, the results also show that all children's groups presented a similar clarity of cue. Therefore, the degree of prematurity and medical risk of the child could have played a major influential role in the children's ability to clearly express their needs (Singer et al., 2003). Between 6 to 12 months (CA), the mother-infant dyadic interaction capacities remained stable in the KC Intervention dyads. Differently, in the same time frame, the Limited and Control dyads reached the same interactive capacities only at 12 months (CA), compared to the capacities that Intervention KC dyads had achieved at 6 months (CA).

Although KC has been shown to promote a better mother-infant relationship both in terms of bonding and of interaction, the maternal representation of the child was found not to be influenced by the KC procedure, against what was hypothesised in this study on the basis of previous findings (Feldman et al., 2002b).

Maternal neonatal perception refers to the mother's mental representation of her infant compared with the representation of an average infant (the typical and healthy infant) as formulated by Broussard & Hartner (1970). The mothers in all three groups presented the same discrepancy between their perception of their actual infant and of the average infant, which augmented across the first three months after delivery. This is an indication that all mothers in the three groups saw their infants as less problematic than the typical healthy infant. The results are in line with previous research, in which a discrepancy between the mother's mental representation of her actual preterm infant compared to her representation of a healthy infant is reported (Levy-Shiff, Sharir, & Mogilner, 1989; Korja et al., 2009, 2010). It seems that all mothers in this study presented the same necessity to maintain a positive perception of their child in situations of high medical risk, through the deterioration of their representation of a typically healthy child. As explained in Chapter 1, the last trimester of pregnancy, which is disrupted by the preterm birth, is the crucial period for the formation of the infant maternal representation (Ammaniti et al., 1992; Choen & Slade, 2000). It seems as if a maternal protective response towards the child is put in place because children who are perceived as worse or more problematic than the average neonates may be at risk for a maladaptive mother-infant relationship (Hernández-Martínez, Canals Sans, & Fernández-Ballart, 2011). No influences of KC were found in this process.

When the effects of KC were studied on the preterm infant's development, the findings have shown a beneficial influence of KC on motor and language development. These are domains in which preterm infants are reported to encounter major difficulties. Thus, the finding of a beneficial influence of KC in these areas appears to be of particular relevance. Interestingly, even though longitudinal analyses have shown that Intervention KC children improved their gross motor skills from 6 to 12 months (CA) contrary to the children in the Limited and Control groups, in the follow-up analyses only children in the Limited KC presented more advanced motor skills than children in the Control group at 6 months (CA), and Intervention KC children did not differ from the others. This result is ambiguous and could be due to the differences among groups in terms of gestational age and medical risk, which are highly influential on the motor skills of preterm infants in the first year of life. Previous research (Feldman et al., 2002b) has proven the efficacy of the same KC intervention on infant motor development at 6 months (CA).

The effect of KC on children's language development is a novel finding. KC children in both the Limited and the Intervention group presented a significant improvement in their language development from 6 to 12 months (CA). The KC procedure (both Limited and Intervention KC) was found to be the only independent contributor of the children's global language development at 12 months (CA). This is of particular clinical relevance considering that, differently from motor delay, which can be assessed by the age of 6 months, language delay is difficult to detect in preterm infants before the pre-school years at which point it becomes more evident (Anderson & Doyle, 2003; Largo, Molinari, Comenale Pinto, Weber, & Duc, 1986; Luoma, Martikainen, & Ahonen, 1998; Sansavini, Rizzardi, Alessandroni, & Giovanelli, 1996; Wolke & Meyer, 1999).

Other factors that have been shown in the wider preterm infant literature to impact upon language development, such as the biological factor of medical risk and of mother-infant dyadic interaction and maternal parenting stress (Arpino et al., 2010) were all not found to be contributors in this research. There was only a slight indication of a potential influence of the environmental factors in terms of the quality of the home environment and of the family's socio-economic background. It could be argued that those factors become more influential to the child at a more advanced age. In fact, in the case of preterm birth, the strong relation between early post-natal events, subsequent experiences and language development is still reported beyond the first year of life (Guarini, Sansavini, Fabbri, Alessandroni, Faldella &

Karmiloff-Smith, 2009). It is important to highlight in this context that infancy is often referred to as the pre-linguistic period. Language, in order to further develop, is in need of auditory stimulation and caregiver responsiveness to the infant's cues (Cusson, 2003). Because of the high heterogeneity of language skills in preterm infants, the modalities through which preverbal communicative skills develop also need to be taken into account. This is because they can potentially affect the language processes. The preterm infant's immature preverbal skills can expose him/her to a higher level of risk of language delay.

As described in Chapter 1, the auditory system starts to function between the 22nd and the 24th weeks GA when the infant's responses to acoustic stimulations can be detected (Busnel et al., 1992). At around 30 weeks of GA, the foetus is able to discriminate auditory stimuli and to show preferences for familiar linguistic stimuli such as the mother's voice and her heartbeat (DeCasper & Fifer, 1980; DeCasper & Sigafoos, 1983). In the case of prematurity, the aforementioned stages of growth and the early ordinary post-natal auditory stimulation are disrupted, and the child's development continues in the NICU environment. In this context, his/her immature central nervous system is exposed to invasive and at the same time non-contingent stimulation, and there exists a prolonged absence of familiar sounds (for instance maternal voice is missing). This could negatively act upon the formation of memory traces that are created through gene-environment interactions in the last trimester of pregnancy and in the early years of infants' life (Fox et al., 2010). KC intervenes during this important and delicate time and can play a protective function against the noxious environmental stimulation that characterises a high-tech NICU.

In accordance with the positive impact on language development, which was only however shown to exist when KC was applied as full intervention, KC similarly improved the children's adaptive behavioural development. This was found in relation to the skills involved in the preverbal social communication and self-regulation development. The KC intervention was shown to improve the children's social, self-care (i.e. sleeping and eating patterns) and motor skills at 6 months (CA), and communication, home living and leisure skills at 12 months (CA), which were all shown to be higher compared to those in the Limited KC and Control children's groups.

Differently from what has been hypothesised, the participating children's socio-emotional and cognitive development did not differ among groups. In relation to cognitive development, these results do not repeat what was found by Feldman (Feldman et al., 2002b, 2004) and Tessier (Tessier et al., 2003). Particularly relevant to this study are Feldman et al.'s (2002b; 2004) results because they derive from the same type of KC intervention, carried out in a similar high-tech NICU. The discrepancy of results could be due to different scales used to measure cognitive development. Feldman assessed the infants' cognitive skills using the Bayley II scale. The present study adopted the later revised version of the scale (Bayley III) instead. In the Bayley II the cognitive development was measured by the Mental Developmental Index (MDI) which was a compound measure of both cognitive and language skills. However, in the third revision of the Bayley, the language and cognitive items have been separated and are assessed in two different scales: the cognitive and the language scales. A direct comparison of results based on the two different methods of assessment (Bayley II vs. Bayley III) is thus highly problematic (Bayley, 2006; Moore, Johnson, Haider, Hennessy, Marlow, 2011). It would be important to establish whether the positive effect found by Feldman et al. on Bayley II mental index is related to items measuring the language components of cognitive development. It should also be noted that it has been established that when infants are born below the 32nd week of gestation there is a stronger linear relation between gestational age and cognitive development (Bhutta et al., 2002; Wolke et al., 2001;

Marlow et al., 2005). It is also possible that because the Intervention group presented a higher number of children below the 32nd week of gestation, this could have impinged on the potential effect of KC on development.

The hypothesised effects of KC on the infant's proximal environment were only partially verified. KC was proven to be efficacious in improving the quality of the infant's home environment. Specifically, it acted upon one of the components of the HOME, which is the quality of stimulations given to the infant in terms of play materials. As previously found by Feldman at al. (2003) and Tessier et al. (2009), KC mothers were found to be more engaged in their children's play activities. In our participants this is not influenced by the socio-economic and demographic backgrounds, as the three groups were homogenous in these aspects.

In relation to the other measures of the infant's proximal environment – the couple's relationship and the perception of the level of social support available – the results did not show any influence deriving from KC. All mothers reported a good quality of parental relationship and felt socially supported consistently along the one-year investigation.

Finally, the pilot investigation of KC on fathers was not conclusive in relation to the hypothesised positive effect that was found in mothers. Due to the fact that the parenting stress in the fathers of Intervention KC children was lower than in the Limited KC group since the first data collection, the subsequent results cannot be attributed to the influence of KC, as was found in Feldman et al.'s (2003). The results, however, indicate a strong relationship between the fathers' parenting stress and their bonding towards their child. Moreover, in accordance with the wider literature on fathers (see Genesoni & Tallandini, 2008 for a review on the literature) the influence of mothers on the fathers' results indicates that maternal parenting stress has an important influence on the fathers' parenting stress, which in turn contributed to infant language development and to the development of fine motor skills at 6 months (CA). Further investigation needs to be carried out in a sample with a higher number of fathers, which are unfortunately very difficult to keep in a research frame.

