THE EFFECT OF PARENT ADMINISTERED INFANT MASSAGE ON THE DEVELOPMENTAL MILESTONES OF PREMATURE INFANTS

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Declaration

I, Megan Leigh Perrie, hereby declare that this dissertation is my own work. It is being submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Occupational Therapy. It has not been submitted before for any degree or examination at this or any other university.

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Abstract

Prematurely born infants have been shown to have developmental delays in multiple areas when compared to infants who were born at term (Formiga & Linhares, 2010) (Guerra, et al., 2014). This study investigated the developmental milestones of infants who had and had not received parent-administered infant massage for the first four to six months of their lives. The Peabody Developmental Motor Scales Second Edition (PDMS-2) test was carried out on infants at birth and then again at four to six months actual age along with the Bayley Scales of Infant and Toddler Development Third Edition (BSID-III). Positive clinical effect sizes were shown in the massaged group in the Cognitive, Reflexes and Visual-Motor Integration sub-tests. There was also a strong correlation between frequency of massage and social-emotional development of the massaged infants. Larger scale research is still required to confirm the findings of this study.

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Table of contents

List of tables

List of figures

Abbreviations

BSID-III	Bayley Scales of Infant and Toddler Development - Third Edition
CHBAH	Chris Hani Baragwanath Academic Hospital
KFC	Kangaroo Father Care
KMC	Kangaroo Mother Care
NEC	Necrotising Enterocolitis
NICU	Neonatal Intensive Care Unit
NNJ	Neonatal Jaundice
PDMS-2	Peabody Developmental Motor Scales - Second Edition
RDS	Respiratory Distress Syndrome
TTN	Transient Tachypnoea of the New-born
UNICEF	United Nations International Children’s Emergency Fund
WHO	World Health Organisation

Definitions

Gestational age

Number of weeks a foetus spends in-utero (WHO, 2018)

Premature infant

An infant born before 36-37 weeks gestational age (WHO, 2018)

Term

An infant born after 37 weeks gestational age (WHO, 2018)

Developmental delay

A significant interval in at least one area of development (Ballantyne, et al., 2016)

Parent

The mother, father or primary caregiver of an infant

Neonate

An infant in the first 28 days of life (WHO, 2019)

CHAPTER 1: INTRODUCTION

1.1 Introduction

Premature infants display different capabilities to those infants born at full-term, as the premature infant has a period of foetal development which takes place outside the supportive environment of the uterus (Vergara & Bigsby, 2004). The capabilities of the premature infant are therefore impacted as the infant undergoes stressful and sometimes painful experiences before reaching gestational age, that an infant born at term would not undergo (Vergara & Bigsby, 2004) (Vinall & Grunau, 2014). A premature infant's sensory system, which is often underdeveloped, can be overloaded with stimuli during medical care procedures, therefore they may respond negatively to the same stimulus that an infant, who was born at term, responds positively to (Vergara & Bigsby, 2004) (Vinall & Grunau, 2014). Premature infants often display low muscle tone as they were not positioned in physiological flexion in-utero, therefore when they reach gestational age, they often display different postures to a full-term infant (Vergara & Bigsby, 2004). The different postures displayed have an effect on attaining age appropriate milestones later on due to the different positions premature and full-term infants have experienced (Vergara & Bigsby, 2004). Therefore, the developmental trajectories of premature and full-term infants differ, often significantly.

Traditionally, occupational therapy offered to premature infants was to address specific deficits such as abnormal muscle tone, decreased range of motion at specific joints or a developmental delay which could have multiple causes (Case-Smith, 2005). However, with ongoing research, developmentally-supportive care is now promoted and practised in neonatal units (Case-Smith, 2005) (Legendre, et al., 2011). Neurodevelopmentally supportive care is any intervention that supports the development of an infant; especially important in the development of a premature infant is brain development and neuronal wiring (Westrup, 2007). Many techniques can be utilised to promote supportive care of the neonate (an infant in the first 28 days of life) (Lubbe, et al., 2012) (Bader, 2014). These techniques include: Kangaroo Mother Care (KMC) or skin-to-skin contact, promotion of calming strategies during

procedures (for example non-nutritive sucking), teaching parents massage techniques and positioning the infant in posturally supportive positions (Lubbe, et al., 2012) (Bader, 2014). Every interaction that a premature infant has with a caregiver (medical staff or parents) has the potential to affect the infant's developmental outcome (Bader, 2014). Therefore, therapeutic care of premature infants must involve not only the infant, but also the caregivers to ensure carry-over and success (Vergara & Bigsby, 2004) (Case-Smith, 2005) (Lubbe, et al., 2012).

Infant massage is a form of positive touch that can be taught to parents by a certified infant massage instructor (Bader, 2014). Infant massage has been shown to have multiple benefits, especially in populations of premature infants. Positive benefits of infant massage in premature infants include, but are not limited to, improved weight gain, improved sleeping patterns and improved bone density (Diego, et al., 2007) (Field, et al., 2010) (Underdown, et al., 2013) (Faure & Richardson, 2014) (Cooke, 2015). Infant massage is generally carried out by the parent/s of the infant as, in addition to other benefits of infant massage, it is a bonding experience for the infant and their parent/s (McClure, 2008).

Physical therapists are traditionally experts in the field of massage. Massage has been used by physical therapists in the treatment of many injuries as a rehabilitative tool to treat injuries as well as pain (Physiotherapy, 2019). Massage is also used by physical therapists, not only to aid in recovery of an injury, but also to prevent injuries or prevent further injuries (Physiotherapy, 2019). There are numerous massage techniques used by physical therapists; however, all the techniques are administered by the therapist themselves as they have been specifically trained in these techniques.

Infant massage differs from massage used by physical therapists in that parents are taught to administer the massage themselves, while taking into account their infants' sensory environment and reading the cues their infants are giving them in terms of whether or not they are coping with, and/or enjoying the massage (McClure, 2008). Infant massage is used not for recovery from, or prevention of injuries, but as a form of positive touch and bonding between an infant and their parent/s (McClure, 2008).

Occupational therapists working with premature infants are not only concerned with the morbidities and occupations of the infant, but also with the new occupation of parenting that is being fulfilled by the parents. Occupational therapists are therefore uniquely positioned not only to provide input to premature infants as well as their parents but also to premature infants through their parents. This can encourage success in the occupation of parenting and also with parent-infant bonding. In turn, the infant has their expected occupations supported and encouraged by their parent.

1.2 Statement of the problem

Prematurely born infants are at risk of developmental delay in many areas (motor, cognition, language, etc.) later in life (Guerra, et al., 2014) (Mansson & Stjernqvist, 2014). As prematurity rates in sub-Saharan Africa are estimated at 12.3% (WHO, 2012) and there is frequently a shortage of staff in government hospitals, a cost-effective hospital- or home-based programme that can be easily carried out daily by parents and that will positively influence development in all areas, would be beneficial. As infant massage has some proven benefits, such as improved weight gain for infants (Cooke, 2015) and is easily carried out both while in hospital and at home after discharge, the effect it has on the developmental trajectory of premature infants needs to be further investigated.

There is a large amount of evidence supporting the benefits of parent-administered infant massage and the effect this has on the infants' growth and length of hospitalisation, however the effect that parent-administered infant massage has on other aspects of the development of premature infants has yet to be studied.

1.3 Purpose of the study

The purpose of this study was to determine the effect that parent-administered infant massage has on the developmental outcomes of premature infants. Infants will have a baseline assessment as well as an assessment after receiving a parent-

administered infant massage programme. Parent's perceptions of the programme as well as the barriers and facilitators to compliance were studied.

1.4 Research question

What is the effect of parent-administered infant massage on the developmental milestones of a premature infant?

1.5 Aim of the research

The aim of this study was to determine the effect of parent-administered infant massage on premature infants on the acquisition of developmental milestones at four to six months actual age.

1.6 Research objectives

The objectives of this study are:

- To determine the developmental outcomes in a group of premature infants at four to six months actual age between those who received infant massage and those who did not, using two developmental screening tools.
- To describe barriers and facilitators identified by parents on the implementation of a hospital- and home-administered infant massage programme into their daily routines.
- To determine the association between compliance of parent-administered infant massage and the developmental outcomes of premature infants at four to six months actual age.

1.7 Null hypothesis

Parent-administered infant massage will have no effect on the developmental trajectory of premature infants as assessed by the Bayley Scales of Infant Development-III (BSID-III) and the Peabody Developmental Motor Scales-Second Edition (PDMS-2).

1.8 Justification for the study

There are many prematurely born infants in public health facilities in South Africa and very few therapists are available to treat the developmental delay and co-morbidities these children often present with. Parents of premature infants regularly spend long periods with their infants during the first few months of life, often feeling unsure and helpless. Including parents in the developmental care of their premature infant may help decrease the stress that the parent experiences as well as to assist with the facilitation of normal development of the infant. Therefore, a cost-effective programme that parents can administer in the hospital or in the home setting that allows these children to “reach their full potential” (Radermeyer & Jacklin, 2013) would be beneficial in South Africa. A programme such as this would allow the therapists to treat the co-morbidities that premature infants experience, using their expert knowledge, while the parents are able to assist with the normal development of their infants. Thus, therapists would have more time to treat premature infants who require their individual specialist attention and parents would feel that they were playing an important part in their infant’s overall care and management. This use of time and resources would also have financial implications for hospitals, especially state funded hospitals, as human resources would be used more efficiently, and knowledge will be transferred to parents to assist with the often-high caseloads.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, the relevant literature on the topics of prematurity, neurodevelopmentally supportive care, infant massage and family-centred care will be discussed. Premature infants will be discussed in terms of their presentation, common morbidities, their occupations and their behavioural states. Neurodevelopmentally supportive care will then be discussed including sensory considerations for the premature infant. Infant massage will be discussed in terms of its history, current practice and benefits. Finally, attention will be paid to parenting of the premature infant and the role of occupational therapy in the care of the premature infant with special attention to family-centred care.

2.2 Prematurity

Prematurity is defined by the World Health Organization (WHO) as a baby born before 37 weeks of gestation (Vergara & Bigsby, 2004). According to the WHO, prematurity rates worldwide are more than one for every 10 births (Dimes, et al., 2012); this accounts for approximately 15 million infants a year. Approximately nine million of the premature births worldwide occur in Southern Asia and sub-Saharan Africa (Blencowe, et al., 2012). The rate of prematurely born infants in sub-Saharan Africa was estimated at 12% in the year 2014 (Chawanpaiboon, et al., 2019).

2.2.1 Causes of premature birth

Although the underlying mechanisms of premature labour and birth are often unidentifiable, many studies have been completed to understand what causes premature birth (Zhou, et al., 2010) (Blencowe, et al., 2012) (Romero, et al., 214). In a 2010 study by Muglia and Katz, three possible causes of spontaneous premature birth were described, namely, “social stress and race, infection and inflammation, and genetics” (Muglia & Katz, 2010). Spontaneous premature birth has been shown

to be associated with maternal anxiety related to pregnancy (Kramer, et al., 2009). In a study conducted in the United States of America, it was shown that the rates of premature birth were double in black women when compared to white women (Muglia & Katz, 2010). It has been estimated that in the general population, intrauterine infections are responsible for approximately 40% of premature births (Agrawal & Hirsch, 2012). Multiple genetic factors contribute to premature birth (Muglia & Katz, 2010).

Maternal conditions can contribute to premature labour and birth (Platt, 2014). Maternal conditions can be pre-existing or related to the pregnancy (Platt, 2014). Pre-existing conditions are those that the mother had before conception such as diabetes (Platt, 2014). Conditions related to the pregnancy include pre-eclampsia and haemorrhage disorders (Berg, et al., 2010) (Platt, 2014). Even though the exact mechanisms and causes of premature birth are not fully understood, they are a problem that continues worldwide in increasing numbers even with advances in medical technology and practice. It is therefore crucial to be able to provide appropriate interventions to the premature infant to assist with their growth and development. In order to understand when and how interventions should be provided, the development of the infant first need to be understood.

2.2.2 Presentation of prematurely born infants

Prematurely born infants are at risk of many complications. The younger the infant's gestational age at birth, the more likely the infant is to present with complications at birth and in later life (Markestad, et al., 2005). Common morbidities of premature infants include respiratory conditions (such as transient tachypnoea of the new-born), gastrointestinal complications (such as necrotising enterocolitis), retinopathy of prematurity, neonatal jaundice and neurological complications often leading to cerebral palsy (such as hypoxic ischaemic encephalopathy and epilepsy) (Vergara & Bigsby, 2004) (Platt, 2014).

Prematurely born infants (even those without complications of prematurity) have different capabilities to full-term infants, which are greatly affected by their gestational age as well as their birth weight (Vergara & Bigsby, 2004). These

differing capabilities often affect the premature infant's ability to cope with stressors as well as to participate in daily occupations.

Some reflexes that are present in full-term infants may be absent or abnormal in premature infants, for example: sucking, Babinski and Moro reflexes (Vergara & Bigsby, 2004) (Sohn, et al., 2011) (Pineda, et al., 2013). The importance of reflexes has been described as the foundation for the development of normal movements by both the Hourglass Model of Motor Development and the Mountain of Motor Development Metaphor (Salehi, et al., 2017). Both of these models explain that reflexes are the first motor actions on which all other motor patterns are developed (Salehi, et al., 2017). Premature infants may also have low muscle tone depending on their gestational age (Vergara & Bigsby, 2004) (Pineda, et al., 2013). At term for gestational age, premature infants have some abnormal postural patterns; these can be attributed to the different postures they have experienced due to their low muscle tone and lack of physiological flexion (Vergara & Bigsby, 2004). This may in turn affect their sense of proprioception as they grow and develop. The development of head control has also been shown to be affected by prematurity (Babik, et al., 2017). These deficits need to be addressed early on to decrease the effect they will have as the infant grows and develops. These deficits can be addressed by occupational therapists with their specialist knowledge on development, motor abilities and sensory system functioning.

Due to their differing capabilities, premature infants are often unable to participate in the occupations that full-term infants are. This inability to participate affects the premature infant's occupational performance as a neonate which can in turn lead to long term complications in terms of the infant's growth and development.

2.2.3 Typical morbidities associated with prematurity

There are many documented long-term complications of premature birth. The risk of life-long disability increases as the gestational age at birth decreases (Moster, et al., 2008). Historically, infants surviving premature birth were considered a success, however later implications are now being further explored (Case-Smith, 2005). Premature infants are at higher risk of neonatal complications such as respiratory

distress and neonatal jaundice (Jaiswal, et al., 2011). Respiratory distress syndrome has, however, been shown to have no effect on later development of an infant (Meisels, et al., 1986). Neonatal jaundice may in turn be a risk factor for other co-morbidities later in life such as asthma and allergies (Ku, et al., 2012) (Wei, et al., 2015).

Infants born prematurely have been shown to have delayed developmental milestones when compared to term infants (Formiga & Linhares, 2010). In a 2014 study carried out on premature infants with low birth weights, it was found that at a corrected age of 18 - 24 months, children displayed delays in multiple developmental areas (Guerra, et al., 2014). This was further confirmed in a 2017 study where it was shown that premature infants were at higher risk of developmental delay than their full-term counterparts (Ballot, et al., 2017). Prematurely born infants were assessed using the BSID-III, which assesses an infant or toddler's development in five areas: Cognitive, Language, Motor, Social-Emotional and Adaptive Behaviour. These infants were shown to have significantly lower scores on the test when assessed at 30 months of age than infants who were not born prematurely (Bayley, 2006) (Mansson & Stjernqvist, 2014). Premature infants have been shown to have difficulties with visual-motor integration and higher-order visual tasks (Bolk, et al., 2018) (Leung, et al., 2018). Furthermore, delays at the preschool age were shown in premature infants in numerous areas such as motor and social abilities (Kerstjens, et al., 2011). During school years, prematurely born infants were shown to perform worse in skills such as maths, reading, spelling and concentration when compared to a group of their peers who had been born full-term (Aarnoudse-Moens, et al., 2009). With further investigation, it was found in a Norwegian study that the lower the gestational age of an infant, the higher their risk of medical and social disorders, even extending into their adult years (Moster, et al., 2008).

In the population of infants born prematurely who did not have a disability, there were significant social disadvantages compared to infants who were born at full-term (Moster, et al., 2008). Some disadvantages later in life were that there was a lower proportion in the premature group that received a higher education or were employed in well-paid formal employment (Moster, et al., 2008). In another study it was shown that female infants who were born prematurely were at greater risk for

giving birth to a premature infant when they reached child-bearing age (Swamy, et al., 2008). Given the risks that premature infants face, supportive care needs to be provided to enhance their overall development.

2.3 Occupations of the premature infant

There is a positive association between gestational age and birth weight, and neurobehavioral stability (Vergara & Bigsby, 2004). Infants that are in a more stable neurobehavioral state tend to have greater capacity for neonatal occupations (Vergara & Bigsby, 2004). An infant should be able to participate appropriately in the tasks required by a care-giver (either a medical professional or the parent of the child) (Vergara & Bigsby, 2004). If a premature infant cannot participate appropriately in the tasks required of them, intervention may be necessary so that they are able to participate and respond appropriately and maladaptive responses do not develop. The occupations that are expected of a neonate have only recently been explored and defined when it comes to their treatment (Vergara & Bigsby, 2004). A neonate's occupations can be explained within the International Classification of Functioning, Disability and Health Model (ICF) (Figure 2.1).

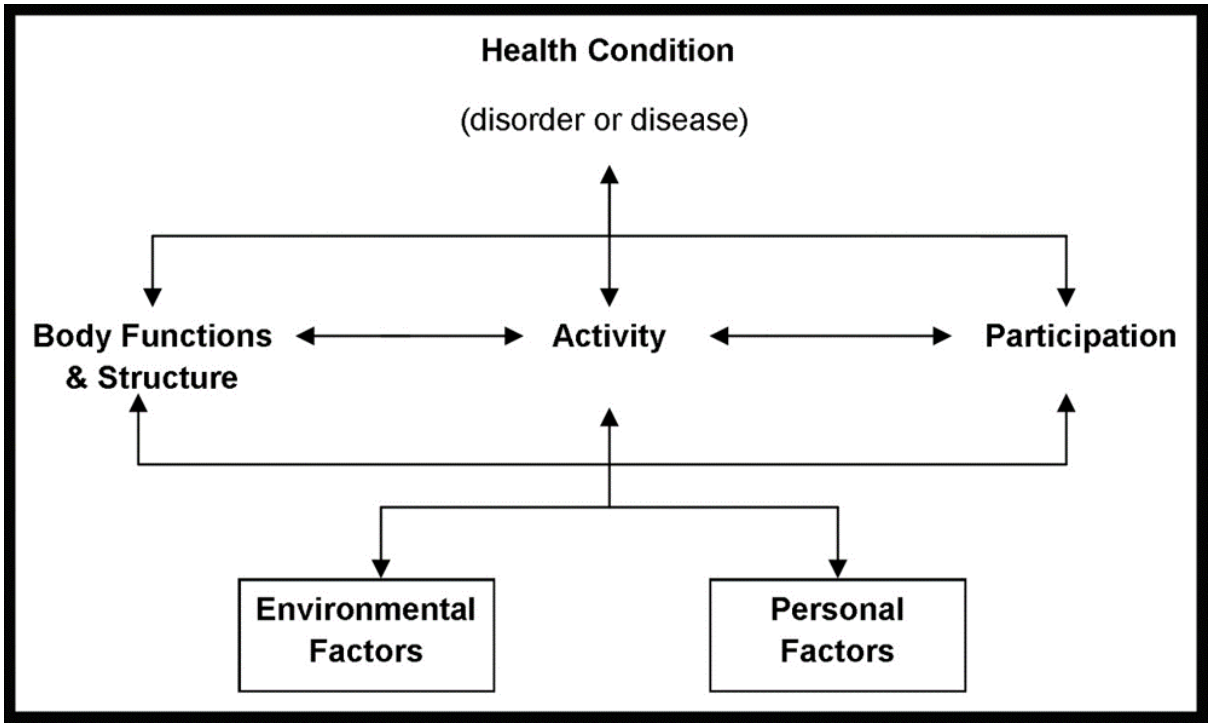

Figure 2.1: International Classification of Functioning Model (Organization, 2007)

The ICF provides a framework to understand which factors will influence an individual's activities and participation, hence their occupations (Rosenbaum & Gorter, 2011). The ICF consists of six areas and the model describes how all these areas are interlinked (Rosenbaum & Stewert, 2004). The areas included in the ICF are as follows: health condition (disorder or disease), activity, participation, body structure and function, environmental factors and personal factors (Rosenbaum & Stewert, 2004).

Prematurity can be considered the health condition of the infant. The health condition will affect the body structures and functions as laid out in the ICF model (Rosenbaum & Stewert, 2004). Structures and functions that may be affected include, but are not limited to: cardiorespiratory, physiological, reflexes, muscle tone, motor activity and arousal state (Vergara & Bigsby, 2004) (Pineda, et al., 2013). The health condition and the body structure and function will in turn affect and be affected by the activities of the infant (Rosenbaum & Stewert, 2004).

The occupations that are expected of the new-born include: social play, feeding, exploration and procuring (Vergara & Bigsby, 2004). The infant's ability to participate in these occupations is affected by their health condition as well as their body structures and functions. Preterm infants are known to have more gaze-aversion when involved in face-to-face play than infants who were born at term (De Schuymer, et al., 2012). Premature infants also frequently have difficulties with feeding in the first few weeks of their lives due to their poor oral-motor skills as a result of premature birth (Dodrill, 2011). According to the ICF model, the infant's personal factors and environment affect each other, as well as the activities of the infant (Rosenbaum & Stewert, 2004).

