

## **THESIS**

Examining the impact of an emotional stimulation intervention on interactions between  
Ethiopian mothers and their infants in the context of treatment for malnutrition.

Elizabeth Jayne Knight

September 2016

Word count 32,094

Thesis submitted in part fulfilment of the degree of

Doctorate in Clinical Psychology

University of East Anglia

© This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with the author and that use of any information derived there from must be in accordance with current UK Copyright Law. In addition, any quotation or extract must include full attribution.

## **Acknowledgements**

Firstly, I would like to thank all of the mothers and infants in Ethiopia who gave up their time to be filmed and in turn provided us with a unique insight into their lives. I will remain grateful for this opportunity and I wish all the best to the families involved in the trial.

Secondly, I must thank my supervisors on this project who have supported me on this long journey. My immense gratitude is with Professor Peter Fonagy, whom it has been a real privilege to work with. Without his guidance, support, motivation and containment, this journey just would not have been possible. Thank you also to Dr Kiki Mastroyannopoulou for your invaluable advice, support, and helpful feedback on drafts.

I would like to thank Professor Lynne Murray, Dr Michelle Slead and Laura Bozicevic for their training and guidance on parent infant interaction scales. Also a special thank you to Rose Palmer at UCL, for your help and guidance in relation to the RCT.

Finally, my enormous gratitude to my parents, family and friends who have supported me in every way possible over many years. To Sadie, Ella and Remy for those moments of calm and serenity that have been so welcomed during this process. And finally to my Rose, who joined us along the way and who has taught me more about the wonder of motherhood, than I realised was possible.

## Abstract

Infant malnutrition in developing countries, such as Ethiopia, has been linked to a number of negative outcomes (Grantham-McGregor et al., 2007). Evidence suggests that aspects of the relationship between mother and infant may be affected by malnutrition, in terms of attachment (Valenzuela, 1990) and the opportunities for emotional stimulation within the mother-infant relationship (Cravioto & Delicardie, 1975; 1976). This study examines whether an emotional stimulation intervention delivered in addition to emergency food supplementation, may improve the quality of mother-infant interactions.

This study uses between-subjects post test and correlational designs. Interactions were recorded for 75 mother-infant dyads, who were enrolled on a randomised controlled trial, comparing the impact of an emotional stimulation intervention on infant weight gain during treatment for malnutrition. Mother-infant interactions were rated using two established coding systems, adapted for the current study.

The results indicated that mothers who had received an emotional stimulation intervention in addition to infant nutritional supplementation, were rated as more positive in their interaction with their infants in comparison to the control group. The nature of the interaction was also rated as significantly more positive for mothers and infants in the intervention group. There were no differences between control and intervention groups on infant positive affect and behaviour. This may be attributable to timeliness and methods of measurement. A significant relationship was found between the rate of infant weight gain and the quality of the interaction. Path analysis failed to find support for pathway between the quality of maternal interaction and infant weight gain. This was an exploratory analysis and results were attributed to a lack of statistical power to detect an effect.

The findings are considered in relation to theories of the mother-infant relationship, models of malnutrition, methodological rigor. Recommendations for further research are discussed.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	ii
ABSTRACT.....	iii
TABLE OF CONTENTS.....	iii
LIST OF APPENDICES.....	ix
LIST OF TABLES.....	x
LIST OF FIGURES.....	xii
CHAPTER ONE: Introduction.....	1
1. Chapter Overview.....	1
1.1 Defining the mother-infant relationship.....	1
1.2 Theoretical understanding of the importance of the mother-infant relationship.....	2
1.2.1 Psychoanalytic theories.....	2
1.2.2 Attachment theory.....	3
1.2.2.1 Sensitivity hypothesis.....	4
1.2.2.2 Universality hypothesis.....	5
1.2.3 Dimensions of mother-infant interactions.....	7
1.2.4 Responsiveness.....	8
1.2.5 Disruptions to the mother-infant relationship.....	9
1.3 Interim summary.....	10
1.4 Measuring mother-infant interaction.....	10
1.5. Improving the quality of the mother infant interaction in developing countries.....	13
1.6. Review of interventions focused on improving mother-infant interactions in developing countries.....	15
1.6.1 Type of intervention.....	20
1.6.2. Training.....	22

1.6.3 Measurement.....	23
1.6.4. Methodology.....	24
1.6.5 Study findings.....	25
1.6.6 Conclusions.....	26
1.6.7 Summary of literature review findings.....	26
1.7 Ethiopia.....	27
1.7.1. Background.....	27
1.7.2. Malnutrition.....	27
1.7.3. Impact of malnutrition on the mother-infant relationship.....	28
1.7.4 Correlates of disrupted mother-infant interaction in the context of malnutrition.....	31
1.7.5 Emotional Stimulation and Malnutrition.....	34
1.8. Theoretical basis for interventions targeted at improved mother-infant interaction....	39
1.9. Interim summary.....	39
1.10. Rationale for this study.....	40
1.10.1. Aims of the current study.....	41
1.10.2. Research Questions and Hypotheses.....	41
1.10.2.1. Primary question.....	41
1.10.2.1. Secondary questions.....	42
CHAPTER TWO: Method.....	43
2.1 Overview.....	43
2.2 Design.....	43
2.3 Participants.....	44
2.3.1 Target sample.....	44
2.3.2 Inclusion and Exclusion criteria for the RCT from which the data is derived..	44

2.3.3. Inclusion/exclusion criteria in relation to the current study.....	46
2.2.4. Sample size.....	47
2.2.5 Sample characteristics.....	48
2.3 Measures.....	48
2.3.1 Coding Interactive Behaviour Scale.....	48
2.3.2. Global Ratings of Mother Infant Interaction Scale.....	49
2.3.3. Rationale for selection of study measures.....	49
2.3.4. Mother GRS scales selected for coding.....	50
2.3.5 Scales omitted from Mother GRS scales.....	51
2.3.6. Mother CIB scales selected for coding.....	52
2.3.7. Infant scales selected for coding.....	52
2.3.8. Interaction scales selected for coding.....	52
2.3.9. Infant weight measurement.....	53
2.4 Ethical considerations.....	53
2.4.1 Ethical approval.....	53
2.4.2 Informed consent.....	53
2.4.3 Confidentiality and storage of interaction data.....	54
2.5 Procedure.....	54
2.5.1 Training of study workers delivering interventions.....	57
2.5.2 Recording interactions.....	57
2.5.3 Training and reliability.....	58
2.5.4 Coding procedure.....	59
2.6 Plan of Analysis.....	60
2.6.1 Data assumptions.....	60
2.6.2 Analysis.....	60

2.6.2.1. Hypotheses 1: Does emotional stimulation in the context of emergency food supplementation lead to more positive mother-infant interactions?.....	60
2.6.2.2 Hypotheses 2: Are the group differences in infant BMI mediated by the quality of the mother-infant interaction? .....	61
CHAPTER THREE: Results.....	63
3.1 Chapter Overview.....	63
3.2 Data preparation.....	63
3.2.1 Testing assumptions of parametric data.....	63
3.2.2 Descriptive statistics.....	63
3.2.3 Coding Interactive Behaviour Scale (CIB) properties.....	66
3.2.4 Global Rating Scale (GRS) properties.....	69
3.3 Analysis of Hypotheses.....	73
3.3.1 Hypotheses 1 - Does emotional stimulation in the context of emergency food supplementation lead to more positive mother infant interactions?.....	73
3.3.1.1 Measuring mother-infant interaction with CIB.....	73
3.3.1.2 Measuring mother-infant interaction with GRS.....	75
3.3.1.3. Summary of Hypotheses 1.....	81
3.3.2.Hypotheses 2 - Are the group differences in infant BMI change mediated by the quality of the mother-infant interaction? .....	81
3.3.2.1 Preliminary analysis.....	81
3.3.2.1 Mediation analysis.....	83
3.4 Chapter summary.....	85
CHAPTER FOUR: Discussion.....	87
4.1 Overview .....	87
4.2 Summary of Results.....	88

4.2.1. Primary Research Question.....	88
4.2.1.1 Maternal interactive behavior.....	89
4.2.1.2 Infant interactive behaviour and communication.....	91
4.2.1.3 Quality of dyadic interaction.....	92
4.2.2 Secondary Research Question.....	93
4.3 Strengths and Weaknesses of the study.....	94
4.3.1 Design.....	94
4.3.1.1 Baseline characteristics.....	96
4.3.2. Recruitment and Participants.....	98
4.3.3 Ethical Issues.....	100
4.3.4 Measures.....	101
4.3.5 Procedure.....	105
4.3.6 Data analysis.....	106
4.4 Theoretical Implications.....	107
4.5 Clinical Implications.....	110
4.6 Further Research.....	110
4.7 Conclusion.....	112
REFERENCES.....	114
APPENDICES.....	139

## **LIST OF APPENDICES**

Appendix A: Literature search

Appendix B: Power calculation

Appendix C: Details of the main study

Appendix D: Reflections on my involvement in the work

Appendix E: Coding Interactive Behaviour Scale

Appendix F: Global Rating Scale

Appendix G: University College London Ethics approval

Appendix H: Amended GRS items

Appendix I: Amended CIB items

## LIST OF TABLES

Table 1.1	Intervention studies aimed at improving mother-infant interaction in developing countries
Table 2.1	Inclusion and Exclusion Criteria from RCT
Table 2.2	Types of medical complications requiring exclusion from the study and referral for inpatient treatment.
Table 2.3	Structure of Nutritional Education Intervention session
Table 2.4	Structure of Emotional Stimulation session
Table 2.5	Inter-Rater Reliability Scores for CIB and GRS Indexes
Table 3.1	Sample characteristics of each group and between group comparisons
Table 3.2	Summary of individual CIB scales and composite scales across both groups
Table 3.3	Correlation matrix for CIB scales
Table 3.4	Summary of individual and composite GRS scales across both groups.
Table 3.5	Correlation matrix for GRS mother scales
Table 3.6	Correlation matrix for GRS infant scales
Table 3.7	Correlation matrix for GRS interaction scales
Table 3.8	Effects of group on GRS and CIB scores, when controlling for mother literacy, last infant BMI measurement (BMIl <sub>last</sub> ) and difference between infant BMI at baseline and after treatment (BMIdiff)
Table 3.9	Correlation matrix for relationship between composite

interaction measures and measures of infant body mass index.

Table 3.10 Correlation matrix of BMI variables with group

Table 3.11 Correlations of CIB and GRS scales with group

## LIST OF FIGURES

Figure 1.1	Extended care model	29
Figure 3.1	Proposed pathway for meditational analyses	84



## **Chapter 1. Introduction**

### **1. Chapter overview**

This study examines whether an emotional stimulation intervention can improve the quality of mother-infant interactions in a developing country, where the prevalence of adversity can impact upon a number of areas of infant development. This study focuses on a particular area of adversity often experienced in developing countries, namely, infant-malnutrition. It explores whether an intervention provided in addition to emergency food supplementation, can improve mother-infant interactions in a sample of Ethiopian mother-infant dyads.

This chapter begins by examining the importance of the mother-infant relationship with a discussion of some of the key theories. It goes on to explore some of the factors that can affect the way in which mothers and infants interact and considers how parent-infant interaction has been measured in the literature. Particular reference to the relative strengths and weaknesses of these measurement methods takes place. A brief discussion of research aimed at improving mother-infant interaction is provided. Following that, a more thorough exploration and review of the literature related to mother-infant interaction in developing countries takes place.

The final section of the introduction addresses issues of key importance to the study population. A summary of the background, social, economic and cultural context of Ethiopia is provided. The impact of malnutrition on infant development is outlined, providing a clinical rationale for the current study. Lastly, it explores the evidence and theoretical underpinning of the study aims, which suggests that mother-infant interaction is modifiable in this population. This leads to the research questions and hypotheses for the current study.

### **1.1 Defining the mother-infant relationship**

Infancy is generally referred to as the period from birth to the acquisition of language. Winnicott (1960) usefully elaborates upon this delineation. He described it as the period in which the infant is without the use of language to communicate its needs and where, crucially, there is a greater reliance on the ability of the mother to empathise with the infant in order to

understand its needs. Over time, it has been observed that the term ‘mother-infant’ is used interchangeably in the literature to also include later stages of child development, following the acquisition of language. In the interest of consistency, the term ‘mother-infant’ is used when describing the current study, but with the term being applied across the period from birth until early childhood.

The mother-infant relationship underpins the provision of infant care (Bowlby, 1951). It is recognized as being of key importance to the survival and development of all aspects of the infant (Engle, Lhotska & Armstrong 1997). Whilst this premise underpins the rationale for this study, it is important to recognise that early relationships are not exclusive to the mother-infant dyad. Indeed, much research has explored and established the importance of father-infant relationships and of relationships with other family members (Lamb & Lamb, 1976). It is also important to consider that the primary caregiver role may not always be exclusive to the biological mother of the infant. However, for the purposes of this study, the focus will remain on the relationship between the mother and infant, but with reference and application to literature relating to caregiver and parent, when relevant. The forthcoming sections refer to the theory and research supporting the importance of the same.

## **1.2. Theoretical understanding of the importance of the mother-infant relationship.**

### **1.2.1 Psychoanalytic theories.**

The early psychoanalytic writings on the infant by Freud were not fully developed in their account of the mother-infant relationship. This was notably due to a large focus on the conceptualisation of the mother as an object for satisfying internal pleasure seeking drives (Ainsworth, 1969). These early positions essentially focused on a behavioural component to the experience (for example, the mother positively reinforces the infant’s drive for pleasure). However, these basic principles have been incorporated and expanded upon by later psychoanalytic theorists. Anna Freud’s (1964) position on object-relations describes the experience of the infant’s connection of the mother to the relief of tension and acquisition of

pleasure (Ainsworth, 1969). Daniel Stern (1985) further developed these early ideas to explain the mother-infant relationship as a key structure in which the infant develops a sense of self. This takes place through the experience of care, social interaction and relations with others, thus placing more of an emphasis on the subjective experience of the infant in these early relationships (Richter, 2004).

A central theme across the psychoanalytic accounts of the mother-infant relationship is that of dependency (Klein, 1946; Winnicott, 1965). The maternal caring environment is seen as changing from one in which the infant is reliant and unable to exist without care, to a move towards independence with the development of a sense of separateness, in accordance with a recognition of the self and mother. The “holding environment” (Winnicott, 1960, 1965) is referred to as the setting through which the infant experiences itself, mirrored through the care received from the mother. This in turn contributes to the development of the self (Richter, 2004).

In essence, psychoanalytic accounts capture the importance of the mother-infant relationship, in terms of the provision of an environment in which the infant can develop a sense of self through its experience of care and interaction within the maternal environment.

### **1.2.2 Attachment theory.**

Attachment theory (Bowlby, 1969) places importance on early relationships for the successful survival and development of infants. Developed from an evolutionary and biological perspective, it presupposes that the mother-infant relationship is innately driven to ensure the infant’s close proximity to the mother for survival. Due to the dependence of the young infant, maintaining proximity to their caregiver enables their physical and emotional needs to be met adequately. Infants therefore engage in attachment behaviours, which are primarily focused on eliciting an appropriate response from the attachment figure (for example, crying and following). This creates a transactional context in which behaviour elicits desired responses to maintain the survival and safety of the infant (Bowlby, 1977). Over time, sensitive maternal responses to infant attachment behaviours lead to the development of a ‘secure base’ (Bowlby, 1988) in

which infants (and later children and adolescents) become confident to explore the world. This confidence is based on their experiences of care, which suggest that their needs will be responded to if required. Attachment theory takes a life span approach, in that attachment behaviours continue to be activated in response to experiences such as threats or losses in order to gain proximity to, or a caring response from another.

As described by Richter (2004), Bowlby posited that the “formation of an ongoing, warm relationship is as crucial to the child’s survival and healthy development as the provision of food, child care, stimulation and discipline (Hinde, 1991; Rutter, 1995)”. This outlines the importance of the infant’s early experiences of receiving care. Ainsworth, Blehar, Waters and Wall (1978) found that during the first year of life there were certain patterns of infant behaviours observed that indicated the quality of attachment security. This gave rise to descriptive terms of attachment classifications. Through research using the Strange Situation Procedure (Ainsworth et al.,1978), infants were found to demonstrate behaviours that fell into four categories of attachment; Secure, Insecure/Avoidant, Insecure Avoidant/Ambivalent, and Disorganised. Broadly, secure attachments were characterised by the use of the mother as a secure base, whereas insecure attachments showed behaviours that would suggest that there is some inconsistency in their experience of a secure base.

#### ***1.2.2.1. Sensitivity hypotheses.***

Ainsworth and colleagues further developed the understanding of attachment theory through noting the relationship between how sensitively the mother responds to the infant’s cues and later attachment classification. This gave rise to the sensitivity-responsiveness hypothesis of attachment theory (Ainsworth et al.1978). Sensitivity is described as a mother’s attunement to their infant’s behaviours and signals, which allows her to adapt and respond appropriately to meet the infant’s needs (Bowlby, 1988; Ainsworth, Bell & Stayton, 1974). In essence, it suggests that responding with sensitivity leads to a more secure attachment. When research has tested this tenant of the theory (Ainsworth et al.,1978; Bakermans-Kranenburg, van IJzendoorn.

& Juffer, 2003), some reviews have found less strong relationships between sensitivity and attachment security. It has been suggested that the predictive validity of maternal sensitivity is only activated in the context of a stable family environment (Goldsmith and Alansky, 1987; Lamb, Thompson, Gardner & Chamov, 1985). The relationship between attachment security and sensitivity has also been found to be less strong in at risk populations (Seifer et al., 1996; Ward & Carlson, 1995). This is perhaps due to the number of additional complex factors that may influence the mother-infant relationship (De Falco et al., 2014) or thorough measurement differences.

Overall, it appears that maternal sensitivity plays a vital part in the secure attachment of mother and infant. However, there is evidence to suggest that it is not an exclusive determinant of attachment security (De Wolff & van IJzendoorn, 1997). Consequently, it may be of benefit to focus more on the interactive quality of maternal sensitivity; for example, in terms of how maternal sensitivity increases in response to child attachment behaviour and vice versa (Koops, Hoeksma & van den Boom, 1997). It is also possible that some of the differences in the literature relating to sensitivity and attachment may relate to difficulties in measurement (Belsky & Fearon, 2008) and particular settings may be more conducive for measuring sensitivity and attachment. This was demonstrated by Leerkes, Weaver and O'Brien (2012), who found that maternal sensitivity measured during an episode of infant distress had a stronger relationship with attachment security. This suggests that there are particular settings in which the construct of maternal sensitivity is more active. Research continues to explore and provide support for the sensitivity-responsiveness hypotheses. However, on balance, it remains that maternal sensitivity and responsiveness are important determinants of secure attachment (Carlson & Harwood, 2003), with maternal insensitivity and unresponsiveness being linked to insecure attachment (Isabella & Belsky, 1991).

#### ***1.2.2.2. Universality hypotheses.***

Another hypothesis derived from attachment theory relates to its universality. Broadly

speaking, this suggests that attachment security is a trait observed across all cultural contexts (Bowlby, 1969, 1988; van IJzendoorn & Kroonenberg, 1988; van IJzendoorn & Sagi, 1999, 2001) as observed by traditional measurement techniques such as the 'Strange Situation Procedure (van IJzendoorn & Kroonenberg, 1988) and Attachment Q-Sort' (Posada et al, 2013). However, the impact of culture on attachment behaviours is complex and an area that requires further exploration. To this end, there has been much debate within the literature. Based upon the findings of a study in Japan, Rothbaum, Weisz, Pott, Miyake and Morelli (2000) argued that some of the core hypotheses of attachment theory and the prediction of the premise of universality (in terms of sensitivity-responsiveness, competence and secure base), were not supported. Prior & Glaser (2006) helpfully outline the main points of this debate and several researchers have since pointed out some of the limitations of the Rothbaum et al (2000) claims. These include methodological flaws from the original study and a failure to account for studies with contrasting findings (Posada & Jacobs, 2001). A further limitation was that there was a failure to take into account individual differences within cultures (Chao, 2001), when it appears that the literature points more to the complexity of intercultural differences (van IJzendoorn & Sagi, 2001).