Potential causal processes involved on KC effects on mothers and on preterm infants

A constellation of factors contributes to the healthy development of the parenting processes and of the preterm infant (see Chapter 1). All the above results indicate that KC is a growth-facilitating interpersonal environment for the mother and the preterm infant, as defined by Fox et al. (2010), provided by the maternal body, which leads to at least a partial correction of the early biological disruption caused by preterm delivery.

On the mother's side, skin-to-skin contact reproduces, if only partially, the sense of 'oneness' mothers feel when their infant is still in utero. It can help relieve the sense of loss experienced at birth through the reestablishment of the mother-infant unit. It can also help initiate the parenting processes, sustaining them through the allowance of maternal nurturing behaviours such as affectionate touch and stroking of the infant, gazing at the infant's face, "motherese" vocalisations, positive maternal affect, and the coordination of the mother's behaviour to the infant's state and signals.

As seen in Chapter 1, the existing literature on preterm infants has demonstrated that following premature birth there is a significant decrease in the amount of maternal behaviours. The mothers of premature neonates have been found to be less competent in coordinating their social behaviour with the infant's moments of alertness (Feldman et al., 1999). It is known that the experience of a nurturing, contingent, stable and predictable early experience with the caregiver is essential for bonding, social learning, and neurological maturation (Fleming, Steiner, & Corter, 1997; Eckerman et al., 1995). A premature delivery therefore places the mother at risk, because her capacity to coordinate maternal behaviours with the infant's social readiness is reduced due to the delay in the mother-infant contact and also due to the increase of her level of stress due to the infant's condition and the NICU environment (Carter et al., 2005; Garel et al., 2004; McGrath et al., 1993; Meyer et al., 1995; Singer et al., 1999). Parenting stress is a critical component that affects the parent-infant system and acts continually on both mother and infant (Abidin, 1990). It is one of the most powerful factors that adversely influences the mother-infant relationship and bonding (Forcada-Guex et al., 2011; Korja et al., 2008; Murray et al., 1996). The mother's postpartum behaviours and the initial mother – infant bond have a critical role for the development of the mothering systems (Leckman, Feldman, Swain, Eichler, Thompson, & Mayes, 2004). Holding is one of the first interactions and shared experiences that occur between mother and infant. Holding through KC skin-to-skin contact is especially important for the maternal-infant relationship at the time of the preterm infant's hospitalisation in the NICU, as it constitutes a unique way in which mothers can enact and practice their caregiving and nurturing behaviours. Maternal behaviours start during pregnancy and are at least partly triggered by hormonal components. Therefore, the positive effect of KC on parenting stress, as well as the here established interrelationship between parenting stress and maternal bonding, could be interpreted as a result of underlying mechanisms at a hormonal level.

The study of the hormonal component of maternal behaviour in humans constitutes a recent field of research. Previous research on the predictors of maternal postpartum behaviour have demonstrated that two specific hormones, oxytocin and cortisol, are predictive of the amount of maternal behaviour, such as gazing at the infant's face, "motherese" vocalisations, affectionate touch, and positive maternal affect during mother–infant interactions in the postpartum period (Feldman, Weller, Zagoory-Sharon, Levine, 2007). Specifically, more oxytocin and less cortisol levels in mothers were each independently predictive of more maternal behaviours of this kind (Feldman et al., 2007). It has been suggested that these two hormonal systems play a major role in shaping maternal psychological stress and behaviour (Gordon, Zagoory-Sharon, Leckman, Feldman, 2008). It could be hypothesised that there exists a potential integration of the stress and affiliation neuroendocrine systems in the formation of parenting, with cortisol assessing stress levels and oxytocin indexing aspects of bonding. Within this context, in the preterm mother-infant dyad, KC could intervene facilitating the integration of stress and affiliation neuroendocrine systems. It could thus positively influence the formation of parenting. In fact, the critical role of mother-infant skin-to-skin contact in the post-natal period in the release of oxytocin in mothers (Matthiesen, Ransjo- Arvidson, Nissen, & Uvnas-Moberg, 2001) and in the regulation of cortisol levels (Neu, Laundenslager & Robinson, 2009) has been verified.

It is well known that cortisol is a glucocorticoid stress hormone which is triggered by the hypothalamic-pituitary axis (HPA) activity by the release of corticotrophin-releasing hormone (CRH) secreted into the brain as a result of a stressor (Sapolsky, 2004). In the last trimester of pregnancy and in the first 2 weeks postpartum, mothers present high level of basal cortisol, which decline within a few days after childbirth (McLean and Smith 1999). After this period, cortisol levels in mothers of preterm infants have been found to be negatively affected by the NICU environment and in particular by the level of sounds involved (Neu et al., 2009). Cortisol is associated with reduced levels of maternal behaviour (Gordon et al., 2008; Neu et al., 2009) and with maternal mood changes (Kammerer, Adams, von Castelberg, & Glover, 2002). The close relationship between psychological stress and cortisol as a biological marker has been already established (Ehlert, Patalla, Kirschbaum, Piedmont & Hellhammer, 1990).

Oxytocin is a mammalian hormone, synthesised in the hypothalamus and secreted by the hypophisis in association with uterine contraction, milk ejection (Insel & Young, 2001) and affectionate touch (Matthisen et al., 2001). It is recognised as an affiliative hormone considered to be a key mediator of social attachment, bonding and mother-infant interaction (Depue & Morrone-Strupinsky, 2005; Feldman et al., 2007; Leng, Simone, Meddle, & Douglas, 2008). From this perspective, the role of oxytocin has been extensively studied in relation to social affiliation in animals (Keverne, 1988; Kendrick, Keverne, Chapman, & Baldwin, 1988; Holman & Goy, 1995; Pedersen, Stewart, Greer, & Shepherd, 1982), proving its relevance in the initiation of maternal behaviours. In humans, there is increasing evidence which shows that the release of oxytocin is triggered by mother-infant touch and contact (Matthisen et al., 2001). A reduced production of oxytocin can be caused by a delay in mother-infant contact after birth (Nissen, Uvnäs-Moberg, Svensson, Stock, Widström, & Winberg, 1996). Oxytocin has been associated with attachment-related factors, such as empathy, closeness, and trust (Grewen, Girdler, Amic, & Light, 2005; Kosfeld, Heinrichs, Zak, Fischbacher, Fehr, 2005). Indeed, maternal oxytocin levels during the postpartum period were related to a clearly defined set of maternal bonding behaviours and to frequent examination of the infant (Feldman et al, 2007). Oxytocin has been found to function primarily by reducing anxiety, increasing calmness, and intensifying the incentive value of the attachment target (Uvnas-Moberg, 1998). Indeed, oxytocin is implicated in maternal stress adaptation by attenuating HPA activity and emotional responsiveness (Slattery & Neumann, 2008).

Therefore, at a neuroendocrine level, KC skin-to-skin contact could act on the regulation of the maternal HPA activity, by promoting the release of oxytocin and regulating the maternal cortisol level. At a psychological level, this could result in the here found KC effect in lowering parenting stress and promoting bonding to the preterm infant, thus providing an enriched primal environment for the preterm infant's development.

On the side of the preterm infant, KC through skin-to-skin contact helps the infant recover some aspects of its prenatal environment, playing a compensatory effect through the provision of a partial continuation of the experiences in the maternal womb, such as the experience of hearing the maternal voice and the sound of her heartbeat. This partially protects him/her from the exposure to the noxious level of environmental stimulation typical of a NICU environment. Moreover, the provision of an environment different to the incubator is helpful, as, through KC, a nurturing, contingent, stable and predictable early experience is delivered within the maternal body, exposing the preterm infant to the initiation of maternal behaviours. The positive effect of KC found here on the preterm infant's language development could be the result of experienced-dependent mechanisms of brain maturation (Fox et al., 2010). As has been illustrated in Chapter 1, the development of the brain systems depends upon the dynamic interaction between genetic factors and environmental influences (Grossmann & Johnson, 2007; Friederici, 2006; Grossmann et al., 2003). The infant's early experiences within the primal environment, such as experiences of reciprocal interactions with the parents (Beckwith & Rodning, 1996; Forcada-Guex et al., 2006; Crnic et al., 1983), initiate and provide the basis for a protracted process of maturation at a structural and functional level (Fox et al., 2010). In the area of language development, social and environmental factors (Lukeman & Melvin, 1993), – in which maternal nurturing and contingent behaviours play a major role –have been found to have a greater impact on preterm infant developmental outcomes than do perinatal complications (Aylward, Verhulst, & Bell, 1989; Lee & Barratt, 1993; Liaw & Brooks-Gunn, 1993).