The personal factors that need to be considered include: self-soothing behaviours, states of arousal, development, and sensory processing and modulation (Vergara & Bigsby, 2004). Sensory processing and modulation are known to be different in premature infants due to the stimuli that they experience (Vinall & Grunau, 2014). This needs to be considered as it can affect an infant's state of arousal and potential to take part in their daily activities.

The environmental factors that affect the infant's activities include: the ward or home environment and the caregivers, including their expectations, values and beliefs (Vergara & Bigsby, 2004). Ward environments are often not conducive to a neonate's occupations as they are often brightly lit and have many loud and repetitive sounds such as beeping monitors. These could affect the child's ability to participate successfully in activities such as sleep or caregiver interaction. This could continue into the home environment on discharge if parents are not made aware of the ideal environment for a premature infant. The role of caregivers in the care of premature infants has been highlighted repeatedly in a review of research on the subject on neurodevelopmentally supportive care (Lubbe, et al., 2012).

In order for an infant to be able to engage in the occupations expected of them, they are required to be in the optimal behavioural state.

2.4 Behavioural states of the neonate

Human infants are known to have six distinct states of arousal as first described by Brazelton (Brazelton, 1978) (Vergara & Bigsby, 2004). These states of arousal are known to impact an infant's ability to take in sensory information from their environment, process this and adapt to it; in this way, learning takes place (Faure & Richardson, 2014). The six states of arousal are namely: deep sleep, light sleep, drowsy, calm alert, active alert and crying (Vergara & Bigsby, 2004) (Maltese, et al., 2017). During deep sleep, infants do not present with rapid eye movements and are not easily awoken (Vergara & Bigsby, 2004) (Case-Smith, 2005). Rapid eye movements are present during light sleep and infants are easily roused from this state (Vergara & Bigsby, 2004) (Case-Smith, 2005). Infant sleep is crucial for learning to take place through development of neural pathways, memory formation and sensory processing (Tarullo, et al., 2011) The calm alert state is the best state for an infant to learn new skills; they are able to focus on stimuli presented to them and learn how to react appropriately to these (Vergara & Bigsby, 2004) (Faure & Richardson, 2014) (Maltese, et al., 2017). In the active alert state, infants are alert and can attend to stimuli but for shorter periods than in the calm alert state, infants also have increased movement in this state (Faure & Richardson, 2014). The crying state is where the infant needs to be soothed and regulated, either by themselves or by an external source (Vergara & Bigsby, 2004). These states are important for parents to know as it helps them to understand what their infant needs and when to provide input. For example, a crying infant requires soothing and calming input while an infant in the calm alert state requires stimulation to learn and to develop. Parents are uniquely positioned to provide many of these interventions with the necessary support from a therapist who provides neurodevelopmentally supportive care interventions to premature infants (for example positive touch or instruction on parent-administered infant massage).

2.5 Neurodevelopmentally supportive care of the premature infant

Premature infants are exposed to multiple stimuli long before their central nervous systems are able to deal with and adapt to these stimuli (Legendre, et al., 2011). The

neurodevelopment of these premature infants is directly affected by the stimuli they receive, as well as medical factors such as weight and comorbidities (Legendre, et al., 2011). A scoping review in 2017, showed that different sensory experiences (light, noise and painful procedures) that are commonly experienced by premature infants had a negative impact on cognitive development and motor development as well as the development of the infant's sensory system (Philpott-Robinson, et al., 2017). With the risks associated with premature birth and low birth weights, the practice of neurodevelopmental-supportive care has increased in recent years (Vergara & Bigsby, 2004). Neurodevelopmental-supportive care can include a range of practices that are individualised to each infant and can include parent education and intervention as well as direct intervention with the infant (Vanderveen, et al., 2009) (Legendre, et al., 2011) (Lubbe, et al., 2012). In a 2012 study, neurodevelopmental-supportive care practices were grouped into nine common themes (Lubbe, et al., 2012). Common themes of neurodevelopmental-supportive care that have been previously identified and relate to this study are: individualised and family-centred care, handling techniques, pain management and an understanding of infant development (Lubbe, et al., 2012). Infants who receive minimal or less individualised neurodevelopmental-supportive care have been shown to exhibit some concerning behaviours that indicate their level of stress (Montirosso, et al., 2012). Signs of stress in a premature infant include, but are not limited to, gaze-aversion, splaying of fingers, arching of the trunk, gagging and yawning (Lubbe, 2008). Premature infants who are unable to independently cope with stressors and self-regulate often show signs that the stress is affecting their autonomic nervous system's functioning (Vergara & Bigsby, 2004). The effect stress has on the autonomic nervous system can even result in saturation and temperature changes in the premature infant (Lubbe, 2008). Conversely, infants who had more neurodevelopmental-supportive care, were shown to be more regulated and have greater physiological stability as coping behaviours such as self-soothing were noted (Montirosso, et al., 2012).

Bader reported in her ladder approach manual that each interaction that a premature infant has with another person has a direct effect on their brain development (Bader, 2012). The ladder approach is a treatment approach that guides the therapist to deliver unimodal sensory input according to the development of an infant's senses

so as not to over-stimulate them (Bader, 2012). According to the Synactive Development Theory (Figure 2.2), developed by Als, the main aim during interaction with a premature infant is for them to be able to self-regulate (Als, 1986) (Bader, 2012) (Maltese, et al., 2017). Als describes self-regulation as an infant being able to interact within their environment despite the demands their environment places on them (Als, 1986) (Vergara & Bigsby, 2004) (Maltese, et al., 2017). The Synactive Development Theory is a hierarchical theory in which each element builds on the previous element of the theory (Als, 1986) (Vergara & Bigsby, 2004) (Bader, 2012). The elements described in the theory, in order of development, are: physiological or autonomic function, motor behaviour, states of arousal, attention to the environment and finally self-regulation (Vergara & Bigsby, 2004) (Bader, 2012) (Maltese, et al., 2017). Physiological or autonomic functions are described as the body's functioning to keep the infant alive, examples include but are not limited to heart rate, respiratory rate, blood pressure and temperature (Vergara & Bigsby, 2004) (Bader, 2012). Physiological stability allows for active motor movements, that aim for self-regulation to develop (Vergara & Bigsby, 2004). As previously discussed, an infant goes through six states of arousal which are greatly affected by the previous two elements of the Synactive Development Theory (Vergara & Bigsby, 2004). When an infant is in the correct state of arousal, they are able to interact with the environment or a caregiver and learn from this interaction (Case-Smith, 2005) (Bader, 2012) (Maltese, et al., 2017). From this comes the ultimate goal of the Synactive Development Theory which is self-regulation (Case-Smith, 2005) (Bader, 2012).

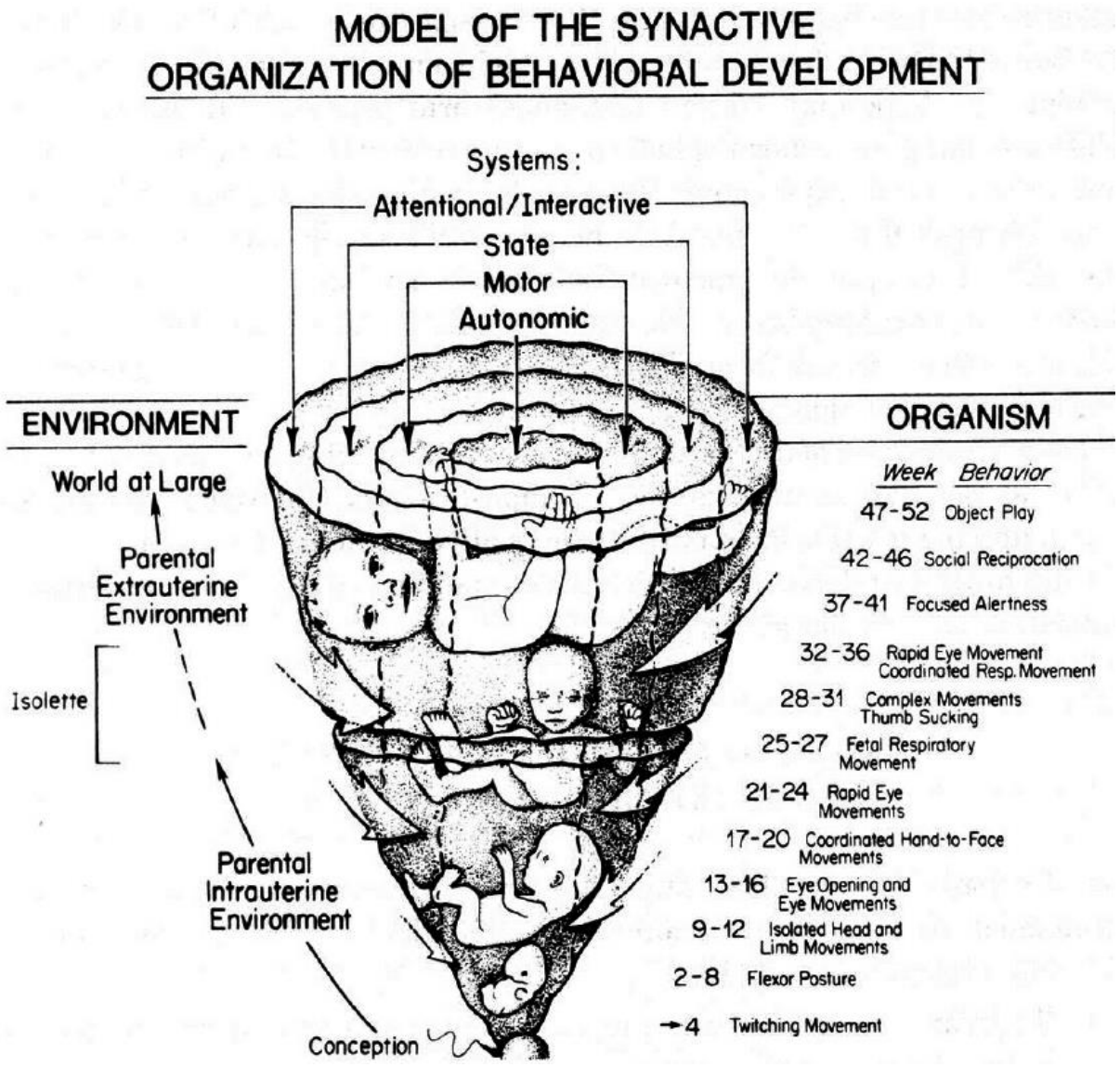

Figure 2.2: The Synactive Development Theory (Als, 1986) (Maltese, et al., 2017).

2.6 Self-regulation

Self-regulation behaviours allow an infant to interact with their caregivers and or environment (Vergara & Bigsby, 2004) and ultimately be able to perform the occupations expected of them. An infant will display two types of behaviours, namely approach signals and coping signals (Vergara & Bigsby, 2004). Approach signals and coping signals are influenced by the other factors of the Synactive Development Theory (Vergara & Bigsby, 2004) (Case-Smith, 2005). Approach signals let a caregiver or observer know that the infant is not stressed and is ready for interaction

(Vergara & Bigsby, 2004). Some approach signals include: bringing hands to the mouth, an alert and relaxed face, vocalising and a small amount of movement (Vergara & Bigsby, 2004). Coping signs let a caregiver or observer know that the stimuli the infant is subjected to are becoming too much and they are having difficulty coping with these (Vergara & Bigsby, 2004) (Brown & Spittle, 2014). Examples of coping signals are: grasping or fisting of the hands, gaze-avoidance, hiccupping, bracing of the legs and arching of the back (Vergara & Bigsby, 2004) (Brown & Spittle, 2014). It is therefore crucial for anyone interacting with a premature infant (whose sensory systems are not adequately developed for extrauterine life) to be able to read these cues and respond to them either by limiting environmental stimuli or providing calming stimuli for the infant (Vergara & Bigsby, 2004) (Case-Smith, 2005) (Bader, 2012) (Vinall & Grunau, 2014), hence the need for individualised neurodevelopmental-supportive care.

Infants who underwent neurodevelopmentally supportive care, have been shown to have significantly higher scores on tests of mental and physical functioning when assessed at one year of age (Vanderveen, et al., 2009).

One of the main aims in the care of premature neonates should be to prevent injury or abnormal development in the developing brain (Saigal & Doyle, 2008). Therefore, premature infants who are admitted to hospital and experience frequent painful procedures require care that will help them cope with these stressors and buffer the possible effects that the pain and stress could have on the developing brain. The management of pain and positive touch are therefore important aspects of neurodevelopmentally supportive care.

2.7 Sensation during the neonatal period

2.7.1 Pain experiences in the neonatal period

Pain and stress experienced during the neonatal period can be detrimental to the developing brain of the premature infant (Brummelte, et al., 2012). Infants admitted to the Neonatal Intensive Care Unit (NICU) frequently undergo painful procedures that can lead to stress of the infant (Carbajal, et al., 2008). Many common

procedures and care practices, which are not commonly thought of as painful, may be registered as painful by premature infants due to hypersensitivity (Grunau, 2013). As well as these common procedures, premature infants undergo many painful medical procedures. Many of the painful and or stressful procedures that an infant undergoes in the NICU are not performed in conjunction with pain management practices (Carbajal, et al., 2008). These painful procedures have been shown to affect the neurodevelopment of premature infants, as shown in a 2013 review of different options for pain management in infants (McPherson & Grunau, 2013). Exposure to painful procedures can result in decreased growth (of body and brain structures) as well as decreased cognitive and motor function (McPherson & Grunau, 2013). Medical interventions aimed at reducing the pain premature infants feel include the use of oral sucrose or analgesia depending on the type and duration of the pain experienced by the infant (McPherson & Grunau, 2013). Due to the lack of evidence on the safety of long-term use of these medical interventions, substitute interventions such as skin-to-skin contact and positive touch are more commonly being suggested (McPherson & Grunau, 2013).

2.7.2 Positive touch in neurodevelopmentally supportive care

Touch is the first sense that a foetus will develop (Lubbe, 2008). At approximately 12 weeks, a developing foetus is able to detect touch through most of their body (Faure & Richardson, 2014). The touch experienced by a foetus is deep pressure or proprioceptive input which enables the foetus to develop a sense of their body and its boundaries (Faure & Richardson, 2014). This is the first form of positive touch that a foetus experiences and this helps with starting the formation of a bond between the mother and the foetus (Lubbe, 2008). Once the infant is born, touch input can be used as a calming strategy by the caregiver of the child (Faure & Richardson, 2014).

Touch is crucial to any new born baby's development, attachment and well-being (Duhn, 2010) (Faure & Richardson, 2014). A lack of touch can lead to stunting of a baby's physical and emotional development, their formation of secure attachment as well as possible failure to thrive later in life (Duhn, 2010) (McClure, 2008) (Faure & Richardson, 2014). Positive forms of touch such as the positive touch technique or

massage can negate the negative effects of painful procedures and assist a preterm infant to remain in a regulated state (Bader, 2012) (McPherson & Grunau, 2013). As previously discussed, a well-regulated state is where infants are most likely to learn new skills and develop (Bader, 2012). The most common form of positive touch in the treatment of premature infants is KMC or kangaroo father care (KFC). KMC or KFC is where a mother or father and their premature and/or low birth weight infant are in skin-to-skin contact for as much time as possible every day (Jefferies, 2012). Mothers who practice KMC also report lower levels of stress (Jefferies, 2012). Another form of positive touch that can be provided by the caregiver is infant massage.

Although touch is the most important sense in relation to this study, hearing and vision are also important components of infant massage and parental bonding.

2.7.3 Auditory and visual foetal development

At approximately 28 weeks, towards the final trimester, a foetus is able to hear environmental sounds (Sullivan, et al., 2011) (Faure & Richardson, 2014). However, while the foetus is still in utero, these sounds are at lower frequencies given the environment of the foetus (Sullivan, et al., 2011) (Faure & Richardson, 2014). At birth, infants are able to recognise their mother's voice and start to respond to this; the mother in turn responds to the infant because of this and the early stages of bonding begin (Sullivan, et al., 2011). As infant massage is a one-on-one activity where the mother talks to the infant throughout the process, it would therefore enhance the bonding process. How an infant bonds with their parent will affect their social development throughout their life (Young, 2013).

At birth, sight is the sense that has had the least opportunity to develop given the environment of the foetus (Lubbe, 2008) (Faure & Richardson, 2014). Premature infants have been shown to have different visual abilities compared to full-term infants, especially with their tracking abilities (Gronqvist, et al., 2011). A full-term neonate will be able to see best at approximately 20 cm and after approximately one week will be able to identify their mother's face (Faure & Richardson, 2014). During

infant massage, the mother is positioned in front of their infant where the infant is able to look at the mother and start face-to-face interaction with her.

2.8 Infant massage

2.8.1 History of massage

Massage is a practice that is not only performed by humans, but also by animals who massage their new-born infants through the practise of grooming (Cooke, 2015). The practice of massage in humans has its roots in the need for contact between humans (Calvert, 2002). Massage has been practiced around the world for centuries, often handed down from one generation to another (Calvert, 2002). Cultures throughout the world have used massage for both physical and spiritual well-being (Calvert, 2002).

2.8.2 Current infant massage practices

Infant massage is a form of positive touch that can be used in premature infants to assist in central nervous system development (Bader, 2014). Central nervous system development will in turn allow the infant to self-regulate and process information with improved efficiency, which can improve the infant's occupational participation.

McClure was one of the pioneering forces in taking traditional massage, specifically from the Indian culture, and adapting it to a practice that is now widely used in western cultures (McClure, 2008). While working at an orphanage in India, McClure became aware that Indian mothers regularly massage their infants (McClure, 2008). She noted that children that had been massaged were warm and playful and willing to accept responsibility despite the poverty-stricken circumstances in which they grew up (McClure, 2008). While in India, McClure became ill with a fever, the women of the village in which she was staying massaged her until her fever broke and she accredits her recovery from the fever to the massage that she received (McClure, 2008). When McClure had her first child, she began daily massage sessions with

him (McClure, 2008). She took massage strokes from Indian and Swedish massage methods and combined these with techniques she had picked up as a yoga instructor (McClure, 2008). After she saw how much her child enjoyed the massage sessions, she developed the massage that is currently taught by the International Association of Infant Massage (IAIM) to their instructors globally (McClure, 2008). Infant massage instructors trained by the IAIM do not necessarily need to be therapists or have a medical background in order to undergo the training. Infant massage instructors are, however, taught to read infants' approach and coping signals and be able to explain these to parents to avoid any detrimental effects on the infant. During the training, instructors are taught to provide instruction to parents on the practise of infant massage. At no time does the infant massage instructor massage the infant but they rather provide instruction and support to the parents in this process. Westernised infant massage has recently become popular due to the benefits for the parent and the infant (Cooke, 2015).

2.8.3 Benefits of infant massage

The perceived benefits of infant massage for infants in western countries are improved weight gain in premature infants, higher bone density in premature infants, better sleeping patterns and improved parent-child attachment and bonding (Kelmanson & Adulas, 2006) (Field, et al., 2010) (Underdown, et al., 2013) (Faure & Richardson, 2014) (Cooke, 2015). The above benefits often decrease the length of hospitalisation of infants which has a financial implication for hospitals (Field, et al., 2010).

Once prematurely born infants are medically stable, they often remain in hospital until they have gained sufficient weight to be safely discharged home (Field, et al., 2010). In a 2007 study, premature infants who were massaged daily were shown to gain more weight than those that did not receive massage intervention (Diego, et al., 2007). In a study in which HIV-positive mothers were taught to massage their infants daily, massaged infants also put on more weight than their counterparts who were not massaged (Oswalt & Biasini, 2011).

There are a number of possible reasons for the increased weight gain noted in regularly massaged premature infants. Regularly massaged infants in the NICU have shown decreased activity levels as well as fewer stress signs which could account for improved gastric absorption (Hernandez-Reif, et al., 2007) (Field, et al., 2008). In a 2014 study, vagal nerve activity was shown to increase during infant massage, this is in turn believed to increase gastric motility and therefore increase weight gain (Diego, et al., 2014). In a 2008 study, where infants received “body stroking” and gentle movements of their arms and legs for 15 minutes three times daily, increased levels of insulin and insulin-like growth factor 1 were shown in infants who received these interventions which also led to improved weight gain in premature infants (Field, et al., 2008).

Bone mineralization has also been shown to increase in premature infants who were on a programme of infant massage and physical activity (Aly, et al., 2004). Tactile stimulation, such as that provided during massage, can result in an increased level of growth hormone (Aly, et al., 2004). Conversely infants who experience maternal deprivation have lower levels of growth hormone (Aly, et al., 2004).

All the above benefits have the potential to posistively impact a premature infant’s growth and development, however there is currently no research to support this.

2.8.4 Infant massage best practice standards

There is no current best practice standard for infant massage and different practitioners recommend different protocols (Cooke, 2015). It is, however, widely accepted that the whole body of the infant should be massaged for the best effect (Cooke, 2015). There are many sources where parents can learn about infant massage such as books on infants, the internet and infant care magazines. There are also professional infant massage instructors that provide instruction to parents after undergoing training in infant massage instruction by the IAIM.