Whilst the majority of the literature supports the cultural universality of attachment in terms of the secure base hypothesis (Posada, 2001; Posada et al, 2013), this remains a complex area requiring further study to address some of the challenges posed in the application of single study research across cultures. Research in Mali, Africa (True, Pisani & Oumar, 2001) found that when exploring attachment classifications, it was possible to observe Secure and Insecure attachments but with noticeable reductions (and in some cases, absence) of Resistant and Avoidant classifications. This suggests a possibility that attachment behaviours can also be adaptive to their specific cultural context. The relationship between sensitivity and attachment also appears to be variable across cultures. There is evidence to suggest that in some African countries, maternal sensitivity alone does not predict attachment security, as was also found in

Mali by True et al. (2001). However, Tomlinson, Cooper and Murray (2005) found that in South Africa, sensitivity was an important predictor of later attachment.

Whilst there remains some variation, the current theory and literature suggest the utility of the application of attachment theory across different cultures. However, it is important that within this, cultural differences are understood and incorporated. An example of this is how maternal sensitivity can be expressed through different behaviours, which may be derived from cultural beliefs about parenting (McCollum & McBride, 1997). Alternatively, cultural differences in the expectations of infant behaviour can influence some of the ways in which outcomes related to attachment are measured. For example, certain cultures may have different views on the encouragement of infant exploration, which is central to the secure base hypothesis (Rothbaum et al 2000). These cultural views would therefore influence the frequency in which these infant behaviours were observed (depending on whether there were cultural views that would encourage or discourage said behaviours) and thus, would need to be taken into account when measuring attachment behaviour.

### **1.2.3. Dimensions of mother-infant interactions.**

As attachment theory has been tested and developed, it has given rise to an understanding of some of the important dimensions of the mother infant relationship. Research has then focused on further exploring these dimensions (Isabella, 1993). Maternal sensitivity is widely accepted to be highly related to secure attachment (Ainsworth, 1978) and this is a finding that has been well replicated, but with differing results as to the strength of the relationship (De Wolff & van IJzendoorn 1997; True et al., 2001; Tomlinson et al., 2005).

De Wolff and van IJzendoorn (1997) identified that in addition to a moderate relationship between sensitivity and attachment; a number of other dimensions of the parent-infant relationship were significant contributors to attachment security. These include: mutuality, which is the extent to which the dyad engage in joint attention and mutual positive exchanges; synchrony, which accounts for the reciprocity of the interaction; stimulation, in terms of the

efforts of the mother to engage the infant; positive attitude of the mother towards the infant; physical contact; co-operation, which includes the extent to which the mother displays non-intrusive behaviour; and emotional support, which describes the mothers emotional availability and ability to make the infant feel secure. The nature of the mother's response to infant behaviour and signals is also considered a key component of the attachment relationship (Trevarthen, Murray & Hubley, 1981) and is included in the dimensions outlined by De Wolff and van IJzendoon (1997). This is explored in depth in the next section.

#### **1.2.4 Responsiveness.**

The ability of the mother to be responsive to the infant is undoubtedly important in terms of meeting the needs of the infant in a timely and appropriate way (Trevarthen et al., 1981). It is essential for the development of the attachment relationship and survival of the infant. As pointed out by Richter (2004), when defining the concept of responsiveness accurately; it is important to go *beyond* the ideas of contingent responses to infant signals (Beckwith & Cohen, 1989; Clarke-Stewart, 1973) and to consider responsiveness more within a relational concept. Richter (2004) defines responsiveness at a relational level as an “attunement, interactive matching and synchrony”, which again, suggests a need to look at the wider context of the reciprocal relationship. These ideas are supported by the findings of a longitudinal study, which observed significant variation in maternal responsiveness over time, according to the infant age (Bornstein, Tamis-Lemonda, Hahn & Haynes 2008). The authors concluded that it was more helpful to consider a multi-dimensional and modular account of responsiveness, in that the level of maternal responsiveness in one area does not necessarily generalise to infant abilities in another area. This also represents a shift from a traditional focus on the behaviour of the mother in response to the infant, to an understanding that infant initiated behaviour is an important determinant of the mother's response.

Maternal responsiveness has been clearly linked to a number of important infant outcomes such as; the quality of attachment (Ainsworth et al., 1978; Raval et al., 2001), and

improved cognitive (Lewis & Goldberg, 1969) and social functioning (Sroufe & Fleeson, 1984). Additionally, maternal unresponsiveness has been found to relate to some negative long-term outcomes such as, aggressive and disruptive behaviours at 3 years old (Shaw, Keenan & Vondra, 1994), as well as externalising problems at 10 years old (Wakschlag & Hans, 1999). Over-responding can also be associated with difficulties, in that it may lead to infant hypervigilance and maternal insensitivity (Ainsworth et al, 1974). Therefore, a more optimal position might be an appropriate response to most, but not every, infant signal (van den Boom, 1994). Overall, maternal responsiveness is an important correlate of the mother-infant relationship with links to infant outcomes, but one that requires further understanding of its specific interactional components and predictive power.

### **1.2.5 Disruptions to the mother-infant relationship.**

The security of the attachment of a child to its mother (or primary caregiver) has been found to be associated with a number of important developmental outcomes, such as: academic attainment (Moss, Rousseau, Parent, St-Laurent, & Saintonge, 1998) and peer relations (Verschueren & Marcoen, 1999); and can relate to childhood externalising behaviour (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman (2010). In the longer term, attachment security has been found to relate to a number of long-term outcomes, such as mental health difficulties (Levy et al., 2005). However, there are some methodological limitations and variability in findings. One example of this is the relationship between attachment security and adult anxiety (Mikulincer et al., 1993; Shaver & Brennan, 1992), which may not necessarily be causal. It is entirely possible that other factors combine with attachment security to account for these future outcomes (Dozier et al.1999). Despite some variability in the strength of associations and other potential variables involved, research generally supports the view that early attachment relationships are an important foundation for the future.

Threats to early attachment security come in many forms, including maternal mental health, poverty and physical illness (Cassidy et al., 1992). Consequently, it has been established

that up to 82% of children deemed to be in high psychosocial risk situations have been found to have disorganised attachment styles (van Ijzendoorn, Schuengel & Bakermans-Kranenburg, 1999). It is clear that there are many wide ranging factors that impact upon attachment security, including individual and systemic factors. In light of the long-term implications of early disruptions to attachment, it is therefore important for interventions to target some of the risk factors for attachment security.

### **1.3. Interim summary**

In summary, there are several theoretical approaches, which underpin the importance of the mother-infant relationship. This thesis has primarily considered psychodynamic and attachment theories. Attachment theory has continued to develop over the years, but essentially, its main premises have held throughout. Research has established the importance of a secure base, the relationship between sensitivity-responsiveness and secure attachment and also supported the universality of attachment theory. In essence this forms the basis for testable predictions, as to the impact of disrupted attachment upon long-term outcomes. This is an area, which again, has been much researched over the years. Due to the relationship between mother-infant interaction and the development of attachment security it is important to consider further, how these concepts are measured.

### **1.4 Measuring mother-infant interaction**

After establishing the theoretical underpinning of the mother-infant relationship and its impact on interactions, it is useful to explore how the predictions deriving from attachment theory have been tested out through research. In general, the quality of mother-infant interaction can be measured in different ways; through rated assessments (parent or self), narrative accounts or through systematised observation. The type of measurement used is often dependent on the behaviours of interest (Lotzin et al., 2015). For example, a self-report measure may be of interest to measure intrinsic variables, such as, beliefs or subjective feelings that may underpin the mother-infant interaction. However, they are consequently at risk of bias due to their subjective

nature.

Observational methods have been prevalent in the literature across several decades. Ainsworth's (1978) work in Uganda demonstrated the utility of deriving data from the observation of mother-infant interactions. Consequently, much of the mother-infant interaction research has continued to utilise these methods in different forms, using a range of methods such as: micro-analysis of behaviours (Feldman, Greenbaum & Yirmiya, 1999) and global rating systems (Ainsworth, Bell, & Stayton, 1971; Biringen, Robinson, & Emde, 1998; Tomlinson, Cooper, & Murray, 2005). A micro-analytic approach involves ratings of discrete behaviors over very small time periods, such as each frame or second. Whilst this may be a very detailed approach, it is also time consuming, which in turn limits the duration of interaction that can be coded (usually around 5 minutes). As pointed out in a review by Mesman (2010), micro-analytic ratings do not necessarily correlate well with global measures of interaction. This may be due to maternal and infant behavior being coded separately, which may not take into account the context of the behaviours. In contrast, macro-analytic approaches focus on a global rating of interactive behavior, based on the entirety of the interaction. A benefit of this approach is the ability to relate maternal responses to infant cues, however, these ratings often use Likert scales with differing variability, thus meaning that some of the detail of the behavior could be lost by the limits of the scale.

Several reviews of parent-infant interaction measures have been published, which give an account of the relative strengths and weaknesses of these approaches (Gardner, 2000; Lotzin et al., 2015). As outlined by Gardner (2000), the reporting of the psychometric properties of these rating systems can be lacking. For example, whilst inter-rater reliability is often described in published studies, test-retest reliability of measures are rarely reported. Gardner (2000) suggests that this may be due to the resources involved in rating interactions, but also potentially the variability in interactive behaviours over time. This leads to the question of whether the measurement of certain behaviours in a discrete setting can be deemed an accurate

representation of the typical mother-infant relationship (Lotzin et al., 2015). Construct and predictive validity is also found to be lacking for many of the parent-infant observational measures (Lotzin et al.; Gardner, 2000). This again affects the extent to which the measures can be reliably assumed to capture a particular construct. Overall, a thorough and systematic review by Lotzin et al. suggests that further work needs to be carried out to ensure that assessment tools are of sound validity, have established relationships with developmental outcomes, provide clear guidelines on scoring and interpretation, and are culturally sensitive and include validation with paternal samples.

Another difficulty is that in order to measure behaviour, whether it be rating the quality or frequency, the behaviour in question needs to be well defined and described. An example of this is the construct of maternal sensitivity (Ainsworth, 1976). Depending on the measurement system, sensitivity can be rated by a single code or by a composite of several scales (Ainsworth, 1976; Feldman, 1998). The variability in the measurement of this construct could therefore account for some of the variability in the literature relating to the association between sensitivity and attachment (Belsky & Fearon, 2008). Whilst comprehensive training and operationalised definitions go some way to reduce the error that can be caused by the ambiguity of behaviours, this is still an area that requires attention for parent-infant interaction research.

A further challenge is that measuring mother-infant interaction during one discrete episode does not always provide a true reflection of the nature of the relationship and usual interactive patterns (Murray, Fearon & Cooper, 2015). Assessments are difficult to carry out in truly naturalistic settings, thus meaning that observations often take place in laboratory or clinic settings and are guided by specific instructions or tasks for the mother-infant dyad to complete. It is therefore not known whether behaviours observed in these settings might be typical of those found at home (Gardner, 2000). There is some evidence to suggest that repeated assessments of interaction can increase their predictive validity (Lindheim, Bernard & Dozier, 2011) and therefore may prove a more accurate picture of the interactive style of mother and infant.

However, as discussed previously, this can be difficult to carry out in practice due to resource constraints. Murray et al., (2015) also recommend that it is optimal to carry out observations in a home setting, in order to gain a more naturalistic understanding of typical interaction of the mother and infant.

One of the greatest challenges in using observational assessment is ensuring that the cultural context is taken into consideration. As discussed previously, the literature points to the universality of certain elements of the mother-infant relationship (for example, sensitivity and attachment). However, there are also cultural differences that influence measurement of such concepts, for example, there may be differences in how these concepts are demonstrated through behaviours as a result of cultural parenting styles and norms. A recent review by Mesmen and Emmen (2013) identified a number of observational scales of maternal sensitivity that have been used widely in Non-Western countries, such as the Emotional Availability Scale (John, Morris, & Halliburton, 2012), Global Ratings of Mother-Infant Interaction (Murray, Fiori-Cowley, Hooper, & Cooper, 1996; Tomlinson, Cooper, & Murray, 2005) and the Coding Interactive Behaviour Scale (Feldman & Masalha, 2010). It is essential that research continues to test and develop valid rating scales of mother-infant interaction, whilst taking into account cultural factors.

In summary, observational methods remain one of the main ways of measuring mother-infant interaction. However, there are many limitations and difficulties inherent with this method of assessment, which require some caution to be applied in the interpretation of the findings of these assessments. Despite these difficulties, the use of observational methods allows a useful insight into the interactive relationship of the mother and infant.

### **1.5. Improving the quality of the mother infant interaction in developing countries**

As discussed above, the mother-infant relationship is of key importance for the physical, social and emotional development of the infant. Some key elements of this relationship (that is, attachment) are shaped by the interaction between the mother and her infant. It has also been

established that there are many adverse factors that can influence these early relationships, such as, poverty, social adversity (De Falco et al., 2014; Gunning et al., 2013; Walker, et al., 2007) and maternal depression (Cooper et al., 1999). These factors may be more prevalent in developing countries and can lead to the loss of developmental potential for many children (Grantham-McGregor et al., 2007), as well as disruption to the mother-infant relationship. As a result, this disruption to the mother-infant relationship can negatively impact upon attachment security (Valenzuela, 1997; Walker et al, 2011). The absence of emotional stimulation in the environment has also been identified as being one of the key risk factors for impaired child development in developing countries (Walker et al., 2007). Consequently, it has been found that increasing the opportunities for emotional stimulation through a targeted mother-infant intervention appears to have a positive effect on the quality of the mother-infant relationship (Cooper et al, 2009).

It is equally important to enhance factors, which may protect against early childhood inequality and disruption to the mother-infant relationship. Walker et al. (2011) suggests that maternal education can act as a protective factor against early childhood inequality. The mother's education is potentially important for the mother-infant relationship, due to the links between caregiver knowledge of child development and the provision of adequate stimulation and response to infant cues (McGillicuddy-DeLisi, 1982; Richter et al., 2004; Sigel, 1985). It may be that low maternal education is linked to a lack of knowledge of the importance of providing developmentally appropriate psychosocial stimulation and sensitive responses to infant cues (Pederson et al., 1990).

It is imperative that we look at the wider context of the developing world and ways in which the risk factors for adversity can be reduced and protective factors increased. Clearly, this would involve a wider focus at a societal level to try and reduce some of the poverty and inequality that is prevalent in these countries. Unfortunately, a more in-depth discussion of these issues is beyond the scope of this current study. However, it is important to add a caveat to the

following sections; that whilst the focus may be at an individual level (that is, on the mother-infant dyad), the need to consider the wider context of these difficulties remains vital.

There have been a wealth of intervention studies in the Western world, which have looked at ways of improving the quality of mother-infant interaction in the presence of a range of risk factors. Such factors have included: depression (Puckering, McIntosh, Hickey & Longford, 2010), homelessness (Sleed, Baradon, & Fonagy, 2013), and at-risk populations, such as mothers and infants in prison (Baradon et al., 2008). These studies have found a number of improved outcomes, such as the security of attachment and quality of mother-infant interaction.

A number of large-scale reviews and meta-analyses have taken place to look at the types of intervention that can improve attachment and/or mother infant interaction in developed countries. Bakersman-Kranenburg, van IJzendoorn & Juffer (2003) concluded from a meta-analysis that the most optimal outcomes, with regards to security of infant attachment, are found in studies where the intervention focuses on improving maternal sensitivity and responsiveness. Research continues to look to find the most favorable approach in terms of outcomes. A recent comprehensive review and meta-analysis was undertaken of Parent Infant Psychotherapy studies (Barlow et al., 2015), a psychodynamic oriented therapeutic intervention. Overall, these interventions were found to be favourable when looking at attachment outcomes. However, there did not appear to be an effect when compared to treatment as usual or no treatment on a number of other outcomes, such as parent-infant interaction.

In light of the evidence demonstrating improved outcomes from mother-infant interventions in the Western world, it is important for research to look towards developing countries where there is a greater prevalence of adverse risk factors.

## **1.6. Review of interventions focused on improving mother-infant interactions in developing countries**

A number of studies have been carried out across low and middle income countries and the developing world, targeted at the mother-infant relationship (Henningham & Boo, 2010; see

also Aboud & Yousafzai, 2015; Grantham-Mcgregor, Fernald, Kagawa, & Walker, 2014). The types of intervention are wide ranging and include: parenting interventions, psychosocial stimulation, educational interventions, as well as those combined with other methods, such as nutritional supplementation.

Searches were carried out on 19<sup>th</sup> July 2016 over CINAHL, PsycInfo, PsycArticles, Medline, PubMed and Embase to identify relevant studies for review. Further details of the procedure are provided in Appendix A. A total of 284 studies from peer-reviewed journals were identified. Studies were included for review if they used a between-groups design, with an intervention component aimed at improving mother-infant interaction. They were also selected for inclusion if there was an outcome measurement related to the quality of mother-infant interaction. Some issues of key importance are related to the feasibility of implementation of these interventions in low resource countries and in terms of the measurement of mother-infant interactions in different cultures. These studies are reviewed with these themes in mind, alongside consideration of the general methodological issues and findings. A summary of these studies can be found in Table 1.1.

Table 1.1

Intervention studies aimed at improving mother-infant interaction in developing countries.

Study	Study characteristics	Intervention type	Outcomes	Summary
Hamadani, Huda, Khatun & Grantham – McGregor (2006)	Pakistan Sample: Undernourished infants between 6 and 24 months	Psychosocial stimulation intervention plus nutritional supplementation.	Bayley Scales of Infant Development.	No improvement to infant growth across both groups.
			Child height & weight	Infants in the

				intervention group showed improvements on development outcomes.  Mothers in the intervention group had greater knowledge of child rearing
	Design; <i>N</i> =214 RCT		Mother's knowledge of childrearing	
Cooper et al. (2013)	South Africa  Sample: Mothers and infants aged between 14-18 months.  Design; <i>N</i> = 30 RCT Pilot study	Book sharing training.	Mothers interactive behaviour and infant language and attention	Improved maternal sensitivity, facilitation and elaboration.  Improvements to infant attention and language relative to controls.
Cooper et al. (2002)	South Africa  Design; <i>N</i> = 64 Between groups	Aimed at improving emotional	Maternal mood, infant growth and quality of	No sustained improvement on maternal mood.

	design	support for mother and encouraging increased sensitivity and responsiveness to infant.	mother-infant interaction	Intervention group were rated as having more positive mother- infant interactions.
Cooper et al. (2009)	South Africa  Sample: Mothers and infants recruited during pregnancy and followed up until 18 months.  Design: <i>N</i> = 449  RCT	Parenting intervention aimed at improving sensitivity and responsive parenting.	Quality of mother-infant interaction, maternal depression and infant attachment at 18 months.	Improved depression symptoms at 6 months but not at follow up.  Improved sensitivity and reduced maternal intrusiveness.  Improved infant attachment at 18 months.
Eterm et al. (2006)	Turkey  Sample: Mothers and infants presenting to	Brief intervention based on the Care for Development Intervention, in	Increased play and mother infant communication	Increased stimulation in the home environment but

	health services for acute minor illness.	addition to standard medical treatment.	as measured by Home Observation for Measurement of the Environment Inventory (HOME)	no differences between groups on mother-infant communication.
	Sample: <i>N</i> = 233 Sequential RCT			
Gardner, Walker, Powell and Grantham-McGregor. (2003)	Jamaica Sample: Mothers of low birth weight infants and matched controls.  Design: <i>N</i> = 222 RCT	Intervention focused on increasing communication between mother and infant, increasing responsiveness and engaging infant with environment	Measures of infant behaviour and cognition.	Infant in the intervention group showed improved behaviour and cognition.
Aboud and Akhter (2011)	Bangladesh Sample: Mothers and infants from low-income area as identified by child health organisation.	Additional responsive feeding and play intervention, added to existing child nutrition and development	Measures of infant weight, language development, stimulation opportunities and maternal	Improved rate of infant feeding, stimulation opportunities and maternal responsive communication

---

programme.	responsiveness.	in intervention
Design: $N = 302$		groups.
Cluster RCT		

---

### ***1.6.1 Type of intervention.***

Hamadani et al. (2006) provided mothers with training based on a protocol used in a Jamaican study (McDonald, Grantham-McGregor & Chang, 1987) and adapted for cultural relevance to Bangladesh. A strength of this study was the comprehensiveness of the intervention, which took place weekly over a range of settings, clinic, group, individual and home, for one year. Whilst this may have provided a rich and detailed intervention, it also required a great deal of commitment both from the participants and those delivering the intervention. Interestingly, the dropout rate was relatively small (4.5%), although these were mainly from the intervention group. Overall, it suggests that the intervention was well placed to keep participants engaged throughout.