Evidence from neurobiological studies indicates that the longer we wait before investing in children who are at great risk, the more difficult it is to achieve an optimal outcome (Fox et al., 2010; Shonkoff, 2010). The result on infant development found here seems to support this, as there is an indication that KC, when provided at a younger gestational age, is more efficacious at ameliorating preterm infant language skills at 12 months (CA) of age.

The developmental process through which KC enhances language development could be the result of the improvement of the infant's capacity for joint attention. This capacity is of paramount importance in predicting later language development (De Schuymer, De Groote, Beyers, Striano, & Roeyers, 2011; Smith & Ulvund, 2003). As recently found in relation to language development, intervention directed at enhancing the early social communication between the mother-preterm infant dyad acted on improving the development of the infant's capacity of joint attention (Olafsen, Rønning, Kaaresen, Ulvund, & Handegård, 2006). Joint attention is influenced by the dyadic mother-infant skills through the development of triadic mother-infant-object skills in infants born preterm (De Schuymer, De Groote, Striano, Stahle, & Roeyers, 2011). The results of this thesis proved that KC has a positive impact on reciprocal maternal and infant responsivity, on parenting stress and on maternal bonding to the child at 6 months (CA), which is the time when a shift occurs from a dyadic mother-infant context to a triadic mother-infant-object context (Carpenter, Nagell, & Tomasello, 1998; Striano & Bertin, 2005). KC could be influential in triggering some developmental mechanisms such as joint attention at 9 months, enhancing, as a consequence, language development at 12 months. Indeed, KC provides a stimulating environment, where for example mothers in our study exhibited a greater number of behaviours to acquaint their children with the world by presenting objects, talking about food, describing and explaining various situations. This appears to be the result of the mothers' better knowledge of their children, which in turn activates maternal behaviours that foster the children's socio-emotional and cognitive skills. Additionally, those children who experienced a mother more attuned to their developmental needs, demonstrated a more developed capacity in responding to their mothers.

In conclusion, these results are in line with the literature that highlights the paramount importance of early experiences of reciprocal infant-caregiver interaction and of a stable nurturing relationship on both the transition to parenthood and on infant development. These early experiences could be in dynamic interaction with the maternal neuroendocrine system responsible for maternal behaviours and bonding and with the child's genetic factors, which have an impact upon the experience-dependent mechanisms responsible for the development of healthy parenthood and brain growth and development (Friederici, 2006; Grossmann & Johnson, 2007; Grossmann et al., 2003; Singer, 1995).

Implications of findings on the NICU's care of preterm infants: recommendation for future KC practice

Following the disruption of the mother and infant primary environment and early experiences caused by premature birth, there may be several ways to diminish some of the negative effects of prematurity on parenting and on infant development. The issue of establishing the best postnatal environment within the NICU for both preterm infants and their parents has been of increasing interest due to the recent advances in neonatal care. As discussed in Chapter 1, there is an overall incidence of about 9% (between 5 to 11%) of preterm birth worldwide (Wen et al., 2004), with an increase in survival of very preterm and of extremely preterm infants (Doyele et al., 1999; Saigal & Doyle, 2008; Spitzer, 1996). Research on the physical environment in the NICU, in terms of lighting, noise, and handling, has shown that each of these factors significantly impact infant development and lead to a longer stay in the NICU (Als et al., 1994; Als et al., 2004; Gardner & Goldston, 2002). The more immature infants are, the more vulnerable they are to the environment to which they are exposed to. The premature infant does not have the developmental capacity to endure environmental stresses the way a full term infant might (Als et al., 2004). In case of preterm birth, the last weeks or months of typical gestation are spent in the NICU environment. Given the physiological limitations of the preterm infant, the physical and psychosocial environment provided is decisive for the continuation of the infant's development and for the bonding between mother and preterm infant.

The physical and psychological environment of the NICU may be the most important factors both in the infant's development and in the transition to parenthood. Indeed, not only does this environment directly affect the premature infant, but these children are also deeply influenced by the caregiver's stress and ability to provide adequate care (Als et al., 1994; Gardner & Goldston, 2002; Hofer, 1994; McGrath & Conliffe-Torres, 1996).

The NICU procedures that have been found helpful for the infant and the parents include psychosocial interventions that educate parents on the need to provide the infant with an appropriately stimulating and nurturing environment and the provision of extra support for parents to promote psychological well-being. However, a recent study has demonstrated that a specific intervention in the NICU that trained mothers on how to reduce anxiety and enhance sensitivity towards the infant, was not sufficient in reducing anxiety and depression in mothers as compared to a group of mothers who received only general information about infant care (Zelkowitz, Feeley, Shrier, Stremler, Robyn Westreich, Dunkley, Steele, Rosberger, Lefebvre& Papageorgiou, 2011). Instead, interventions that focus on mother-infant touch and contact, such as KC, have been shown to clearly promote maternal behaviour, to reduce parenting stress, to increase the maturation and developmental rate of the preterm infant, and to contribute positively to the mother-infant relationship (Feldman & Eidelman, 2003; Feldman, Keren, Gross-Rozval, & Tyano, 2004; Goldstein-Ferber, Feldman, Kohelet, Kuint, Dolberg, Arbel, & Weller, 2005). The results of the present study offer more information on the efficacy of close skin-to-skin contact and the re-establishment of the mother as primary physical and psychological environment to support the psychological health of the parents, to promote mother-infant bonding and of the normal developmental growth in premature infants. The KC intervention, as applied in the present study, addresses both the maternal and the preterm infant needs at a psychological, physiological, developmental and behavioural level. Therefore, the results obtained indicate that it should be recommended for preterm infants and their mothers as soon as physiological stabilisation has been achieved.

The KC intervention applied during the research projects has successfully changed the policy and practice of the hospitals involved. The careful training of staff, the creation of accurate and specific guidelines and the sensitisation on the positive results on mother-infant dyads obtained during the course of the project, all played a pivotal role in overcoming the lack of knowledge of all the KC benefits that outweigh any perceived risks. This is similar to what is reported in the latest paper addressing the application of KC in high-tech environments (Nyqvist et al., 2011). This and the support received by the senior Consultant neonatologist, have resulted in a radical change of practice within the NICUs involved in the study.

The dissemination of these results within nursing staff and clinicians is of paramount importance because, as this project seems to highlight, KC is most beneficial when it is applied in a continuous and structured way. Indeed, the positive impact of the KC intervention on the maternal reported outcomes has been produced following an intervention of at least one hour a day for at least 14 consecutive days, similarly to previous studies which applied a similar procedure (Ahn et al., 2010; Chiu & Anderson, 2009; Feldman et al., 2002b, 2003; Neu & Robinson, 2010; Tallandini & Scalembra, 2006). When the intensity and duration of KC intervention were diminished, different results were obtained in the mother and mother-infant dyad. This could explain the results obtained by the two studies previously carried out in the UK, which did not find any effect on mothers and children following a KC procedure of an average of 30 minutes per session (Whitelaw, 1988; Miles et al., 2006). This points to the possibility of a "dose-response" effect which is supported, in the present research, by the findings pertaining the Limited KC group. In this group of participants, the parenting stress levels did not diminish as a result of the KC procedure, nor was there evidence of a better quality of mother-infant interaction and of mother-infant bonding, although the infants in this group were, on average, born less preterm than in the KC intervention group. Both Limited and Intervention KC mothers applied KC for a daily duration of at least 1 hour but the mothers of the Limited Intervention applied KC for fewer days than the Intervention Group. Therefore, these findings can be considered conclusive only with respect to the continuity and the minimum number of days of KC's application. The two groups presented high variation in regards to the total amount of KC. However, the nature of the present sample in which the severity of medical risk and gestational age were confounded with the total amount of KC, did not allow for further analyses to be carried out; mothers who practiced KC for a longer time had premature infants with higher medical risks and with longer hospital stays. It would be important to be able to disentangle the characteristics of the KC intervention that were the most influential for the effects found. Moreover, it would be of fundamental importance to be able to indicate the relevance of the sessions' regularity, the postnatal and gestational age at which KC needs to be introduced, the best daily amount and the best length of duration in days.