The IAIM prescribes the use of a cold pressed vegetable oil in the practice of infant massage (McClure, 2008). However, there are currently no guidelines on the use of a lubricant during massage and insufficient evidence is available on the effect of

different lubricants, usually natural oils, on the skin of an infant (Cooke, 2015). There are studies emerging that imply that oil use on the skin of a neonate may be associated with an adverse effect on the barrier function of the skin (Cooke, 2015). Infants may even develop an allergic rash when oil is used during the massage practice (Kulkarni, et al., 2010).

Many infant massage studies that have been carried out on premature infants were to study whether there were greater weight gains and shorter hospitalisations amongst the massaged infants during the neonatal period (Field, et al., 2010) (Abduallah, et al., 2013). These studies required the mother or a therapist to massage the premature infant for between 10 and 15 minutes, one to three times per day (Field, et al., 2010) (Abduallah, et al., 2013) (Diego, et al., 2014). These studies were of short duration, usually only 10 days but sometimes as short as five days (Field, et al., 2010) (Abduallah, et al., 2013) (Diego, et al., 2014).

As the IAIM teaches that the parent, and not the massage instructor, should massage the infant, infant massage forms a part of family-centred care when related to the supportive care of a premature infant.

2.9 Parenting and premature birth

Before their infant is born, parents often have preconceived ideas of parenthood; these ideas are often drastically altered after their infant is born prematurely (Lasiuk, et al., 2013). Furthermore, the admission of an infant to the NICU is a stressful event for parents. Parents frequently report that they feel hopeless, fearful, anxious and disappointed (Obeidat, et al., 2009) (Lasiuk, et al., 2013). The stress they experienced was further compounded by the thought of leaving the health and safety of their infant in the hands of the NICU staff who were strangers to them at first (Lasiuk, et al., 2013). Furthermore, the incidence of postpartum depression in mothers who give birth to premature infants is as high as 40%, especially during the initial period where these infants are often admitted to the NICU as reported in a systematic review (Vigod, et al., 2010). Mothers of infants with very low birth weights were at further risk for continued depression for the first year of their infant's life (Vigod, et al., 2010). There are multiple risk factors to the development of

postpartum depression including high levels of stress and anxiety which are frequently reported by mothers of premature infants (McGrath, et al., 2008) (Obeidat, et al., 2009) (Lasiuk, et al., 2013). Depressed mothers have been proven to require assistance to feel secure in their role of motherhood as well as to find synchronicity with their infant (McGrath, et al., 2008). Children of mothers with postpartum depression have been shown to present with behavioural problems as well as cognitive deficits and decreased academic performance (Wachs, et al., 2009). This could furthermore hinder infant development along with the delays and complications associated with prematurity.

2.10 Parenting and infant massage

There are benefits for parents who provide infant massage to their infants, especially for parents in high-risk groups. A 2011 study suggested that increasing a mother's sensitivity to her infant's cues may have a positive effect on the disposition of the infant (Oswalt & Biasini, 2011). Infant massage has been shown to increase a mother's confidence in her parenting ability and to assist mothers with the transition into their new role (Vincente, et al., 2017). Infant massage has also been shown to reduce anxiety in mothers of premature infants (Afand, et al., 2017). Furthermore, infant massage was shown to improve interactions between an infant and their mother in a group of mothers diagnosed with human immunodeficiency virus (HIV) and the mothers reported fewer feelings of depression and distress (Oswalt & Biasini, 2011). Infant massage has also been shown to support fathers through their new role as a parent (Cheng, et al., 2011). Fathers who took part in an infant massage programme reported lower levels of stress (Cheng, et al., 2011).

The benefits of including not only mothers but also fathers in the care of premature infants highlights the need for implementation of family-centred care for high-risk infants such as those born prematurely.

2.11 Family-centred care

The neonatal period is frequently stressful for new parents as they adjust to caring for their new infant. This stress is often worse for parents who have premature infants as discussed above. Family-centred care is therefore crucial to help parents of premature infants adjust to their new roles as well as to understand the difficulties their infants are having and may possibly have in the future. Family-centred care programmes in the NICU need to have a few common factors in order to be successful (Gooding, et al., 2011) (Ramezani, et al., 2014). These factors include, but are not limited to: education of the parents about the environment and their infant's condition, collaboration with parents when it comes to decision making including respecting the family's values and beliefs, active participation of caregivers in equal measure in routine care procedures, allowing the parents to be present in the NICU and having structures in place to support the process of discharge and returning home (Gooding, et al., 2011) (Ramezani, et al., 2014). Family-centred care programmes that have been started in neonatal units, where the parents have increased access to their infants and are able to perform some of the necessary care procedures, have resulted in decreased parental stress and feelings of helplessness (De Bernardo, et al., 2017). In a study in Italy in 2017 it was shown that inclusion of the parents in routine care procedures led to increased weight gain by the infants when compared to infants who only had medical staff complete their daily care routines (De Bernardo, et al., 2017). Family-centred care does not, however, only take place while the infant is admitted to hospital, there needs to be carry over to the home environment where the different professionals are not present.

2.12 Family-centred home programmes

Family-centred and or parent-administered home programmes do, however, come with the risk of non-compliance. Numerous facilitators and barriers have been shown to influence a parent or caregiver's compliance to a home exercise programme for their child (Rone-Adams, et al., 2004). Factors that affect compliance include age of the caregiver, socio-economic status of the family as well as how many other children the caregiver is taking care of (Rone-Adams, et al., 2004). Stress has been

identified as a main factor when determining the future compliance to a home programme, with decreasing compliance noted with increasing levels of parental stress (Rone-Adams, et al., 2004). A 2014 study showed that home programmes are often more successful when they form part of the child and caregivers' daily routines so as not to add an additional demand on the caregiver (McConnell, et al., 2014).

Parental involvement is crucial in the neonatal period, especially for premature infants, the benefits of this are not only for the infants but for the parents as well.

2.13 Role of occupational therapy in the care of premature infants

Recently, the United Nations International Children's Emergency Fund (UNICEF) has described a crucial period for development as "The First 1000 days of Life", going further to say that this period is "The Brain's Window of Opportunity" (Cusick & Georgieff, 2016). These first 1000 days are said to be the ideal start to normal growth and development throughout a person's life (Cusick & Georgieff, 2016). Children in developing countries, such as South Africa, have been shown to be more at risk of losing out on some of the developmental opportunities during this period (Cusick & Georgieff, 2016). During these first 1000 days, children in developing countries are at risk of non-optimal brain development given their nutritional status (Cusick & Georgieff, 2016). It is therefore important that high-risk children, such as those in developing countries or premature infants, have their development closely monitored and neurodevelopmentally supportive programmes made available to them.

Occupational therapy aims to assist individuals to partake in their daily activities or occupations (Crepeau, et al., 2003). Occupational therapy with regards to neonatal care, aims to enhance a neonate's ability to perform their occupations as well as to promote the relationship between neonates and their caregivers in order to promote normal development (Vergara & Bigsby, 2004) (Craig, et al., 2015) (De Bernardo, et al., 2017). As mentioned above, the occupations expected of a neonate include feeding, basic social interaction, exploration and sleep (Vergara & Bigsby, 2004). The occupations of a neonate develop according to the Synactive Development Theory as discussed previously. It is during this crucial neonatal period that skills are

developed for later adaptive behaviours which they will eventually require as they become more independent children, adolescents and adults. Premature infants often have difficulty engaging in the occupations that are expected of a full-term infant, as they can struggle to self-regulate or process and modulate sensory input which can affect them in the first few months of life (Cabral, et al., 2016) (Vergara & Bigsby, 2004). Therapists who provide services to premature infants include occupational therapists, physiotherapists and speech therapists (Ross, et al., 2017). Although many interventions provided by these therapists to premature infants are similar, each profession has a specific focus when providing interventions (Ross, et al., 2017). These interventions are termed neurodevelopmentally supportive care (Lubbe, et al., 2012). Therapeutic interventions, provided by occupational therapists, for premature infants need to support the infant's engagement in their expected occupations (Vergara & Bigsby, 2004). Given occupational therapists holistic understanding of an individual's occupations and how they participate in these as well as of the different systems that allow for optimal function (sensory, motor, etc.), they are uniquely positioned as a part of the team of professionals who provide neurodevelopmentally supportive care, which may include instruction on infant massage. The ultimate goal of occupational therapy provided to children is to promote normal growth and development so that they are able to participate in the occupations expected for their age.

2.14 Conclusion

Prematurity rates remain high across the world but specifically in Asia and sub-Saharan Africa. As premature infants present with multiple different problems at birth that often continue throughout their lives, supportive care needs to be provided to promote their growth and development. To provide the correct supportive care, one needs to understand the sensory development of the infant as well as their behavioural states to ensure the intervention is correctly timed and delivered. An important technique used by therapists with premature infants and their parents is positive touch. One intervention, that uses the principles of positive touch, is infant massage. Infant massage has been shown to have multiple benefits for the infant as well as the parent. No evidence is, however, currently available on the effect of infant

massage on the development of premature infants. Occupational therapists are uniquely positioned to provide this intervention by using a family-centred approach to support the occupations of the premature infant, as well as the care provided by their parent

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter will provide an outline of the study, the methods used to collect data and the processes used to analyse the collected data. The study design, population, context and selection of the sample will be described. After this, the data collection instruments and collection of data will be described, including the intervention that was provided and how instruments were chosen or developed as well as how a research assistant was trained. The steps taken to ensure the accuracy of the data will be discussed together with the ethical procedures and considerations used in this study.

3.2 Stages of the study

Table 3.1: Stages of the study

Stage	Processes
First	Protocol development (researcher) • Postgraduate committee clearance • Ethical clearance
Second	Pilot testing and adaptations made to questionnaire (researcher) • Five therapists Training of research assistant (researcher) • Training in massage protocol used in the study • Training in how to administer the parent questionnaire
Third	Initial assessments • Randomising participants to the two groups (research assistant) • Obtaining informed consent (research assistant) • Background information (researcher) • Baseline assessments (researcher) Intervention • Massage taught to experimental group (research assistant)
Fourth	Follow up assessments • Collection of massage timetables and declaration of accuracy (research assistant) • Parent questionnaire (research assistant) • Follow-up developmental assessments (researcher) Teaching of massage protocol to control group (research assistant)
Fifth	Data analysis (researcher) Research write-up and submission (researcher)

3.3 Type of study and general design

The study was a quantitative, blinded, randomized control trial.

The study was quantitative as the results obtained from the study were in the form of numbers from the standardised developmental tests which were then analysed (Polit & Beck, 2012). The parent questionnaire was analysed quantitatively by looking at frequencies of responses on the different items in the questionnaire.

This study was blinded as the parents and the research assistant knew to which group each infant had been assigned, however the researcher who completed the assessments did not know which group each infant was in (Polit & Beck, 2012). The benefits of this were that the same instruction on massage was given by the research assistant to all participants in the experimental group and all the assessments were standardised as they were all completed in the same manner by the researcher who was blind to which group each infant was in.

The participants who met the inclusion criteria were randomly assigned to either the control or the experimental group by the research assistant who made use of a computer-generated randomiser (Polit & Beck, 2012).

A control trial study is where a group of participants receiving an intervention is compared to a group of participants who do not receive any intervention (Polit & Beck, 2012). The study was a control trial as there was an experimental group of infants who received the infant massage from their parent/s and there was a control group that did not receive any infant massage for the duration of the study.

3.4 Study population

The population studied were infants born prematurely at Chris Hani Baragwanath Academic Hospital (CHBAH) and admitted to the neonatal wards. Approximately 30 premature infants are admitted to the neonatal wards at CHBAH per month.

3.5 Context of the study

CHBAH is the largest hospital in the Southern Hemisphere and as an academic hospital, has a strong emphasis on research, thus CHBAH was chosen for this study. The neonatal department at CHBAH caters for infants who are born prematurely and infants who experience complications during pregnancy or during birth. Infants who are born prematurely are admitted to the NICU if necessary, and when they are stable, they are transferred to the general neonatal ward. From the general ward they may be transferred to the KMC ward to await weight gain prior to discharge. High-risk premature infants or those with complications are referred for occupational therapy for neurodevelopmentally supportive care as inpatients and long-term follow-up post discharge. Inpatient care of these infants generally consists of positioning and calming strategies as well as caregiver education on the needs of their infants. Outpatient care of these infants usually consists of screening for developmental delay and referring to appropriate clinics for therapy when necessary. Infant massage is not currently offered as a standard of care for premature or high-risk infants.

3.6 Sample size

The sample size was calculated at 43 participants per group. This was calculated using a power analysis. The calculation was based on an effect size of 10%, a standard deviation of 15 on the BSID-III assessment with a power of 80% (Greene, et al., 2013). Twenty percent was added to the sample size to account for compliance and drop-out.

After six months of recruiting participants for the study, the final sample size was 47. This was due to the fact that the sample size was calculated on the total number of premature infants admitted to the neonatal wards monthly. These admission statistics however did not take into account multiple births, infants receiving KMC or admissions to the NICU which were all exclusion criteria for this study.

3.7 Sampling method

Purposive sampling was used for this study as any infants and parents who met the inclusion criteria and were in the wards were invited to participate in the study. If appropriate infants were in the ward but were too young to begin the study, their contact details were taken so that they could come back to the hospital to have a baseline assessment and be assigned to a group when they reached 32 weeks gestational age. Parents who were willing to participate in the study were assigned to the intervention or the control group using simple randomisation. Randomisation was performed using a research randomising programme that is offered online (Urbaniak & Plous, 2016) to avoid researcher bias.

3.8 Inclusion and exclusion criteria

3.8.1 Inclusion criteria

- Prematurely born infants (infants born between 28- and 36-weeks gestational age) who were, at the time of recruitment, aged between 32- and 36-weeks gestational age.
- Infants who were admitted to a neonatal ward at CHBAH.
- Infants who were medically stable.
- Infants whose parents were able to speak and understand English.
- Infants whose parents were 18 years or older.
- Infants whose parents were able to read and write to be able to complete the massage timetables.

3.8.2 Exclusion criteria:

- Infants who had a neurological diagnosis (e.g. all grades of hypoxic ischemic encephalopathy or interventricular haemorrhage).
- Infants with a genetic disorder or a metabolic disorder (e.g. Trisomy disorders).
- Infants who had been previously admitted to the NICU unit at CHBAH.

- Infants who were not deemed medically stable for massage by the treating doctor.
- Infants who were receiving kangaroo care in the KMC Unit as KMC is a form of positive touch like infant massage, improvements in developmental milestones could not be attributed to infant massage if infants were also receiving KMC.
- Infants from multiple births to ensure siblings were not randomised to different groups.

3.9 Data collection instruments

3.9.1 Demographic questionnaire

The researcher filled in a demographic questionnaire (Appendix 1) with the caregiver of each infant who participated in the study. The demographic questionnaire was divided into two sections, namely the caregiver's demographics and the infant's demographics. Information that was collected using the demographic questionnaire included information about the infant such as their gestation period, weight, head circumference, length, corrected age and any neonatal complications. This information was gathered by reviewing the infants' hospital records. The questionnaire also included information about the mother of the infant such as her age, any complications she may have had while pregnant, highest level of education and whether she had returned to work. The information on the mothers was collected when they returned for the follow-up assessment.

3.9.2 Peabody Developmental Motor Scales – Second Edition (PDMS-2)

An initial assessment on each participant was carried out by the researcher at the time of recruitment for the study. The assessment was to provide a baseline functional evaluation of the infant. The same test was completed with the infant at four to six months actual age. The test that was used for both the initial and follow-up assessments was the PDMS-2 (Appendix 2). The PDMS-2 was used for the assessments as it has been shown to be reliable and valid in assessing the motor

development of premature infants with low birth weights (Tavasoli, et al., 2014). The PDMS-2 was shown to have a reliability coefficient of 0.92 when assessed using the Chronbach Alpha coefficient (Tavasoli, et al., 2014). Furthermore, the test-retest reliability was shown to be a coefficient of 0.98 (Tavasoli, et al., 2014). The PDMS-2 is a test that can be used from birth to five years of age and assesses motor capabilities of infants and children (Folio & Fewell, 2000). The test is composed of six sub-tests, namely: Reflexes, Locomotion, Stationary, Grasp, Object Manipulation and Visual-Motor Integration (Folio & Fewell, 2000). As the infants being assessed in this study are younger than one year of age, the Object Manipulation sub-test was omitted as this is only assessed from one year of age. Scores from this test were converted to standard scores. Using standard scores allowed for the scores of infants with different ages to be compared.

3.9.3 The Bayley Scales of Infant Development - Third Edition (BSID-III)

The BSID-III assesses infants holistically but can only be used on infants from 16 days corrected age, it is, however, the gold standard for infant assessment (Yildirum, et al., 2012). The BSID-III was used to assess the development of infants in both the experimental and the control groups (Appendix 3) at four to six months actual age. The BSID-III scores an infant's development on five scales, namely: Cognitive, Language, Motor, Social-Emotional and Adaptive Behaviour (Bayley, 2006). The Cognitive, Language and Motor sub-tests are scored by the examiner while interacting with the infant (Bayley, 2006). The Social-Emotional and Adaptive Behaviour sub-tests are completed by the caregiver of the child based on their performance in general during their daily activities (Bayley, 2006). Scores on the test were converted to standard scores according to the age of the child being assessed. The BSID-III is reliable for testing the development of the general population as well as groups of children with special needs such as infants who were born prematurely (Bayley, 2006). Although the BSID-III was developed and referenced in the United States of America, a 2013 study proved that the test was valid for use with South African urban children (Radermeyer & Jacklin, 2013), which is why it was utilised together with the PDMS-2 in this study.

3.9.4 Parent questionnaire

There were no available appropriate questionnaires on the facilitators and barriers to hospital- or home-based, parent-administered infant massage programmes. A questionnaire was therefore developed based on the questions that would be of interest to the researcher in terms of parents' experiences and perceived facilitators and barriers to doing the infant massage. This was guided by research on facilitators and barriers to completion of home programmes (Rone-Adams, et al., 2004) (McConnell, et al., 2014). The questionnaire went through a pre-testing phase where the questionnaire was analysed by five occupational therapists who regularly give their clients parent-administered hospital- or home-exercise programmes. The therapists were satisfied with the questions and the content of the questionnaire. A parent questionnaire on the facilitators and barriers to hospital- or home-based, parent-administered infant massage (Appendix 4) was filled in by the parent of the infant prior to the completion of the PDMS-2 and the BSID-III following the intervention period.

3.10 Intervention

3.10.1 Training the research assistant

The research assistant, who is a qualified occupational therapist, and an internationally certified infant massage instructor, was trained by the researcher to teach the caregivers the specific massage strokes for the research (Appendix 5). Although the research assistant was a certified infant massage instructor, the researcher still trained her on the protocol for this study to ensure standardisation of the instruction she gave to participants. This training took two hours during which the researcher and research assistant went through the strokes and discussed the key points of control. The protocol used for this study included massage of the upper limbs, the stomach and chest and the lower limbs of the infant (Appendix 5). Due to the risk for infection, oil was not used for the massage sessions. The researcher also discussed the avoidance signs of infants with the research assistant and indicated how important it was to explain these to parents so that they would know when their infant was not tolerating the massage. The research assistant then trained three

caregivers who were not part of the study to massage their infants with the researcher present to ensure that the assistant trained all three caregivers in the same manner.

3.10.2 Training the parents

Massage of the infant's lower limbs, stomach, chest and upper limbs was taught to the parents in one session. A massage session took 10 - 15 minutes and parents were asked to carry out this routine once daily when they returned home. Any parent that had been trained was able to carry out the massage sessions. If both parents had been trained, they could take turns to do the massage. The research assistant facilitated a discussion with the parents as to how they would be able to fit a 10- to 15-minute massage session into their daily routines without disturbing them too much (for example performing the massage after bathing the infant or when other children are at school). The instruction sessions were done individually as the parents were only with their infants (to practice on) during visiting times prescribed by the neonatal ward. The research assistant went through the avoidance behaviours of infants with the parents so that they were aware of when it was safe to massage their infant and when their infant was giving them cues to stop the massage so that no harm was caused by the massage (Appendix 6). These avoidance behaviours were given as a handout to parents with the massage strokes. The research assistant demonstrated the massage to the parent on a doll while the parent did the massage with their infant. During the instruction session, the research assistant ensured that all massage strokes were being carried out correctly and corrected parents where necessary. The parents were given handouts on all the massage strokes that they had been taught as well as a massage timetable (Appendix 7) in which they could record on which days they performed the massage on their infants. Parents were then given an opportunity to ask any questions they had to clarify what they had been taught. The research assistant re-emphasised the importance of carrying out the massage daily for the benefit of their infant as well as the study as the researcher was not present at these sessions thereby ensuring blinding.

3.11 Data collection procedures

The researcher screened the neonatal wards twice weekly to find appropriate infants for the study. Parents of infants who qualified for the study were invited by the researcher to participate in the study. Willing parents were randomly assigned by the research assistant to either the experimental or control group. Parents were given an information sheet that explained the study by the research assistant. There were two information letters, one for each group (Appendix 8 and Appendix 9). Parents from both groups were asked to sign an informed consent form, by the research assistant, to participate in the study as well as to allow the researcher to review their infants' medical records (Appendix 8 and Appendix 9). The parents in the control group were informed in their information letter (Appendix 9) that their infant would be assessed using the PDMS-2 initially and then using the PDMS-2 and BSID-III at four to six months actual age and they would be taught the infant massage after the study if the results proved that the massage was beneficial in terms of an infant's development. The infants and parents in the control group continued to get the routine occupational therapy, speech therapy and physiotherapy that were offered at the Neonatal Follow-Up Clinic (NNFUC) if they had been referred there by the doctors. Although parents in the control group were not taught the massage protocol, it was not possible to prevent these parents from researching and carrying out massage with their infant. The parents in the experimental group were informed in their information letter that (Appendix 8) they would be taught infant massage that they would have to do with their infant daily for the duration of the study. The researcher read through the information letter with each parent to ensure that they understood the process of the study. No translator was used as all parents understood and could speak English.