Cooper et al. (2013) utilised a book-sharing project based on similar interventions with demonstrated efficacy in developed countries (Fletcher & Reece, 2005). It was a relatively short intervention, over 6 weeks, and included both group teaching and a short period of individual training. This meant that it did not rely heavily on resources for delivery or time constraints of the participating mother. Despite this, just under half of the mothers completed the full training course, although most (14 out of 17) attended four out of the six sessions. The authors report a universal positive response to the training, suggesting that the failure to attend all sessions may not have been attributable to the acceptability of the intervention. It does, however, indicate that consideration needs to be given to understand some of the factors impacting upon attendance and for these to be addressed.

Cooper et al. (2002; 2009) used a stimulation intervention incorporating aspects from existing programmes and World Health Organisation guidelines (WHO, 1995) and most

impressively combined items from a validated assessment measure (Neonatal Behavioural Assessment Schedule; NBAS; Brazelton & Nugent, 1995). This allowed the intervention to be tailored to the individual. Again, this was a comprehensive programme over a 6 month period, with sessions ranging from twice weekly to fortnightly. A total of 20% of the participants were lost to follow up but were all as a result of relocation. The fact that the intervention was delivered in participants' homes was a strength and, as attrition can be attributed to relocation, it appears that the method of delivery was optimal in keeping participants engaged.

Eterm et al. (2006) delivered an intervention based on the Care for Development Intervention(CDI; WHO, 2001). The intervention was well described and efficient, taking place over two sessions. There was relatively low loss to follow up, particularly in the comparison group (92.3% completed). The method of delivery was via observation and feedback, with the inclusion of recommended book sharing. It is not clear from the description of the intervention, whether a specific focus was made on responsiveness and sensitivity.

Gardner et al. (2003) described an intervention delivered at home over 8 weekly sessions, lasting an hour. Similar to the other studies, the intervention was based on a comprehensive program developed by the WHO (1995) and is well described by the authors. Reference is made to encouraging mothers to respond appropriately to their infant cues. This suggests that there is a focus on increasing responsiveness and sensitivity, which may be optimal in terms of increasing the quality of the mother infant relationship (Bakersman-Kranenburg, van IJzendoorn, & Juffer, 2003). A relatively small loss to follow up was reported (5.1%).

About & Akhter (2011) delivered a 6 week intervention, in addition to a 12 session nutrition and development program. The additional intervention focused on interaction specific to the feeding environment, as well as training on responsiveness during play. A strength of the study was the approach which was based on social-cognitive learning theory. A control group received only the 12 session nutrition and development program, however, this also included references to child development and responsiveness. Therefore, it is difficult to isolate the

effects of the intervention. Similar to other studies, a relatively small loss to follow up indicated good acceptability of the intervention.

### ***1.6.2. Training.***

An important aspect to consider is the feasibility of the intervention, in terms of the resources required to deliver it in low-income countries. All studies provide details on training methods, with the exception of Gardner et al. (2003), which is a limitation of the study in terms of the replicability of the intervention.

All studies appointed people from the local communities to deliver the interventions, which is a strength in terms of their cultural knowledge and as a potential way to reduce the power dynamic between researcher and participants and to provide a more culturally sensitive intervention. There was variability as to the professional background of the workers delivering the interventions. This ranged from; paediatricians who received further training on the intervention of unclear duration (Eterm et al., 2006); Community Health Workers, with secondary school education (Gardner et al., 2003) to other people from the local community who had received some schooling and were literate (Aboud & Akhter, 2011; Cooper et al., 2003; 2009; 2013; Hamadani et al., 2006).

The length and intensity of the training was again variable. Cooper et al. (2009) trained local women over a period of 4 months in basic parenting and counselling skills, alongside the intervention. It also involved significant support from supervisors. Whilst this is clearly a benefit in terms of delivering a high quality intervention, it is also somewhat resource intensive and may impact upon the replicability and larger scale implementation of the intervention. Cooper et al. (2002) also provided training in basic counselling alongside the intervention, but details of the duration of this were not reported.

Hamadani et al. (2003) described a 2 week training programme in which study workers were trained to serve as play leaders. It also states that they were supervised regularly during the intervention phase, which is a strength of the study and suggests good treatment fidelity. Other

studies in the review, aside from Cooper et al. (2009), did not report supervision of the delivery of the intervention. Aboud & Akhter (2011) describe brief 4 day training on the implementation of the intervention manual. Details of the nature of this training were not provided. Training in the Cooper et al. (2013) study took place over a week and was clearly described. Overall, the majority of these studies demonstrate interventions that are not excessively labour or resource intensive, suggesting that they may be easily implemented on a larger scale.

### ***1.6.3 Measurement.***

All of the studies used different observational methods and provided details of the development of their respective ratings systems. Most of the studies required adaptation of existing validated rating systems to fit with cultural constraints in the absence of validated scales for the population in question. All but one study reported good to excellent inter-rater reliability. Cooper et al. (2002) only achieved satisfactory inter-rater reliability on 3 of their scales that had been developed for the study. Whilst excluding the remaining scales was methodologically necessary, it meant a missed opportunity to examine the impact of the intervention on the overall quality of the interaction and engagement (as well as sensitivity during play and feeding and positive affect). In an extension of the study Cooper et al. (2009) used a well established rating scale (Parent Caregiver Involvement Scale; Farran, Kasari, Comfort, & Jay, 1995), as well as ratings of interactive behaviour and intrusiveness and found excellent inter-rater reliability. Erterm et al. (2006) used a standardised measure HOME (Home Observation for Measurement of the Environment Inventory, Caldwell & Bradley, 1984) and in light of a lack of standardisation for that sample, the authors adapted certain items to be more culturally relevant. It was also used in Aboud and Akhter (2011). However, there are no details of any adaptations that took place for the study population, which may be a limitation. Overall, it is a strength of many of these studies, that efforts have been made to enhance the cultural validity of these scales. This is of particular relevance when considering the absence of highly standardised rating scales for these populations involved in the studies. It further adds to the evidence base for

establishing valid assessment tools for use in these countries.

Aboud and Akhter (2011) also included a picture-talk task in which maternal verbal responsiveness was rated. These were rated by a research assistant on whether each utterance was negative, directive or responsive. This method of measurement is limited as it was carried out in-situ, which therefore did not allow for inter-rater reliability to be reported. It also did not provide an opportunity to code other aspects of responsiveness (such as non-verbal behaviours) or provide an indication of the sensitivity of the responses.

Two of the studies focused their observational measures on infant behaviour, using established scales (Gardner et al., 2003; Hamadani et al., 2006). The scales were developed and adapted to fit with the cultural considerations of the population. However, by not including a measure of maternal interactive behaviour, as well as the general quality of the dyadic interaction, it is not possible to conclude whether the intervention had a specific effect on the quality of the interactions, despite there being some improvements to infant behaviours such as, co-operation, happiness, emotional tone and vocalisations. Hamadani et al. (2006) also included an interview administered questionnaire relating to mothers' caregiving knowledge. Details of the development of this questionnaire or psychometric properties were not reported. However, there was good inter-rater reliability for the scoring of the questionnaire.

#### ***1.6.4. Methodology.***

Overall, the studies reviewed were of sound methodology, with impressive rigour considering some of the challenges faced with carrying out research in the developing world. All but one of the studies reviewed were randomised controlled trials, with the exception of Cooper et al. (2002), which was a pilot feasibility study and included a group of matched controls, without randomisation. Therefore, these studies were well controlled, which is a strength. Where significant differences were found between groups at baseline, they controlled for this in the analysis (Aboud & Akhter, 2011; Cooper et al., 2002; Gardner et al., 2003; Hamadani et al., 2006) Assessors in all studies were blinded to treatment aim, so as to control for bias. All studies

measured outcomes post intervention and two studies included follow-ups. Aboud and Akhter (2011) followed up at 6 months post intervention and Cooper et al. (2009) included a 12 and 18 month follow up. It would have been useful to compare outcomes at follow up for all of the studies to see whether any effects of the intervention were observable. However, it is understandable in the context of research in the developing world, that this may have been challenging to undertake in practice.

Several of the studies included a baseline measure of maternal depression, since this a targeted outcome (Cooper et al., 2002; 2009). However, in light of the association between maternal depression and the quality of mother-infant interaction (Richter, 1994), it may also have been prudent to understand whether any intervention effects could have been confounded by this variable.

#### ***1.6.5 Study findings.***

Both Cooper et al. (2002; 2009) studies did not find any sustained improvement in maternal depressive symptoms as a result of the intervention. Across both studies, mothers in the intervention group were found to be more sensitive and responsive and a greater quality of interaction was observed, in comparison to the control group. Furthermore, Cooper et al. (2009) found a higher rate of secure attachment for infants in the intervention group at 18 months, demonstrating a positive long term impact of the intervention. Maternal sensitivity and interaction quality was also found to be greater for those who had received a book sharing intervention (Cooper et al., 2013).

Both Gardner et al. (2003) and Hamadani et al. (2006) found improved infant behaviour following the intervention, although the effects on aspects of the mothers' interaction were not measured. Hamadani et al. (2006) also found an improvement in mothers' knowledge of childcare, although we are not able to examine specific components that were potentially improved by the intervention. Despite this, Hamadani et al. (2006) did not find any differences in infant growth (a primary outcome), as a result of the intervention.

Eterm et al. (2006) found significant improvements in measures of the stimulation opportunities for infants in the home environment in the intervention group. However, they did not find any differences between groups in mother-infant communication. The authors' qualify this surprising outcome by relating it to a generally higher quality of mother-infant communication across participants and suggesting that this accounted for the lack of an effect. Aboud and Akhter (2011) also found improved infant language skills and stimulation opportunities and an additional improvement in maternal responsive talk.

### ***1.6.6 Conclusions.***

Overall, some well conducted research has taken place across several developing countries, which suggest that interventions targeted at improving mother-infant interaction can lead to improved quality of interaction and infant behaviour. Despite only a small number of studies, there are promising indications of potential interventions that could be effectively implemented across the developing world. Some issues for consideration are around the loss to follow up, acceptability and feasibility of the intervention and resources required for delivery. Areas for further research might be to; include measures of maternal depression; measure outcomes at follow up; and also to use dismantling studies to find out the specific effective components of these treatments.

### **1.6.7 Summary of literature review findings.**

In reviewing the research that has looked at ways of improving the mother-infant relationship in developing countries, a number of conclusions can be drawn. Firstly, the interventions themselves appear to vary somewhat. Therefore, it is difficult to know which parts of the intervention may influence outcomes. A further challenge exists in terms of the variability of outcome measures, which range from maternal depression, sensitivity and responsiveness to infant weight gain, cognitive and socio-emotional development and attachment security. Again this presents a difficulty in understanding exactly what these interventions are designed to improve. Despite these challenges, it is possible to conclude that various interventions that aim

to improve the mother-infant relationship can lead to a range of improved outcomes for mothers, infants and the quality of their interaction. It also highlights that further research is required to this area.

## **1.7. Ethiopia**

### **1.7.1. Background.**

Ethiopia is a country in East Africa with a history of severe deprivation, poverty and famine. In 2011, it was calculated that 29.6% of the population lived below the national poverty line (World Bank Data, 2013). Whilst in recent years, improvements have been made in terms of economic growth, it remains one of the poorest countries in the world (Rural Poverty in Ethiopia, 2013), not least due to the propensity for drought and famine. The impacts of the country's economic difficulties are far reaching and include food shortages, which negatively impact upon the development of the country's children.

### **1.7.2. Malnutrition.**

It is estimated that, between 2007 and 2011, 16% of children under five were underweight with the figure rising to 30% in rural areas. Malnutrition is estimated to account for around a third of the causes of mortality in the country, sadly highlighting the dire consequences in terms of outcomes. Around two in every five children are said to suffer from stunting; a failure to reach their expected height for age as a result of poor nutrition in-utero and in their first 5 years of life (Cost of Hunger in Africa Study, 2014; Tariku et al., 2016). Stunting has life-long consequences, in terms of brain development and motor skills. UNICEF estimate that it can lead to a reduction in school grades of 0.7 points and the proportion of children completing school in developing countries has been found to decrease with increased prevalence of stunting (Grantham McGregor et al., 2007). In adulthood, the consequences of stunting are also related to a loss of potential in terms of adult earning ability. Estimates of the loss of adult earning income range from 22% to 30% (WHO, 2012). The consequences of malnutrition further contribute to the loss of potential within the country. Women of childbearing age who are of low

weight and height may be more likely to give birth to an infant of low birth weight, thus perpetuating the cycle (Victora et al., 2008).

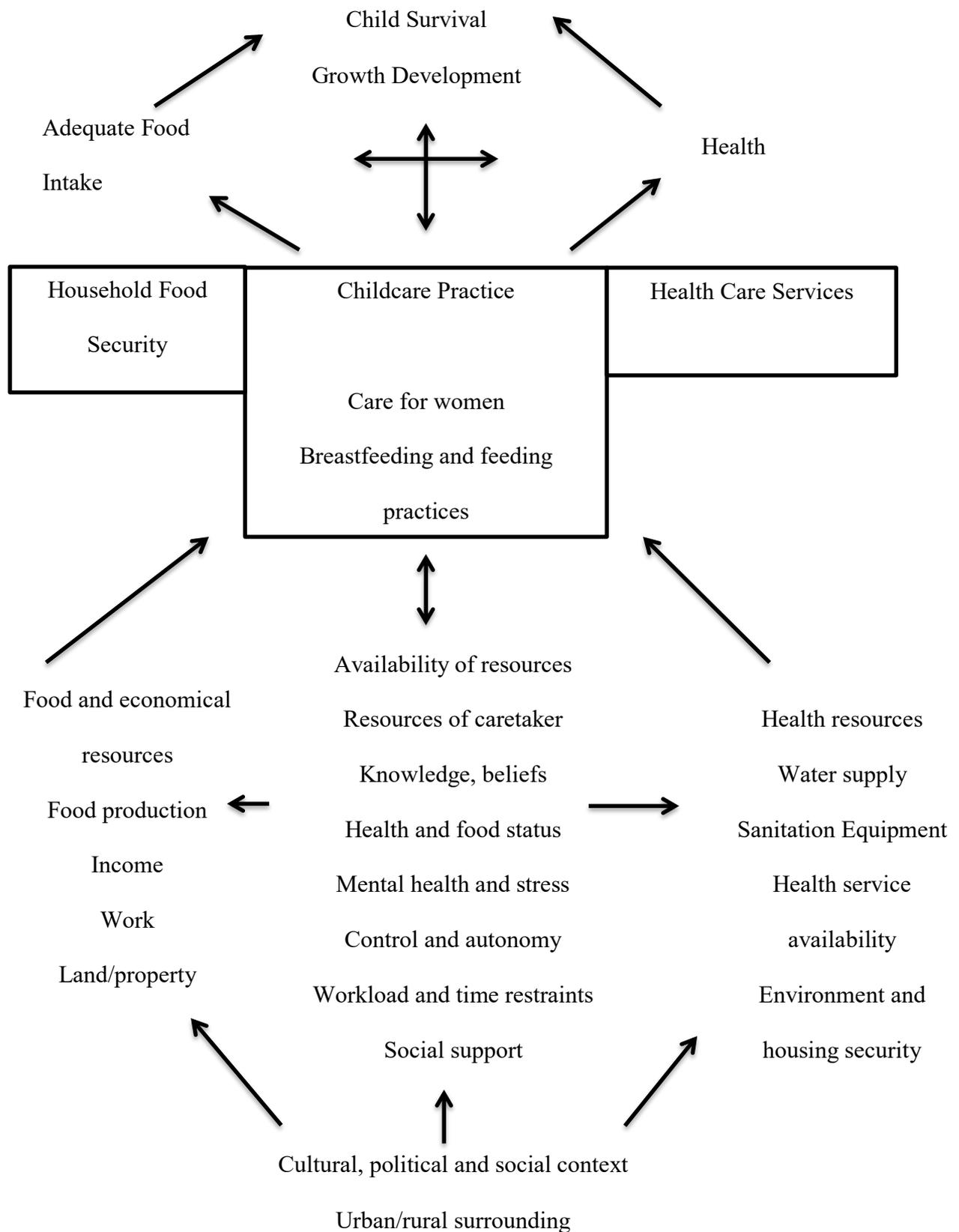
The cause of malnutrition can be linked to famine and the unavailability of food, as well as a result of infection and disease. For example, specific health problems such as; Acute Diarrhoeal Syndrome, Acute Respiratory Illness, anaemia and fever are more likely to be experienced by infants suffering from malnutrition (Cost of Hunger in Africa Study, 2014). The increased risk of infection and severe illness can further limit the nutritional intake of the infant, thus creating a vicious cycle of malnutrition and infection

It is crucial that effective interventions are developed to tackle the impact of poverty, poor health and nutrition from a humanitarian perspective and also for the future development of the country. Consequently, it is important to look at interventions that can be widely delivered and targeted towards reducing infant malnutrition and its detrimental effects on development.

### **1.7.3. Impact of malnutrition on the mother-infant relationship.**

In order to understand the wider context of malnutrition and the complex interplay between the various factors involved in its cause and maintenance, attempts have been made to conceptualise this in a framework. Figure 1 depicts the Extended Care Model (Engle, Mennon, & Haddad, 1996). Within this framework, care practices are highlighted as a link between the availability of resources, and the more immediate factors affecting malnutrition such as adequate food intake and health.

Figure 1 Extended care model (Engle, Menon & Haddad, 1996)



However, given the context of malnutrition, it would be expected that the conditions for malnutrition may negatively impact upon the mother's availability to care for her infant and that this could be observed within the context of the mother-infant relationship. This will be explored further in the following section.

As discussed in the previous section, malnutrition can have negative consequences on infant physical and cognitive development, leading to future loss of potential (Grantham-McGregor et al., 2007). A vast amount of research has identified the impact of malnutrition on the infant. Infants who are suffering from stunting were found less likely to display positive affect (Gardner, Grantham-McGregor, Himes, & Chang, 1999) and appear less engaged in the environment, in terms of interest in play (Gardner, Grantham-McGregor, Chang, Himes, & Powell, 1995; Gardner et al., 1999; Graves, 1978; Lozoff et al., 1998). Guedeney (1995) described the affective and behavioural appearance of the infant suffering from malnutrition, as being one that would meet the criteria for infant depression (Richter, 2004).

Several studies have also observed infants experiencing malnutrition or nutritional deficits from birth, as showing greater physical contact and more dependency towards their caregivers (Chavez, Martinez, & Yaschine, 1975). There is also evidence to suggest that attachment can be affected in infants who are chronically underweight. Valenzuela (1990) reported a greater proportion of insecure/anxious attachment classification (as measured by Ainsworth Strange Situation) in underweight children from Chile aged 17-21 months, when compared to children without a history of nutritional deficits. Similar findings were observed by Graves (1976; 1978) in that infants who were malnourished displayed fewer attachment behaviours when compared to those without nutritional deficits.

A number of studies have also established that the quality of maternal interactions may be less than optimal in the context of infant malnutrition, as outlined in a review by Richter (2004). A number of characteristics, such as: reduced social contact, reduced sensitivity and responsiveness, and increased passivity, have been observed across many studies (Arya, 1989;

Chavez et al., 1975; Cravioto & DeLicardie, 1976; de Miranda et al., 1996; Dixon, LeVine & Brazelton, 1982; Galler & Ramsay, 1985; Graves, 1976, 1978; Kerr, Bogues & Kerr, 1978).