Importantly for the clinical application of KC, these results may be interpreted as due to the necessity of allowing the dyad the minimal time necessary to adapt to each other's body and to feel comfortable in this type of intimate exchange. In fact, the procedure of taking the baby out of the incubator and placing him/her between the mother's breasts could be in itself a reason for stress. This can potentially happen when KC is not accompanied by a time long enough and by the establishment of a daily routine, in order to allow the mother to appreciate the contact with the baby and in order for the baby to adapt to the change in the environmental circumstances. This can produce in the mother a sense of familiarity that derives from daily contact with her infant and a sense of confidence that she is actually able to care for her fragile infant and to meet some of his/her needs. Finally, the consistency of caregiving allows the time to develop synchrony within the mother-infant dyad and to create an expectation on the part of the infant of its primary environment.

Differently to most of the longitudinal studies on the psychological impact of KC, this study has provided a baseline measure before the practice of KC. The pre-post intervention data collection was essential in order to investigate the psychological evolution of a parent and parent-infant dyad during the hospitalisation period, looking at how KC intervened in this time frame and along the first year of the infant's life, addressing specific infant milestones as detailed in Chapter 3. When addressing the psychological and developmental processes, this is important in order to establish: firstly, whether the areas investigated were affected by the KC procedure; and secondly, whether the magnitude and direction of such changes were different among the groups.

Limitations of the study

The main limitation of this study is that it was not a randomised controlled study. As reported previously, KC is a care option offered to the parents and its randomisation was not considered ethical due to its already established medical benefit on preterm infants. Participants were recruited following a convenient grouping, dependent upon the availability of eligible participants born at the time of the research study. The self-selection bias that could have occurred when mothers chose to participate or not in KC was controlled by the recruitment of the Control participants before the introduction of KC in the neonatal wards. Moreover, maternal personality was assessed to control for any potential differences that could be responsible for the choice to apply the KC procedure.

As addressed in the previous section of this Chapter, another limitation of this study has to do with the differences among the groups, in terms of the preterm infants' gestational age at birth and their medical risk. Such differences were statistically controlled within the analyses on the outcome variables; however, they did not allow further analyses to investigate the characteristics and the influence of the KC procedure, in terms of postnatal age and gestational age at the beginning of the intervention, length in days and regularity of the sessions.

This limitation has both theoretical and clinical importance. From a theoretical perspective, the establishment of the most efficacious time for the intervention's application (maternal psychological status, maternal bonding, mother-infant interaction and preterm infant development) could have shed light on particularly sensitive entry-points to correct the disrupted mother-infant's primary environment and early experiences. From a clinical point of view, as already addressed in the previous section, it would have given further information for the practical implementation of KC.

With respect to sample size, the mother-infant dyads did not reach the target sample of 125 due to a higher than expected rate of participants' dropout. Even if other studies on KC's psychological outcomes have reported similar sample sizes (Chiu & Anderson, 2009; Neu & Robinson, 2010; Tallandini & Scalembra, 2006), it must be considered that this research might have been less able to detect a statistically significant relationship between the studied variables.

Families who drop out from the research did not differ when it came to infant characteristics. However, the mothers were, to a larger degree, younger, single, with a higher percentage of unemployment and with a lower socio-economic status compared to those mothers who continued participating. This is not a new phenomenon in the field of child developmental research in high-risk populations such as that of preterm infants.

Direction for future research

In my opinion, as a result of this research project's findings, three main lines of future research should be developed in order to enhance the understanding of KC's effect and underlying mechanisms.

In order to establish the underlying processes of the found effect on maternal stress and maternal bonding to the infant, as addressed in the previous section, future research should combine psychological data with the identified neuroendocrine correlates of maternal cortisol and oxytocin. Given the indication of the interconnection of maternal psychological stress and maternal bonding, it would be of great interest to follow up this type of data with a collection of longitudinal data on the style of maternal attachment representations and infant attachment. More established and rigorous measures of attachment should be used, rather than the one used here and in the other KC research on maternal attachment (Ahn et al., 2010; Gathwala et al., 2008; Miles et al., 2006), such as the Working Model of Child Interview (WMCI; Zeanah, Benoit, Hirshberg, Barton, & Regan, 1994) for mothers and the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978) for children. This type of research could evaluate the changes in maternal cortisol and oxytocin concentrations in relation to the style of mothering – Kangaroo Care or conventional nursing care – and could relate the magnitude of these differences to anticipated differences in maternal psychological parenting stress and maternal attachment representations. Moreover, this type of research could further investigate the effect of KC on infant attachment style in relation to both maternal neuroendocrinological and psychological changes.

Further research is needed to study the long-term developmental effects over the first 2 years of life. The present results indicate that KC has long-term effects on language development. It would be of great relevance to understand the processes involved in the effect of KC on language and to further investigate such effects in relation to the development of the triadic mother-infant-object skills and of joint attention at 9 months (CA) (De Schuymer, De Groote, Striano, Stahle, & Roeyers, 2011). Moreover, it would be important to establish whether the positive effect on language development is maintained at the pre-school years, when the detection of language delay in preterm infant is more common (Anderson & Doyle, 2003; Largo, Molinari, Comenale Pinto, Weber, & Duc, 1986; Luoma, Martikainen, & Ahonen, 1998; Sansavini, Rizzardi, Alessandroni, & Giovanelli, 1996; Wolke & Meyer, 1999). In this context, as previously discussed, it is important to achieve a homogeneous sample within a KC group and a Control group in terms of infant characteristics at birth such as gestational age, medical risk and duration of hospitalisation and in terms of family socio-economic status. Given the fact that the present results have shown the efficacy of KC for both the limited and the full intervention and have indicated that the lower the gestational age the better the results were at 12 months (CA), as seen in the previous sections, the infants' characteristics are particularly important in order to disentangle the KC characteristics most involved in its efficacy.

The last line of research deriving from the present data is to carry out a future study in order to replicate the results on fathers in combination with data on mothers. This is because the interesting results obtained in this study cannot be considered conclusive due to the limited sample size. Indeed, further research is necessary on the indication found here that there exists an interrelationship between the practice of KC during the perinatal period, maternal parenting stress and paternal parenting stress. With an appropriate sample size, the way the different variables all operate together could be investigated, for example, through a path analysis, in order to investigate both their direct and indirect effects.

Conclusion

KC in high technology settings is a beneficial procedure that addresses some of the adverse early life experiences related to preterm birth. Preterm infants should be regarded as extero-gestational foetuses (Nivisq et al., 2010a) needing skin-to-skin contact to promote maturation and to help repair a disrupted bonding process. Moreover, KC partially re-establishes the typical experiences of the preterm baby and the mother, which are disrupted by preterm delivery.

Acknowledgments

Above all, this thesis would not have been possible without the generous help, support, constructive feedback and guidance of my principal supervisor, Prof. Maria A. Tallandini, through out the years.

I am also extremely grateful to Dr Angela Huertas-Ceballos, Consultant Peaditrician at UCLH, responsible for the research implementation at the NICU. She shared with me her expertise and knowledge of premature infant and their developmental assessment.

A special acknowledgment goes to the families and infants who took part in the study. Without them and their willingness to share their lives, homes and families, this study would not have been possible.

Far too many people to mention individually have assisted in so many ways during my work at UCL and at the NICUs involved in the study. They all have my sincere gratitude. In particular, I would like to thank Dr Raoul Blumberg and Dr Juliet Penrice form the Whittington Hospital and Silvia Konig from the Barnet Hospital, and all medical and nursing staff of the NICUs for their support during data collection and KC implementation. My sincere gratitude goes to Anne Canterella and Robyn Leight Curran, research nurses involved in the KC project, and Lynne Collier, research nurse involved in the clinical follow-up of preterm infants.

I would like to acknowledge the academic and technical support of the UCL Psychology Department. I also owe a huge debt of gratitude to Dr Alastair McClelland who was instrumental in the statistical plan for the analyses carried out. Special thanks to my colleagues Korina Soldatic, Laura Gottardis, Valentina Morsan, Lucia Tellini, Valentina De Nardi, Chiara Chiavedale and Antonella Bertin, and the "Laboratorio di Osservazione del

Comportamento Infantile" Trieste University, Psychology Department for their invaluable work and support given to this research.

This research was partly supported by BLISS the premature birth charity, to whom I am in debt for providing the necessary financial support for this research.

An ultimate thank-you goes to my wonderful parents and sister. For always being there when I needed them the most, and for never complaining about how infrequently I visit, they deserve far more credit than I can ever give them.