When infants and their parents were recruited for the study, the researcher filled in a demographic questionnaire (Appendix 1) that included a participant code and general information about both the infant and the parent. Confounding variables such as surgery, co-morbidities and length of hospitalisation were addressed in the questionnaire. The infant's demographic information was filled in by the researcher when the participants were recruited for the study and the initial PDMS-2 was completed. Parents in the experimental group were taught the infant massage by the

research assistant according to the massage stroke handouts (Appendix 5). The parent's demographic information was completed when the parent and infant returned for their follow-up assessment.

Infants had a baseline assessment completed by the researcher using the PDMS-2 while they were admitted to hospital, they were then taught the infant massage strokes if they formed part of the experimental group. Parents in the experimental group then carried out the massage daily while their infants were still admitted to hospital and continued with this when they were discharged. When the infants attended their first or second doctor's appointment when they were between four- and six-months actual age, they were reassessed. The reassessment took place at the occupational therapy department on the same day as the infant had their doctor's appointment at the hospital where possible. Prior to the reassessment, the parents in the experimental group were supposed to hand in their massage timetable to the research assistant; however, none of the returning mothers had completed this. As there is no other way to confirm the number of times parents executed the infant massage on a daily or weekly basis once they were home, the researcher had to accept their declaration. The research assistant therefore administered the parent questionnaire (facilitators and barriers to infant massage as well as mothers' perceptions) on the parents from the experimental group and the mothers signed a declaration (Appendix 10) that they carried out the massage at the frequency they had reported in the questionnaire. The research assistant then told the parents not to mention to the researcher whether or not they had been doing the massage so that the researcher could remain blinded. The researcher then assessed the infants using the PDMS-2 and the BSID-III. At the end of their participation in the study, the parents from the control group were all offered instruction in infant massage by the research assistant using this study's massage protocol.

3.12 Ethical considerations

The study proposal was submitted to the University of the Witwatersrand's Human Research Ethics Committee for ethical clearance before the data collection

commenced. The research was approved with ethical clearance no. M160418 (Appendix 11).

The study proposal was submitted to the Chris Hani Baragwanath Academic Hospital Medical Advisory Committee for approval to conduct the study at the hospital (Appendix 12). The proposal was also submitted to the Head of the Occupational Therapy Department for approval for the research to take place in the department (Appendix 13).

Permission for the study was further acquired from the Head of the Department of Paediatrics (Appendix 14) at CHBAH prior to its commencement. The nursing staff in the neonatal wards at CHBAH were informed of the study as the massage classes were presented in the neonatal wards.

Parents who were willing to participate in the study were given an information letter. The information letter informed the parents that involvement in the study was voluntary and that they were able to withdraw from the study at any time without consequences. All parents signed a consent form, stating that they were willing to participate in the research, that their child's file could be reviewed by the researcher and that they were willing to do the infant massage if they were in the experimental group.

Participants in the study were given a participant code. Participant's codes and details were kept separately from the collected data to maintain confidentiality. All data that were collected for this study will be stored safely in a locked cupboard for six years after the completion of the study according to the Health Professions Council of South Africa's regulations.

3.13 Analysis of results

All collected data was recorded on a Microsoft Excel 2010 spread sheet where participant codes were used to ensure confidentiality.

Descriptive and inferential statistics were used to analyse the demographic data of the parents and the infants to determine if the two groups were comparable. GraphPad InStat 3 software was used for statistical analysis. Percentages were used to analyse the demographic information of the infants and their parents. Percentages were rounded to the nearest percent and therefore did not always total to 100.

Data collected from the developmental screening tools were summarised using means and standard deviations of the standard scores. Comparisons between groups were made using the Unpaired t-test as the data was not normally distributed.

Linear regressions were used to compare the effect that frequency of massage had on the test scores. The strength of correlations found were graded according to Kielhofner (2006) as shown below in Table 3.2 (Kielhofner, 2006).

Table 3.2: Correlation coefficient description (Kielhofner, 2006)

Correlation coefficient (r)	**Correlation strength**
0.2 - 0.4	Low correlation
0.4 - 0.6	Moderate correlation
0.6 - 0.8	High correlation
0.8 - 1.0	Very high correlation

Cohen's d test was used to find the clinical effect size between the two groups on the standard scores (McGough & Faraone, 2009). The explanation of the clinical effect size is shown in Table 3.3.

Table 3.3: Cohen's d test description (McGough & Faraone, 2009)

Cohen’s d value	Clinical effect size
d ≥ 0.2	Small
d ≥ 0.5	Medium
d ≥ 0.8	Large

Data collected from the parent questionnaire were summarised using percentages and frequencies for the different items on the questionnaire.

3.14 Conclusion

In conclusion, the research methodology used was in order for the researcher to be able to achieve the objectives of the study. A randomised control trial was used to determine the effect of parent-administered infant massage on developmental outcomes. The researcher was blinded to which group each participant was assigned to and a research assistant was therefore used to teach the massage to the experimental group. Data analysis methods were used to analyse the results of the study. The methodology described is detailed so that the study could be replicated by another researcher.

CHAPTER 4: RESULTS

4.1 Introduction

In this chapter the results of the participating premature infants at both their first and second assessments will be discussed together with their caregivers' demographics and compliance to the massage programme if they were in the experimental group.

The study sample consisted of 47 infants and their parents. All parents were recruited for the study after their premature infant had been admitted to the neonatal wards at CHBAH. Many premature infants admitted at the time of recruitment met the exclusion criteria as they were receiving KMC or were from multiple births.

Forty-six of the 47 recruited infants were assessed within the neonatal period. One infant was unexpectedly discharged prior to being assessed and could not return to the hospital for assessment and was therefore excluded from the study. One infant did not have all anthropometric data available (birth length and head circumference) at birth but was still included in the study. Of the 46 participants who were assessed, 48% (n=22) were allocated the control group and 52% (n=24) to the experimental group. Allocations to the two groups were completed by a computer-generated randomiser as indicated in the methodology chapter.

Eighteen infants and their mothers returned for follow-up assessments and completion of the parent questionnaire (if they were in the experimental group). Four infants and their parents had moved out of the province, one infant's mother had passed away and one mother from the experimental group reported that she had not completed the infant massage sessions at home due to a tragic family event; these infants and mothers were therefore excluded from the study. Mothers of the remaining 23 infants could not be reached telephonically at the time of follow-up despite numerous attempts by the researcher.

4.2 Consort diagram

Figure 4.1: Recruitment of participants

4.3 Sample demographics

4.3.1 Initial infant demographics and anthropometrics

The demographics of the 46 infants initially assessed for the study are shown in Table 4.1. The groups were comparable in terms of gender (p=0.515), mode of delivery (p=0.143) and neonatal complications (p=0.202). The p-value for the complications was calculated between having a complication and not having a complication rather than between each individual complication.

Table 4.1: Initial infant demographics (n=46)

Variable	Group			p-Value
	Total (n=46)	Control (n=22)	Experimental (n=24)	
	n (%)			
Gender				
Female	27 (59%)	14 (64%)	13 (54%)	0.515
Male	19 (41%)	8 (36%)	11 (46%)	
Mode of delivery				
Natural vaginal	22 (48%)	13 (59%)	9 (38%)	0.143
Caesarean section	24 (52%)	9 (41%)	15 (63%)	
Neonatal complications				
NNJ	9 (20%)	5 (23%)	4 (17%)	
TTN	2 (4%)	0 (0%)	2 (8%)	
NEC	1 (2%)	1 (5%)	0 (0%)	
RDS	34 (74%)	18 (82%)	16 (67%)	0.202
Other	3 (7%)	2 (9%)	1 (4%)	
None	10 (22%)	3 (14%)	7 (29%)	

Neonatal jaundice (NNJ)
Transient tachypnea of the new-born (TTN)
Necrotising enterocolitis (NEC)
Respiratory distress syndrome (RDS)

$p \leq 0.05$ statistical significance*

The anthropometrics were not available for one infant at the time of assessment and were therefore excluded in Table 4.2 (n=45). There were no statistically significant differences found between the control and experimental groups in terms of gestational age (p=0.367), birth weight (p=0.751), length at birth (p=0.776) and head circumference at birth (p=0.908). The groups were therefore comparable on the above-mentioned parameters.

Table 4.2: Initial infant anthropometrics (n=45)

Variable	Group			p-Value
	Total (n=45)	Control (n=22)	Experimental (n=23)	
	Mean (SD)	Mean (SD)	Mean (SD)	
Gestational age (weeks)	32.78 (1.88)	33.00 (1.77)	32.57 (2.00)	0.367
Birth weight (g)	1690.13 (276.68)	1689.14 (275.24)	1691.09 (284.23)	0.751
Length at birth (cm)	43.13 (3.41)	43.27 (3.72)	43.00 (3.16)	0.776
Head circumference at birth (cm)	30.78 (2.18)	30.82 (2.22)	30.74 (2.20)	0.908

p ≤ 0.05 statistical significance*

4.3.2 Follow-up infant demographics and anthropometrics

A total of 38% (n=18) of infants returned for follow-up assessments. Nine participants from the control group returned for follow-up assessment and nine participants from the experimental group. One participant from the experimental group who returned for follow-up was excluded as the mother reported that she had not carried out the intervention.

The infants who returned for follow-up from both the control and experimental groups were comparable in terms of gender (p=1.000), mode of delivery (p=0.620) and neonatal complications (p=0.087) (Table 4.3). The p-value for the complications were again measured as the difference between having a complication and not having a

complication due to the small number of infants having some of the complications. The control and experimental groups were therefore comparable.

Table 4.3: Follow-up infant demographics (n=17)

Variable	Group			p-Value
	Total (n=17)	Control (n=9)	Experimental (n=8)	
	n (%)			
Gender				
Female	10 (59%)	5 (56%)	5 (63%)	1.000
Male	7 (41%)	4 (44%)	3 (38%)	
Mode of delivery				
Natural vaginal	6 (35%)	4 (44%)	2 (25%)	0.620
Caesarean section	11 (65%)	5 (56%)	6 (75%)	
Neonatal complications				
NNJ	2 (12%)	1 (11%)	1 (13%)	0.087
TTN	0 (0%)	0 (0%)	0 (0%)	
NEC	1 (6%)	1 (11%)	0 (0%)	
RDS	13 (76%)	8 (89%)	5 (63%)	
Other	0 (0%)	0 (0%)	0 (0%)	
None	3 (18%)	0 (0%)	3 (38%)	

Neonatal jaundice (NNJ)
Transient tachypnea of the new-born (TTN)
Necrotising enterocolitis (NEC)
Respiratory distress syndrome (RDS)

$p \leq 0.05$ statistical significance*

The anthropometrics of the infants who returned for follow-up can be seen in Table 4.4. Gestational age and birth weight were compared between the groups with no statistically significant differences (p=0.589 and p=0.736 respectively). Anthropometric measurements were taken at the follow-up appointment and no statistically significant differences were found for weight (p=0.923), length (p=0.874) and head circumference (0.063) between the two groups.

Table 4.4: Follow-up infant anthropometrics (n=17)

Variable	Group			p-Value
	Total (n=17)	Control (n=9)	Experimental (n=8)	
	Mean (SD)	Mean (SD)	Mean (SD)	
Gestational age (weeks)	33.06 (1.71)	33.33 (1.22)	32.75 (2.19)	0.589
Birth weight (g)	1681.18 (288.34)	1636.67 (212.31)	1731.25 (364.85)	0.736
Actual age (months)	5.50 (0.87)	5.46 (1.06)	5.54 (0.67)	0.961
Corrected age (months)	3.95 (1.01)	3.97 (1.18)	3.94 (0.86)	1.000
Weight at follow-up (g)	5811.76 (1229.61)	5791.11 (1206.35)	5835.00 (1338.47)	0.923
Length at follow-up (cm)	54.88 (4.50)	58.25 (3.77)	58.38 (5.40)	0.874
Head circumference at follow-up (cm)	38.88 (2.02)	40.38 (2.13)	42.25 (1.49)	0.063

$p \leq 0.05$ statistical significance*

Medical information was collected for infants who attended the follow-up sessions during the time between their discharge from the neonatal unit and their follow-up appointments in terms of readmissions, surgery and therapeutic intervention (Table 4.5).

Readmission to hospital following their neonatal admission occurred in 29% (n=5) of the total sample. There was however no statistically significant difference between the two groups for readmission (p=1.000). Only 6% (n=1) of the entire sample had undergone surgery (for a hernia repair). Again, no statistically significant difference for surgery was found between the two groups (p=0.471). Of the total sample, 6% (n=1) had received therapeutic intervention, however, this was only for a screening at the NNFUC and was not statistically significant (p=1.000).

Table 4.5: Infant medical demographics on follow-up (n=17)

Variable	Group			p-Value
	Total (n=17)	Control (n=9)	Experimental (n=8)	
	n (%)			
Hospital readmissions				
Yes	5 (29%)	3 (33%)	2 (25%)	1.000
No	12 (71%)	6 (67%)	6 (75%)	
Surgery				
Yes	1 (6%)	0 (0%)	1 (13%)	0.471
No	16 (94%)	9 (100%)	7 (88%)	
Therapeutic intervention				
Screening	1 (6%)	1 (11%)	0 (0%)	1.000
Treatment	0 (0%)	0 (0%)	0 (0%)	
None	16 (94%)	8 (89%)	8 (100%)	

$p \leq 0.05$ statistical significance*

4.3.3 Parent demographics

The demographics of the infants' parents were collected at the follow-up appointment and are shown in Table 4.6. All the returned parents were female (100%, n=17). There were nine mothers assigned to the control group and eight mothers assigned to the experimental group.

There were no statistically significant differences between the groups' highest level of education (p=0.289), work status (p=0.620) or maternal conditions (p=0.637). The groups were therefore comparable on these parameters.

In the age of the mothers at follow-up, no statistically significant difference was found (p=0.490). The mothers in the control and experimental groups were therefore comparable.

Table 4.6: Parent demographics (n=17)

Variables	Group			p-Value
	Total (n=17)	Control (n=9)	Experimental (n=8)	
	n (%)			
Gender				
Female	17 (100%)	9 (100%)	8 (100%)	Not applicable
Male	0 (0%)	0 (0%)	0 (0%)	
Highest level of education				
Grade 9	5 (29%)	2 (22%)	3 (38%)	
Matric	10 (59%)	7 (78%)	3 (38%)	0.289
Diploma	1(6%)	0 (0%)	1 (13%)	
Degree	1 (6%)	0 (0%)	1 (13%)	
Currently working				0.620
Yes	5 (29%)	2 (22%)	3 (37.5%)	
No	12 (71%)	7 (78%)	5 (62.5%)	
Maternal conditions				
Diabetes	0 (0%)	0 (0%)	0 (0%)	0.637
Hypertension	5 (29%)	2 (22%)	3 (37.5%)	
Pre-eclampsia	2 (12%)	1 (11%)	1 (12.5%)	
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**p-Value**
Age of caregiver at follow-up	28.29 (6.80)	28.33 (7.05)	28.25 (6.98)	0.490

p ≤ 0.05 statistical significance*

4.4 Peabody Developmental Motor Scales-Second Edition

4.4.1 Initial scores

The PDMS-2 was conducted with infants recruited to the study. All infants were assessed at zero months of age (prior to two weeks of age) and the standard scores were compared between the two groups as shown in Table 4.7. All the infants scored the same on the Reflexes and Visual-Motor Integration sub-tests. The p-value could not be calculated for the Reflexes and Visual-Motor Integration sub-tests as they had standard deviations of zero. There were no statistically significant differences between the other three sub-tests, namely: Stationary (p=0.608), Locomotion (p=0.955) and Grasping (p=0.325). The groups were functioning at a similar level and therefore considered comparable.

Table 4.7: Initial Peabody Developmental Motor Scales-Second Edition Standard Scores (n=46)

	Group			p-Value
Sub-test	**Total (n=46)**	**Control (n=22)**	**Experimental (n=24)**	
	Mean (SD)			
Reflexes	10.00 (0)	10.00 (0)	10.00 (0)	Not applicable
Stationary	7.15 (0.36)	7.18 (0.39)	7.13 (0.39)	0.608
Locomotion	7.37 (1.20)	7.32 (1.06)	7.42 (1.32)	0.955
Grasping	10.37 (0.84)	10.45 (0.89)	10.30 (0.79)	0.325
Visual-Motor Integration	6.00 (0)	6.00 (0)	6.00 (0)	Not applicable

$p \leq 0.05$ statistical significance*

The initial assessment scores for the infants who returned for follow-up assessments are shown in Table 4.8. The p-value could not be calculated for three of the sub-tests (Reflexes, Stationary and Visual-Motor Integration) as the standard deviations were zero. Locomotion and Grasping showed no statistically significant differences

between the two groups with p=0.396 and p=0.954 respectively. The scores of the participants who returned for follow-up indicated similar delay in the same sub-tests as the total group of 46.

Table 4.8: Initial Peabody Developmental Motor Scales-Second Edition - Standard Scores of infants who returned for follow-up (n=17)

Sub-test	Group			p-Value
	Total (n=17)	Control (n=9)	Experimental (n=8)	
	Mean (SD)			
Reflexes	10.00 (0)	10.00 (0)	10.00 (0)	NA
Stationary	7.06 (0.24)	7.11 (0.31)	7.00 (0)	NA
Locomotion	7.24 (1.11)	7.44 (0.96)	7.00 (1.23)	0.396
Grasping	10.47 (0.98)	10.33 (1.25)	10.63 (0.48)	0.954
Visual-Motor Integration	6.00 (0)	6.00 (0)	6.00 (0)	NA

p ≤ 0.05 statistical significance*

4.4.2 Follow-up scores

At four to six months actual age, the infants were reassessed. The standard scores of the PDMS-2 follow-up can be seen in Table 4.9. There were no statistically significant differences between the two groups on any of the sub-tests on the PDMS-2 reassessment. However, the follow-up standard scores indicate infants in both groups improved with scores around the mean of 10 indicating they were not a risk for developmental delay at this stage. The control and experimental groups were then compared using the Cohen's d test. Large clinical effect sizes were found in favour of the experimental group, on the Reflexes (0.78) and the Visual-Motor Integration (1.09) and medium clinical effect size was found on the Stationary (0.55) sub-test indicating the improvement in the experimental group was greater than in the control group. A small to medium negative clinical effect size was found on the

Locomotion (-0.42) sub-test, indicating that the control group had performed better than the experimental group on this sub-test.

Table 4.9: Follow-up Standard Scores for the Peabody Developmental Motor Scales-2 (n=17)

Sub-test	Group			p-Value	Cohen's d
	Total (n=17)	Control (n=9)	Experimental (n=8)		
	Mean (SD)				
Reflexes	11.59 (1.09)	11.22 (1.23)	12 (0.71)	0.240	0.78°°°
Stationary	9.82 (1.04)	9.56 (0.50)	10.13 (1.36)	0.315	0.55°°
Locomotion	9.77 (0.64)	9.89 (0.57)	9.64 (0.70)	0.392	-0.42°°
Grasping	9.47 (1.04)	9.44 (0.96)	9.50 (1.12)	0.960	0.05
Visual-motor integration	10.53 (0.92)	10.11 (0.57)	11.00 (1.00)	0.054	1.09°°°

p ≤ 0.05 statistical significance*
d ≥ 0.8 large clinical effect size °°°
d ≥ 0.5 medium clinical effect size °°
d ≥ 0.2 small clinical effect size °

4.4.3 Change in scores at follow-up on the Peabody Developmental Motor Scales-2

The initial scores and follow-up scores of the PDMS-2 were compared; the results can be seen in Table 4.10. There were no statistically significant differences between the control and experimental groups. There were however significant clinical effect sizes noted. A large clinical effect was noted on the Reflexes (0.73) and Visual-Motor Integration (1.03) sub-tests in favour of the experimental group. The Stationary sub-test had a medium clinical effect size (0.62) in favour of the experimental group. There was a small clinical effect size on the Locomotion sub-test (0.19) in favour of the experimental group. There was a small negative clinical effect size on the Grasping sub-test (-0.14) indicating that the control group had performed better than the experimental group on this sub-test.