Transactional models of the relationship between infant malnutrition and disturbances to the quality of mother-infant interaction have been proposed by Lester (1979) and Rosetti-Ferreira (1978). It is suggested that the disturbed patterns of interaction can be attributed both to the reduction in infant social cues and to the mothers availability to respond sensitively to a “difficult, unresponsive and irritable infant” (Valenzuela, 1990). Similarly, Grantham McGregor (1984) suggests that reduced responsiveness of the mother may result in reduced social interaction, which in turn, can lead to a negative cycle of mother-infant interaction. In the long term, this may contribute to the poor developmental outcomes for the infant.

#### **1.7.4 Correlates of disrupted mother-infant interaction in the context of malnutrition.**

When exploring the links between malnutrition and the quality of mother-infant interaction, it is important to look at some of the factors that may relate to these disturbances.

Evidence has established a link between maternal depression and low infant weight across both countries of high and low income countries (Fisher, de Mello, & Izutsu, 2009; Patel, Rahman, Jacob, & Hughes, 2004; Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004; Stewart, 2007; Rauh, Wasserman, & Brunelli, 1990). However, this is not an equivocal finding across all countries, as concluded from a review by Parsons, Young, Rochat, Kringelback, and Stein (2012). This disparity in findings applies across several African countries, where research has taken place into the links between maternal depression and infant physical growth. For example, in Ethiopia, a study found no links between maternal common mental disorder and infant growth (Medhin et al, 2010). However, this study did not specifically assess for depression using validated measures. A recent study in Uganda by Ashaba, Rukundo, Beinempaka, Ntaro and LeBlanc (2015) has also found an increased prevalence of maternal depression in mothers of malnourished children in comparison to those in a control group. The findings of this study

should be interpreted with caution, due to the difficulty in generalizability from a hospital-based sample. The cross-sectional design of the study also limits the ability to find a causal link between depression and infant malnutrition. Despite there being some variation across countries and methodological limitations, there is sufficient evidence to support a relationship between maternal depression and infant malnutrition.

One possibility is that the context of malnutrition may trigger depression in mothers, which in turn can compromise the interaction between mother and infant (Richter, 1994). The relationship between maternal depression and impaired responsiveness and sensitivity in developing countries has been established (Cooper et al., 1999; Cooper et al., 2009) and interventions have been targeted towards improving the interactive capacities of the mother and infant. It is also important to consider that depression can also lead to impaired nutrition in mothers. This could impact upon their infant at a number of levels, potentially through the impact on milk supply for breastfeeding mothers (Patel, Rodrigues, & DeSouza, 2002), and there is also evidence to suggest that maternal depression may be a predictor of low infant weight (Patel, Rodrigues, & De Souza, 2003). A recent meta-analysis (Surkan, Kennedy, Hurley, & Black, 2011) found that in developing countries, mothers with depression were more likely to have infants who were classified as underweight or stunted. Although a relatively small number of studies were included in the review, it points to the importance of considering depression in relation to infant growth in developing countries. Despite these relationships being observed, the question remains as to whether depression is a causal or co-morbid factor. Overall, it appears likely that mothers of malnourished children in Ethiopia may be at an increased risk of depression, which can further impede the quality of the interaction between mother and infant and may be linked to the maintenance of infant malnutrition.

Maternal Education appears to be an important determinant in the context of infant malnutrition. Stunting has been found to be more common in mothers who are illiterate (Tariku et al., 2016) and it may be that educated mothers are better able to recognize illness in their child

and access services (Tomlinson & Landman, 2007), thus leading education to be somewhat of a protective factor. There also appears to be a link between reduced maternal sensitivity and less maternal education in developing countries (Valenzuela, 1997). This may be due to reduced awareness of the importance of their responses in terms of the infant's development (Reis, 1988), which results from a lack of educational experiences. Conversely, from a study in Ethiopia, there is also evidence to suggest that mothers with longer years of education, were more likely to have infants with stunting. However, this finding could be explained by the lack of variation in years of education within the sample (Mekonnen, Jones, & Tefera, 2005). On balance, it is possible that lack of maternal education may not only be a risk factor for infant malnutrition but may be an additional factor which impairs the quality of mother-infant interaction.

The link between infant malnutrition and disturbed mother-infant interaction, may also be explained in terms of a protective mechanism against the trauma and potential bereavement that could potentially occur as a result of malnutrition. Scheper-Hughes (1985) described how caregivers may actively disengage from their infant in order to protect themselves from this potential loss. However, a study by Aboud and Alemu (1995) looking at links between nutrition, maternal responsiveness and child mental development found that maternal responsiveness was not related to the child's nutritional status. Responsiveness was more contingent on the fussiness or crying behavior of the child or beliefs about child developmental milestones. Whilst this may appear to go against the hypothesis of Scheper-Hughes (1985), it is important to note that the majority of the study population were mild-moderately malnourished and therefore may not have activated disengagement from the caregiver.

The suboptimal care and environment of an infant suffering from malnutrition has also been understood in relation to the functional isolation hypothesis (Levitsky & Barnes, 1972; Wachs et al, 2011). One of the suggestions posed is that mothers may not engage optimally or respond appropriately to malnourished infants due to their physical appearance, as a result of

poor growth. It suggests that mothers may perceive their child to be a younger age than their chronological age, thus meaning their interactions and responses are not age appropriate (Pollitt, Gorman, Engle, Martorell, & Rivera, 1993). Additionally, Wachs et al. (2011) consider the possibility that the failure of mothers to provide a sensitive and responsive environment for feeding, may further impact upon the feeding behavior of the child. This would fit with some of the research findings which have established links between parenting styles and the feeding environment in the Western world (Hubbs-Tait, Kennedy, Page, Topham & Harrist, 2008). It is not clear, however, how these hypotheses would translate to the developing world in the context of severe malnutrition, such as that found in Ethiopia. However, there is tentative evidence to suggest that the same processes may be applicable to this population. The hypotheses would fit with the findings of Aboud and Akhter (2011), which suggested that responsive and stimulating feeding environments led to greater mouthfuls of food eaten by malnourished infants in Bangladesh when compared to a control group.

In summary, there are a number of ways in which malnutrition and impaired mother-infant interaction may be connected and different models and hypotheses suggested. It is most likely that a combination of these factors account for the disruption of mother-infant interaction in the context of malnutrition and further research may try to work to understand better how these factors relate to each other.

#### **1.7.5 Emotional Stimulation and Malnutrition.**

As noted in the previous sections, the quality of mother-infant interactions are likely to be suboptimal in the context of infant malnutrition across developing countries. Linked to this, are repeated findings in the literature that in developing countries (where malnutrition is more prevalent), infants are less likely to receive adequate psychosocial stimulation in their environment as required for optimal development. The term psychosocial stimulation is used broadly in the literature to cover a range of behaviours. The WHO (2006) define psychosocial stimulation as both physical stimulation in the environment, through sensory input, and

emotional stimulation through the development of an affectionate caregiver-child bond.

Stimulation interventions are often developed in line with these ideas but with variability in terms of the nature of the intervention. Often there are psychoeducational elements around the optimal way to play and interact with infants (in terms of providing opportunity for play, following the lead of the infant, responsiveness and so on) combined with play sessions where parents are encouraged to develop new skills. However, these interventions can vary somewhat across studies and therefore may make it difficult to understand their effective components. Therefore in light of the broad nature of these terms and of the interventions themselves, is of use to consider all types of stimulation interventions when looking at their efficacy in terms of improving infant outcomes.

Bornstein and Putnick (2012) concluded from a review of 28 developing countries, that parents from lower income countries may only engage in one or two play activities with their infant each day. Additionally, Cravioto and Delicardie (1975; 1976) reported a relationship between malnutrition, reduced provision of stimulation at home as well as links with caregiver sensitivity and responsiveness. A large number of studies have been carried out to look at ways of improving psychosocial stimulation in developing countries. A recent review and meta-analysis by Aboud and Yousafzai (2015) looked at studies in developing countries, measuring infant cognitive and language development, where either psychosocial stimulation interventions or nutritional interventions had been delivered. The review found moderate effect sizes for stimulation studies for cognitive development ( $d=.42$ ) and language ( $d=.46$ ). When compared to the very small effect sizes of nutritional interventions alone ( $d=.08$ ), it appears that stimulation interventions are an important way of increasing the developmental potential of infants in these countries. This recent meta-analysis replicates previous findings of substantial improvements in child cognitive and language development as a result of stimulation interventions (Engle et al., 2007; Walker et al., 2007). Whilst, on balance, the evidence appears to point towards the utility of psychosocial stimulation interventions leading to improved infant development, it is

important to note that there are some important differences in the demographics of some of the countries where large effects of stimulation interventions have been found. In the review by Aboud and Yousafzai (2015), there were noted to be a high rate of attrition in nutritional intervention studies and a number of the stimulation studies were carried out in higher income countries, which may facilitate such interventions due to the greater availability of resources required to deliver them and potentially higher levels of education.

In light of the importance of the provision of maternal care in the context of malnutrition, and the reduced amount of cognitive and emotional stimulation provided to infants in developing countries, it can be hypothesised that improving stimulation for malnourished infants may lead to improved outcomes. Indeed, there is promising evidence in support of such hypotheses. Richter, Bac and Hay (1990) followed up children who had received treatment for malnutrition in infancy and found that at 2 years old, maternal warmth and responsiveness were predictors of the rate in which infants had caught up with growth.

Stimulation interventions have showed some promising outcomes in terms of child growth and recovery from malnutrition (Engle et al., 2007; Grantham-McGregor, Schofield, & Harris, 1983; Walker, Chang, Powell, & Grantham-McGregor, 2005; Walker, Chang, Powell, Simonoff, & Grantham-McGregor, 2006). Treatment of malnutrition fundamentally includes some form of nutritional supplementation, in order to improve the weight and nutritional status of the infant. However, promising outcomes from early studies found improved cognitive and physical outcomes for children who received an emotional stimulation intervention in addition to treatment for malnutrition (Grantham McGregor et al., 1983). However, a criticism of these studies were that they involved interventions that were difficult to replicate due to the resources required to deliver them (in terms of training of professionals and so on). Since then, work has taken place to look at ways of testing out stimulation interventions alongside nutritional approaches to malnutrition.

Stimulation interventions delivered to malnourished infants have largely found

improvements in developmental outcomes and the World Health Organisation has therefore recommended psychosocial stimulation in their malnutrition management guidelines (WHO, 2006). Aboud and Akhter (2011), carried out a cluster randomised controlled trial looking at the impact of a stimulation and feeding intervention in a rural area. The results suggested that the addition of a stimulation intervention led to improved stimulation in the home environment as well as improved language and eating. It did not appear to impact upon the physical growth of the child. The study did not classify the malnutrition status of the infants in accordance with the World Health Organisation, so it was not clear the levels of malnutrition experienced in the sample. In addition, the authors did not describe the recruitment process for the study in terms of whether the parents recruited were seeking help or receiving treatment for inadequate nutrition. The findings do, however, suggest that combining stimulation and nutritional interventions may be of promise to infants who require intervention for malnutrition.

There are other reported long term benefits of interventions combining stimulation and nutritional interventions, such as improved cognitive outcomes, mental health and academic attainment (Walker et al, 2005; 2006; 2011). In terms of physical outcomes, the findings of studies are mixed as to whether combined nutrition and stimulation interventions can lead to improvements. Grantham McGregor et al. (2014) found no effect of these interventions on infant weight, whereas, other studies such as Nahar et al. (2012), have reported improvements to weight gain.

Stimulation interventions are varied in nature and can take place across a variety of settings, for example in a home, clinic or group format (Aboud & Yousafzai, 2015). Typically they will be delivered by a person trained in the methods and will follow a manualised format. One of the main drawbacks of these interventions are the time and resources involved in delivery. Engle et al. (2007) point out that the intervention needs to be of sufficient quality and intensity and of sufficient duration, in order to optimise the effects. The implementation of such interventions require significant resources in an already stretched country. This therefore may be

a limitation of rolling out these programmes on a wider scale (Aboud & Yousafzai, 2015; Cooper et al., 2013).

In Ethiopia, some promising work recently has taken place in a study by Play Therapy Africa (2009). Methods of providing psychologically based support have already been put into place in Ethiopia, with the aims of using play and creative therapies to tackle a number of negative outcomes associated with the levels of poverty and deprivation in the country. These include issues such as abuse, bereavement, attachment difficulties and trauma (Play Therapy Africa, 2009). In light of the negative developmental outcomes associated with infant malnutrition, a natural extension to this research was to investigate whether the addition of emotional stimulation of children (via Play Therapy) could lead to more effective outcomes with regards to weight gain in the treatment of malnutrition. The study was based on a sample of mothers and infants who had presented for treatment for malnutrition. In addition to food supplementation, a group were randomly assigned to receive a culturally tailored play coaching technique called Filial Therapy. Two main outcomes were measured in relation to infant weight gain and infant development. Overall, infants who received emotional stimulation via play therapy, were found to gain significantly more weight over the initial course of treatment when compared to the control group. This difference did not remain over time and at follow up, there were no differences between infant weight in the two groups. However, it is clear that infants in the intervention group gained weight more quickly than controls. In addition, infants in the intervention group were rated as more attentive, less irritable and less lethargic in comparison to the control group. This suggests that the intervention may have had an impact on the mother's perception of their children. There were some limitations to the study, related to the small sample size for the intervention group and the fact that the raters were not blind to the assignment of group. Despite this, the study provided some promising findings that an intervention, which would be relatively easy to implement may add favourable outcomes to infants' recovering from malnutrition.

## **1.8. Theoretical basis for interventions targeted at improved mother-infant interaction**

The previous sections explore the impact of malnutrition on mother infant interactions. It also summarises some of the evidence that suggests that the home environment of infants in developing countries (and those suffering from malnutrition) may be suboptimal in terms of the availability of emotional and cognitive stimulation. Consequently, interventions aimed at improving stimulation may provide benefit across a number of outcomes.

Attachment theory would predict that the reduced quality of mother-infant interaction in the context of malnutrition, may lead to disrupted attachments (Ainsworth et al., 1978; Chavez & Martinez, 1975; Chavez et al., 1975; De Wolff & van IJzendoorn, 1997; Posada et al., 2002; Tomlinson et al., 2005). It would also suggest that early interventions targeted at improving mother-infant interaction, may in turn improve the security of attachment (Cooper et al., 2009). This is of key importance when considering the long-term risks of insecure attachment, for example in relation to behavioural difficulties or mental health problems (Wachs et al., 2011).

## **1.9. Interim summary**

In summary, research has established the importance of nature of the interaction that takes place between mother and infant as an indication of the security of their relationship. The timeliness and appropriateness of maternal responses to infant behaviour and communication have been largely found to predict the attachment style of the infant, which has key links to future behaviours.

There are, however, different approaches to measuring the quality of mother-infant interactions. Whilst observational methods remain the most prevalent in the literature, it is important to consider factors that impact upon the validity of these measures and to take steps to minimise them.

A review of the literature suggests that the quality of mother-infant interaction can be improved, both in the developed world and in a developing population. Therefore this may be one approach that could be used to try to improve the mother infant relationship (and as

predicted by attachment theory, the security of infant attachment). This may in turn lead to better outcomes in relation to cognitive and social development. Further studies are needed, however, in the developing world, in order to establish whether there are long term benefits from these interventions.

One of the key areas of adversity in some developing countries (such as Ethiopia) is malnutrition. Childhood malnutrition in particular, can lead to poor long-term outcomes and loss of developmental potential. There is also evidence to suggest that malnutrition can compromise the quality of mother-infant interaction and infants living in the context of famine and adversity may be less likely to receive emotional stimulation.

### **1.10. Rationale for this study**

As the previous chapter has established, it is clearly clinically important to develop effective and deliverable interventions to improve infant developmental outcomes and recovery from malnutrition in Ethiopia and there is promising evidence to suggest that psychosocial interventions may be well placed to achieve this. Previous research and theory, would predict that an intervention aimed to increase the emotional stimulation of infants, would also improve the quality of the mother-infant interaction. This may take place through improved maternal sensitivity, reduced intrusiveness and increased responsiveness, which may also relate to infant affective experience and the transactional nature of the dyadic interaction.

It is therefore of interest that further preliminary findings from Ethiopia (Play Therapy Africa, 2009) suggest that adding an emotional stimulation intervention to emergency food supplementation can lead to a number of improved outcomes in recovery from malnutrition. In particular, research has yet to establish whether an emotional stimulation intervention (delivered in the context of emergency food supplementation) can effectively improve the quality of mother-infant interactions in this population. The implications and importance of these questions are of relevance when considering theories relating to malnutrition and attachment which would predict that improved mother-infant interaction may lead to improved attachment security and

longer term outcomes in relation to infant development.

### **1.10.1. Aims of the current study**

The primary aim of this current study is to investigate whether an emotional stimulation intervention, in addition to nutritional supplementation, for Ethiopian malnourished infants and their mothers can improve the quality of mother-infant interactions. The study utilises recorded data from a randomly selected number of participants from a larger RCT. Mother-infant interactions are measured using coding systems (modified where necessary) and applied to recordings of mothers and infants interacting at a health centre setting.

A secondary aim of the study is to explore the relationship between the quality of the mother-infant interactions measured by the coding systems, and increase in infant BMI during treatment.

### **1.10.2. Research Questions and Hypotheses**

#### ***1.10.2.1. Primary question***

The primary question for this study is whether more positive mother-infant interactions, are observed in a group of mother-infant dyads who were randomly assigned to receive an emotional stimulation intervention in addition to emergency food supplementation, when compared with a group who have received a control intervention in addition to nutritional supplementation. Based on previous research (Cooper et al., 2009), the primary hypothesis is that more positive behaviours as rated by the Global Rating Scale (Murray, Fiori-Cowley, Hooper, & Cooper, 1996) and Coding Interactive Behaviour scale (Feldman, 1998) will be observed in the intervention group. It is hypothesised that maternal education (or literacy) may act as a protective factor against disruptions to the mother-infant relationship (Walker et al., 2011) and therefore it may be necessary to control for the influence of this variable on the ratings of mother-infant interaction. Previous research would also suggest that rates of weight gain may differ between groups (Play Therapy Africa, 2009) and that the potential impact of this on the ratings of interaction, should also be controlled for.

### ***1.10.2.1. Secondary questions***

Based on previous research (Play Therapy Africa, 2009), it is predicted that infants whose mothers have received training in emotional stimulation via play therapy, will have a larger difference in Body Mass Index (BMI) from baseline to last observation, than infants of mothers who have received a control intervention. When taking into account the literature in relation to emotional stimulation and recovery from malnutrition (Nahar et al., 2012), a number of hypotheses regarding the relationship between the interaction ratings and body mass increase are generated.

1. It is hypothesised that there will be a significant positive relationship between the interaction ratings, group assignment and the difference in infant BMI over treatment, when controlling for covariates.
2. It is further hypothesised that the quality of mother-infant interactions may mediate the predicted difference in infant growth over treatment (as measured by infant BMI change).

## **Chapter 2**

### **Method**

#### **2.1 Overview**

This chapter provides a description of the design, as well as information about the study participants and the selection criteria. The recruitment method and procedure is summarised and details of the coding systems used are described. Finally, a discussion around relevant ethical considerations is given and details of the plan and procedure for analysis outlined.

#### **2.2 Design**

The sample for this study was selected from a large cluster randomised controlled trial (RCT) of an emotional stimulation intervention for malnourished children in Ethiopia (Palmer, 2016). Further details of this study are provided in Appendix C and reflections of the author's role are provided in Appendix D. The primary outcome for this RCT was to explore the impact of the addition of a stimulation intervention to nutritional supplementation on infant growth during recovery from malnutrition. The primary outcome measures was the rate of infant weight gain, with the main hypotheses being that infants in the intervention group would gain weight more rapidly than the control group.

The primary research question for the present study explored whether there is a difference between the control (nutritional education: NE) and emotional stimulation (ES) intervention group, in the quality of mother-infant interactions. A between subjects, post-test only, control group experimental design was used. In addition, a correlational design was used to investigate the relationship between the quality of mother-infant interactions on the wider study outcome variable, increased infant BMI.