Data presented at national and international conferences

Poster presentations

Genesoni, L., Huertas-Ceballos, A., & Tallandini, M. A. Influence of Kangaroo Care Intervention on Psychomotor Development of Preterm Infants and Mother-Infant Relationship. 8th International conference on KMC, Quebec, Canada 2010

Genesoni, L., Curran, R. L., Huertas-Ceballos, A., & Tallandini, M. A. Kangaroo care and its effects on mothers of preterm infants in a UK setting. *1st European Conference on Kangaroo Mother Care Method*, & 7th International conference on KMC, Upsala, Sweeden, 2008

Genesoni, L., Curran, R. L., Huertas-Ceballos, A., Tallandini, M. A. Kangaroo mother care and its effects on parenting stress and maternal postnatal attachment in cases of premature birth. Perinatal Medicine, Harrogate, UK, 2008.

Genesoni, L., Tallandini, M. A., Huertas-Ceballos, A., Scharf, G: Psychological effects of premature birth on mothers and fathers. Institute of Women's Health, London, 2007

Genesoni, L. & Tallandini, M. A. Maternal psychological state and the attachment formation with her premature child. 2nd Italian Workshop for PhD and Young Researchers, Padua, Italy, 2007

Oral presentations

Tallandini, M. A., Huertas-Ceballos, A., & Genesoni L. Preterm Infants: Influence of Kangaroo Care During the First 6 Months of Life. Analysis of Mother-Child Attachment, Psychomotor Development and Family Environment. 8th International conference on KMC, Quebec, Canada 2010

Genesoni, L., Curran, R. L., Huertas-Ceballos, A., & Tallandini, M. A. Kangaroo care and its effects on mothers of preterm infants in a UK setting. *1st European Conference on Kangaroo Mother Care Method*, Upsala, Sweeden, 2008

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Appendix 1

Demographic information and infant medical characteristics collection form

Study Number:……………

Age
Mother: Age:……..
Father: Age:……..
Sibling(s): Age:……. Age:……. Age:……..

Smoker:	Mother			Father		
	Yes	No	N/a	Yes	No	N/a

Ethnic Background

	Mother	Father
White UK		
White Irish		
White other		
Black UK		
Black other		
Indian/Pakistani		
Far Eastern (China, Japan, Korea)		
Middle Eastern		
Mixed race		
Other		
Not known		

Education

	Mother	Father
At school		
GCSEs		
College		
"A" Levels		
University		
Other Training		
Other		

Job situation

	Mother	Father
Going to school		
Unemployed		
Employed		
Employed-part time		
Looking for job		
Looking after the home and family		
Other		

Occupation: Mother:……………………

Father:……………………..

Parental marital status

Married/Co-habiting
Separated/Divorced
Re-married
Widowed
Single parent
Other

Accommodation in which the family live

Owned outright
Owned with mortgage/loan
Rented form local authority
Rented privately unfurnished
Rented privately furnished
None of the above

Family in receipt of state benefit

No
Income support
Family/child credit
Housing benefit

There is a car or van normally available for use by you or any members of your household?

Yes
No

Study number:………………….
Date of recruitment:………………

ADMISSION

<table>
<tr><td colspan="2">Date of birth</td><td colspan="2"></td></tr>
<tr><td colspan="2">Order of birth</td><td colspan="2"></td></tr>
<tr><td colspan="2">Type of delivery</td><td colspan="2"></td></tr>
<tr><td colspan="2">Apgar score</td><td colspan="2">1 minute
10 minute
5minute</td></tr>
<tr><td colspan="2">Presence of infection at birth</td><td colspan="2"></td></tr>
<tr><td colspan="2">Date of first cuddle by mother/father/other</td><td colspan="2"></td></tr>
<tr><td rowspan="5">C
R
I
B</td><td>Gender</td><td colspan="2"></td></tr>
<tr><td>Gestation at birth</td><td colspan="2"></td></tr>
<tr><td>Birth weight (grams)</td><td colspan="2"></td></tr>
<tr><td>Temperature at admission (◦ C)</td><td colspan="2"></td></tr>
<tr><td>Base excess (mmol/L)</td><td></td><td>Crib total score:</td></tr>
</table>

INTERVENTION

Date in which intervention has started	
Baby age in days at the beginning	
Baby weight at the beginning	
Total duration of KC in hours	
Total duration of KC in minutes	
Days of KC	
Mean daily duration of KC in hours	
Mean daily duration of KC in minutes	
Date on which intervention ended	
Baby weight at the end	
Weight difference at the beginning and at the end	

DISCHARGE

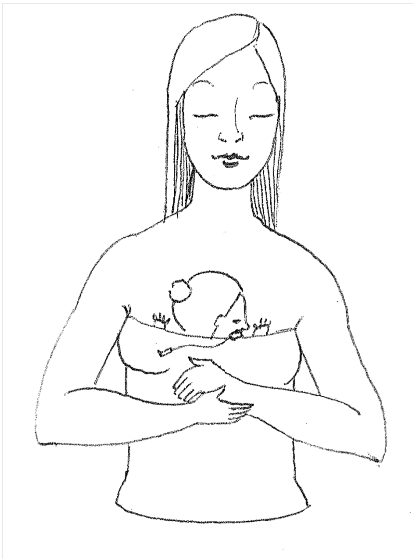
Date		
Gestation at discharge in days		
Weight at discharge (grams)		
Weight difference between admission to discharge		
Type of feeding		
Transfusion		
Days in antibiotics		
Days with central or peripheral cannula		
Total days on:	Ventilation	
	CPAP	

Appendix 2

University College London Hospitals NHS
NHS Foundation Trust

NEONATAL UNIT

KANGAROO MOTHER CARE GUIDELINES FOR STAFF



Prof Maria A. Tallandini, Dr Angela Huertas-Ceballos, Lucia Genesoni and Robyn Leigh Curran

UCL HOSPITALS

UCL Hospitals is an NHS Trust incorporating the Eastman Dental Hospital, Elizabeth Garrett Anderson Hospital, Hospital for Tropical Diseases, The Middlesex Hospital, National Hospital for Neurology & Neurosurgery and University College Hospital.

INDEX

1 Introduction

This is an initial and provisionary booklet. We warmly invite all the staff to give suggestions in order to make this leaflet clearer and more beneficial.
Thank you for your help and contribution.

1.1 Definition of Kangaroo Mother Care
Kangaroo Mother Care (KMC) is a type of care for preterm infants, which provides early skin-to-skin contact between the baby and mother or father or another caregiver.
It empowers parents in providing care and comfort to their baby during the hospitalization time.
It is a powerful, easy-to-use method to promote the health and well-being of preterm infants.

Kangaroo Mother Care key features are:

- Prolonged direct skin-to-skin contact between the caregiver and the baby;
- Promotion of breastfeeding;
- Promotion of caregiver/baby's interaction;
- Promotion of the caregiver's knowledge of the baby;
- Promotion of baby's exchange with caregiver.

Kangaroo Mother Care is initiated in hospital as soon as the baby is stable. It is a gentle, effective method that diminishes the agitation routinely experienced in a busy ward with preterm infants.

1 Requirements

Setting
KMC can be carried out by the caregivers within the Neonatal Intensive Care, the Special Care and the Transitional Care Units.

Staffing
KMC does not require any more staff than conventional care.
Existing staff (doctors and nurses) should know:

- when and how to initiate the KMC method;
- how to position the baby between and during feeds;
- how to feed LBW and preterm infants;
- how to encourage breastfeeding and to introduce alternative feeding methods until breastfeeding becomes possible;
- how to involve the mother in all aspects of her baby's care, including monitoring vital signs and recognizing danger signs;
- how to take timely and appropriate action when a problem is detected or the mother is concerned;
- How to encourage and support the mother and the family.

2.3 Caregivers
Adopting KMC should be the result of an informed decision and should not be perceived as an obligation.
The main caregiver is usually the mother. However, all caregivers can provide KMC, irrespective of age, parity, education, culture and religion.
The various aspects of this method must be explained to the caregiver i.e. the position,

feeding options, care in the institution, what she can do for the baby attached to her body and what she should avoid i.e. not placing blankets over the baby in the Kangaroo care position unless required. The advantages and the implications of such care for the caregiver and her baby must always be supported by adequate reasons for the recommendations.

The following points must be taken into consideration when counselling on KMC:

- the mother must be willing to provide KMC;
- other family members can offer skin-to-skin contact even if, they cannot breastfeed;
- mother should recover before initiating KMC if she suffered complications during pregnancy or delivery or is otherwise ill;
- the mother/caregiver should be able to visit the baby in hospital;
- mother will need support to deal with other responsibilities at home;
- There is a need for a supportive community this is particularly important when there are social, economic or family difficulties.

2.4 Baby

Almost every small baby can be cared for with KMC.
Babies with severe illness or requiring special treatment may wait until recovery before KMC begins. KMC sessions can begin when the baby still requires medical treatment.
However, the **baby's condition must be stable**.
The ability to feed (to suck and swallow) and breathe spontaneously are not an essential requirement (KMC can begin during tube-feeding and while the baby is still on CPAP).