Table 4.10: Comparison of change in Standard Scores on the Peabody Developmental Motor Scale-Second Edition sub-tests from initial to follow-up scores (n=17)

Sub-test	Group			p-Value	Cohen's d
	Total (n=17)	Control (n=9)	Experimental (n=8)		
	Mean (SD)				
Reflexes	1.59 (1.01)	1.22 (1.30)	2,00 (0.76)	0.240	0.73°°°
Stationary	2.76 (1.06)	2.45 (0.53)	3.13 (1.46)	0.212	0.62°°
Locomotion	2.53 (0.92)	2,45 (1.01)	2.64 (0.92)	0.758	0.19°
Grasping	-1.00 (1.64)	-0.89 (1.97)	-1.13 (1.46)	1.000	-0.14°
Visual-motor integration	4.53 (0.92)	4.11 (0.60)	5.00 (1.07)	0.054	1.03°°°

p ≤ 0.05 statistical significance*
d ≥ 0.8 large clinical effect size°°°
d ≥ 0.5 medium clinical effect size°°
d ≥ 0.2 small clinical effect size°

4.5 Bayley Scales of Infant and Toddler Development-Third Edition

The standard scores of the follow-up BSID-III test are shown in Table 4.11. There were no statistically significant differences between the two groups on any of the sub-tests of the BSID-III. There was, however, a medium clinical effect size on the Cognition (0.58) sub-test and a small clinical effect size (0.41) on the Motor sub-test in favour of the experimental group. The Social-Emotional and Adaptive Behaviour sub-tests showed negative, small and medium clinical effect sizes (-0.22 and -0.56 respectively) indicating that infants in the control group performed better than the experimental group infants. The Language sub-test showed a negligible clinical effect size.

Table 4.11: Follow-up Standard Scores for the Bayley Scales of Infant and Toddler Development-Third Edition (n=17)

	Group			p-Value	Cohen's d
Variable	**Total participants (n=17)**	**Control group (n=9)**	**Experimental group (n=8)**		
	Mean (SD)				
Cognition	9.29 (2.37)	8.67 (2.16)	10.00 (2.40)	0.326	0.58°°
Language	17.59 (2.61)	17.56 (2.87)	17.63 (2.29)	0.845	0.03
Motor	19.53 (3.97)	18.78 (3.94)	20.38 (3.84)	0.528	0.41°
Social-emotional	16.29 (2.61)	16.56 (2.91)	16.00 (2.18)	0.487	-0.22°
Adaptive behaviour	69.76 (7.03)	71.56 (7.15)	67.75 (6.23)	0.228	-0.56°°

p ≤ 0.05 statistical significance *
d ≥ 0.8 large clinical effect size °°°
d ≥ 0.5 medium clinical effect size °°
d ≥ 0.2 small clinical effect size °

4.6 Parent questionnaire results

Mothers from the experimental group (n=8) were asked to fill in a parent questionnaire at their follow-up appointment. Information collected from the mothers included:

- frequency of massage sessions completed per week
- barriers to completing massage sessions
- enjoyment of the massage sessions
- what the parent had enjoyed most about the massage sessions
- how long the daily massage sessions had been
- convenience of completing daily massage sessions
- time of day that was best to complete massage sessions
- satisfaction with the daily massage
- general comments about the massage sessions
- if they would continue with massage sessions after the study was completed

4.6.1 Frequency of massage sessions per week on average

Figure 4.2 shows the number of times per week mothers provided infant massage to their infants. The most common number of massage sessions per week was three times with 38% (n=3) of mothers reporting this frequency.

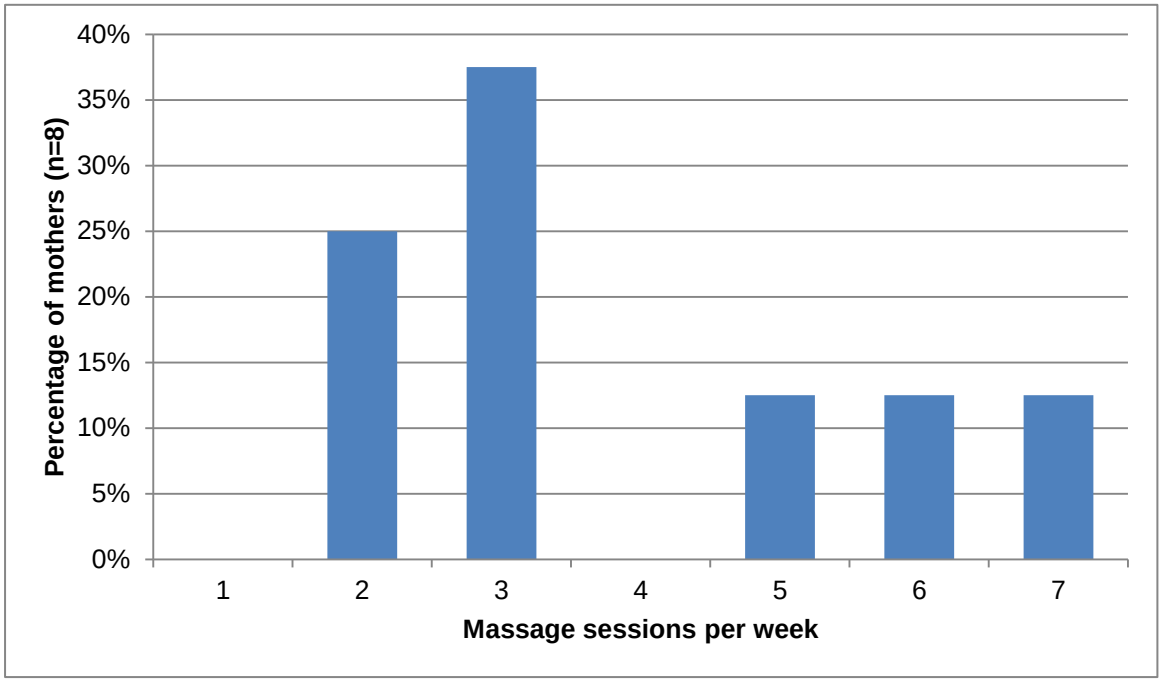

Figure 4.2: Average number of massage sessions per week (n=8)

4.6.2 Barriers to completing the massage programme

- The mothers were able to identify barriers to completing the massage programme daily. There were no common barriers to massage with looking after other children reported by 25% (n=2) of the mothers. None of the mothers reported that work was a barrier, nor did they report that they did not see the benefit of the massage. Other barriers reported by mothers were: “busy with other household tasks” (13%, n=1), “the baby was asleep” (13%, n=1) and “the baby was very small – I was scared to do massage” (13%, n=1).

4.6.3 Parental enjoyment of massage sessions

When asked whether they enjoyed the massage, all the mothers answered either that they enjoyed the massage somewhat or that they enjoyed the massage very much. The massage was enjoyed “very much” by 88% (n=7) of the mothers and “somewhat” by 13% (n=1) of the mothers.

When asked what they enjoyed the most about the massage sessions with their infant, 25% (n=2) of mothers reported that it was the one-on-one time with their infant that they found most enjoyable. The one-on-one time with their infant as well as the infant’s reaction was enjoyed most by 75% (n=6) of mothers. When asked to comment on their enjoyment, one mother stated that the massage time was “relaxing for mom and baby”.

4.6.4 Daily massage sessions

Mothers were asked to report on the massage sessions they did with their infants in terms of the average length of massage sessions, whether the massage fitted into their routine and at what time of day they had found the massage sessions easiest to complete.

As shown in Figure 4.3, 75% (n=6) of mothers reported that their massage sessions were between 16 and 30 minutes at a time. Massage sessions lasting up to 15 minutes were completed by 13% (n=1) of mothers. Massage sessions lasting between 31 and 45 minutes were completed by 13% (n=1) of mothers.

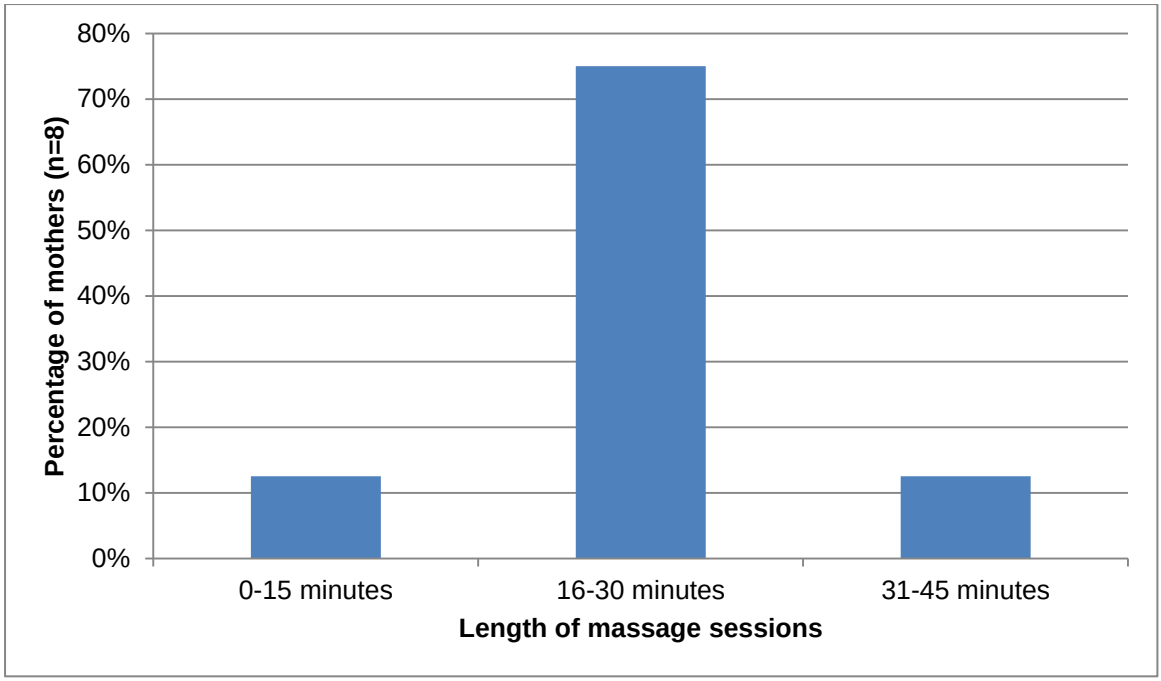

Figure 4.3: Average length of daily massage sessions as reported by mothers

Mothers were asked whether the massage sessions they had completed were too long to fit into their daily routine (including tasks such as care of the infant, care of other children, household chores and work where appropriate). Of the mothers, 63% (n=5) reported that the sessions were not too long to fit into their daily routine, while 38% (n=3) reported that the sessions were too long.

The response rates were the same when asked if massage sessions were easy to fit into daily routines. Of the mothers, 62.5% (n=5) reported that massage sessions were easy to fit into their daily routines while 37.5% (n=3) reported that sessions were not.

Mothers were asked to report on what they found the best time of day for massage was and to comment on why this was. One mother reported that she had found two times of the day for massage that suited her and there are therefore 9 responses shown. As shown in Figure 4.4, the most popular times for massage sessions were mid-day and afternoon as indicated by 33% (n=3) of the participants for each. The next most popular times were in the evening 22% (n=2) followed by morning massage sessions 11% (n=1). No mothers reported that night-time massages were convenient for them.

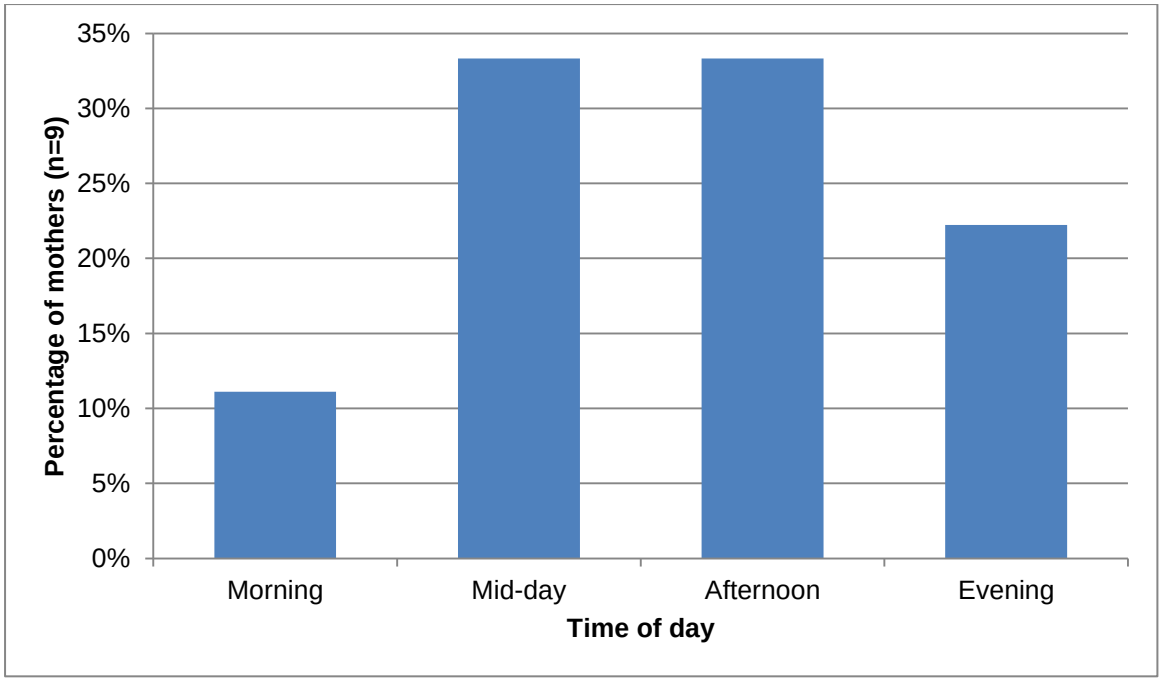

Figure 4.4: Best time of day for massage sessions

When asked to comment on the best time of day for massage sessions, 75% (n=6) of mothers reported their massage sessions were done around their infant's bath times (either before their bath or after). One (13%) mother reported that the massage sessions were most convenient after she had completed her daily chores. The remaining mother who reported that she did the massage either in the morning or in the evening stated that the infant was "nice and awake" in the morning but she also did the massage in the evening "before sleeping".

4.6.5 Satisfaction with the massage sessions

Finally, mothers were asked whether or not they found the massage sessions with their infants satisfying. The mothers' responses indicated that 75% (n=6) found the sessions very satisfying and 25% (n=2) found the massage satisfying.

Mothers were asked to elaborate on why they found the massage satisfying and their responses fell into three main response categories. The first response category was that the massage was a bonding experience with 37.5% (n=3) of mothers reporting that "it was nice to spend time with baby", "it was bonding time" and that the parent

“got to know baby better”. The second response category that was identified by 50% (n=4) of mothers was the benefits for the infant with mothers elaborating that “baby enjoyed it”, “it was relaxing for baby” and that “baby got stronger”. The third response category that was identified by 12.5% (n=1) of mothers was that the massage was “relaxing for mom”.

Mothers were then further asked if they would continue the massage programme after the research was complete and all participants (n=8) responded that they would be continuing with the massage sessions.

4.7 Linear regression between frequency of massage and developmental test scores

4.7.1 Peabody Developmental Motor Scales-2

A linear regression was performed to establish whether the frequency of massage sessions had an impact on the PDMS-2 follow-up scores of the infants in the experimental group. As can be seen in Table 4.12, there were no statistically significant correlations. There was one high correlation on the Reflexes sub-test (0.61). It must further be noted that there were two negative correlations, on the Locomotion (-0.11) and Grasping (-0.07) sub-tests, however these correlations were very low and statistically insignificant.

Table 4.12: Linear regression between frequency of massage and PDMS-2 Standard Scores

	Reflexes	Stationary	Locomotion	Grasping	Visual-motor integration
Correlation coefficient (r)	0.61	0.11	-0.11	-0.07	0.31
p-Value	0.144	0.816	0.821	0.873	0.496

p ≤ 0.05 statistical significance*
r = 0.2-0.4 low correlation
r = 0.4-0.6 moderate correlation
r = 0.6-0.8 high correlation
r = 0.8-1.0 very high correlation

4.7.2 Bayley Scales of Infant and Toddler Development-III

A linear regression was then completed on each sub-test of the BSID-III together with the frequency of massage sessions per week as can be seen in Table 4.13. There were low to moderate negative correlation coefficients on the Language (r=-0.41), Motor (r=-0.29) and Adaptive Behaviour (r=-0.10) sub-tests; however, the p-values of these tests showed no statistically significant differences. The Cognition sub-test showed a low positive correlation (r=0.33) but again no significance (p=0.307). The Social-Emotional sub-test showed a high positive correlation with frequency of massage sessions (r=0.75) as well as a statistically significant difference (p=0.033).

Table 4.13: Linear regression between frequency of massage and BSID-III Standard Scores

	Cognition	Language	Motor	Social-emotional	Adaptive behaviour
Correlation coefficient (r)	0.33	-0.41	-0.29	0.75	-0.10
p- value	0.432	0.307	0.488	0.033*	0.806

p ≤ 0.05 statistical significance*
r = 0.2-0.4 low correlation
r = 0.4-0.6 moderate correlation
r = 0.6-0.8 high correlation
r = 0.8-1.0 very high correlation

4.8 Conclusion

In conclusion, the two study groups were comparable in terms of their demographics and anthropometrics for both the infants on initial assessment and the mothers.

On initial assessment with the PDMS-2, there were no statistically significant differences between the two groups. On follow-up assessment with the PDMS-2, there were no statistically significant differences. However, there were positive clinical effect sizes in the Reflexes, Stationary and Visual-Motor Integration sub-tests.

On follow-up assessment of the infants using the BSID-III, there were no statistically significant differences between the two groups. There were however positive clinical effect sizes in the Cognition and Motor sub-tests with negative clinical effect sizes on the Social-Emotional and Adaptive Behaviour sub-tests.

Mothers generally enjoyed the massage sessions and identified the facilitators and barriers to carrying out the massage programme at home. All the mothers in the experimental group reported they would be continuing with the massage after the study.

There were no correlations between the frequency of massage and any of the PDMS-2 sub-tests. There was, however, a strong correlation with a statistically

significant difference between the number of massages performed per week and the Social-Emotional sub-test of the BSID-III.

CHAPTER 5: DISCUSSION

5.1 Introduction

In this chapter the results of the study will be discussed and compared to other literature on the topics being discussed. Unexpected results will be highlighted. Firstly, the demographics of the study sample will be discussed, the results from the initial (PDMS-2) and follow-up developmental tests (PDMS-2 and BSID-III) will then be discussed. Finally, the parents' perceptions of the parent-administered infant massage will be discussed in terms of facilitators and barriers to completing the massage sessions. The chapter will conclude with the implications of the findings of this study.

5.2 Overview of the findings

The aim of the study was to determine the effect of parent-administered infant massage of premature infants on the acquisition of developmental milestones at four to six months actual age. With comparison of standardised test scores of infants who had received massage and those who had not, conclusions can be drawn as to the benefit of parent-administered infant massage on developmental outcomes in the premature infant population. The infants in the control and experimental groups were comparable in terms of their demographics as well as their anthropometrics.

There were no statistically significant differences between the two groups on either of the developmental tests. There were however differing clinical effect sizes between the two groups on the different sub-tests of both developmental tests. With regards to the clinical effect sizes of each test, four out of five sub-tests on the PDMS-2 and two out of five sub-tests on the BSID-III were in favour of the experimental group and the null hypothesis of the study can therefore be rejected.

5.3 Study demographics

The study sample initially comprised of 46 premature infants who were assessed and their parents. All infants recruited for the study had been born at CHBAH and were admitted to the neonatal unit at the time of recruitment. Twenty-two infants of the total sample were randomly allocated to the control group and 24 to the experimental group. Due to high drop-out rates, the sample that returned for follow-up assessment comprised of 18 infants and their mothers. Many of the mothers who did not return for follow-up could not be reached telephonically as their phones were often off or had been disconnected, this indicates that there were possibly socio-economic concerns for these mothers. One participant from the experimental group who returned for follow-up was excluded as the mother reported that she had not carried out the intervention.

Of the final 17 participants, nine were from the control group and eight from the experimental group. The following discussion will focus on the infants who returned for follow-up assessment unless otherwise stated.

5.3.1 Infant demographics

There were high numbers of caesarean section deliveries that occurred in both groups (Table 4.3). The rate of caesarean section in this study (65%) is higher than the global trend measured in developed countries, with most developed countries having rates of between 19.8% and 32.7% (Niino, 2011). A 2015 study showed that the rate for caesarean sections in developing countries was 14.4% (Vogel, et al., 2015). The rate of caesarean section in this study is therefore significantly higher than the average of developed and developing countries. As demonstrated by a 2017 study, the high rate of caesarean sections demonstrated in this study should not have an impact on developmental outcomes of infants, specifically their neuromuscular and physical maturity (Khosla, et al., 2017). Therefore, although there were more infants born via caesarean section in this study, this should have no effect on their later developmental outcomes. There was also no statistically significant difference in the mode of delivery between the control and experimental

groups, therefore developmental differences between the two groups would not be able to be attributed to this factor.

Both groups had a similar number of neonatal complications, with the highest rate in both groups for respiratory distress syndrome (Table 4.3). Respiratory distress syndrome, however, has no effect on later development of a premature infant (Meisels, et al., 1986). As there was no statistically significant difference between the two groups in terms of neonatal complications, the developmental outcomes of the infants between the two groups could therefore not be attributed to the neonatal complications the infants experienced.

There were no statistically significant differences between the two groups on initial assessment and follow-up with regards to gestational age, weight, length and head circumference (Table 4.2). A study in 2008 noted that there is an increased risk of life-long disability with decreased gestational age (Moster, et al., 2008). As this study only assessed infants who were over 28 weeks gestational age and as shown by the mean ages of the two groups, the infants in this study were moderate to late premature infants (32- to 37-weeks' gestation) rather than very or extremely premature (WHO, 2018). The infants in this study would therefore not be expected to have significant developmental delays but rather delays related to their actual ages. In a 2015 systematic review, it was shown that weight gain in premature infants was shown to have a positive effect on the development of premature infants (Ong, et al., 2015). Conversely it could be surmised that infants who were not putting on weight would have developmental delays. The growth of the infants in terms of length was also comparable between the two groups (Table 4.4). A 2015 study noted that growth of an infant is positively associated with their developmental outcomes (Sudfeld, et al., 2015). Therefore, checking for growth restrictions in this population who are already at risk of delay is crucial. The same was applicable for head circumference at birth and at follow-up. This indicates that the infants did not have any neurological conditions that would affect their head circumference (such as hydrocephalus or microcephaly) that could potentially affect their developmental outcomes. Therefore, developmental outcomes between the two groups could not be attributed to the gestational age, weight, length or head circumference of the infants at initial assessment or at their follow-up appointment.