The independent variable was the group (NE or ES) and the dependent variable was ratings of mother-infant interactions. A randomised sample of 75 mother-infant dyads were taken from the larger RCT. Data relating to baseline characteristics were analysed to identify any differences within this sample, that should be controlled for in the analysis. Maternal education

was found to be a covariate and was subsequently controlled for within the analysis.

Additionally, results from the RCT from which the study was derived, found differences between groups for the infant BMI change over treatment and the last measurement of infant BMI. This was also controlled for in the analysis for the secondary research question.

## **2.3 Participants**

### **2.3.1 Target sample.**

The participants for this study were a randomly selected sample of mothers and infants that were selected as part of the procedure for the larger RCT. Details of this procedure will be outlined briefly.

The participants were recruited from a number of health centres in Southern Ethiopia, which are the first point of contact for infants who were experiencing signs of malnutrition. In addition to food supplementation, participants were randomly allocated, using cluster randomisation, to either an intervention group (ES) or a control group (NE). The RCT recruited a total of 384 families. From this, 75 families were randomly selected across both groups to record mother-infant interactions. This formed the sample for this current study.

### **2.3.2 Inclusion and Exclusion criteria for the RCT from which the data is derived.**

The inclusion and exclusion criteria from the RCT are outlined in Table 2.1. The inclusion criteria for the RCT were children aged between 6 months and 5 years who meet the defined study criteria of severe acute malnutrition as defined by the World Health Organisation (WHO, 2009: see Table 2.1). They must have been deemed to have sufficient family involvement to support the intervention and to have passed an appetite test as defined in the Ethiopian malnutrition management protocol (Ethiopian Federal Ministry of Health, 2007). Participants were excluded from the study if they had serious medical complications requiring inpatient treatment (full details described in Table 2.2), congenital abnormalities, preterm birth or low birth weight. In addition, exclusion from the study could also take place if there were indications during the trial that the infants were failing to gain adequate weight during the trial.

Table 2.1.

*Inclusion and Exclusion Criteria from RCT.*

---

Inclusion criteria
Age greater than 6 months and less than 5 years.
Undernourishment defined as 3 SD (70%) below World Health Organisation published norms of height or forearm skinfold thickness less than 110mm.
Sufficient family involvement to support intervention.
Passing the appetite test.

---

Exclusion criteria
The presence of serious medical complications requiring referral for inpatient treatment (see Table 2.2).
The presence of clinically apparent congenital abnormalities.
Preterm birth (<37 weeks gestation) or birthweight >2SD below weight weight/gestation limit.

---

Table 2.2

*Types of medical complications requiring exclusion from the study and referral for inpatient treatment.*

---

Conditions for medical exclusion
Bilateral pitting edema Grade 3 (+++)
Marasmus-Kwashiorkor (Weight/Height<70% with edema or Mid Upper Arm Circumference <11cm with edema)
Severe vomiting/ intractable vomiting
Hypothermia: axillary's temperature < 35°C or rectal < 35.5°C

---

---

Fever > 39°C

Number of breaths per minute:

- a. 60 respirations/ min for under 2 months
- b. 50 respirations/ minute from 2 to 12 months
- c. >40 respirations/minute from 1 to 5 years
- d. 30 respirations/minute for over 5 year-olds
- e. Any chest in-drawing

Extensive skin lesions/ infection

Very weak, lethargic, unconscious

Fitting/convulsions

Severe dehydration based on history & clinical signs

Any condition that requires an infusion or nasal gastric tube feeding.

Very pale (severe anemia)

Jaundice

Bleeding tendencies

Other general signs the clinician thinks warrants transfer to the in-patient facility for assessment

---

### **2.3.3. Inclusion/exclusion criteria in relation to the current study.**

From the 75 mother-infant interactions that were selected, a total of 71 were coded and included in the analysis. Further exclusion criteria were applied in relation to the length of interaction and the possibility of external influence on the interaction after discussion and reviewing with the researchers involved in the larger trial. Based on these criteria, one tape was excluded due to insufficient length of interaction time for coding. A further three were excluded due to there being involvement from an observer present in the interaction, and insufficient time without their presence to code a clear 5 minutes of interaction.

#### **2.2.4. Sample size.**

An estimated sample size was generated using G Power 3.1 for the first research question. Details are provided in Appendix B. To calculate the power required to detect differences between groups in relation to mother, infant and dyadic interaction, an estimated effect size of .4 was used based on the findings of Aboud and Akhter (2011). In order to detect differences using Analysis of Covariance (ANCOVA), with a power of .80 and alpha of .05, a total sample size of 52 was required.

For the second research question, in order to establish whether there is a relationship between the quality of interactions and infant BMI increase, a moderate positive relationship ( $r=.6$ ) was predicted. This was based on the findings of Cooper et al. (2002) of a significant increase in infant growth in relation to emotional stimulation. Therefore, it was calculated that a minimum sample size of 23 was required to have sufficient power to detect a relationship between the quality of mother, infant, dyadic interactions and infant increased BMI. If the predicted relationships were found, then consideration would be given to the application of structural equation modelling to explore whether the quality of interaction could account for the change in infant BMI. In accordance with Thoemmes, McKinnon and Reiser (2010), the minimum sample required for a single mediator model with medium to large effect sizes is 66. However, if more modest effect sizes were observed then the required sample size increases substantially (for example, for small and medium effect sizes a sample size of 404 would be required). These analyses are therefore carried out cautiously, on an exploratory basis.

In summary, based on a good effect size relating to between group differences in interactions, and a conservative estimate of a moderate relationship between interaction quality and BMI increase, the minimum required sample size for this study was found to be 66. Therefore, the actual sample size of 71 gave sufficient statistical power for the planned analyses.

### **2.2.5 Sample characteristics**

The demographic statistics are provided in section 3.2.2 along with the analysis of baseline characteristics. The total sample size was 71 participants, 40 participants formed the control group and 31 formed the ES intervention group. The mean (SD) age for infants in the control and intervention group were 17.04 (9.83) and 17.84(9.73) months respectively.

## **2.3 Measures**

This section details the variables examined in the present study, starting with a description of the assessment information gathered in the primary study. It also provides further information regarding the coding measures used to rate the quality of mother-infant interactions.

### **2.3.1. Coding Interactive Behaviour Scale (CIB; Feldman, 1998).**

The CIB (Appendix E) is a global rating scale, which assesses the quality of interactions between parent and child. The scale provides separate ratings of the parent, child, interaction, family and during feeding. The scale was developed for infants aged between 2 months and 3 years old. It consists of 43 items; 22 relating to parent interaction, 16 relating to child interaction and five dyadic scales. These items can be categorised into six constructs: parental intrusiveness, sensitivity, child involvement and withdrawal, dyadic reciprocity and negative dyadic states. All constructs were observed to have a high level of internal consistency ( $\alpha = .72-.95$ ; Feldman, 1998). Each item is rated on a 5 point scale, with 1 representing a low level of the behaviour and 5 representing a greater level of the observed behaviour. The CIB has good predictive validity and test-retest reliability (Feldman, 1998). It has been found to be sensitive to change as a result of a range of parent-infant interventions, such as: massage therapy for preterm infants (Ferber et al., 2005), attachment-based interventions (Sleed et al., 2013), and Kangaroo Care (Feldman, Eidelman, Sirota, & Weller, 2002). The CIB has also demonstrated sensitivity to a number of variables such as biological risk (Feldman & Eidelman, 2006), trauma and parental mental health (Feldman, 1998).

### **2.3.2. Global Ratings of Mother Infant Interaction Scale (GRS; Murray, Fiori-Cowley, Hooper & Cooper, 1996).**

The GRS (Appendix F) is also a global rating system of mother-infant interaction and consists of 16 maternal rating scales, seven infant rating scales and five interactive behaviour scales. Maternal rating scales consist of items, such as: sensitive to insensitive, accepting to rejecting and warm/positive to cold hostile. Infant scales contain items, such as: lively to inert, attentive to avoidant, and engaged with environment to self-absorbed. Dyadic interaction scales capture aspects such as, levels of engagement and satisfaction. Scales are rated on a 5-point basis, with 5 being high levels of the aspect (such as warmth) and 1 being low levels of the aspect (such as cold/hostile). The GRS has been used in mother-infant interaction research in developing countries, for example, South African mothers (Tomlinson et al., 2005), and has been found to have good reliability, with intraclass correlation coefficients ranging between .70 to .89 (Gunning et al., 2004) and sensitivity to maternal psychiatric diagnosis, and economic and social adversity (Gunning et al., 2004; Murray et al, 1996; Tomlinson et al., 2005).

### **2.3.3. Rationale for selection of study measures.**

The majority of coding items were selected from the GRS and included some additional scales from the CIB. DeWoolf and van IJzendoorn (1997) identified nine dimensions of mother-infant interaction that were found to contribute to attachment security. Therefore interaction scales were selected with a view to capturing a range of these dimensions. The selection of coding items took place in consultation with an expert in the field and author of the GRS (Professor Lynne Murray). A selection of the study recordings were piloted to ensure that the selected scale items would fit with the available interactions and to guide necessary adaptations to the scoring criteria. Appendix D provides some reflections on this process. A decision was made to adapt the scales to exclude the rating of speech content in the interactions. This was for a number of reasons. Firstly, due to the wide geographical area covered in the trial, there were a

number of regional dialects covered so therefore translation of the tapes may have required more extensive work that was beyond the scope of this current study. Secondly, the sound quality of the tapes was often poor, meaning that even with translation/interpreters, much of the content may have been uncodable. Thirdly, in the interactions piloted (and subsequently found across the sample), there was found to be very little speech present in the interaction. It is not clear whether this is a cultural consideration or in response to the research setting. However, much of the interaction was related to non-verbal cues and behaviours. When language was used in the interaction, it was rated in the context of the wider behavior being demonstrated, for example, if the tone appeared to be warm or hostile it was rated as such, or if the speech appeared to be a response to infant cues, it was rated under responsiveness.

#### **2.3.4. Mother GRS scales selected for coding.**

Warm/Positive - Cold/Hostile - This scale assesses the mothers “attitude and feelings towards the infant” with the “expression of her love and affection” on one dimension and “anger and criticism” on the other. Due to the limited amount of language in the study interactions, it was not possible to compare the number of positive and negative comments towards the infant to count towards the scoring profile. As a result, the scale was modified to note the amount of touching, smiling and looking, warmth communicated through tone of voice (where verbal communication was present), and mother’s expression towards the infant.

Accepting - Rejecting - This scale broadly assesses the level of acceptance (or rejection) of the infant experience, both within and outside of the interaction. Some modification was required to account for the limited amount of verbal communication within the majority of the study interactions. Acceptance within the interaction was based upon non-verbal communication, such as: the mother following the infant gaze, responses to the infant’s affect and behaviour (whether responses are empathic or in contrast with the infant), and cutting gaze or dampening down the infant’s affect. The rating of acceptance outside of the interaction is heavily reliant on verbal communication, for example, whether the mother makes reference to

difficulties coping with the infant's usual behaviour outside of the interaction. Therefore, it was not possible to rate this aspect of the scale.

Responsive - Unresponsive - This index assesses the mother's ability to notice and respond to their infant's behaviours and includes both appropriate and inappropriate responses. Little modification was required to this index and non-verbal responses such as facial mirroring or changes in tone (where some language is present), suggested an awareness of the changes in infant behaviour and state.

Sensitive - Insensitive - This scale is highly related to the warmth, accepting and responsive scales as well as an additional omitted scale (Non-Demanding – Demanding). Essentially, it rates the mother's awareness of the infant's signals and the appropriateness of her response. For this study, some slight modifications were necessary in order to focus largely on non-verbal demonstrations of the mother's attunement to the infant's state (such as non intrusive behaviour, mirroring and eye contact) and sensitivity of response.

The following scales were included and required no modification from the original coding system; Non Intrusive Behaviour - Intrusive Behaviour; Happy – Sad; Much Energy - Low Energy; Absorbed in Infant - Self Absorbed; and Non-remote - Remote.

### **2.3.5 Scales omitted from Mother GRS scales.**

The following scales were omitted due to the heavy reliance on speech required within the scoring criteria; Non-silent - Silent and Non-Intrusive speech - Intrusive speech. Also, after piloting it was decided to further omit; Much Effort (to engage baby) - No Effort and Much Engagement - No Engagement. This was in light of a generally low level of maternal engagement activity across the interactions, which would therefore lead to a floor effect. Additionally the Relaxed - Tense scale was omitted, since it was felt that this data was better captured through the CIB scale relating to Parent Anxiety. The Non-Demanding - Demanding scale was also omitted due to the absence of speech and limited observations of these behaviours

within the piloting of the videos. The No use of object - Constant use of object scale was omitted due to the lack of availability of objects for play in a large proportion of the interaction videos.

### **2.3.6. Mother CIB scales selected for coding.**

Acknowledging - This scale was selected to rate the awareness of the mother to the infant's social signals and her reaction to the same. The scale includes many elements of non-verbal behaviour such as: gaze, facial expression and body movement and therefore was deemed appropriate for use in light of the limited amount of verbal communication. The scale is highly related to the sensitivity construct and therefore provides a further measure of this.

Depressed mood - This was selected as an additional rating of maternal mood which incorporates both expression, tone of vocalisations (if present) and response to infant signals.

Anxiety - This scale required no modification from the original manual and provided a measure of maternal anxiety, which is of particular interest in light of the novelty of the recording process for the mothers involved.

Supportive presence - This scale assesses the extent to which the mother provides a "secure base" (Bowlby, 1988). After piloting the videos, it was felt that this was particularly useful in capturing the degree of security via affect, touch, gaze, smile or physical proximity.

### **2.3.7. Infant scales selected for coding.**

The following infant scales were selected from the GRS: Active communication - No active communication, Engaged with environment - Self absorbed, Lively – Inert, and Happy - Distressed. No modification was required from the original coding scheme. The Positive Affect scale from the CIB was added as an additional measure of infant emotionality.

### **2.3.8. Interaction scales selected for coding.**

Six scales were used to measure the quality of the dyadic interaction, three from the GRS and three from the CIB. Scales from the GRS rating the mother-infant interaction also required little modification from the original coding system. Those selected were aimed at capturing the level of fun, mutual satisfaction and engagement. The Adaption-Regulation scale from the CIB

was included as an additional measure of the degree to which both mother and infant are able to respond adaptively to the signals of their partner. Those omitted from the GRS were Smooth/Easy - Difficult, since this was deemed to be more comprehensively covered by several of the CIB scales: Dyadic Reciprocity which records the nature of 'give and take' in the interaction, and Constriction, which rates the extent of emotional expression and exploration in the interaction. Excited engagement - Quiet engagement from the GRS was also omitted as the majority of videos piloted reflected a general sense of quiet engagement.

### **2.3.9. Infant weight measurement.**

The primary outcome measure from the larger study was in relation to the infant's recovery from malnutrition, which was captured by the difference in height and weight measurements as measured using BMI. The literature suggests a number of ways in which growth can be measured during treatment for malnutrition, and BMI is recommended by the World Health Organisation (WHO; 2009) as being a key outcome variable in relation to infant nutrition status. BMI is calculated by dividing infant height (or adjusted length if the infant is below 6 months old) by weight in kilograms.

## **2.4 Ethical considerations**

### **2.4.1 Ethical approval.**

The main research questions of this study relate to the larger RCT and therefore were covered in the original ethical approval. An application for the author to be added to the research team was submitted and approved in April 2013 (Appendix G). Ethical approval for the larger study was obtained from University College London (reference 3325/001) and also the National Health Research Ethics Review Committee in Ethiopia.

### **2.4.2 Informed consent.**

No additional consent was required for this study, since it formed part of the larger study aims. Procedures to obtain informed consent from mothers recruited to this trial were put in place. These included: providing information about benefits and risks, communicating that no

adverse outcomes would occur should participants decline or withdraw consent and information, and explaining confidentiality of information. Information sheets were provided to participants in the relevant language and there were opportunities to have these explained by the Health Extension Worker's (HEW) administering them. This was important due to the low rate of literacy among participants in the study.

#### **2.4.3 Confidentiality and storage of interaction data.**

Within the larger study, participant information was fully anonymised and stored securely on password protected databases, with locked files for consent forms and paper based information.

With regards to the interaction recordings, these were sent to the UK where they were transferred to an MP4 format and stored on an encrypted hard drive. Each recording was further allocated an identification number by other members of the research team. This was undertaken in order that the interaction data could later be matched up to the larger data file. The recordings were copied on to a password protected external hard drive for coding to take place by the author. Coding data was then stored on a password protected spreadsheet, prior to the transfer of the information back on to the larger study database.

Upon completion of this study, the interaction data will be stored in line with the UCL Research Ethics Committee guidelines.

#### **2.5 Procedure**

Mother-infant dyads presenting to Health Clinics were screened for eligibility and invited into the study, where appropriate. Parents and infants then underwent a baseline assessment, including height and weight measurements of the infant, the infant's medical history, the mother's demographic information and secondary measures. Secondary measures included those relating to the child's emotional and social behavior, mother's sense of perceived control over their living situation and a measure of mothers' emotional wellbeing. Study measures were again taken at 7, 12 and 24 weeks.

Following assessment, randomisation to either the NE control group or ES group took place. Both groups received emergency food supplementation. Details of the interventions will be outlined.

The NE intervention aimed to provide education around the links between nutrition and health. It was based on the information pack produced by the Ethiopian government to assist mothers with malnourished infants and contains information about three key messages: (1) the importance of hygienic preparation and storage of food; (2) the importance of a balanced diet and advice on how to achieve this through meal preparation; (3) the importance of meal planning. 2.3 outlines the topics covered in each session of the NE intervention. NE interventions were delivered by either Health Education Workers (HEW's) or local youths, both of whom had received training in relation to the study. The interventions took place on a one-to-one basis, either at the Health Posts or at the family home. They were divided into sessions in order to be equal to the ES intervention. A total of 12 45 minute sessions were provided on a weekly basis after enrollment in the study.

Table 2.3

*Structure of Nutritional Education Intervention session*

---

Topics covered in each session of NE intervention.

---

Greet mothers and establish rapport.

Ask the mother how well the child has been eating.

Ask if the child has gained weight.

If not, ask if the child has been ill.

If not, probe to find out why the child is not gaining weight.

Find out if the mother has been feeding the baby at appropriate intervals.

Based on what information has been gathered, deliver appropriate key message.

Discuss hygiene, balancing a meal, food rich in Vitamin A, iodine etc. (each visit focusing on

---

---

one issue).

---

The ES intervention was based on Filial Play Therapy. This refers to a model of parent training, delivered by professionals to parent-infant dyads. It was developed by Guerney in the 1960's (Bratton, Ray, Rhine, & Jones, 2005) and is underpinned by a number of psychological theories including; psychodynamic, humanistic, cognitive-behavioural and developmental (Van Fleet, 2011). It has the aim of improving parenting behaviours and the parent-child relationship (Topham, Wampler, Titus, & Rolling, 2011) through helping the parent to “deal with emotional and behavioural problems in the context of parental empathy and validation”. Since its original development, it has been adapted to cover more condensed, group and individual formats (Landreth, 1991; Van-Fleet. 1994). A growing body of evidence has found filial play therapy to be an effective intervention in reducing child problem behaviours and improving the parental-child relationship across a range of variables such as internalising and externalising problem behaviours, social adjustment, anxiety and family relationships (Bratton et al., 2005). The filial therapy ideas informed the emotional stimulation intervention for this study, which was based on four key principles: (1) encouraging complete focus on the child, (2) boundary setting, (3) using imitation, and (4) play using home made toys. Table 2.4 outlines the activities covered in each session.

Table 2.4

*Structure of Emotional Stimulation session*

---

Topics covered in each session of Emotional Stimulation intervention.

---

Greet mothers and establish rapport

Ask what changes the mother has observed in her interaction with her child (for example, smile, make eye contact). Appreciate what she has done and answer any questions she might have.