2.5 Equipments

Figure 1: KMC gift pack

Clothing for the mother

The caregiver will be offered a dressing-gown. However, the mother can wear what she finds comfortable and warm in the temperature, provided the dress accommodates the baby and herself, i.e. keeps the baby firmly and comfortably in contact with her skin.

The support binder

A carrying pouch (Fig. 2) will be provided for the caregivers. This is the only special item needed for KMC. It helps mothers hold their babies safely and close to their chest. This option leaves the mother with both hands free.

Figure 2 

Clothing for the baby
The baby is carried in the kangaroo position naked, except for the diaper, a hat and socks.
If cold, the baby should wear a cotton shirt, open at the front to allow skin to skin contact with the mother's chest and abdomen.

Other equipment and supplies
A **hand mirror** (Fig. 1) will be given to the caregiver. This will allow the caregiver to see her/his baby's face while doing KMC.
The others are the same as for conventional care:

- a thermometer
- Basic resuscitation equipment and oxygen where possible, should be available where preterm babies are cared for.

3 Kangaroo Mother Care in practice

3.1 When to start

KMC for premature babies **must be judged individually**, and full account should be taken of the condition and status of each baby and his/her caregivers.
The major requirement is that the baby **needs to be stable**.
Mother's of low birth weight babies can be encouraged to adopt KMC as soon as possible.

In general it can be expected that for babies weighing 1800g or more at birth (gestational age 30-34 weeks or more) KMC can start soon after birth.
In babies with birth weight between 1200 and 1799g (gestational age 28-32 weeks), it might take a week or more before KMC can be initiated.
For babies weighing less than 1200g (gestational age below 30 weeks) it may take weeks before their condition allows initiation of KMC.

3.2 The Procedure for Kangaroo Mother Care positioning

KMC positioning may require 3 individuals i.e. the mother and 2 nurses, in infants receiving CPAP or ventilation. For self-ventilating infants only 2 individuals are required.

- The baby must be placed between the mother's breasts in an upright position, chest to chest (as shown in Fig. 3).

- Both flexion and hyperextension of the head must be avoided. The hips should be abducted in a "frog-like" position; the arms should also be flexed (Fig.3).

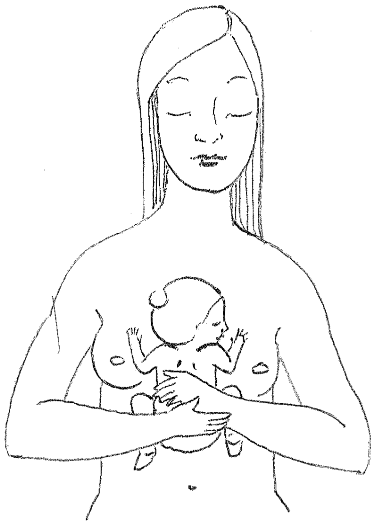


Figure 3

- The baby's abdomen should not be constricted and should be at the level of the mother's epigastrium. In this way the baby has enough room for abdominal breathing (Fig. 4). The mother's breathing makes the baby aware of the caregiver/mother's presence.

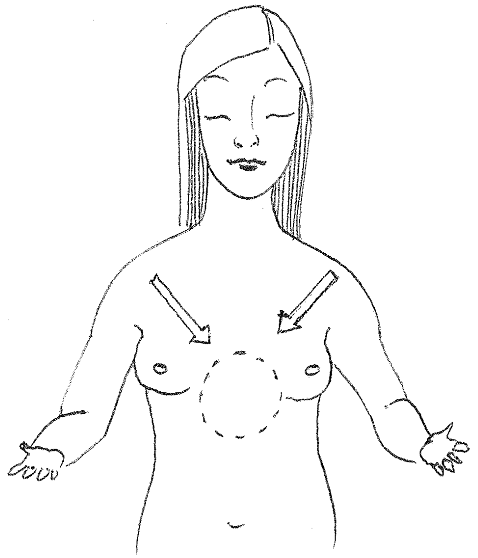


Figure 4

- The baby must be secured with the binder. The head turned to one side. The top of the binder must be just under the baby's ear. The head position should ensure the airway is open and the mirror allows eye-to-eye contact between the mother and the baby (Fig. 5).

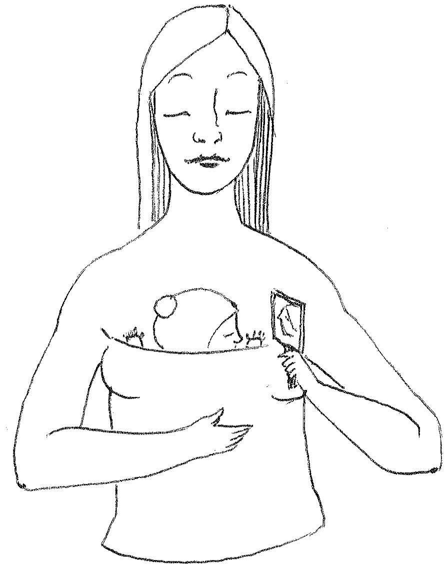


Figure 5

- The binder must fit perfectly and support the baby in such a way that it enables the mother to stand up without the baby sliding out.

3.2.1 Procedure for moving the baby out of the binder.

- Place one hand behind the baby's neck and back to provide support;
- The lower part of the jaw must be lightly supported with the thumb and fingers to prevent the baby's head from slipping down and blocking the airway when the baby is in an upright position;
- The other hand must be placed under the baby's buttocks (Fig. 6).

- Figure 6

3.3 Initiating Kangaroo Mother Care

When the baby is ready for KMC, a suitable time should be arranged that is convenient for the mother and for her baby. The first session is important and requires time and undivided attention.
The mother should be encouraged to bring her partner or a companion of her choice if she so wishes to offer support and reassurance.

While the mother is holding her baby, each step of KMC should be described, then demonstrate them and let her go through all the steps herself. Always explain why each gesture is important and what it is good for. Emphasize that skin-to-skin contact is essential for keeping the baby warm and protecting him/her from illness.

Explain to the mother that she can breastfeed in kangaroo position and that KMC actually makes breastfeeding easier. Furthermore, holding the baby near the breast stimulates milk production.

The mother can care for twins too: each baby is placed on one side of her chest. She may want to alternate the position. Initially she may want to breastfeed one baby at a time, later both babies can be fed at once while in kangaroo position.

After positioning the baby let the mother rest with him/her.
Stay with them and check the baby's position. Explain to the mother how to observe the baby, and what to look for.

When introducing the mother to KMC she should also be informed about possible difficulties:

- For some time her life will revolve around the baby and this may upset her daily routine.
- A small baby at first might not feed well from the breast. During that period she can express breast milk and give it to the baby with a cup or other implements, but this will take longer than breastfeeding.
- Encourage her to ask for help if she is worried.
- Be prepared to respond to her questions and concerns. Answer her questions directly and honestly – she needs to be aware of the limitations that KMC may put upon her daily activities as well as the benefits it can undoubtedly bring to herself and her baby.
- Experience shows that most mothers are very willing to provide KMC, especially if they can see other babies thriving.
- By sharing the same environment for a long time, KMC mothers exchange information, opinions and emotions, and develop a sense of mutual support and solidarity.

3.3 Length and duration of Kangaroo Mother Care

Length

Skin-to-skin contact should start gradually, with a smooth transition from conventional
care to continuous KMC. Sessions that last less than 60 minutes should, however, be avoided because frequent changes are too stressful for the baby. The length of skin-to-skin contacts gradually increases.

Duration

When the mother and baby are comfortable, skin-to-skin contact continues for as long as they like.

It tends to be used until the baby reaches term (gestational age around 40 weeks) or 2500g. Around that time the baby also outgrows the need for KMC. The baby starts wriggling to show that she/he is uncomfortable, pulls her/his limbs out, cries and fusses every time the mother tries to put her back skin-to-skin.
This is when it is safe to advise the mother to wean the baby gradually from KMC.

3.5 Monitoring baby's condition

Temperature
When starting KMC, measure axillary temperature every 30 minutes.
If the body temperature is below 36.5 C, make sure that the mother is staying in a warm place and possibly cover the mother with a light blanket.

Observing breathing and well-being
Observations (heart rate/respiration) should be done hourly if required. The mother must be aware of the risk of apnoea, be able to recognize it, intervene immediately and seek help if she becomes concerned.