5.3.2 Parent demographics

Matric was reported by the most mothers (59%) to be their highest level of education while only 12% of mothers had completed undergraduate studies (degree and diploma) (Table 4.6). A mother's educational level has been shown to affect a child's development (Venetsanou & Kambas, 2010). As there were no statistically significant differences between the two groups of caregivers when it came to their highest level of education, any differences between the infants' developmental outcomes could therefore not be attributed to their mothers' educational levels.

Of the experimental group, just more than a third of the mothers had returned to work, the same as the number of mothers who reported that the massage sessions were too long to fit into their daily routines. As work would take up a large portion of a mother's day, it would be feasible that work would be a barrier to finding time to carry out a home programme. On closer analysis, however it was found that only one of the mothers, who reported that the massage sessions were too long to fit into her daily routine, had returned to work. In a 2004 study, it was suggested that another reason for home programme non-compliance is the size of the family (Rone-Adams, et al., 2004). From this it can be surmised that the larger the family that a mother must take care of, the less time that she will have to individually carry out a programme with one of her children. Another mother who had stated that the sessions were too long, was found to be looking after three other children, supporting the findings of other studies.

All the parents who returned for follow-up sessions were female, and all these mothers were the primary caregivers to the infants. Fathers, however, can also use infant massage as a supportive structure to their new role as well as to decrease their stress in their new role of father (Cheng, et al., 2011). Unfortunately, in this study, no fathers were taught the massage nor did any fathers return with the infants for their follow-up sessions. The fathers were not taught the massage as none of them were present in the neonatal wards during the massage teaching sessions. This is probably due to the fact that fathers are only allowed into the neonatal wards during a short daily visiting time at CHBAH. This highlights the need for a shift towards family-centred care of premature infants as the whole family, and not just the mother, should be involved in the infant's care for best outcomes. In a 2017

study on “Compliance with best practice guidelines for neurodevelopmental-supportive care in South Africa: A situational analysis”, the need for family-centred care was emphasised (Rheeder, et al., 2017). Involving fathers in the care of a premature infant would decrease the burden of care placed on the mother and would rather share the responsibility between both parents. Having fathers carry out the massage sessions would also allow for bonding between the father and the infant. A 2017 study showed that there were psychological benefits for parents and physical benefits for their infant when the parents were involved in the care of their infant during the neonatal period (De Bernardo, et al., 2017). Studies on successful family-centred care of premature infants re-emphasise that the “parents” are involved, educated and supported in their roles rather than just the mother (De Bernardo, et al., 2017) (Gooding, et al., 2011).

5.4 Developmental test scores

The scores of the infants on initial and follow-up assessments will be discussed in relation to the first objective of the study which was to determine the developmental outcomes in a group of premature infants at four to six months actual age between those who received infant massage and those who did not, using two developmental screening tools.

5.4.1 Initial Peabody Developmental Motor Scales-Second Edition scores

The PDMS-2 test was used to assess the infants initially as it is a test that can be used with premature infants as well as through the first few years of life. A neonatal test such as the Neonatal Behavioural Assessment Scale would have been more comprehensive in assessing infants during the neonatal period, however, would not be able to be used to reassess the infants and to show a comparison between initial and follow-up scores since is only used to assess infants under two months old.

There were no statistically significant differences between the two groups on initial administration of the initial PDMS-2 (Table 4.8). The infants’ scores were comparable on the Stationary, Locomotion and Grasping sub-tests. The infants in

both groups scored zero for both the Reflexes and Visual-Motor Integration sub-tests, the standard deviation was zero and these were therefore not analysed statistically.

The first item tested for the Reflexes sub-test was the “walking reflex”. It is understood that premature infants may have different capabilities in terms of reflexes than full-term infants (for whom the PDMS-2 was developed) (Vergara & Bigsby, 2004). The walking reflex should be present between 32- and 36-weeks’ gestation according to the authors however, the infant would not be able to sustain this (Vergara & Bigsby, 2004). The findings in this study were not congruent with this as none of the infants displayed the walking reflex. Reflexes will be further discussed when discussing the follow-up test scores of the infants.

The Visual-Motor Integration sub-test items that were tested on the premature infants were related to visual tracking abilities. All the infants from both groups again scored zero on this sub-test. It has however been described that even between the ages of two and four months, premature infants have different tracking abilities to their full-term counterparts (Gronqvist, et al., 2011). As shown by the PDMS-2 test, tracking is the basis for later visual-motor integration skills. A deficit in this area would need to be closely monitored as this could have life-long implications for the infant in all areas of development and all occupations expected of them. Areas that could potentially be affected include gross motor skills such as ball throwing or catching, fine motor skills such as writing as well as activities of daily living such as dressing.

5.4.2 Follow-up test scores

The PDMS-2 was repeated with the infants again at four to six months actual age. At the same time the BSID-III was completed with the infants as it is the gold standard developmental assessment (Yildirum, et al., 2012). During the time between the initial assessment and follow-up assessment, the experimental group had received parent-administered infant massage according to the study’s massage handouts while the control group had received no intervention.

No statistically significant differences were found between the two groups on the follow-up assessments using the PDMS-2 and the BSID-III. This could be due to the small sample size that was achieved in this study. As no significant differences were found, the Cohen's d test of clinical effect size was used to show the effect of the treatment being provided (McGough & Faraone, 2009).

5.4.2.1 Follow-up Peabody Developmental Motor Scales-Second Edition scores

On the Cohen's d test, clinically significant effect sizes were identified, in favour of the experimental group, on three of the five sub-tests, namely Reflexes, Stationary and Visual-Motor Integration sub-tests (Table 4.9).

Large clinical effect sizes were identified in the Reflexes and Visual-Motor Integration sub-tests with the experimental group having performed better on these sub-tests. A medium clinical effect size was identified in the Stationary sub-test with the experimental group having performed better. There was a small to medium negative clinical effect size in the Locomotion sub-test, meaning that the control group had performed better overall in this test.

When comparing the Hourglass Model of Motor Development and the Mountain of Motor Development Metaphor, it is noted in both models, that reflexes are the basis of all movements that a human acquires or learns (Salehi, et al., 2017). As reflexes are the foundation for later voluntary movements, a large clinical effect in the early stages of development is important to note. According to the above two models, all motor skills that the infant will learn are based on their reflexes. Therefore, reflexes are crucial for all the motor skills that the infant will need to learn as they grow and assume different roles and take part in different occupations throughout their life. Motor skills have further been shown to have an impact on skills such as mathematical and reading abilities when they start school (Cameron, et al., 2016). A positive effect in reflexes is an important finding as it provides the basis for not only later motor development but also school-based skills.

It has been established that infants who are born extremely prematurely are at risk for later visual-motor integration problems (Pinheiro, et al., 2014) (Bolk, et al., 2018).

Furthermore, in a 2018 study, it was concluded that children who were born prematurely are at risk of dysfunction in many higher-order visual tasks (Leung, et al., 2018). There are two critical skills, which require visual-motor integration, which a child will use throughout their schooling careers and into their adult lives, namely: hand writing and mathematics which have been shown to be affected in premature infants (Case-Smith, 2005) (Aarnoudse-Moens, et al., 2009). As children who present with visual-motor integration disorders are often only identified at crèche or school age when more structured visual-motor tasks are required of them, the finding of a large positive clinical effect size in infants who have received infant massage is a positive finding that could assist with minimising the problems premature infants often have in these areas later on.

The Stationary sub-test of the PDMS-2 looks at an infant's head and trunk control abilities. It has been suggested that premature infants have decreased abilities when it comes to head control developmental milestones (Babik, et al., 2017). Showing a medium clinical effect in this area following the implementation of the massage programme could have further positive implications for other stationary gross motor milestone such as sitting and standing of premature infants. These two positions are especially important as most daily occupations of children and adults take place in sitting and standing. Furthermore, the ability to control ones' trunk and maintain upright positions, such as sitting, has been shown to be strongly correlated to the reaching ability of an infant (Rachwani, et al., 2013) (Rachwani, et al., 2015). This could potentially have a positive effect on the developmental trajectory of their activities of daily living as well as their occupations. If infants could assume and maintain these positions sooner, they would be able to learn new skills in these positions such as hand function skills which would in turn affect their ability to participate in all occupations.

Further studies would need to be conducted to establish a possible reason the negative clinical effect size on the Locomotion sub-test.

5.4.2.2 Comparison between initial and follow-up Peabody Developmental Motor Scales-Second Edition

Although both the control and experimental groups improved from the initial to the follow-up assessment when assessed using the PDMS-2, infants in the experimental group showed larger improvements in most sub-tests (Table 4.10). The experimental group improved more than the control group in the Reflexes, Stationary, Locomotion and Visual-Motor Integration sub-tests, with three of the above-mentioned sub-tests having large clinical effect sizes. The importance of improvement in these three sub-tests has been discussed in detail above.

5.4.2.3 Follow-up Bayley Scales of Infant and Toddler Development-Third Edition scores

There were no statistically significant differences between the results of the BSID-III of the two groups of infants. Medium clinical effect sizes, in favour of the experimental group, were however identified for two of the five sub-tests, namely Cognition and Motor sub-tests (Table 4.11).

There was a medium clinical effect size on the Cognition sub-test, indicating again that the experimental group had performed better in this area. In a 2014 study, it was found that up to two years of age, premature infants score statistically lower than their full-term counterparts when tested on the BSID-III Cognitive sub-test (Ionio, et al., 2014). The same study showed that infants do tend to improve from the initial cognitive impact of prematurity; however, the effect of the initial cognitive disadvantage over a longer period was not studied (Ionio, et al., 2014). Given the intricacies of development, one could argue that cognition plays an important role in overall development therefore; a medium clinical effect from infant massage in these at-risk premature infants is a potentially important finding.

There was a small to medium clinical effect size on the Motor sub-test (0.41) of the BSID-III, indicating that the experimental group had performed better on this sub-test. The Motor sub-test is further divided into fine motor and gross motor components. The fine motor test included items such as: tracking abilities, bringing

hands to mouth and grasp. As described earlier, premature infants have different tracking abilities and a delay in their development of “smooth pursuits” when compared to their full-term counterparts therefore a positive, even if small, clinical affect in this area is important to note (Gronqvist, et al., 2011). Improved visual abilities would positively affect visual motor integration skills as discussed above. As discussed above, improvements in trunk control and sitting ability would have a positive impact on reach (Rachwani, et al., 2013) (Rachwani, et al., 2015). This would ensure that the hand was correctly placed for grasping. Furthermore, improvements in grasping behaviours could potentially have an effect on hand function later. Improved hand function would have a positive impact on the infant’s later participation in all activities of daily living and their attainment of milestones in these activities. Examples of activities that would be impacted by hand function include dressing, hygiene, school tasks and play activities. Items that formed the gross motor test include head control in different positions, rolling abilities, prone play and sitting abilities. The importance of these gross motor milestones in relation to development and participation in occupations are discussed above.

There was a small negative clinical effect size on the Social Emotional sub-test and a medium negative effect on the Adaptive Behaviour sub-test showing that the control group performed better on both sub-tests. The Social-Emotional sub-test questions the parent on aspects such as if the infant enjoys sounds and sights, enjoys being touched by different textures, enjoys vestibular input and how the infant responds to a well-known person as well as how they respond to social interaction. The Adaptive Behaviour sub-test is sub-divided into seven areas when assessing children younger than one year of age. These subdivisions include questions on the child’s communication skills, play skills and activities, the initial stages of personal management and their motor abilities. These two sub-tests on the BSID-III are self-reported parent questions. The results should therefore be analysed with caution. Further investigations are required into these results to establish a possible reason for these findings.

5.5 Experimental group parent questionnaire

The parent questionnaire results will be discussed in response to objective two of this study which was to identify parents' perceptions about hospital- and home-administered infant massage in terms of facilitators and barriers to implementation of the programme into their daily routines.

5.5.1 Facilitators to parent-administered infant massage

The execution of home exercise programmes is most successful when they can be integrated into a caregiver and infant's daily routine (McConnell, et al., 2014). As shown in this study, the majority of mothers reported that the daily massage sessions were not too long to fit into their daily routines and three quarters of mothers were found to have integrated the massage sessions into their infant's bath time with massage sessions either being done before or after bath time, showing that mothers had integrated the sessions into their daily routines with the infant which was already one-on-one time with their infant. The ability to integrate the massage programme into their daily routine would be a facilitator to making the programme successful as described in a 2014 study (McConnell, et al., 2014).

When asked about their satisfaction with the massage programme, all the mothers were either satisfied or very satisfied. Furthermore, all the mothers enjoyed the massage. A 2012 study on "the link between treatment satisfaction and adherence, compliance and persistence" suggested that the greater satisfaction there is with a programme, the greater the compliance to that programme is (Barbosa, et al., 2012). Although the research assistant indicated to mothers that they should perform the massage sessions daily, as per the research protocol used, until their follow-up appointments, more than half of mothers completed the massage sessions less than four times a week, despite their satisfaction with the programme and enjoyment of the programme. The mothers did, however, identify barriers to completing the sessions daily which potentially impacted on their compliance.

5.5.2 Barriers to parent-administered infant massage

The mothers in the study noted a few barriers to completing daily massage sessions with their infant. A quarter of the mothers reported that they were looking after other children and could therefore not complete the massage sessions daily. Looking after other children can affect the compliance to a home exercise programme (Rone-Adams, et al., 2004). It was suggested that parental stress levels can also play a role in compliance to an exercise programme (Rone-Adams, et al., 2004). This was evident in this study as one mother had a tragic event in their family and therefore did not complete the massage programme at home. One mother in this study also noted that they were “scared to do massage” as “baby was very small”, although all mothers had extensive training on infant massage by the research assistant. However, this is in line with the anxiety experienced by parents of premature infants that has previously been reported on (Lasiuk, et al., 2013) (Obeidat, et al., 2009). Furthermore, having a premature infant changes the preconceived ideas of parenthood which may result in anxiety (Lasiuk, et al., 2013). Infant massage has however been shown to decrease parental distress (Oswalt & Biasini, 2011). Parent-administered infant massage would therefore be beneficial with anxious mothers to assist with their anxiety levels as well as to facilitate them in their new role of not only mother but mother of a premature infant. Although one mother had reported that she had returned to work, she did not identify this as a barrier to completing the massage sessions. One mother reported that she was busy with housework and could therefore not complete the massage daily. Overall, this highlighted that each mother’s personal circumstances and occupational profiles need to be taken into account when prescribing a home-programme.

5.5.3 Overall perceptions of infant massage

The first category of responses that mothers gave about their experiences of infant massage was that the massage sessions were a bonding experience for the parent and the infant. Findings such as these have been described multiple times in the literature on the topic of benefits of infant massage practices (Cooke, 2015) (Faure & Richardson, 2014) (Field, et al., 2010) (Underdown, et al., 2013). Furthermore, as

described above bonding is crucial between infants and their parents as it is the first bond an infant forms and it is the groundwork for later social development and interaction (Young, 2013). The opportunity that parent-administered infant massage provides in terms of one-on-one time and bonding would therefore be beneficial for the infant throughout their lives and social interactions are required in most human occupations and many activities of daily living.

The second category of responses described by mothers was that the massage sessions were beneficial for their infants. Current research has noted increased weight gain in premaure infants who receive massage (Diego, et al., 2007) (Oswalt & Biasini, 2011) (Diego, et al., 2014). Although parents in the study could not measure increased weight gain, one parent did note that she thought that her “baby got stronger” with the massage sessions. There was however no significant difference between the two groups in terms of their follow-up weights (Table 4.4). One mother also reported that she carried out the massage “before sleep” and although she did not comment on the effect the massage had on the infant’s sleep, a study in 2006 did suggest that infant massage has a positive effect on the infant’s sleep (Kelmanson & Adulas, 2006). Another benefit of infant massage is improved weight gain in massaged infants (Diego, et al., 2014). The same was however not found in this study. This could be due to the fact that the study in 2014 was a short-term study that was carried out in hospital over only five days (Diego, et al., 2014). There would therefore need to be further research into weight gain over a prolonged infant massage programme involving premature infants.

The final category of responses identified by one of the mothers was that they found the massage sessions relaxing for themselves. The literature confirms this by stating that infant massage can have many benefits for the parent as well as the infant (Afand, et al., 2017). One of the benefits for mothers, as reported in a 2017 study, was the reduction in anxiety in mothers with premature infants (Afand, et al., 2017). Massage would therefore be a relaxing and stress-reducing activity for a mother. This is important to note as mother’s of premature infants have high levels of parental distress, often higher than their counterparts who have full-term infants (Harris, et al., 2018). This distress was further shown to have a negative effect on the confidence these mothers of premature infants have in their role of mother

(Harris, et al., 2018). It would therefore follow that an intervention that relaxes and alieviates stress in mothers would have a positive effect on their parenting role and in turn their interaction with their infant.

The overall peceptions of the mothers' were positive and they identified benefits for themselves and their infants. These positive perceptions could be viewed as further facilitators to parent-administered infant massage.

5.6 Correlation between home programme compliance and developmental outcomes

The correlation between frequency of massage sessions and test scores on different sub-tests of the PDMS-2 and the BSID-III will be discussed in relation to objective three which was to determine the association between compliance of parent-administered infant massage and the developmental outcomes of premature infants at four to six months actual age. These results do, however, need to be analysed with caution as most mothers did not follow the protocol of daily massage as was prescribed to them by the research assistant.

5.6.1 Correlation between frequency of massage and Peabody Developmental Motor Scales-2 scores

There were no statistically significant correlations found between frequency of massage sessions and sub-test scores on the follow-up PDMS-2 assessment for the experimental group (Table 4.12). The Reflexes sub-test showed a moderate, but not statistically significant, positive correlation with the developmental test results. As described earlier, reflexes form the foundation for later voluntary movement, therefore a positive correlation with frequency of massage is important to note along with the large clinical effect size in favour of the experimental group.

5.6.2 Correlation between frequency of massage and Bayley Scales of Infant and Toddler Development-III scores

When the Social Emotional development sub-test (on the BSID-III) was correlated with the frequency of massage sessions, a statistically significant correlation was found with a high positive correlation (Table 4.13). Infant-parent bonding and attachment affects the infant's life-long social development (Young, 2013). The parent is described as the first bond infants will have and this is the basis for their future emotional development (Young, 2013). At the conception of current Westernised infant massage, it was observed that infants who had received massage had grown up with "warm" dispositions and "accepted responsibility" easily (McClure, 2008). Parents were taught, during instruction on infant massage, to read their infants' cues and respond appropriately. Parents were taught to look for signs that their infants are not coping with the massage such as crying, avoiding eye-contact, back arching or hand splaying (Appendix 6) and to respect the infant's reaction and stop the massage sessions. They were also taught that when their infant is looking at them, holding their own hands, cooing or smiling it is a sign that the infant was enjoying the massage and they could continue with the session (Appendix 6). It would therefore make sense that there was a positive correlation between frequency of massage and social-emotional development as the parents are responding to the infants' earliest form of communication which is one of the main occupations of an infant. This would further be impacted by the fact that infant massage is taught to parents as a one-on-one bonding time with their child, free from distractions. Therefore, the higher the frequency of the massage sessions, the more time the parent was giving their infant their undivided attention. On the correlation of the results with frequency of massage it was further noted that the Cognition sub-test had a positive but low correlation while the Language sub-test had a moderate negative correlation. As described above, language and cognition are inter-linked and further investigation would be required into this finding.

5.7 Implications for occupational therapy and the South African context

Occupational therapists need to support the roles of new-born premature infants so that they can develop the many skills that they will require later in life (Crepeau, et al., 2003). Occupational therapists also need to provide neurodevelopmentally supportive care to premature infants who are inherently at risk of later developmental delay in numerous areas (Ross, et al., 2017). As shown in this study, there are two main roles for occupational therapists in the infant massage process of premature infants as well as in their overall neurodevelopmentally supportive care.

The first role of the occupational therapist is as one of the members of the neurodevelopmentally supportive care team (Ross, et al., 2017). The occupational therapist has a deep understanding of the infant's sensory environment and can therefore provide interventions that can decrease the pain that they experience (Lubbe, 2008). The occupational therapist can provide interventions such as positive touch to decrease the stress that a premature infant experiences due to pain (Lubbe, et al., 2012) (Faure & Richardson, 2014). The occupational therapist is uniquely positioned to understand the occupations of both the infant and the mother and support these through interventions aimed at both parties. As discussed in this study, one of those interventions would be to train parents on the infant massage process so that they are able to provide parent-administered infant massage in the home setting. Infant massage has been shown to have a positive impact on bonding with their parent through one-on-one and communication between the parent and the infant (Sullivan, et al., 2011). This can facilitate the infant's occupations of social play and procuring (Vergara & Bigsby, 2004). Another occupation that can be supported by infant massage is sleeping (Kelmanson & Adulas, 2006). Through training the parent in infant massage, the occupational therapist will need to support them to overcome the identified barriers to parent-administered massage as well as to assist the parent to identify and make use of the facilitators to the process. Inclusion of the parents in this type of family-centred care can assist in decreasing their stress levels (Gooding, et al., 2011).