Encourage the mother to prepare a boundary within which the “play” session will occur, during

---

---

a specified time period

Gently coach the mother to make eye contact, reflect on what the child is doing and to follow the child's lead.

Make sure the mother closes the session after giving her child warnings

Briefly discuss the benefit of reflection and following the child's lead. Ask what she does outside of the coaching session and appreciate her efforts.

Confirm the next appointment and let her know the next session's point of discussion.

---

The ES intervention was either delivered in small groups of up to five mother-infant dyads by HEWs at health posts: or by trained youths in the family home on an individual basis. Both methods of delivery consisted of 12 weekly, 45-minute sessions. Participants were randomised to either mode of delivery. Participants receiving the intervention at the health posts did so at the same time as their visit to receive emergency food supplementation. The intervention therefore did not continue past discharge of the infant from the supplemental feeding programme. In contrast, participants receiving the intervention delivered by youths on a one-to-one basis were able to continue to receive the intervention after discharge from the feeding programme.

### **2.5.1 Training of study workers delivering interventions.**

HEWs and local youths were recruited to deliver the study interventions. HEWs were paraprofessional local women, who had received training to deliver a range of health interventions. The HEWs additionally recruited a number of local literate men and women to work on the study, who were deemed suitable for the post. Training for each of the interventions was provided to both HEWs and youths over a 7 day period.

### **2.5.2. Recording interactions.**

Participants were randomly selected from each of the study groups to record interactions. The recordings took place following completion of the 12-week intervention (NE or ES) at

either health posts or at the family home by a trained study worker. Mothers were told they were to be recorded with their infants for 10 minutes and were not given any specific instructions on how to interact with their infants. The recordings therefore provide a naturalistic observation of the mother-infant relationship.

### **2.5.3. Training and reliability.**

The author completed training in the study measures. Training for the GRS involved individual teaching sessions with the author of the measure (Professor Lynne Murray) and a researcher from the University of Reading, who was an established trained rater on the scale. They also acted as a second rater for the purposes of reliability. Four face-to-face training sessions took place at the University of Reading using recorded training interactions, and further practice using the recordings took place in addition to this. A total of 10 interactions were used for the training phase. During the training interactions, regular clarification and feedback was sought from the established rater to ensure that any differences in scoring could be addressed. The author then coded a further 10 interactions for which the levels of agreement reached the criteria for reliability on the measure.

Following this, a total of three recordings from this study were piloted and rated by both raters, in order to discuss and address any differences in scoring in relation to the modified scoring criteria developed for the study (Appendix H). A good level of agreement existed between raters on these piloted interactions and thereafter a total of 20% of the interactions ( $n=14$ ) were randomly selected for inter-rater reliability ratings. As illustrated in Table 2.5, Intra Class Correlations (ICC) suggest excellent agreement between raters across the GRS scales.

The training on the CIB was coordinated by an expert rater and published author using the measure (Dr Michelle Slead, Anna Freud Centre), who also rated for reliability purposes in this study. A total of 10 training interactions were completed and feedback was provided in relation to comparisons to the expert rater's scores on the training tapes. This allowed for

identification of any scales in which there were differing levels of agreement and subsequent clarification and further training. Ten further interactions were rated and compared to the expert rater's scores to establish reliability on the measure. There was found to be 86.4% agreement between the raters, reaching the required level of agreement for reliability on this measure.

Details of necessary modifications to the manual for this study were circulated to the second rater (Appendix I). A further 20% of the interactions were randomly selected for rating for reliability ( $n=14$ ). An excellent level of agreement was reached between raters on the CIB scales, as illustrated in Table 2.5.

Table 2.5.

*Inter-Rater Reliability Scores for CIB and GRS Indexes*

	ICC	Sig.
CIB Total	0.91	0
CIB Mother Indexes	0.94	0
CIB Infant Index	0.95	0
CIB Interaction Indexes	0.90	0
GRS Total	0.96	0
GRS Mother Indexes	0.96	0
GRS Infant Indexes	0.93	0
GRS Interaction Indexes	0.97	0

**2.5.4. Coding procedure**

The GRS system was randomly selected for use as the first coding measure. Each interaction was assigned to a number between 1 and 71 and a random sequence was generated to be used for the order of coding. The interactions were viewed on the author's laptop, via a secured and encrypted hard drive. Each recording was coded between 2 and 7 minutes, aside from two of the tapes where there was some interference from outside observers and a different

5-minute section was coded. As a rule, each recording was viewed multiple times and coding of the infant, mother and dyad occurred separately. The raw scores for each of the recordings were then entered into a password protected database.

Once all of the recordings had been coded on the GRS, a further random sequence was generated to designate the order of coding for the CIB scale. The above process was then repeated for the CIB.

## **2.6 Plan for analysis**

This section outlines the procedure undertaken for data analysis, including testing parametric assumptions and outline of analysis. Following completion of the data coding, the raw scores were returned to an unblinded researcher within the wider research team, in order that the scores could be integrated into the main data set and to be allocated to their respective groups.

### **2.6.1 Data assumptions.**

The skewness and kurtosis of the data was examined to check whether it was normally distributed and met parametric assumptions. Details of these are outlined in Tables 3.2 and 3.4. Overall, the data was found to be relatively normally distributed with broadly homogeneous variance between the groups for the means of each scale. There were no substantial violations of the assumptions for parametric analyses and therefore these were applied.

### **2.6.2 Analysis.**

*2.6.2.1. Hypotheses 1: Does emotional stimulation in the context of emergency food supplementation lead to more positive mother-infant interactions?*

It is predicted that the ES group will have significantly more positive ratings of maternal interactive behavior, infant interactive behavior and dyadic interactive behaviour than the control group.

In the first instance, preliminary analyses were carried out to check for any differences between the groups on potential confounding variables using t-tests and Chi-Square tests where

data was categorical. It was identified that the proportion of mothers who were literate was significantly greater in the control group. In light of the relationship between maternal education and maternal sensitivity (Valenzuela, 1997), this variable was controlled for within the analysis. In the larger RCT, preliminary analyses had established a significant difference between groups on the difference in BMI over the treatment period (BMIdiff) and also the BMI at last measurement (BMI last). Consequently, these variables were also controlled for within the analyses.

To look at the relationship between the scale indexes; one-tailed Pearson's correlation analyses were used for the CIB and GRS variables. As nearly all the scales were found to be highly correlated, it was decided to create composites of the scales for the separate mother, infant and interaction indexes. The non-intrusive scale from the GRS was omitted as it was not significantly related to the other scales. Principal components factor analysis was then used for the GRS mother scales. A single factor was identified and a composite score was therefore generated. For the CIB mother composite, GRS infant composite and interaction composites for both coding systems, the mean of the combined items was taken. The CIB infant composite was represented by the infant positive affect score. This resulted in the development of total, mother, infant and interaction scores for both coding systems.

Analyses of co-variance (ANCOVA) were carried out, controlling for maternal education, BMIdiff and BMIlast to compare the differences between groups on each of the indexes.

*2.6.2.2 Hypotheses 2: Are the group differences in infant BMI mediated by the quality of the mother-infant interaction?*

Preliminary analyses on data from the larger RCT established a significant effect of length of treatment on infant BMI difference as well as an effect of group. Accordingly, a new variable was created which included the infant BMI difference when controlling for length of treatment and maternal literacy. This variable was called BMIDa.

One-tailed Pearson's correlation coefficients were carried out to look at the relationship between the scores on the GRS and CIB and the BMI variables in order to find the variables with the strongest relationship, which may be able to be applied in a mediational model. In order to explore further whether the difference in infant BMI gain could be related to the mother-infant interaction variables, Structural Equation Modeling was applied. This analysis was carried out with caution, due to the small sample size.

## Results

### 3.1. Chapter Overview

This chapter presents the descriptive statistics of the study data. The properties of each of the rating scales are then reported before examining the results in line with each of the study hypotheses.

### 3.2 Data preparation

The data were analysed using STATA version 13. Visual inspection took place to rule out missing and anomalous data, prior to analysis.

#### 3.2.1 Testing assumptions of parametric data.

The data were inspected to check whether the assumptions required for parametric data were met. Visual inspection of the skewness and kurtosis of the individual CIB and GRS scales suggested that the data is mostly normally distributed (Table 8 and Table 10). Homogeneity of variance was assessed via Hartley's  $F_{max}$  test, which found that the variances between groups for the CIB scores ( $F_{max}= 1.7$ ) and GRS scores ( $F_{max}=2.0$ ) did not differ significantly. Therefore, homogeneity of variance was assumed. In discussion with the project supervisor, it was decided that the application of parametric tests was acceptable.

#### 3.2.2 Descriptive statistics.

A selection of demographic variables were used to compare baseline characteristics between the two groups, to inform whether it was necessary to control for any variables within the analysis. The demographic information of participants and results of the subsequent analyses are presented in Table 3.1.

Independent samples t-tests and chi-square tests established that, overall, the control and emotional stimulation (ES) groups did not differ significantly on most variables. There was a significant difference between groups in terms of primary complaint, with the majority of infants in the control group presenting to services for malnutrition (70%). Across both groups, roughly

two thirds of participants were presenting for malnutrition and weight loss. A small amount of participants presented for other reasons relating to malnutrition, such as edema, and some primary complaint information was unknown. There was no significant difference in infant age across groups, however, the standard deviation for both groups was large, indicating variability in the ages of participants. Both groups were similar in terms of the height and body mass index (BMI) of the infants. Only a few infants were found to be experiencing severe edema (5% of the control group and 1% of the ES group) and the majority of infants in both groups were new admissions to the health clinics. More than half of the children in each group were breastfed and very few mothers were pregnant at the start of the study. The mean length of treatment was comparable for both groups. Nearly all of the mothers in the study were married and a large proportion of participants had families with land. The groups differed on maternal literacy, with there being more literate mothers in the control group in comparison to the ES group. Consequently, maternal literacy was controlled for throughout the analysis.

Table 3.1

*Sample characteristics of each group and between group comparisons*

	Control group (n=41)	Emotional stimulation (n=30)	Statistical test	p
Female (%)	24 (58.45%)	17 (56.67%)	$\chi^2 (1) = 0.025$	n.s.
Mean age in months (SD)	17.04 (9.83)	17.84 (9.73)	$t(69) = -0.34$	n.s.
Mean height across measurement points (SD)	68.96 (7.40)	68.97 (6.46)	$t(69) = -0.0072$	n.s.
	14.39 (3.06)	14.68 (2.20)	$t(69) = -0.45$	n.s.

Body Mass Index (SD)

Mean number of children in household (SD)	3.5 (1.89) (n=39)	4.27 (1.93)	t(67)= -1.68	n.s.
Length of treatment	6.98 (2.72)	6.9 (1.92)	t(69)=0.13	n.s.
Primary complaint (%):			$\chi^2 (5) = 18.22$	$p = 0.003$
Malnutrition	29 (70.73%)	12 (40%)		
Weight loss	1 (2.44%)	8 (26.67%)		
Edema	0 (0%)	1 (3.33%)		
Irritability	0 (0%)	2 (6.67%)		
Other	4 (9.76%)	0 (0%)		
Not known	7 (17.07%)	7 (23.33%)		
New admission (%)	35 (85.37%)	25 (83.33%)	$\chi^2 (1) = 0.055$	n.s.
Child currently being breastfed (%)	25 (60.98%)	21 (70.00%)	$\chi^2 (1) = 0.62$	n.s.
Mother known to be pregnant at baseline (%)	3 (7.32%)	1 (3.57%)	$X^2 (1) = 0.43$	n.s.
Mother is literate (%)	11 (26.83%)	1 (3.33%)	$X^2 (1) = 6.81$	$p = 0.009$
Family has land (%)	37 (90.24%)	26 (86.67%)	$X^2 (1) = 0.22$	n.s.

Mother is married (%)	41 (100%)	29 (96.67%)	$X^2(1)=1.39$	n.s.
Infant has severe edema	2 (5%)	1 (3.33%)	$X^2(1)= 0.12$	n.s.

## Preliminary analysis

### 3.2.3 Coding Interactive Behaviour Scale (CIB) properties.

Table 3.2 outlines the mean, standard deviation, skewness and kurtosis for each of the indexes coded in the CIB.

Table 3.2

*Summary of individual CIB scales and composite scales across both groups*

Scale	Variable	Mean	SD	Skewness	Kurtosis	
CIB	Composite	Average CIB score	3.38	0.88	0.0035	1.95
		Mother positive	3.48	0.89	-0.22	2.10
		Interaction positive	3.40	1.00	-0.083	2.01
	Mother	Acknowledging	3.02	1.05	-0.12	2.06
		Supportive	3.35	1.07	-0.20	2.02
		Depressed mood	2.41	1.32	0.38	1.75
		Mother anxiety	2.05	0.98	0.92	3.05
	Infant	Infant positive affect	2.96	1.06	0.14	2.19
	Interaction	Dyadic reciprocation	3.22	1.18	-0.095	1.97
		Adaptation regulation	3.37	0.96	-0.23	2.09
	Constriction	2.39	1.11	0.22	1.98	

In order to carry out checks against the internal consistency of the measures, correlational analyses were applied to examine the relationship between all of the CIB scales. Details are provided in Table 3.3. As demonstrated in Table 3.3; nearly all of the mother, infant and dyadic scales correlated strongly and significantly with each other, in the directions expected and in general, more positive ratings of behavior on one scale were related to positive ratings on the other scales. The exception to this were the findings that maternal ratings of anxiety on the CIB, were unrelated to the level of infant positive affect observed, and that maternal acknowledging behavior was not significantly related to the degree of constriction observed in the interaction. Overall, the relationship between the scales was satisfactory.

Table 3.3 *Correlation matrix for CIB scales*

	Acknowledging	Supportive	Depression	Anxiety	Infant positive affect	Dyadic reciprocation	Adaptation – regulation	Constriction
Acknowledging	1.000							
Supportive	0.92*	1.000						
Depression	-0.62*	-0.58*	1.000					
Anxiety	-0.36*	-0.34*	0.35*	1.000				
Infant positive affect	0.63*	0.53*	-0.42*	-0.19	1.000			
Dyadic reciprocation	0.78*	0.80*	-0.72*	-0.38*	0.62*	1.000		
Adaptation – regulation	0.78*	0.77*	-0.54*	-0.35*	0.62*	0.82*	1.000	
Constriction	-0.71	-0.65*	0.78*	0.46*	-0.59*	-0.82*	-0.66*	1.000

\* $p < .05$

It was not necessary to carry out a principle components factor analysis on the CIB scales, due to their being fewer variables (4 maternal scales, 1 infant scale and 3 dyad scales). In light of the significant relationship between these variables, it was possible to combine the individual scale scores to provide a composite score. A score for the maternal scales was created (CIB-m) and for the interactional scales (CIBint). Scores were reversed for negatively correlated items (depressed mood, anxiety and constriction) so that for all composites: a score of 5=good. An infant composite was also created using the infant positive affect scale and was renamed CIBi.

### 3.2.4 Global Rating Scale (GRS) properties

Table 3.4 outlines the mean, standard deviation, skewness and kurtosis for each of the GRS scales.

Table 3.4

*Summary of individual and composite GRS scales across both groups.*

Scale	Variable		Mean	SD	Skewness	Kurtosis
GRS	Composite	Mother positive	3.17	1.02	-0.25	1.88
		Infant positive	3.44	0.73	-0.30	2.49
		Interaction positive	2.87	1.27	-0.097	1.74
	Mother	Warm	3.41	1.15	-0.17	2.09
		Accepting	3.27	0.96	0.038	2.76
		Responsive	3.20	1.05	-0.10	2.24
		Sensitive	3.00	0.94	0.10	2.70
		Non-intrusive	4.25	0.91	-1.22	4.29
		Non-remote	3.48	1.36	-0.26	1.69
		Happy	3.01	1.10	-0.50	2.39
		Much energy	3.23	1.41	-0.19	1.78

	Absorbed in infant	3.30	1.28	-0.28	1.94
Infant	Active communication	2.99	1.09	0.36	2.23
	Engaged with environment	3.73	0.91	-1.05	4.12
	Lively	3.66	1.05	-0.47	2.57
	Happy	3.45	0.60	0.58	2.80
Interaction	Fun	2.69	1.25	-0.11	1.78
	Mutually satisfying	2.90	1.34	-0.033	1.80
	Much engagement	3.20	1.39	-0.20	1.78

As per the procedure with the CIB items, correlational analyses were applied to assess the relationship between the variables and to establish a degree of internal consistency. Details of the correlation between items on the separate mother, infant and interaction scales are provided in Tables 3.5, 3.6 and 3.7. All items related significantly to each other, with the exception of the Non-Intrusive scale.

Table 3.5 *Correlation matrix for GRS mother scales*

	Warm	Accepting	Responsive	Sensitive	Non-intrusive	Non-remote	Happy	Much energy	Absorbed in infant
Warm	1.00								
Accepting	0.69*	1.00							
Responsive	0.72*	0.63*	1.00						
Sensitive	0.80*	0.86*	0.81*	1.00					
Non-intrusive	-0.10	0.32*	-0.068	0.17	1.00				
Non-remote	0.75*	0.54*	0.80*	0.75*	-0.29*	1.00			
Happy	0.82*	0.48*	0.70*	0.68*	-0.36*	0.79*	1.00		
Much energy	0.74*	0.52*	0.77*	0.72*	-0.33*	0.88*	0.85*	1.00	
Absorbed in infant	0.69*	0.48*	0.74*	0.69*	-0.34*	0.88*	0.72*	0.87*	1.00

\* $p < .05$

Table 3.6

*Correlation matrix for GRS infant scales*

	Active communication	Engaged	Lively	Happy
Active communication	1.00			
Engaged	0.56*	1.00		
Lively	0.59*	0.69*	1.00	
Happy	0.57*	0.53*	0.47*	1.00

\* $p < .05$ 

Table 3.7

*Correlation matrix for GRS interaction scales*

	Fun	Mutually satisfying	Much engaging
Fun	1.00		
Mutually satisfying	0.91*	1.00	
Much engaging	0.88*	0.92*	1.00

\* $p < .05$ 

A principal components factor analysis was carried out so that the indexes could be collapsed into composite scores, whilst maximizing the amount of variance explained in the data. As the non-intrusive scale was not significantly related to the other scales (with the exception of the scale rating maternal accepting behavior), it therefore accounted for little of the variance and thus was omitted from the analysis. In accordance with Kaiser (1960), factors with

eigenvalues  $>1$  were considered significant. When applied to the maternal scales, a single factor emerged as accounting for a large percentage of the variance (76.4%, eigenvalue= 6.11). A single factor also emerged from the infant scales, which accounted for 67.82% of the variance (eigenvalue= 2.71) and similarly for the interaction scales (GRSint), a single factor accounting for 93.89% (eigenvalue= 2.80) of the variance emerged. This allowed a composite score to be generated using the mean scores for mother (GRSm), infant (GRSinf) and interaction indexes (GRSint). Scores therefore were rated from 1-5, with 5 representing high levels of observed positive behaviours.

### **3.3 Analysis of Hypotheses**

#### **3.3.1. Hypotheses 1 - Does emotional stimulation in the context of emergency food supplementation lead to more positive mother infant interactions?**

One-way analysis of co-variance (ANCOVA) were carried out to look at differences between groups on the CIB and GRS scores. Maternal literacy was controlled for, as was the difference between the BMI of the infant at baseline and follow up (BMIdiff) and BMI at last measurement (BMIlast).

##### **3.3.1.1 Measuring mother-infant interaction with CIB.**

Table 3.8 presents the outcome of the ANCOVA's. The composite scores will be discussed first. In line with the hypothesis, a one way ANCOVA found that when controlling for maternal literacy, infant last BMI measurement (BMIlast) and the change in infant BMI over treatment (BMIdiff) there was a significant main effect of group on maternal CIB scores. The mean rating of interactions for mothers in the ES group was therefore significantly more positive than that of the control group. The effect size, suggested a modest amount of variance in mother CIB scores that was explained by the group membership.