Record keeping
Each mother-baby pair will be provided with a diary to keep record of the KMC daily timing and to note any observations.
Essential information on KMC, when this is part of the care programme, must also be recorded. The following additional information should be recorded daily:

- when KMC began (date, weight and age);
- condition of the baby;
- details on duration and frequency of skin-to-skin contact;
- whether the mother is hospitalized or is coming from home;
- predominant feeding method;
- observations about lactation and feeding;
- daily weight gain;
- episodes of illness, other conditions or complications;
- the drugs baby is receiving;
- details on discharge: condition of the baby, maternal readiness, conditions at home that make discharge possible; date, age, weight and gestational age at discharge; feeding method and instructions for follow-up.

4 Kangaroo Mother Care in scientific literature

The KC procedure provides a physical environment as safe as the incubator. For this reason, the technique is now practiced in many developed as well as developing countries (Charpark et al., 1994; Sloan, 1994).

4.1 Benefits of Kangaroo Mother Care intervention

Literature shows that <u>*during hospitalization*</u> and in continuous Kangaroo Mother Care, babies:

- spend more time in quiet sleep (Acolet et al., 1989) and this result persists after 6 months (Gale et al., 1993)
- have a lower and more stable heart rate (Ludington et al., 1996)
- have a decrease in apnoea and bradycardia (Fohe et al., 2000)
- maintain body temperature and their oxygenation and gas exchange improve (Fischer et al, 1998; Acolet et al., 1989; Bauer et al., 1996; Fohe et al., 2000)
- improve in arousal regulation and stress reactivity (Michelsson et al., 1996; Mooncey

et al., 1997)
- experience analgesic effect during painful medical procedure (Gray, Watt, & Blass, 2000)
- have prolonged and augmented breastfeeding rates (Charpark, Figueroa, & Ruiz, 1998; Ramanathan et al., 2001)
- have faster growth rates and earlier discharge from hospital (Kambrani, Chdede, & Kowo, 1999)
- have mothers who increased maternal behaviour during hospitalisation period (Feldman, 2002).

Literature has also shown that ***following discharge*** from hospital and those in continuous Kangaroo Mother Care, babies:
- present longer alert states and less crying at 6 months (Whitelaw et al., 1988)
- have mothers who reported more positive feelings towards the baby
- have mothers with lower maternal stress (Tallandini & Scalembra, 2006) and less depressed (Feldman, 2002)
- have parents with better sense of parenting role (Affonso et al.,1993)
- have mothers who perceive their infant as less abnormal (Feldman, 2002)
- have mothers who fell more confident and competent in meeting their baby needs (Tessier et al., 1998)
- are more alert and more responsive (Feldman et al., 2002; Tessier et al., 1998)
- have higher developmental rates on the Bayley Scales (Feldman et al., 2002)
- have more sensitive and less intrusive mother and father, more cohesive family style (Feldman et al., 2003).

4.2 Reported experiences from medical staff of Kangaroo Mother Care implementation

Different journal articles have recently reported the positive experiences and the obstacles in the implementation of Kangaroo Mother Care intervention in both developing and developed countries.

4.2.1 Benefits for the hospital staff reported by the medical and nursing staff in their experience of KMC

- Promotion of parental relationship building and family formation (Johnson, 2007).
- Constitute a positive experience for parents (Johnson, 2007).
- Improves sleep and better oxygenation (Johnson, 2007).
- More success with breastfeeding and milk supply
- Once the caregivers learn and are confident with KMC, they become more involved in the care of the baby, reducing the work of the nurses.

4.2.2 Barriers reported by the medical and nursing staff in the implementation of KMC

- Kangaroo Care might be considered by neonatal medical and nursing staff a sub-standard care because it is a low-cost procedure and does not involve high technology. However, KMC is supported by sound scientific principles (Charpak & Ruiz-Pelaez, 2006).
- Assessment of the infant readiness for KMC, such as infant safety concerns and physiological stability (Johnson, 2007)
- KC can be considered as extra work for the nursing staff in developing countries where KC holding is performed 24 hours and early discharge is implemented. Mother and baby are strictly followed-up in outpatient clinics until term. However, even in this condition the main provider of the basic needs of the infant and the first-line monitor

of the baby condition is the mother, who progressively relieves the health professional of many routine activities (Charpak & Ruiz-Pelaez, 2006).

- Cultural issues can arise in culture where skin-to-skin contact between the KC providers and the baby is considered inappropriate (Charpak & Ruiz-Pelaez, 2006). This issue must be addressed within local system of believes and KC must NOT be forced.
- Inadequate level of privacy during the teaching of KC can be upsetting for certain mother (Charpak & Ruiz-Pelaez, 2006).
- The presence of cultural barriers to paternal participation. Mothers and health professional can be the most reluctant to allow paternal participation (Charpak & Ruiz-Pelaez, 2006).

4.2.3 Suggestions from the literature

- Less experienced nurses need to be supported by their colleagues in order to improve their security and confidence with their assessment of readiness of the baby (Johnson, 2007). Institute educational programs for staff about kangaroo care which emphasise the research findings (Johnson, 2007).
- Emphasise the benefits for parents and babies (Johnson, 2007).
- Develop a consistent clinical method for assessing kangaroo care readiness of the infant, family and environment (Johnson, 2007).
- Keep records of infants who experience kangaroo care (Johnson, 2007).
- Provide to the medical staff easy access to guidelines and the scientific papers supporting KC (Wallin et al., 2005).
- Make all medical, nursing staff and careers aware of KC by the creation of poster and information booklet.

5 Kangaroo Mother Care on the World Wide Web

Kangaroo Care Studies at University College London
Prof. Maria A. Tallandini, Dr Angela Huertas-Ceballos, Lucia Genesoni & Robyn Leigh Curran
http://www.kangaroocare.ucl.ac.uk

Kangaroo Studies at University of Trieste, Italy
Prof. Maria A. Tallandini
http://www.psico.univ.trieste.it/labs/tallandini/kangaroo.html

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KMC's promotion, from Mowbray Maternity Hospital, Cape Town, South Africa
Dr Bergman
http://www.kangaroomothercare.com/

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http://fpb.case.edu/KangarooCare/index.shtm

Kangaroo Mother Care Initiative, India
http://www.kmcindia.org/healthcare/index.html

Kangaroo Mother Care Our Little Miracle
Kristinne Collard: KC from a mother's point of view
http://www.geocities.com/roopage/
http://www.geocities.com/roopage/
Bliss the Premature Baby Charity
http://www.bliss.org.uk/

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ACKNOWLEDGEMENT

We are extremely grateful for BLISS –the premature baby charity, who are funding the Kangaroo Mother care study. Without their help we would have been unable to produce these guidelines!

Version: 1 (adapted from WHO guidelines)
Date: 06.08.2007

Appendix 3

University College London Hospitals NHS
NHS Foundation Trust

NEONATAL UNIT

KANGAROO CARE

INFORMATION FOR PARENTS

UCL Hospitals is an NHS Trust incorporating the Eastman Dental Hospital, Elizabeth Garrett Anderson Hospital, Hospital for Tropical Diseases, The Middlesex Hospital, National Hospital for Neurology & Neurosurgery and University College Hospital.

DEAR PARENTS…
Kangaroo care is skin-to-skin contact. It is the practice of holding a naked, premature infant between the mother's breasts or against the father's chest. The infant's face pokes out of the top of mum's clothing, and looks like a pouched kangaroo.

Kangaroo care was first introduced in Colombia. Due to a lack of incubators and advanced technology parents were taught to Kangaroo their infant's. A survey produced showed that babies weighing as little as 1000g were surviving-despite their impoverished conditions.

More research has shown that babies respond well to Kangaroo care. Parent's confidence in caring for their babies also increases.
Since the 1980's Kangaroo care has been one of the main approaches to premature care in this neonatal unit, as we see that both mother, father and infant benefit from it!

Here are a selection of answers to questions that have already been raised:

How might Kangaroo care help my baby?

- Enhances and facilitates the bonding process.
- Maintains satisfactory heart rate and temperature.
- Oxygen saturations stay the same or may improve without needing to increase oxygen levels.
- Breathing may become more stable and less erratic.
- Can aid earlier discharge home due to increased parental confidence.
- Parents can have quality 'cuddles' with their baby.
- Can console your baby if he/she is upset.

How might it help me/ my family?

- Increase bonding with your baby.
- Helps increase/ maintain milk supply.
- Increases confidence/ motivation when caring for your baby.
- Decreases anxiety.
- Enables you to be more assertive with your baby's care.
- Increases your ability to ask more questions.
- Increases self esteem.
- Decreases any feelings of guilt you may have.

How do we do Kangaroo care?