The second role that the occupational therapist needs to assume is that of advocating for family-centred care and involvement of fathers in the care of premature infants.

This study has highlighted the impact that family-centred care and home programmes can have on the overall development of premature infants in their first few months of life. One of the home programmes that occupational therapists can provide is instruction to parents on infant massage, which has benefits for the infant and the parent. However, the facilitators and barriers to completing a programme such as this would need to be taken into account in order to make it successful in the future. Such a cost-effective and resource-effective intervention would be beneficial to the South African context given the current strain on government-funded medical resources.

It was disappointing that all the parents who returned for follow-up and who had been carrying out the massage sessions were mothers. This highlights the need for occupational therapists and all professionals involved in care of premature infants to encourage the concept of family-centred care as well as to support the fathers of the premature infants in their new role which can be carried out through infant massage (Cheng, et al., 2011).

Given the benefits for both parents and infants, this study highlights that occupational therapists are positioned to teach parents to provide parent-administered infant massage to their infants in order to facilitate normal development and participation in daily occupations.

5.8 Conclusion

In this chapter, the research question and objectives were discussed in relation to current literature on the topics highlighted. Overall there were medium to strong clinical effect sizes in favour of the experimental group in three of the five sub-tests of the PDMS-2 and in two of the five sub-tests of the BSID-III, indicating that the massage programme may have had a positive effect on the neurodevelopment of premature infants. These were discussed along with the possible implications of

these findings. The null hypothesis of the study was therefore rejected. There were however some medium clinical effect sizes in favour of the control group, possible reasons for these findings have been discussed. A positive correlation between frequency of parent-administered infant massage and Social-Emotional development was discussed. The facilitators and barriers to implementing parent-administered infant massage were also discussed. The findings have implications for occupational therapists in the South African context, showing the benefits of teaching parents of premature infants the technique of infant massage for benefit of the infant and the parent.

CHAPTER 6: CONCLUSION

6.1 Introduction

There is a vast body of research on the effects of infant massage on premature infants; however most of the research studies have been short term, in-hospital studies to determine the effect on weight gain and length of hospitalisation of the premature infant (Field, et al., 2010). There is, however, no research on the use of infant massage programmes studying the effect of infant massage in the developmental trajectories of premature infants who are at risk of developmental delay.

This study therefore aimed to determine the effects on an infant's development of a parent-administered infant massage programme that took place over the first four to six months of a premature infant's life.

In this chapter, the main findings of this study will be highlighted. The limitations of the study will then be discussed along with suggestions for further research studies on the topic.

6.2 Main findings

The main findings of this study are discussed in relation to the aim and objectives of the study.

The first finding was that there were no statistically significant differences between the two groups when the infants developmental test scores were compared. There was however a positive clinical effect on the developmental milestones of premature infants when assessed at four to six months actual age when compared to infants who had not received parent-administered infant massage.

The second finding was that there were many facilitators to parent-administered infant massage that supported the mothers in carrying out the massage sessions such as integration into daily routines and enjoyment of the programme. It was also

found that there were barriers to completing the massage sessions including parental stress, performing other household chores and looking after other children. Mothers did generally have positive feelings towards the massage sessions with their infants.

The third finding was that there was a strong positive correlation between frequency of massage sessions and the social-emotional development of premature infants. This was substantiated by the literature and practice of parent-administered infant massage with parent-infant bonding as well as the one-on-one time with the infant with the mother being able to read the infant's cues during the process and respond appropriately.

Overall the findings of the study are in favour of parent-administered infant massage on premature infants to assist with the attainment of their developmental milestones as well as the parent-infant bonding process.

6.3 Limitations of the study

The first limitation of this study was the small sample size that returned for follow-up. Although the initial sample was 46 premature infants and their mothers, the final size that returned for follow-up assessment was only 17 infants. This small sample size reduced the chances of finding statistically significant differences between the two groups.

The second limitation was that the mothers did not follow the prescribed massage programme in terms of frequency of sessions. Many mothers did less than half the prescribed sessions per week. This again would have affected the results and reduced the chance of finding a statistically significant difference between the two groups.

The third limitation was that the infants were only studied over the first four to six months of their lives. A longitudinal study with assessments at a few different ages would have given a better idea of the effectiveness of the massage programme with regards to a premature infant's long-term development.

The fourth limitation was that the questionnaire completed by the mothers was a quantitative questionnaire. Although there were brief opportunities for the mothers to comment on quantitative questions, there were limited opportunities for them to go in depth into their feelings and perceptions regarding the infant massage process.

6.4 Suggestions for further research

It is recommended that further research be carried out on the effect of parent-administered infant massage on the neurodevelopmental outcomes of premature infants. A study with a larger sample size as well as a higher compliance rate would be able to provide more in-depth information and more accurate conclusions could be drawn from this.

A study that followed up the infants over a longer period of time would also be beneficial to determine whether there were long-term effects on development as a result of parent-administered infant massage.

Further investigation into the mother's perceptions of the infant massage process would be beneficial. A qualitative study into the mother's experiences, concerns, perceptions and fears would provide further information on the process of infant massage from the mothers' point of view.

This study supports the use of parent-administered infant massage in premature infants to positively affect their developmental milestone attainment.

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APPENDICES

Appendix 1: Demographic information

Participant code:_____

Infant Demographic Information

1. Infant's date of birth _____
2. Infant's gender M☐ ☐
3. Gestation _____/40
4. Mode of delivery

   Caesarean section ☐

   Normal vaginal delivery ☐
5. Infant's current age_____
6. Infant's corrected age_____
7. Infant's birth weight_____
8. Infant's current weight_____
9. Neonatal conditions diagnosed while in hospital
   a. Neonatal jaundice ☐
   b. Transient tachypnea of the newborn ☐
   c. Necrotising Enterocolitis ☐
   d. Respiratory distress syndrome ☐
   e. Other:_____
10. Any hospital admissions since being discharged from the neonatal wards?

    Yes ☐ No ☐

    Elaborate_____

    _____
11. Any previous surgery? Yes ☐ No ☐

Elaborate:_____

_____

12. Has the child received any therapeutic intervention (OT, PT or ST) since discharge?

    a. Occupational therapy ☐
    b. Physiotherapy ☐
    c. Speech therapy ☐

Elaborate:_____

_____

Parent Demographic Information

1. Parent's age_____
2. Parent's gender_____
3. Number of previous children_____
4. Parent's highest level of education?

   Grade 7 ☐ Grade 9 ☐ Matric ☐ Diploma ☐ Degree ☐

   Postgraduate degree ☐
5. Has parent returned to work? Yes ☐ No ☐

   Elaborate_____

   _____
6. Maternal conditions?

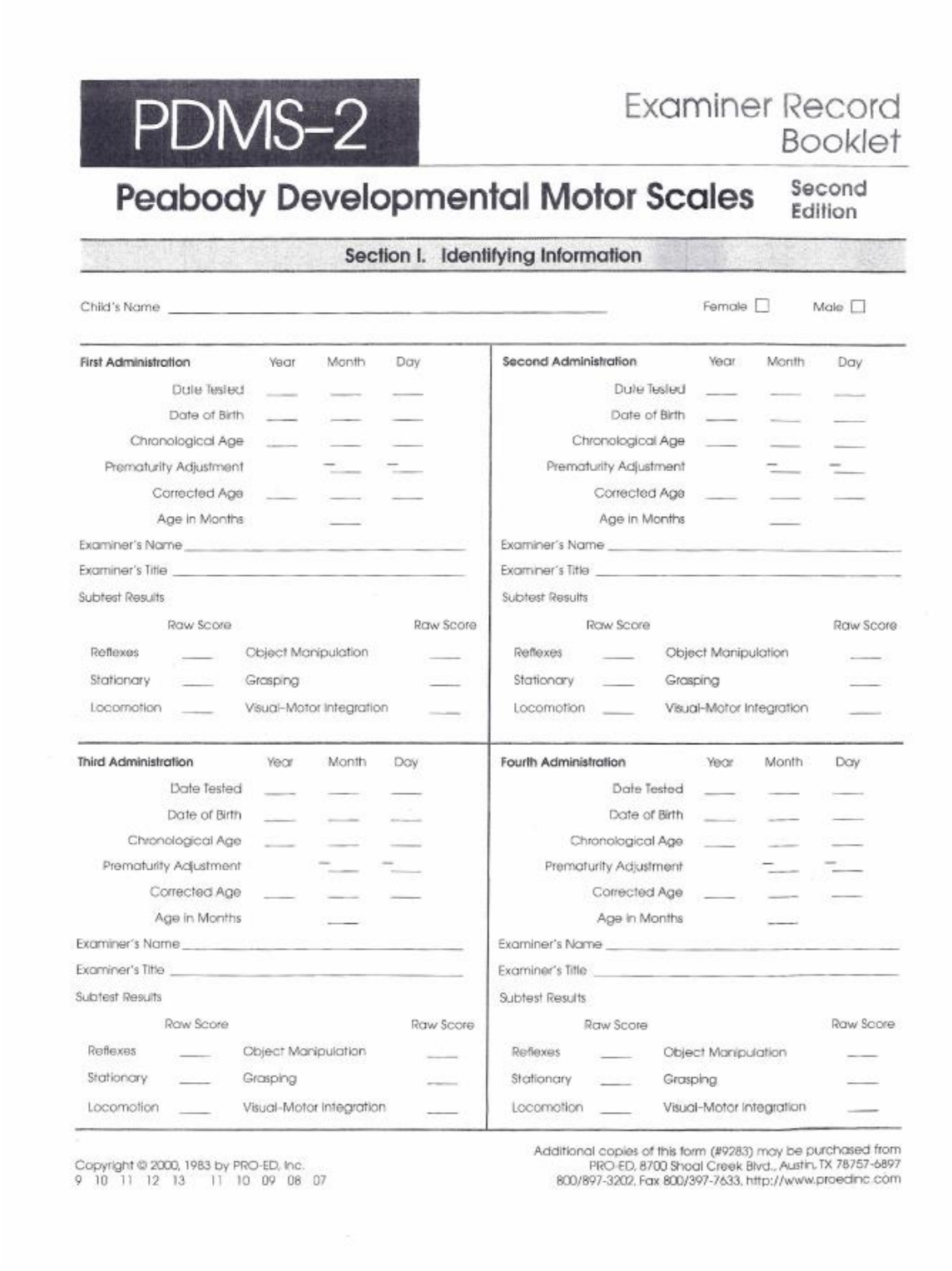
   Diabetes ☐

   Hypertension ☐

   Pre-eclampsia ☐

Other:_____
_

Appendix 2: Peabody Developmental Motor Scales-2



PDMS–2

Examiner Record Booklet

Peabody Developmental Motor Scales Second Edition

Section I. Identifying Information

Child's Name _____ Female ☐ Male ☐

First Administration	Year	Month	Day
Date Tested	___	___	___
Date of Birth	___	___	___
Chronological Age	___	___	___
Prematurity Adjustment		– ___	– ___
Corrected Age	___	___	___
Age in Months		___	

Examiner's Name _____

Examiner's Title _____

Subtest Results

	Raw Score		Raw Score
Reflexes	___	Object Manipulation	___
Stationary	___	Grasping	___
Locomotion	___	Visual-Motor Integration	___

Second Administration	Year	Month	Day
Date Tested	___	___	___
Date of Birth	___	___	___
Chronological Age	___	___	___
Prematurity Adjustment		– ___	– ___
Corrected Age	___	___	___
Age in Months		___	

Examiner's Name _____

Examiner's Title _____

Subtest Results

	Raw Score		Raw Score
Reflexes	___	Object Manipulation	___
Stationary	___	Grasping	___
Locomotion	___	Visual-Motor Integration	___

Third Administration	Year	Month	Day
Date Tested	___	___	___
Date of Birth	___	___	___
Chronological Age	___	___	___
Prematurity Adjustment		– ___	– ___
Corrected Age	___	___	___
Age in Months		___	

Examiner's Name _____

Examiner's Title _____

Subtest Results

	Raw Score		Raw Score
Reflexes	___	Object Manipulation	___
Stationary	___	Grasping	___
Locomotion	___	Visual-Motor Integration	___

Fourth Administration	Year	Month	Day
Date Tested	___	___	___
Date of Birth	___	___	___
Chronological Age	___	___	___
Prematurity Adjustment		– ___	– ___
Corrected Age	___	___	___
Age in Months		___	

Examiner's Name _____

Examiner's Title _____

Subtest Results

	Raw Score		Raw Score
Reflexes	___	Object Manipulation	___
Stationary	___	Grasping	___
Locomotion	___	Visual-Motor Integration	___

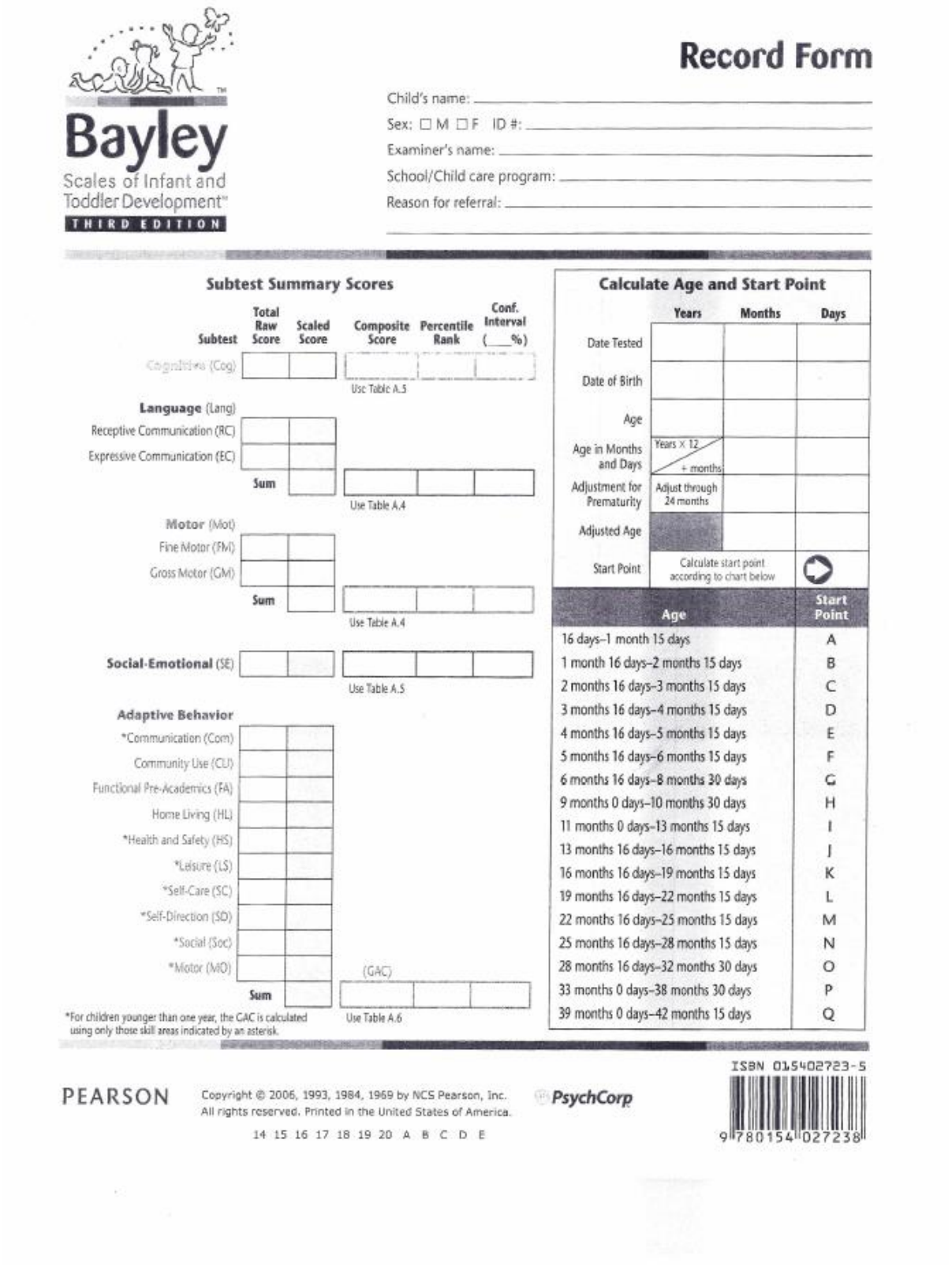
9 10 11 12 13 11 10 09 08 07

Additional copies of this form (#9283) may be purchased from PRO-ED, 8700 Shoal Creek Blvd., Austin, TX 78757-6897 800/897-3202, Fax 800/397-7633, http://www.proedinc.com

Section II. Record of Item Performance

Item #	Age in Months	Item NAME, Position, and Description	Score Criteria	Administration 1	2	3	4
Gross Motor Scales							
Reflexes							
1 Start: 1–11 months	2	WALKING REFLEX With hands around trunk, hold child in standing position (facing away). Tilt child slightly forward. Brush top of child's feet against edge of table, then hold child so feet are resting on table.	2 Lifts 1 foot, then the other, in forward walking movement within 3 seconds 1 Lifts 1 foot within 3 seconds 0 Feet and legs remain still				
2	4	POSITIONING REFLEX: Asymmetrical Tonic Neck Reflex (Integrated) *(Lying on back, head toward examiner)* Turn child's face so left cheek is parallel to surface. Hold his or her head in that position for 3 seconds and observe child's reaction. Repeat procedure to right side.	2 Does not move arms and legs as a result of head being turned 1 Arms and legs respond as described below, but can move arms and legs out of position while head is turned 0 Reflex still present [When face is turned left, left arm and leg extend while right arm and right leg flex. When face is turned right, right arm and right leg extend while left arm and left leg flex. Reflex disappears by 6 months.]				
3	6	LANDAU REACTION Hold child suspended horizontally, stomach toward floor, side toward you with your hands under his or her chest and stomach.	2 Raises head above horizontal plane, extends trunk, and symmetrically raises hips and legs into full extension 1 Extends head above plane and extends trunk but hips and legs remain below horizontal 0 Head and hips remain below horizontal				
4	6	PROTECTING REACTION—Forward [Either kneel on floor or stand facing table so when child is tilted forward, he or she can reach surface.] Hold child in suspended horizontal position, stomach parallel to floor, buttocks toward you, then quickly tilt child's head toward the surface.	2 Extends arms, straightens elbows, and bears weight on open palms 1 Extends arms or puts hands on surface, elbows bent, but doesn't bear weight 0 Fails to extend arms or put hands on surface				
5	6	PROTECTING REACTION—Side *(Sitting, back toward you)* With hands at hips, support child in sitting position, then quickly tilt child 45 degrees to one side.	2 Breaks fall by extending arm and supporting self with open palm for 2 seconds 1 Breaks fall by falling on forearm 0 Falls on side				
6	6	PROTECTING REACTION Forward *(Sitting, back toward you)* With hands at hips, support child in sitting position, then quickly tilt child 45 degrees forward.	2 Breaks fall by extending one or both arms and supporting self with one or both open palms for 2 seconds 1 Extends one or both arms and falls forward 0 Fails to extend arms				
7	9	RIGHTING REACTION—Forward *(Sitting, back toward you)* Place your hands on child's shoulders and pull him or her backward 20 degrees from vertical. (Be prepared to catch child if no reaction occurs.)	2 Extends arms and head forward to recover balance and returns to upright sitting position 1 Extends arms forward and to floor to recover balance and returns to upright sitting position 0 Fails to extend arms or head forward				
8	10	PROTECTING REACTION—Backward *(Sitting, facing you)* Place your hands on child's chest and push gently and rapidly backward at least 45 degrees. (Have someone prepared to catch child or stop fall if no reaction occurs.)	2 Stops fall by extending arm(s) backward and supporting weight on open palm(s) 1 Rotates trunk to one side and extends arm but continues to fall 0 Fails to extend arms				

Appendix 3: Bayley Scales of Infant and Toddler Development-III



Bayley
Scales of Infant and Toddler Development™
THIRD EDITION

Record Form

Child's name: _____

Sex: ☐ M ☐ F ID #: _____

Examiner's name: _____

School/Child care program: _____

Reason for referral: _____

Subtest Summary Scores

Subtest	Total Raw Score	Scaled Score	Composite Score	Percentile Rank	Conf. Interval (___%)
Cognitive (Cog)					
			Use Table A.5		
Language (Lang)					
Receptive Communication (RC)					
Expressive Communication (EC)					
Sum					
			Use Table A.4		
Motor (Mot)					
Fine Motor (FM)					
Gross Motor (GM)					
Sum					
			Use Table A.4		
Social-Emotional (SE)					
			Use Table A.5		
Adaptive Behavior					
*Communication (Com)					
Community Use (CU)					
Functional Pre-Academics (FA)					
Home Living (HL)					
*Health and Safety (HS)					
*Leisure (LS)					
*Self-Care (SC)					
*Self-Direction (SD)					
*Social (Soc)					
*Motor (MO)					
Sum			(GAC)		
			Use Table A.6		

*For children younger than one year, the GAC is calculated using only those skill areas indicated by an asterisk.