For the CIB infant composite scale, the study hypothesis was not supported. The ANCOVA revealed that there were no significant effects of group on infant interaction scores and no

significant effects of the covariates; maternal literacy, infant BMI<sub>last</sub> and infant BMI<sub>diff</sub>. As expected, the variance explained by group was minimal.

In line with the primary hypothesis, the ANCOVA revealed a significant positive effect of group on interaction scores. Thus, mothers and infants in the ES group were rated as having more positive interactive styles. The effect size suggested a small effect of group assignment, with a substantial amount of unexplained variance remaining. When controlled for, maternal literacy, infant BMI change and infant BMI at last measurement did not have a significant effect on the CIB interaction scores, thus suggesting that the observed group differences cannot be explained by these variables.

The individual scales will now be discussed. For the GRS indexes, the ANCOVA analyses revealed significant positive main effects of group on maternal acknowledging behavior, supportiveness, depressed mood and anxiety when controlling for the effects of maternal literacy, infant BMI at last measurement (BMI<sub>last</sub>) and infant BMI change across treatment (BMI<sub>diff</sub>). The effect of group assignment on ratings of maternal depressed mood was highly significant, with a significantly higher rating of depressed mood in the control group. When looking at effect sizes, a modest proportion of variance in depression ratings was explained by the group variable.

On the CIB interaction indexes, a series of ANCOVAs controlling for maternal literacy, infant BMI at last measurement (BMI<sub>last</sub>) and infant BMI change over treatment (BMI<sub>diff</sub>) found a significant effect of group assignment on ratings of reciprocity and emotional constriction. Significantly higher ratings of constriction were found in the control group, with a modest amount of variance explained by the group variable ( $\eta^2=0.24$ ). The interaction between mothers and infants in the ES group was observed to be more reciprocal and again, a modest amount of variance is explained by group assignment ( $\eta^2=0.24$ ). An ANCOVA for adaption-regulation ratings failed to find an effect of group membership and consequently did not support the study hypotheses.

Overall, this suggests that mothers and infants who received an emotional stimulation intervention scored significantly higher on measures of positive mother behaviours and positive dyadic interaction, and significantly lower on ratings of depressed mood and constriction in the interaction, when compared to the control group. As outlined in Table 3.8, the variances explained by group effects were small to modest across the scales, with the largest effect size found for the impact of group assignment on ratings of maternal depressed mood. There were no observed effects of group on ratings of positive infant affect, when measured by the CIB. This therefore indicates that the study hypotheses are not fully supported.

### **3.3.1.2 Measuring mother-infant interaction with GRS.**

As outlined in Table 3.8, an ANCOVA controlling for maternal literacy, BM<sub>Ilast</sub> and BM<sub>I</sub>diff found a significant effect of group assignment on the maternal composite scale for the GRS (GRS<sub>m</sub>). In line with the hypotheses, this suggests that mothers in the intervention group displayed more positive behaviours and interactions with their infants when compared with mothers in the control group. As illustrated in Table 3.8, this difference was found to be highly significant with a substantial amount of the variance in GRS<sub>m</sub> scores accounted for by group assignment.

Similarly, an ANCOVA controlling for maternal literacy, BM<sub>Ilast</sub> and BM<sub>I</sub>diff, revealed a main effect of group on ratings of the quality of dyadic interaction, with significantly more positive ratings of interaction in the ES group. The effect was small to modest. There were no significant differences between groups with regards to infant behavior and communication (GRS<sub>inf</sub>), which again, does not fully support the study hypotheses.

When looking at the individual GRS scales; ANCOVA's found significant effects of group assignment on the ratings of maternal warmth, responsiveness, sensitivity, remoteness, happiness, energy and extent that mothers were absorbed in the infant. The proportion of variance explained by these effects were modest to large. Highly significant differences were found between groups on maternal responsiveness, non-remote behavior, energy and level that

mothers were absorbed in their infant. These effects were substantial, as illustrated by the large proportion of variance explained by the group variable. These effects were all significant when controlling for the covariates of maternal literacy, infant BMIlast and infant BMI<sub>diff</sub>, apart from the ratings of mother's energy in the interaction. In this case, more literate mothers were found to be rated as significantly more energetic, however, the significant effect of group on ratings of greater maternal energy remained when this was controlled for.

The results of one-way ANOVA's failed to fully support the study hypotheses for the accepting and non-intrusive scales. When controlling for maternal literacy, BMIlast and BMI<sub>diff</sub>, there was no observed effect of group on ratings of acceptance and non-intrusive behavior.

As illustrated in Table 3.8, the results of one-way ANCOVA's on the individual infant GRS scales failed to find significant effects of group assignment on the ratings of infant active communication, engagement with the environment, liveliness and happiness.

The ANCOVA's carried out on the interaction scales, when controlling for the covariates, revealed significant effects of group assignment on all of the indexes. Effect sizes were small to modest, as explained by the proportion of variance in the scores that is accounted for by the group assignment.

Table 3.8

*Effects of group on GRS and CIB scores, when controlling for mother literacy, last infant BMI measurement (BMIlast) and difference between infant BMI at baseline and after treatment (BMIdiff)*

Scale	Indicator	Predicted Group Mean (SD)		Group effect		Literacy	BMIlast	BMIdiff	
		NE	ES	F (1,66)	Eta sq (n2)	F (1,66)	F (1,66)	F (1,66)	
GRS	Composite	Mother	2.69 (0.26)	3.99 (0.15)	30.31***	0.45	3.12	0.14	2.85
		Infant	3.40 (0.17)	3.54 (0.11)	0.52	0.04	0.77	0.53	0.28
		Interaction	2.46 (0.34)	3.57 (0.21)	7.77**	0.23	2.34	0.04	1.72
GRS	Mother	Warm	2.95 (0.27)	4.03 (0.16)	11.48**	0.26	1.60	0.61	2.16
		Accepting	3.05 (0.22)	3.57 (0.12)	2.89	0.10	1.32	1.16	1.00
		Responsive	2.68 (0.27)	3.90 (1.45)	21.31***	0.37	3.41	0.36	1.90
		Sensitive	2.63 (0.27)	3.50 (0.17)	10.53**	0.27	1.42	1.19	4.68

---

	Non-intrusive	4.41 (0.15)	4.03 (0.11)	1.58	0.06	0.37	1.03	0.00
	Non-remote	2.71 (0.23)	4.53 (0.16)	38.06***	0.47	0.86	0.04	1.40
	Happy	2.54 (0.27)	3.66 (0.17)	14.09**	0.30	2.07	0.05	2.30
	Much energy	2.39 (0.36)	4.36 (0.22)	43.51***	0.53	4.46*	0.69	1.02
	Absorbed in infant	2.54 (0.30)	4.33 (0.19)	43.45***	0.52	3.14	0.02	2.36
Infant	Active communication	2.93 (0.27)	3.07 (0.18)	0.24	0.05	0.96	0.98	0.22
	Engaged with environment	3.68 (0.85)	3.80 (0.34)	0.40	0.01	0.35	0.00	0.00
	Lively	3.61 (0.29)	3.73 (0.21)	0.06	0.06	0.36	1.59	0.42

		Happy	3.37 (0.09)	3.57 (0.04)	1.85	0.04	0.50	0.09	0.36
	Interaction	Fun	2.27 (0.33)	3.27 (0.21)	6.35*	0.21	2.01	0.01	2.30
		Mutually satisfying	2.44 (0.31)	3.53 (0.20)	7.01*	0.20	1.80	0.01	1.38
		Engaging	2.68 (0.38)	3.90 (0.24)	8.10**	0.25	2.69	0.32	1.22
CIB	Composite	Mother	3.09 (0.16)	4.01 (0.12)	16.45***	0.29	0.20	0.09	1.32
		Infant	2.81 (0.22)	3.17 (0.14)	0.96	0.05	0.00	0.54	2.24
		Interaction	3.06 (0.25)	3.86 (0.20)	7.54**	0.21	0.23	1.04	1.27
CIB	Mother	Acknowledging	2.71 (0.18)	3.45 (0.11)	6.57*	0.14	0.00	0.29	1.60

	Supportive	3.01 (0.17)	3.82 (0.11)	6.47*	0.16	0.85	0.01	0.59
	Depressed mood	3.00 (0.26)	1.6 (0.19)	16.99***	0.31	0.76	1.01	0.36
	Anxious	2.37 (0.18)	1.62 (0.11)	9.08**	0.17	0.39	0.06	0.82
Interaction	Dyadic reciprocation	2.82 (0.37)	3.77 (0.28)	6.51*	0.24	1.02	1.72	1.79
	Adaptation regulation	3.15 (0.76)	3.67 (0.06)	3.84	0.07	0.00	0.07	0.12
	Constriction	2.79 (0.32)	1.85 (2.50)	8.82***	0.24	0.07	1.33	1.79

\* p<.05 \*\*p<.01 \*\*\*p<.0001

NE = Nutritional Education, ES = Emotional Stimulation

### **3.3.1.3. Summary of Hypotheses 1**

The quality of the mother-infant interaction between groups was based upon ratings of the positive behavior and interaction of the mother, infant behavior and communication and the quality of the interaction itself. It was found that mothers who had received an ES intervention were more positive in their own behavior and interaction and that the quality of the dyadic interaction was more positive, when compared to the control group. The effects of group assignment on the maternal rating scales were modest to large. Where there was a significant effect of a covariate (maternal literacy), these group effects remained when the covariate was controlled for within the analysis. The effects of group assignment on ratings of the dyadic interaction were small to modest. Ratings of positive infant behavior and communication did not significantly differ between groups when assessed by either of the study measures.

### **3.3.2. Hypotheses 2 - Are the group differences in infant BMI change mediated by the quality of the mother-infant interaction?**

#### **3.3.2.1 Preliminary analysis**

A one-way ANCOVA found that infants in the ES group showed a significantly greater difference in BMI change over the course of treatment. ( $F(1,67) = 5.26, p < .05$ ), when controlling for the length of treatment and maternal literacy. Length of treatment was found to be a significant covariate ( $F(1, 67) = 4.04, p < .05$ ), however maternal literacy was not ( $F(1, 67) = 0.56, p > .05$ ). With this in mind, a new variable was created to reflect the BMI change over treatment, when adjusted to control for length of treatment and maternal literacy (BMI<sub>da</sub>)

In order to assess whether these differences in infant BMI change over treatment could be explained by the improved quality of mother-infant interactions; the relationship between group assignment, mother-infant interaction ratings and a number of variables related to infant BMI change were explored. Firstly, correlational analyses were carried out to explore the relationships between the interaction measures and the infants' BMI at last measurement (BMI<sub>last</sub>), the difference between the BMI at baseline and after treatment, (BMI<sub>diff</sub>) and the

difference between the infant's BMI change, when controlling for length of treatment and maternal literacy (BMIda). Table 3.9 presents the correlation coefficients.

Table 3.9

*Correlation matrix for relationship between composite interaction measures and measures of infant body mass index.*

	BMI	BMIlast	BMI <sub>diff</sub>	BMIda
CIB <sub>m</sub>	0.060	0.18	0.27*	0.37*
CIB <sub>i</sub>	-0.076	0.023	0.19	0.10
CIB <sub>int</sub>	0.13	0.25*	0.29*	0.31*
GRS <sub>m</sub>	-0.0005	0.14	0.29*	0.38*
GRS <sub>i</sub>	0.098	0.16	0.15	-0.020
GRS <sub>int</sub>	0.043	0.16	0.26*	0.22

\* $p < .05$

There appeared to be no relationship between the measures of infant positive behavior and communication and any of the BMI measures. The maternal composite scales on the CIB and GRS (CIB<sub>m</sub> and GRS<sub>m</sub>) were found to be significantly related to infants' change in BMI (BMI<sub>diff</sub>) and also when this change was calculated with the length of treatment and maternal literacy controlled for (BMIda). The interaction measures of the CIB were found to have significant relationships with BMI<sub>last</sub>, BMI<sub>diff</sub> and BMIda. This suggests that the more positive the interaction, the greater the increase in infant BMI over treatment. The GRS was also found to have a slight relationship to BMI change (BMI<sub>diff</sub>), but not when adjustments were made for length of treatment and mother literacy (BMIda). There was also no relationship between the GRS interaction measures and the infant BMI at baseline (BMI) or last measurement (BMI<sub>last</sub>).

Tables 3.10 and 3.11 show the correlations between group, BMI variables and CIB and GRS scales. Group membership was related significantly to the change in infant BMI after treatment, and a stronger association was observed when controlling for length of treatment and

maternal literacy. Significant relationships were also observed between group membership and CIB and GRS composite scales, with the exception of the infant scales. The strongest relationship was found between group membership and the GRS mother composite scale.

Table 3.10

*Correlation matrix of BMI variables with group*

	Group
BMI	0.16
BMI <sub>d</sub>	0.24*
BMI <sub>da</sub>	0.69*

Table 3.11

*Correlations of CIB and GRS scales with group*

	Group
CIB	0.45*
CIB <sub>m</sub>	0.51*
CIB <sub>i</sub>	0.16
CIB <sub>int</sub>	0.40*
GRS	0.47*
GRS <sub>m</sub>	0.64*
GRS <sub>i</sub>	0.095
GRS <sub>int</sub>	0.42*

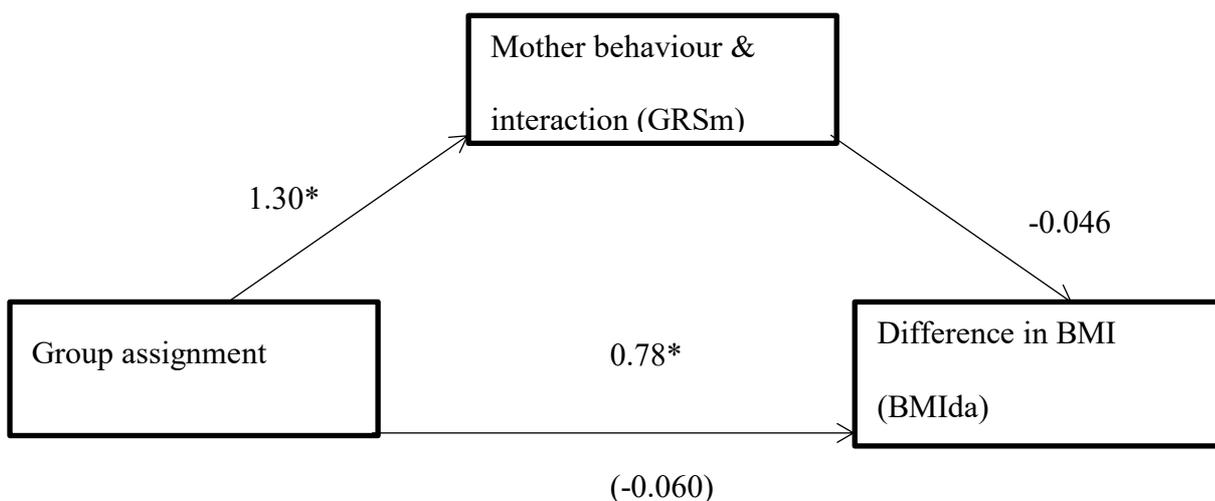
### 3.3.2.1 Mediation analysis

Having established that infants in the ES group had a greater change in BMI over the course of treatment (when controlling for length of treatment and mother literacy), it was also

found that GRS mother variables related significantly to BMIda and also strongly related to group membership. An equally strong significant relationship was observed between group membership and adjusted BMI change over treatment. Therefore, a preliminary path analysis was used to test whether positive maternal behavior and interaction (measured by the GRS), could mediate the effect of group membership (control or intervention). The proposed path is outlined in figure 2.

The model was tested using a maximum likelihood method. An evaluation of the goodness-of-fit between the model and the data carried out using a Chi Square ( $X^2 = 39.14, p < .0000$ ) which found a significant probability value, thus suggesting a poor fit for the model. Structural equation modeling found direct effects of group assignment on adjusted BMI change ( $z = 7.95, p, .000$ ) and of group on GRSm ( $z=6.99, p, .000$ ) but no direct effects of GRSm on BMIda ( $z= -.80, p .05$ ). The analysis therefore, did not find support for the hypotheses that positive mother behavior and interaction could account for some of the relationship between group membership and difference in adjusted BMI.

Figure 2 Proposed pathway for mediational analyses. Indirect effects in brackets and \* denotes significance at  $p < 0.0001$



### 3.4 Chapter summary

The findings were somewhat supportive of the primary hypothesis for the study, in that an emotional stimulation intervention appeared to have a positive effect on the quality of mother-infant interaction. More positive behaviour and interaction scores were observed in the ES group in relation to the mothers' behaviour and interaction with the infant and the quality of the dyadic interaction. These effect sizes ranged from small/modest to large. The exception to these findings were on two of the GRS mother scales which found that there were no differences between the groups on measures of mothers' accepting behaviours and non-intrusive behaviour. The observed group differences remained when controlling for whether the mother was literate (as this was found to be a significant difference between the groups at baseline), the infant's BMI at last measurement and the infant's BMI change over the treatment period. This suggests that the observed effect of the intervention could not be explained by these other variables. The covariates were found to be non-significant across all analyses, aside from the finding that maternal literacy had an effect on ratings of maternal energy (in that more literate mothers were rated as more energetic). When controlling for this significant finding, the effect of group assignment on the improved ratings of maternal energy remained. In contrast with the primary hypothesis, this study failed to find support for a predicted positive effect of the intervention on infant behaviour and communication.

The findings failed to support the secondary hypothesis which predicted that an observed difference in mother-infant interaction would account for some of the group effects of increased infant BMI difference over the treatment period. Preliminary analyses found it was necessary to control for the effects of the length of treatment and mother literacy on infant BMI change (BMIda). It also was found that the measures of mother behaviour and interaction on the GRS scale (GRSm) were most strongly related to the infant change in BMI (when controlled for length of treatment and mother literacy). Significant and moderate to strong correlations were found between group assignment, measures of mother's positive behaviour and interaction on

the GRS (GRSm) and infant BMI change (BMIda). When structural equation modeling was applied, it did not find support for a proposed pathway between group assignment, ratings of positive mother behaviour and interaction and change in infant BMI. Group assignment independently predicted BMIda and GRSm, but the pathway between GRSm and BMIda remained non significant. Due to the power limitations in the sample, these analyses were exploratory in nature and therefore, it may be that there was insufficient power to detect an effect.

## Chapter 4

### Discussion

#### 4.1 Overview

Mother-infant interactions provide an important cornerstone for infant cognitive, social and physical development. Theoretically, this is underpinned by psychodynamic theories and attachment theory. Strong links have been established between the nature of mother-infant interaction and infant attachment security, through maternal sensitivity and responsiveness, which in turn may be predictors of future cognitive and social development (Moss, Rousseau, Parent, St-Laurent, & Saintonge, 1998; Verschueren & Marcoen, 1999). Additionally, insecure attachment is linked to adverse outcomes such as, externalising behaviour, adult anxiety and borderline personality disorder (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010; Levy et al., 2005). Studies in the developed world have established that improving mother-infant interaction can lead to improved attachment security (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003).

In developing countries, such as Ethiopia, the rates of adversity are high and consequently can negatively impact upon children's developmental potential (Walker et al 2007; Engle et al 2007). The prevalence of childhood malnutrition is great and the physical, cognitive and social consequences of this are dire. Evidence further suggests that the availability of psychosocial stimulation and the quality of mother infant interaction may be sub-optimal for infants with malnutrition. This study sought to explore whether the quality of mother-infant interaction could be improved by an emotional stimulation intervention, delivered alongside nutritional supplementation for malnourished infants. The primary aims were to compare the interaction quality between a group of Ethiopian mother-infant dyads who had been randomly selected to receive an emotional stimulation intervention alongside nutritional supplementation, with a control group who had received nutritional education and nutritional supplementation alone. It was predicted that more positive interaction would be observed in the intervention

group. Secondly, it was hypothesised that infants in the intervention group would gain weight more rapidly over the treatment period, and that these gains may be related to the hypothesized improvements in mother-infant interaction. It was further hypothesized that the mother-infant interaction was a mediator of the change in infant BMI.