We (or you) undress your baby to his/ her nappy **only.** Mum/dad wear a loose gown / shirt or top with buttons down the front. A support binder may be used. Mum normally removes her bra and the baby is then placed on their front, head to the side, between mothers' breasts in a 'frog-like' position.

Can DAD join in?

YES

On this unit we believe in family-centred care, so if you wish for other family or friends to join in, then give us your consent. Kangaroo care is a very special form of a cuddle, which is nice to limit to a chosen few. Some Dad's are not around, so Granddad/uncle can join in, or a special friend.

Will my baby get cold?

NO

Your baby maintains his/her temperature by using your body heat as an incubator. Nursing staff will monitor your baby's temperature and can teach you how to do so.

Will my baby get tired?

NO and YES

All babies need to sleep. In Kangaroo care they have the opportunity to be undisturbed by the doctors and nurses! This is yours and your baby's time together. They get quality sleep/comfort. As your baby is getting bigger he/she will be able to tolerate longer periods of Kangaroo care.
You will be able to pick up your baby's cues as to when he/she wants to go back to bed. The nurses will also discuss the best time with you.

What about all the drips and tubing etc.?

The nurses will discuss with you whether Kangaroo care is suitable for your baby, and when is the best time.
Most babies can have Kangaroo care, even ventilated ones. The nurses will be able to sort out the monitor wires and drips. Certain babies' conditions mean that Kangaroo care is unsuitable. Your baby's condition i.e. heart rate and breathing, will be monitored during kangaroo care.

Who will help me?

The nurses will help and enlist the help from you and your family. You will find as your confidence increases kangaroo care gets easier.

Is my baby too poorly for Kangaroo care?

Each baby is an individual and has good days and not so good days. Your baby's condition will always be discussed with you. If the nurses feel that your baby is too unstable for Kangaroo care they will explain why. Kangaroo care can be done from the first day of life.

Parents Comments about Kangaroo care

"It was the first time my baby felt like my baby and not the nurses"
"I wish I had done Kangaroo care when he was first born, when he was ventilated, and not waited so long."
"I really enjoy giving kangaroo care as I am the only person who can do this with my baby.'"
"It's wonderful to feel her skin on mine."
"It helps my emotions come to the surface. I hold back when I just hold his hand."
"I can't wait to get him home."
"He feels relaxed."

Please do not hesitate to ask about Kangaroo care if you are interested or have anymore questions. We will be pleased to help you.

References

1.Bliss Booklets www.bliss.org.uk (i)Handle me with care Pg 12
(ii)Parent Information Guide Pg25-26
2.Unicef www.unicef.org -Off to the best start Pg 17
3.Kangaroo Mother Care on the World Wide Web :

Kangaroo Studies at University of Trieste, Italy
Prof. Maria A. Tallandini
http://www.psico.univ.trieste.it/labs/tallandini/kangaroo.html

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http://www.geocities.com/roopage/
Bliss the Premature Baby Charity
http://www.bliss.org.uk/

Version: 2 (updated by Robyn Curran, Mae Nugent,
Geraldine Boreland, Angela Huertas Ceballos)
Date: 06.08.2007

Appendix 4

Patient Information Sheet and Consent Form

University College London Hospitals **NHS**
NHS Foundation Trust

Neonatal Unit
Elizabeth Garrett Anderson Hospital
Huntley Street
London WC1E 6DH

Telephone: 0845 155 5000
Fax: 020-7380-9775

Patient information sheet

08/06/2006 – Version number – 3

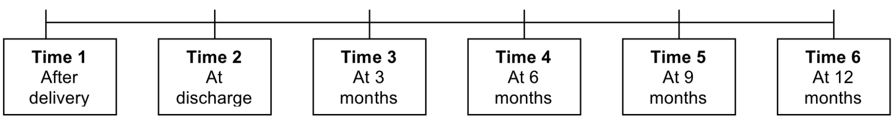
Title of the project: **Kangaroo Care and mother and father-premature infant psychological variables**

We would like to invite you to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.
Take time to decide whether or not you wish to take part.
Thank you for reading this.

What is the study about?
We are conducting a study on the relationship between parents and their premature baby in order to understand the impact of different caring methods on the early interaction between parents and baby. We will study the infant psychological development, the psychological well being of the parents, the parents-infant bonding and interaction.

Why have I been chosen?
The study is about mothers and fathers of babies who have a birth weight of less than 2000 grams. The study involves 122 participants who are willing to help us to improve our knowledge on this matter.

What will happen to me if I take part?
If you decide to take part, you will be asked to give us some information about yourself (for example, your age, occupation, education), to fill in some questionnaires regarding your experience of premature birth, your feelings towards it, and the experience of it as a couple. This will be carried out, at the hospital and at home, at the following times: (i) following the birth of your baby, (ii) at the time of your baby's discharge from the NICU, (iii) when you come for the check-up with your pediatrician after 3 months, (iv) when your baby is 6 months old, (v) when your baby is 9 months old, and (vi) when your baby is 12 months old (corrected gestational age). At each visit we also will make a short video of you with your baby and a copy of each will be available for you as a memory. Finally, we will observe your baby's psychomotor development at time (vi) (see figure 1). We will pay for your travel expenses for the visits to the hospital.



What are the possible risks of taking part?
The way this research is carried out does not entail any physical or psychological risk for you and your baby.

If you wish to make a complaint, or if you have any concern about how the study was conducted, the normal National Health Service complaint's mechanisms are available to you.

Will my taking part in this study be kept confidential?
All information that is collected about you during the course of the research will be kept strictly confidential. All the data will be kept in the Department of Psychology University College London. Prof. Maria A. Tallandini will be responsible for the handling and processing of the data, which in any case will be carried out anonymously. Any information about you, which leaves the hospital, will have your name and address, date of birth and all identifiable information (including patient/hospital/NHS number) removed so that you cannot be recognised from it. All information regarding your medical records will be treated as strictly confidential and will only be used for medical purposes. The videotaped material will only be retained until it is no longer needed for the data analysis purposes of this study. It will then be destroyed. Participation in this study will in no way affect your legal rights.

What will happen to the results of the research study?
The data collected will be analysed and may be published. This will be done in a form where participants are treated anonymously. If you wish to receive a copy of any eventual publication, you can ask for it. In any case, you will not be identified in any report or publication.

If you decide to take part, you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive.

We thank you very much for taking the time to read this information.

Prof. Maria Tallandini
Senior Lecturer in Developmental Psychology
Dept. of Psychology
University College London
Tel: 020 7679 5704
Email: m.tallandini@ucl.ac.uk

Lucia Genesoni
Research Assistant
Dept. of Psychology
University College London
Tel: 020 7679 5363
Email: l.genesoni@ucl.ac.uk

Dr Angela Huertas-Ceballos
Consultant Neonatologist
Neonatal Unit
Elizabeth Garrett Anderson &
Obstetric Hospital UCLH
Tel: 0845 155 5000 ext 8094
Email: angela.huertas-ceballos@uclh.nhs.uk

Robyn Leigh Curran
Research Nurse
Neonatal Unit
Elizabeth Garrett Anderson &
Obstetric Hospital UCLH
Tel: 0845 155 5000 ext 8094
r.curran@ucl.ac.uk

A research ethics committee reviews all proposals for research using human subjects before they can proceed. The joint UCL/UCLH committees reviewed this proposal and ethical approval has been obtained

University College London Hospitals NHS
NHS Foundation Trust

Neonatal Unit
Elizabeth Garrett Anderson Hospital
Huntley Street
London WC1E 6DH

Telephone: 0845 155 5000
Fax: 020-7380-9775

Centre Number:

UCLH Project ID number:

Patient Identification Number for this study:

01/02/2005 – Version number - 1

CONSENT FORM

Title of the project: Kangaroo Care and mother and father-premature infant psychological variables

Principal investigator: Prof. Maria Tallandini

Please initial box

1. I confirm that I have read and understood the information sheet dated 08/06/2006 (version 3) for the above study and have had an opportunity to ask questions. ☐

2. I confirm that I have had sufficient time to consider whether or not want to be included in the study ☐

3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐

4. I understand that sections of any of my medical notes may be looked at by responsible individuals from University College London, Department of Psychology or from regulatory authorities where it is relevant to my taking part in the research. I give permission for these individuals to have access to my records. ☐

5. I agree to take part in the above study. ☐

--	----------------------------------	---------------------------
Name of Patient	Date	Signature
--	-----------------------------------	---------------------------
Name of Person taking consent (if different from researcher)	Date	Signature
--	----------------------------------	---------------------------
Researcher	Date	Signature

1 for patient; 1 for researcher; 1 to be kept with hospital notes

UCL HOSPITALS