Calculate Age and Start Point

	Years	Months	Days
Date Tested			
Date of Birth			
Age			
Age in Months and Days	Years × 12 + months		
Adjustment for Prematurity	Adjust through 24 months		
Adjusted Age			
Start Point	Calculate start point according to chart below		

Age	Start Point
16 days–1 month 15 days	A
1 month 16 days–2 months 15 days	B
2 months 16 days–3 months 15 days	C
3 months 16 days–4 months 15 days	D
4 months 16 days–5 months 15 days	E
5 months 16 days–6 months 15 days	F
6 months 16 days–8 months 30 days	G
9 months 0 days–10 months 30 days	H
11 months 0 days–13 months 15 days	I
13 months 16 days–16 months 15 days	J
16 months 16 days–19 months 15 days	K
19 months 16 days–22 months 15 days	L
22 months 16 days–25 months 15 days	M
25 months 16 days–28 months 15 days	N
28 months 16 days–32 months 30 days	O
33 months 0 days–38 months 30 days	P
39 months 0 days–42 months 15 days	Q

ISBN 015402723-5

PEARSON

PsychCorp

14 15 16 17 18 19 20 A B C D E

Cognitive Scale

Reversal Rule: The child must obtain scores of 1 on the first three consecutive items at the start point of any age to go forward. If the child obtains a score of zero on any of the first three items, go back to the start point for the previous age and administer those items.

Discontinue Rule: Stop administration when the child obtains scores of zero on five consecutive items.

Item	Materials	Score Criteria and Comments	Score
1. Calms When Picked Up	None	**Score:** Child calms when picked up by either you or caregiver.	1 0
2. Responds to Surroundings Series: Inspects	None	**Score:** Child freely turns eyes or head in visual exploration of surroundings.	1 0
3. Regards Object for 3 Seconds	Ring with string, ball, or other small object of interest	**Score:** Child gazes continuously at object for at least 3 seconds.	1 0
4. Habituates to Rattle	Rattle	Trials: 5 **Score:** Child displays orienting response to stimulus, then habituates during any of the remaining trials.	1 0
5. Discriminates Between Objects	Bell Stopwatch 5 seconds	**Score:** Child responds to bell by displaying a marked behavioral change within 5 seconds after you ring bell.	1 0
6. Recognizes Caregiver	None	**Score:** Child's expression changes to indicate recognition of the caregiver.	1 0
7. Becomes Excited in Anticipation	None	**Score:** Child displays anticipatory excitement.	1 0
8. Regards Object for 5 Seconds	Block or other small object of interest Stopwatch 5 seconds	**Score:** Child regards object continuously for at least 5 seconds.	1 0
9. Reacts to Disappearance of Face	None	**Score:** Child changes facial expression or displays other reaction to caregiver's disappearance.	1 0
10. Shifts Attention	Bell Rattle	Trials: 3 **Score:** Child's eyes move from one object to another in response to sound or movement of object(s).	1 0

Appendix 4: Parent questionnaire

1. How many times a week did you do infant massage with your infant on average?

1	2	3	4	5	6	7

2. What were the barriers to completing the massage as often as possible?

Working full time	Taking care of other children	Didn't believe the massage was beneficial	Other (please elaborate below)

_____
_____
_____
_____

3. Did you enjoy the massage with your Infant?

Very much	Somewhat	Indifferent	No

4. If no, why?

_____
_____
_____

5. What part did you enjoy the most?

One on one time with infant	Infant's reaction	Both
Other:_____ _____ _____ _____		

6. How long did the massage take you each day?

0-15 min	16-30 min	31-45 min

7. Was this too long to fit into your daily routine?

Yes	No

8. Was it easy to fit the massage into your and your baby's daily routine?

Yes	No

9. What time of day did you find it easiest to do the massage?

Morning	Mid-day	Afternoon	Evening	Night

Elaborate (before feeding, after bathing, etc.)

_____
_____
_____
_____

10. Did you find the massage process with you child satisfying?

Very satisfying	Satisfying	Indifferent	Unsatisfying	Very unsatisfying

Elaborate

_____
_____
_____
_____

11. Will you continue to do the massage regularly?

Yes	No

12. If no, why?

_____
_____
_____
_____

13. Any further comments?

_____
_____
_____

Appendix 5: Massage strokes

Massage Strokes: Legs (repeat each stroke for 30seconds, massage one leg at a time)

Whole leg: using “C” shaped hands, move your hands from your infant’s hips to their feet, slowly alternating your hands

Foot: run your thumbs over the bottom of your infant’s feet from their heel to their toes, slowly alternating your thumbs

Foot: press over the whole of the bottom of your infant’s foot with your thumbs

Foot: run your thumbs over the top of your infant’s feet from their toes to their ankles, slowly alternating your thumbs

Whole leg: using “C” shaped hands, move your hands from your infant’s feet to their hips, slowly alternating your hands

Whole leg: run your hands down your infants whole leg from their hips to their toes

Massage Strokes: Arms (repeat each stroke for 30 seconds on each arm, massage one arm at a time)



Whole arm: using “C” shaped hands, move your hands from your infant’s shoulder to their hand, slowly alternating your hands


Hand: run your thumbs over the palm of your infant’s hand from their wrist to their fingers, slowly alternating your thumbs


Hand: press over the whole of your infant’s palm with your thumbs

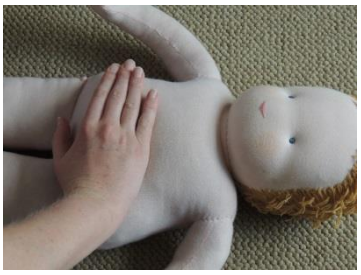

Hand: run your thumbs over the top of your infant’s hand from their fingers to their wrists, slowly alternating your thumbs

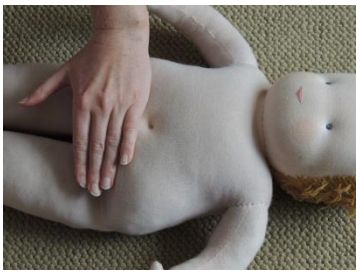


Whole arm: using “C” shaped hands, move your hands from your infant’s hand to their shoulder, slowly alternating your hands


Whole arm: run your hands down your infants whole arm from their shoulder to their hands

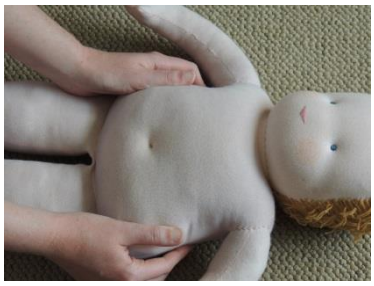
Massage Strokes: Stomach and chest (repeat each stroke for 1 minute)



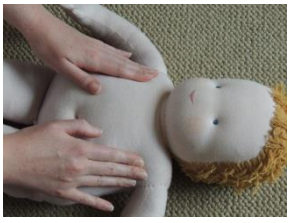


Whole stomach: run your open hands down your infants stomach from their ribs to their pelvis, alternate your hands



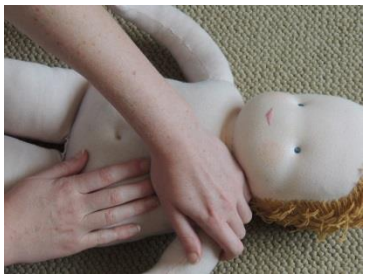


Whole stomach: place your thumbs together in the centre of your infants stomach, then move your hands outwards to your infant's sides

Whole chest: place your hands on your infants chest at the top, move your hands down to the sides, to the centre and back up to the starting point.





Crossing the chest: start with your hands on the bottom of the ribs, move hands upwards to the opposite shoulder, alternating your hands



Chest and stomach: run your open hands down your infant’s whole chest and stomach, from their shoulders to their hips

Appendix 6: Infant avoidance and approach behaviours

Avoidance behaviours

If your infant displays any of the below behaviours, stop the massage and try to resume it at a later time when your infant is calm.

- If your infant begins crying
- Infant is avoiding making eye contact with you
- Infant is hiccupping
- Infant is arching their back or neck
- Infant is showing the ‘stop sign’ with their hand

Approach behaviours

If your infant displays any of the below behaviours, it is safe to begin and continue the massage.

- If your infant is awake and looking at you
- If your infant is sucking their hands
- If your infant has wide eyes
- If your infant is holding their own hands or their blanket
- If your infant is cooing
- If your infant is smiling

Appendix 7: Massage timetable

Participant code:

Month:

Date	Massage performed (yes or no)	Time spent on massage (minutes)	Date	Massage performed (yes or no)	Time spent on massage (minutes)	Date	Massage performed (yes or no)	Time spent on massage (minutes)
1			12			23		
2			13			24		
3			14			25		
4			15			26		
5			16			27		
6			17			28		
7			18			29		
8			19			30		
9			20			31		
10			21					
11			22					

Appendix 8: Experimental group information letter and informed consent

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Department of Occupational Therapy
Wits Education Campus

Hello,

My name is Megan Perrie; I am a paediatric occupational therapist at Chris Hani Academic Hospital. I am currently completing a Master of Science in Occupational Therapy at the University of the Witwatersrand. I would like to invite you and your child to participate in my study which is titled: "The effect of parent-administered infant massage on the acquisition of developmental milestones in premature infants".

The study aims to determine the effect that a hospital and home infant massage program has on the developmental outcomes of infants that are born prematurely. The parent's attitudes and opinions of the massage program will also be evaluated. This study will aim to determine whether parent-administered infant massage is a viable option to support and enhance the development of premature infants.

Participation in this study is voluntary and all participants will have to sign a consent form stating that they are willing for themselves and their infant to take part in the study. All infants' and caregivers' information will be kept confidential as no names will appear on scoring sheets or questionnaires.

Willing parents will be taught basic infant massage strokes that they will be required to do daily with their child. Parents will be given a massage timetable where they can record the dates that they do the massage during the study period. When parents bring their infants back to the hospital for their check-up (between four and six months) a developmental test will be administered on their infant and they will be asked to fill in a short questionnaire on their experiences of the massages they provided in hospital and at home. The infant's medical records will be reviewed at the initial and follow up assessments.

Test scoring sheets, massage timetables and questionnaires will only be seen by me, my assistant and my research supervisor. Participants may, at any time, withdraw from the study without reason and without penalty.

There will be no incentive for partaking in the study, however participation in the study will aid in the knowledge therapists have of infant massage and its possible benefits for the development of premature infants.

Please ensure that you understand all the above information before signing the consent form to take part in the study.

Thank you for your time. Please direct any questions about this study to:

- Megan Perrie (researcher): 084 770 6263 (megan.perrie@gmail.com)

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leilane.bogoshi@wits.ac.za | www.wits.ac.za

- HREC (medical) committee:
  - Prof P Cleaton Jones: 011 717 2301 (peter.cleaton-jones1@wits.ac.za)
  - Ms Z Ndlovu: 011 717 2700 (zanele.ndlovu@wits.ac.za)
  - Mr Rhulani Mkansi: 011 717 2656 (rhulani.mkansi@wits.ac.za)
  - Mr Lebo Moeng: 011 717 1234 (lebo.moeng@wits.ac.za)

Sincerely,

Megan Perrie

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leliane.bogoshi@wits.ac.za | www.wits.ac.za

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Department of Occupational Therapy
Wits Education Campus

I, _____ (parent/legal guardian) of _____ hereby agree to participate in the study entitled "The effect of parent-administered infant massage on the acquisition of developmental milestones in premature infants".

_____ _____

Parent's signature Date

Witness:_____

Signature:_____

Date: _____

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leilane.bogoshi@wits.ac.za | www.wits.ac.za

Appendix 9: Control group information letter and informed consent

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Department of Occupational Therapy
Wits Education Campus

Hello,

My name is Megan Perrie; I am a paediatric occupational therapist at Chris Hani Academic Hospital. I am currently completing a Master of Science in Occupational Therapy at the University of the Witwatersrand. I would like to invite you and your child to participate in my study which is titled: "The effect of parent administered infant massage on the acquisition of developmental milestones in premature infants".

The study aims to determine the effect that a hospital and home infant massage program has on the developmental outcomes of infants that are born prematurely. The parent's attitudes and opinions of the massage program will also be evaluated. This study will aim to determine whether parent administered infant massage is a viable option to support and enhance the development of premature infants.

Participation in this study is voluntary and all participants will have to sign a consent form stating that they are willing for themselves and their infant to take part in the study. All infants' and caregivers' information will be kept confidential as no names will appear on scoring sheets or questionnaires.

Willing parents will have their infant assessed at the start of the study as well as when they come to their doctor's check-up appointment when your infant is between four and six months old. The infant's medical records will be reviewed at the initial and follow up assessments. After the four to six month assessment, you and your infant will be invited to attend an infant massage class at the hospital where you will be taught to massage your infant which you can do daily at home.

Test scoring sheets and demographic information will only be seen by me and my research supervisor. Participants may, at any time, withdraw from the study without reason and without penalty.

There will be no incentive for partaking in the study, however participation in the study will aid in the knowledge therapists have of infant massage and its possible benefits for the development of premature infants.

Please ensure that you understand all the above information before signing the consent form to take part in the study.

Thank you for your time. Please direct any questions about this study to:

- Megan Perrie (researcher): 084 770 6263 (megan.perrie@gmail.com)
- HREC (medical) committee:
    - Prof P Cleaton Jones: 011 717 2301 (peter.cleaton-jones1@wits.ac.za)

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leliane.bogoshi@wits.ac.za | www.wits.ac.za

- Ms Z Ndlovu: 011 717 2700 (zanele.ndlovu@wits.ac.za)
- Mr Rhulani Mkansi: 011 717 2656 (rhulani.mkansi@wits.ac.za)
- Mr Lebo Moeng: 011 717 1234 (lebo.moeng@wits.ac.za)

Sincerely,

Megan Perrie

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leliane.bogoshi@wits.ac.za | www.wits.ac.za

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Department of Occupational Therapy
Wits Education Campus

I, _____ (parent/legal guardian) of _____ hereby agree to participate in the study entitled "The effect of parent-administered infant massage on the acquisition of developmental milestones in premature infants".

_____ _____

Parent's signature Date

Witness:_____

Signature:_____

Date: _____

School of Therapeutic Sciences, Faculty of Health Sciences, 7 York Road, Parktown, 2193, South Africa
Tel: +27 11 717 3701 | Fax: +27 717 3709 | Email: leliane.bogoshi@wits.ac.za | www.wits.ac.za

Appendix 10: Declaration of accuracy of massage timetable

I, _____ parent of _____ (infant's name), hereby confirm that all the information I have supplied in the massage timetable is correct to the best of my knowledge.

_____

_____

Signature Date

Appendix 11: Ethical clearance from the University of the Witwatersrand Human Research Ethics Committee (Medical)

R14/49 Megan Leigh Perrie

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160418

NAME: (Principal Investigator)	Megan Leigh Perrie
DEPARTMENT:	Occupational Therapy Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	The Effect of Parent-Administered Infant Massage on the Developmental Milestone of Premature Infants
DATE CONSIDERED:	06/05/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Lizelle Jacobs
APPROVED BY:	Professor P. Cleaton-Jones,Chairperson, HREC (Medical)
DATE OF APPROVAL:	10/03/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004,10th floor, Senate House/2nd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated,from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review in April and will therefore be due in the month of April each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 12: Permission from the Medical Advisory Committee at Chris Hani Baragwanath Academic Hospital

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 27 June 2016

TITLE OF PROJECT: The effect of parent-administered infant massage on the developmental milestones of premature infants

UNIVERSITY: Witwatersrand

Principal Investigator: M Perrie

Department: Occupational Therapy

Supervisor (If relevant): L Jacobs

Permission Head Department (where research conducted): Not yet

Date of start of proposed study: June 2016
Date of completion of data collection: Dec 2017

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Human Research Ethics Committee of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 27 June 2016

.....
Approved/Not Approved
Hospital Management
Date: 29/06/16

Appendix 13: Permission to conduct research from the Head of the Occupational Therapy Department at Chris Hani Baragwanath Academic Hospital

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL
OCCUPATIONAL THERAPY DEPARTMENT
Tel: 011 933 8294 / 9113/ 8187/ 9054

28 March 2017

To whom it may concern

This letter grants formal permission for Megan Perrie (student no: 305421) to carry out her master's degree research project titled, 'The Effect of Parent-Administered Infant Massage on the Developmental Milestones of Premature Infants' in the Occupational Therapy Department at Chris Hani Baragwanath Academic Hospital.

Kind regards

Lynn Soulsby
AD Occupational Therapy
011 933 8187

Appendix 14: Permission to conduct research from the Head of Paediatrics at Chris Hani Baragwanath Academic Hospital

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Department of Paediatrics and Child Health
Metabolic Unit
Chris Hani Baragwanath Academic Hospital
P. O. Bertsham
2013

30th October 2017

The Research Protocol Review Committee
Chris Hani Baragwanath Academic Hospital
Soweto
Johannesburg
South Africa

Dear Madam/ Sir

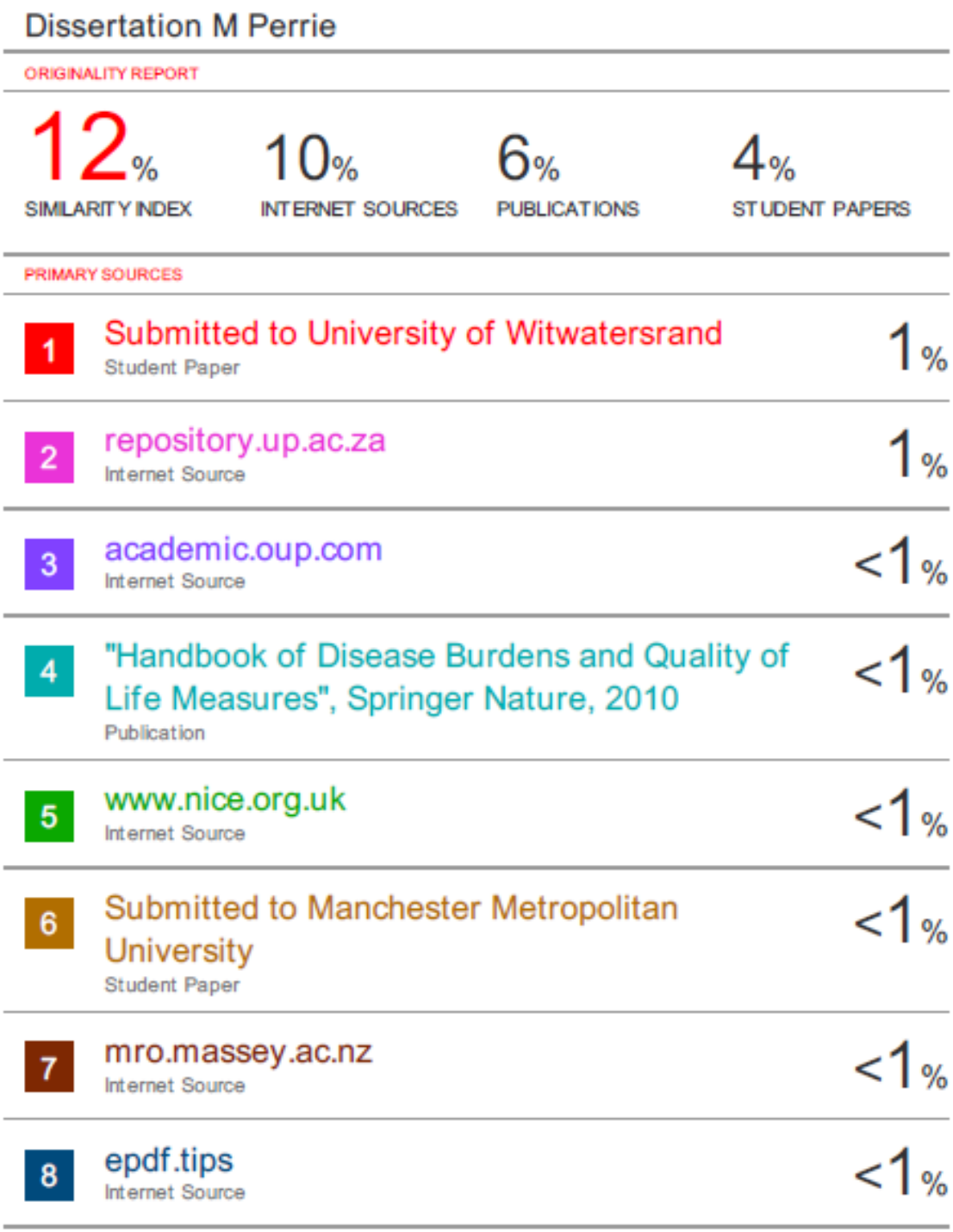
I would like to inform you that **Megan Perrie** has been given a permission to conduct her research study in the Department of Paediatrics at Chris Hani Baragwanath Academic Hospital. The title of her study is: **"The effect of parent administered infant massage on the developmental milestones of premature infants."**

While she has been given permission to conduct this study, she cannot start with data collection until she has provided the Department with Ethics Committee Clearance Certificate.

Yours Sincerely

Professor Sithembiso Velaphi
Associate Professor and Head of Department of Paediatrics
Chris Hani Baragwanath Academic Hospital

Appendix 15: Turnitin report



Dissertation M Perrie

ORIGINALITY REPORT

12%	10%	6%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Witwatersrand Student Paper	1%
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3	academic.oup.com Internet Source	<1%
4	"Handbook of Disease Burdens and Quality of Life Measures", Springer Nature, 2010 Publication	<1%
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