This chapter will summarise the findings in relation to each of the research questions, before exploring the links to theory. The clinical implications of the study findings will be discussed, before an appraisal of the strengths and weaknesses of the study and suggestions for further research are considered.

## **4.2 Summary of Results**

This study compared the quality of mother-infant interaction between a group of mother-infant dyads who had received an emotional stimulation intervention ( $N=30$ ) and a control group, who had received a nutritional education intervention ( $N=41$ ). Both groups received nutritional supplementation. In addition to the interaction measures, the groups were compared on other outcome variables relating to the change in infant BMI, and this analysis had taken place as part of a larger RCT from which this study derived from.

Mother-infant interaction was measured using scales from two coding systems, which have been validated for use in developing countries. Across both coding systems maternal interactive behaviour, infant affect and behaviour and the quality of the interaction was rated. Data regarding the impact of the intervention on the change in infant BMI, collected from the larger RCT from which the study was based, was also used in the analysis.

### **4.2.1 Primary Research Question**

The primary aims of the study were to explore whether mother-infant dyads in Ethiopia who had received an emotional stimulation intervention in addition to nutritional supplementations for malnutrition, were rated as having more positive mother-infant interactions when compared to a control group who had received a nutritional education intervention. The emotional stimulation intervention was designed to improve the interactions between the mother

and infant using a combination of techniques such as, play therapy and psychoeducation around the importance of emotional communication. The interactions were rated in respect of the maternal interactive behaviour, infant interactive behaviour, dyadic interactive behaviour and the overall quality (rated by a composite for each of the indexes). The findings from this study were that in the intervention group there was significantly more positive maternal interaction observed as well as more positive ratings of the dyadic interaction. There were no differences found between groups in infant behaviour.

#### ***4.2.1.1 Maternal interactive behaviour***

The findings from this study generally supported the primary hypotheses. On both rating systems, the quality of maternal interactions were rated as more positive for mothers in the intervention group. These effects remained when controlling for covariates. This suggests that the group difference observed could not be explained by the variance in maternal literacy, the difference in infant BMI over the treatment period (BMIdiff) or the infant's last BMI measurement (BMIlast). Mothers in the intervention group were deemed to have increased sensitivity, warmth, responsiveness, happiness and more energy, were more absorbed in the infant and were less remote when compared to mothers who had received a control intervention (nutritional education). They were also more acknowledging and supportive of the infant and displayed less behavioural signs of depressed mood and anxiety. These findings are consistent with previous research where emotional stimulation interventions have been found to improve the quality of maternal interactive behaviour in developing countries (Cooper et al., 2002; Cooper et al., 2009; Cooper et al., 2013). This is also in line with previous research with malnourished infants and their mothers, which has established that including psychosocial stimulation interventions alongside nutritional supplementation can lead to improved outcomes associated with maternal knowledge and behaviour (Hamadani et al., 2006). It builds on work by Aboud and Akhtar (2011), which found that mothers who had received training around responsive behaviours during feeding, were subsequently more responsive towards their infants

when compared to controls. The present study has further established increased responsiveness outside the specific feeding context, as a result of an emotional stimulation intervention, in that it has found improvements in observed free play. In addition, it has established that other important aspects of maternal interactive behaviour such as sensitivity and warmth are modifiable in this population. This has also been established in previous research in developing countries as leading to more secure attachments for infants (Cooper et al., 2009).

This study failed to find a difference between groups in the ratings of maternal accepting behaviours, that is the extent to which mother's take an interest and respond positively to their infant's behaviour (as rated by the GRS). This was somewhat surprising, since this scale was found to have a significant relationship with the other maternal constructs on the GRS. It is possible, that the modification of the scale to fit the cultural context failed to accurately measure the construct. However, if this were the case then it may also be predicted that the construct would not correlate with the other items in the scale, which was not the case. This finding could be as a result of a lack of infant directed behaviours across the sample, meaning that there were fewer infant directed behaviours for mothers to be accepting or rejecting of.

In addition, there were no group differences observed in relation to non-intrusive behaviours of the mother. This may be explained by a general lack of intrusive behaviour across the whole sample. This could also be as a result of the infant behaviour, which in general was less active and engaged across both groups therefore meaning that there were fewer opportunities for mothers to behave intrusively towards their infant. This hypothesis has mixed support from previous research and is unexpected in light of the findings of Masur, Flynn & Lloyd (2013), who reported that intrusive maternal directives were made as a result of infant 'off task' behaviour. This would therefore predict a greater level of intrusiveness for the current study interactions as a result of low infant engagement or 'off task' behaviour. However, Lloyd & Masmur (2014), take a different perspective on the definition of intrusive behaviour, for example, by acknowledging that some re-direction may be appropriate in response to a

disengaged infant, despite this not being deemed sensitive and consequently labelling it as ReDirective behaviour. This therefore led to findings of a low level of intrusive behaviour in response to infant disengagement, which would support the potential explanation for the findings of the present study. Ipsa et al. (2004) summarised that positive maternal interactive behaviours such as warmth and sensitivity are negatively correlated with intrusiveness (Hubbs-Tait, Culp, Culp, & Miller, 2002; Hubbs-Tait et al., 2002) but that there are variations across cultures as to the extent of such relationships. Based on these findings, it may have been hypothesized that the present study would have found a positive relationship between non-intrusive behavior and other maternal interaction variables such as sensitivity and warmth and therefore a difference between groups. In fact, the only significant relationship observed was a weak positive correlation between non-intrusive behavior and maternal acceptance, both of which failed to find a significant difference between groups. Further work is required to understand these maternal interactive behaviours in this culture and also to consider appropriate means of measurement.

#### ***4.2.1.2 Infant interactive behaviour and communication***

The study findings failed to support the hypotheses that improved infant interactive behaviour and communication would be observed for infants who had received an emotional stimulation intervention. This suggests that the intervention had no effect on the communication, engagement, liveliness or happiness of the infant. Previous studies in developing countries and including infants recovering from malnutrition, have established some improvements in infant interactive behaviour. These include more vocalisations, improved activity and happiness in the interaction as a result of an emotional stimulation intervention directly targeting the quality of mother-infant interaction (Gardner et al., 2003; Hamadani et al., 2006). Therefore, this study failed to replicate these findings in an Ethiopian population of mother-infant dyads receiving interventions for malnutrition. There are several possibilities for this. Firstly, the previous research which had established improved infant behaviours had both used a different methodology from the present study (Gardner et al., 2003; Hamadani et al., 2006). Their ratings

of interactive behaviour took place in the context of an assessment setting where other measures of infant development had also been administered such as the Bayley Scales of Infant Development. When contrasting the more naturalistic setting of the present study, it may be that these group differences were only observable in a structured context, where infant and maternal engagement in previous tasks had been primed. Due to the mixed findings of only a handful of studies, it may also be of interest to consider whether the potential effects of the intervention on infant interaction are observable at the end of treatment, due to the complexities involved in the physical and psychological recovery from malnutrition. It is possible that the impact of improved interaction on the infant develops over a longer period than that captured by this study.

#### ***4.2.1.3 Quality of dyadic interaction***

The results of this study found significantly more positive ratings of the dyadic interaction. Namely, the interactions of the mother-infant dyads in the intervention group were rated as more fun, mutually satisfying, with increased reciprocity and decreased constriction when compared to the interactions observed in the control group. The study failed to find a difference between groups on the adaption-regulation scale, which looks at the degree to which the mother and infant respond and adapt to each other's cues and behaviours. This result is perhaps understandable when considering that across the study, infant behaviour was of low activity and engagement, therefore meaning that there were fewer behaviours for the mother to adapt to.

This study appears to be the first to examine the nature of the dyadic mother-infant interaction following an intervention for malnourished infants in this population. However, the findings are in line with previous research in Ethiopia in which a parenting program had led to improvements relating to the synchronicity of the interaction, for example a greater frequency of turn taking and observed shared positive affect (Klein & Rye, 2004). Due to the proposed transactional nature of malnutrition and the mother-infant interaction (Lester, 1979; Rosetti-Ferreira, 1978) it is a strength that this study assesses the impact of the intervention at the dyadic

level.

#### **4.2.2 Secondary Research Questions**

The secondary research question looks to establish whether an improved rate of weight gain in the intervention group could be accounted for by the hypothesised improvements to the quality of mother-infant interactions. It was hypothesised that there would be an observed relationship between the quality of the mother-infant interaction and the difference in infant weight gain across treatment. In addition, group membership (intervention or control) would be related to the difference in infant weight gain (when adjusted to account for maternal literacy and BMI at last measurement). These hypotheses were generally supported by the study findings. Positive ratings of maternal interaction were significantly related to larger adjusted infant BMI change, although these relationships were modest but significant. In addition, more positively rated dyadic interaction on the CIB scale was related to larger adjusted BMI gains. This relationship was weak but significant. A further prediction was that an exploratory path analysis would establish that the relationship between the group assignment and change in infant BMI was mediated by aspects of the mother infant interaction. This study failed to find support for this hypothesis, which may be due to the lack of power in the sample to detect such a path.

Previous literature has been mixed in relation to the efficacy of psychosocial interventions on infant growth from nutrition. Studies such as Nahar et al. (2012) and preliminary work by Play Therapy Africa (2009) did find an improvement to infant weight gain as a result of adding a psychosocial intervention to the treatment for malnutrition. This study's findings of the positive relationships between group membership, infant weight gain (BMIDa) and quality of maternal and dyadic interaction, would support these findings. The previous research and this study's findings lead to the consideration of whether there are elements of the quality of mother-infant interaction that account for the rate of weight gain in infants. Literature from developed countries has found a relationship between parenting styles and infant feeding practices (Hubbs-Tait et al., 2008). Additionally, Aboud and Akhtar (2011) found a relationship

between the rate of infant feeding and a more responsive feeding environment in a developing country. These findings may again lead to a prediction that improvements to the quality of mother-infant interaction would create a more sensitive and responsive feeding experience (Wachs et al., 2011) and thus may improve the feeding behaviour of the infant and lead to improved growth.

In contrast with these predictions, are findings from studies such as Hamadani et al. (2006) in Bangladesh, who found that as a result of interventions infant cognitive development, emotional stimulation and interaction improved, but there was no effect on infant weight gain. These findings do not support a proposed model whereby the quality of mother-infant interactions may account for the rate of infant growth (BMI change) unless there are specific elements of the maternal interactive experience that were not captured by their methodology. Equally, comprehensive reviews of the literature have provided mixed conclusions as to the impact of psychosocial interventions on physical recovery from malnutrition (Grantham-Mcgregor et al., 2014; Baker-Henningham, & López Bóo, 2010), which again casts some doubt as to the predictive power of interaction quality on infant weight gain. The findings from the present study fit cautiously with other studies which suggest that the pathway between psychosocial interventions and infant growth is not accounted for by the quality of mother-infant interaction. However, further work in this area is required for a better understanding of what variables influence infant weight gain after recovery from malnutrition. This will be discussed further in section 4.8.

### **4.3 Strengths and Weaknesses of the study**

#### **4.3.1 Design.**

The present study used a randomly selected sample of participants from a large cluster randomised controlled trial. The larger study design is a key strength, in that it represents the ‘gold standard’ of study methodology (McGovern, 2001) despite the difficulties in overcoming the practicalities and challenges of carrying out research of this magnitude in a developing

country. Due to the nature of the main RCT from which this data was taken, a cluster randomisation process was implemented. Again this was a strength of the study in terms of feasibility and also in ensuring that information about the intervention was not shared between participants in different groups, and thus reduced potential effects of ‘contamination’ (Puffer, Torgerson, Watson 2005; Velengtas, Mohr & Messner, 2012). A potential limitation of this particular type of design is that regional clustering can result in similar characteristics of participants and create intercluster correlation (Velengtas et al., 2012). This may require a larger sample size to achieve sufficient power to detect an effect. As robust group differences were established for some of the variables (for example, maternal interactive behaviour and quality of dyadic interaction) and in light of the a-priori power calculation, it is thought to be unlikely that the study was underpowered.

In addition to the randomisation process, the author was blind to the participants’ group allocation and other demographic information when coding the interactions. This is another key strength of the study, in particular when attempting to reduce some of the bias that can be introduced using observational rating systems.

Historically, countries in the developing world may not have benefitted from well-designed, large scale research trials such as the one from which the present study’s data is derived. In more recent times, there has been an increased focus on research in these at risk populations, however, RCT’s have tended to focus on specific interventions which can be easily implemented in a trial (Duke & Fuller, 2014), without perhaps a focus on more complex interventions which address some of the wider factors involved. It could be argued that the present study, in connection with the primary RCT from which this study is derived, both explore a comprehensive intervention with a vulnerable and hard to reach population. In addition, the study also attempts to understand the variables that account for the observed outcomes, despite this being limited by a lack of statistical power to carry out path analysis.

A limitation of the study design is the lack of availability of baseline measures of

mother-infant interaction. This will be explored further in the forthcoming section. Essentially for the primary research question, the design is a cross-sectional, between-groups comparison. Despite analysis of group differences and subsequent controlling of variables upon which they differed, there are inherent limitations to the conclusions that can be drawn from this study. For example, it is possible that the findings did not capture an improvement in the treatment group as a result of the intervention, but instead a worsening of interaction in the control group. This clearly limits the inferences that can be made as to the impact of the intervention on the quality of the interaction.

In addition, as the measurement of mother-infant interaction took place at the end of treatment, some of the randomisation process may have been compromised, since there would inevitably be some attrition from the sample. The sample compared in this study would inevitably be drawn from those who had completed treatment and consequently, there is no way of carrying out analysis on those participants lost to follow up. Therefore it is not known whether participants who did not complete treatment had, for example, more negative or positive mother-infant interactions which may have impacted upon the findings. This is therefore a further limitation of the study design.

Equally, it is likely that there was insufficient power to detect a potential mediational model to explain the infant growth as a result of the quality of mother-infant interaction. These analyses were preliminary and carried out with caution due to the sample size (Thommes et al., 2010). However, without a valid statistical model, the relationship between the quality of mother-infant interaction and infant growth is merely correlational, and therefore no causal attributions or predictions can be made at this time. Further studies with greater statistical power are therefore required to investigate this further.

#### **4.3.1.1 Baseline characteristics.**

As discussed in the previous section, the lack of baseline measures of interaction were a key limitation of the study design. In addition, there were some other variables which would

have been beneficial to compare groups on at baseline. These will be considered in turn.

A potential limitation of the study was that baseline measures of depression were not available for this sample. Again, whilst the characteristics of the two groups were broadly comparable at baseline, there is the potential that maternal depressive symptoms differed between groups. This could have impacted upon the findings, since depression is known to relate to impaired maternal responsiveness and sensitivity (Cooper et al., 1999; 2009). On objective measures of maternal mood in the interaction, mothers in the intervention group were rated as less depressed/more happy. Without baseline measures of the mother-infant interaction, we cannot assume with certainty that the observed difference in maternal mood is as a result of the intervention. It is possible that mothers in the control group were more depressed prior to treatment and that the significantly lower quality interactions were related to this. On balance, it is likely that the randomisation process would minimise the chances of this occurring. However it is an important consideration if the study were to be replicated and expanded upon in the future.

Additionally, there was not information about the mother's nutritional status at baseline. If mothers were also suffering from malnutrition then it could be expected that their energy and ability to interact actively with their infant could be impaired (Aboud & Alemu, 1995). It would have been optimal to have information on this, since it may have accounted for some of the difference in interaction quality between groups.

It would also have been of interest to know about the levels of social support received by mothers in the intervention and control group. It is likely that the mechanism for change was not the work completed in the intervention sessions, but how well this was implemented in the home environment. Therefore, it would be useful to compare the amount of actual or perceived support received in the home, since it might be expected that a well supported mother would have more opportunities to interact with her infant and practice the strategies taught, than one who is overwhelmed with competing demands. Indeed, information from qualitative research in the

Gambia (Mwangome et al., 2014) identified that themes relating to social support both within the family and community and in terms of professional support were important factors in mother's abilities to practice health and care practices for their children. Although there may be a cultural variation, if there are similar themes observed in Ethiopia, then it is a limitation of the study that it is not possible to understand the impact of these wider social contexts on the outcome.

A key limitation of this study is that it cannot be assumed with confidence that the quality of mother-infant interactions were the same between groups at baseline. There is the possibility of other extraneous variables, including those discussed, which may have led to group differences in interaction, but which were not measured. Overall, the randomisation process and careful consideration of baseline characteristics demonstrate steps were taken to minimise and account for any variation between the groups prior to treatment. However, ideally future research may benefit from including a pre and post measure of mother-infant interaction.

#### **4.3.2. Recruitment and Participants.**

The sample size for this present study was relatively small in comparison with other emotional stimulation studies focused on enhanced mother-infant interaction (Cooper et al., 2009; Hamadami et al., 2006). As a preliminary study however, the sample size is sufficient.

The study sample focused on the interactions between mothers and infants for a number of reasons, as it was generally the infant's mother who would seek help for her infant with malnutrition. As attachment theory also describes the potential for multiple attachment figures (Bowlby, 1969; van IJzendoorn et al., 1992), it may also have been of interest to explore the quality of interactions with other key attachment figures and caregivers. This is for future research to explore and may be of particular relevance to the functional isolation hypotheses of malnutrition (Levitsky & Barnes, 1972; Wachs et al., 2011). It is hypothesised that parents of malnourished infants may interact with them at a lower developmental level than their chronological age due to their small appearance and therefore it would be of further interest to

explore how this hypothesis relates to the quality of infant interactions with other caregivers and attachment figures.

A key strength of this study was the use of a targeted clinical population, in a developing country. It is also a strength of the recruitment process of the larger RCT from which this study data derived from, that it was able to capture a large sample of participants across a wide geographical area. Although it is hoped that the recruitment methods may have captured a heterogeneous group, inevitably, there will be some similarities between the participants, which in turn limit generalizability of the findings. Firstly, participants were recruited from those who were actively engaged with health care services for their infant. There is therefore the assumption that they were actively help seeking. As outlined in the extended care model (Figure 1; Engle et al 2007) there are many factors that impact upon childcare practices in the context of malnutrition in the developing world, some of which include the knowledge and beliefs of the caretaker. Therefore, individuals who perhaps lack knowledge of health care practices may fail to recognise ill health in their infant, leading to a failure to seek help. Also, beliefs about help seeking may also impinge upon the availability of the mother or family to actively seek help. Therefore, it is unclear whether the findings of our study would be generalisable to the wider Ethiopian population, to include those who do not actively present to services for help.

There was a large degree of variability in infant age, although there were no significant differences between groups. In considering this, it is perhaps difficult to be sure how the intervention may (if at all) have influenced mother-infant dyads at different stages of development. The period from 6 months to 5 years old is a time for rapid growth and change (Crockenberg & Leerkes, 2000), and accordingly the mother-infant relationship and interactive style develops along with this. However, in covering such a wide age range, it can not be assumed that the between group differences in interaction were present across all ages. For example, the interaction may have improved for older mother-infant dyads but not for the younger ones in the sample. In order to address this, it would be useful to examine group

differences across smaller age ranges and it was a limitation of the present study that the sample size did not allow for these comparisons.

#### **4.3.3 Ethical Issues.**

One of the limitations of this study relates to ethical issues. Whilst steps were taken to minimise issues of this nature, there are a number of questions raised. Firstly, in a developing country where research is less frequently encountered, issues of informed consent are highlighted. Inevitably, in a low income country where resources are scarce, participants may acquiesce to treatment because it is being offered in connection with a health facility that is providing emergency care (via food supplementation). An inevitable power imbalance is created where research funded from the developed world is being offered to a population who may be reliant on receiving aid from others in order to survive. In order to mitigate these issues, the usual ethical procedures were followed in terms of explaining consent and providing this in an accessible way (for example, through verbal explanation, due to levels of illiteracy). In addition, special consideration was given towards addressing ethical issues in a developing population, for example, working in collaboration with the community (Emmanuel, Wendler, Killan, & Grady, 2004). Whilst this is a strength of the study, there remains a potential cultural power imbalance which may not have been possible to address.

Equally, it was clear that most participants found the experience of being video recorded novel and potentially uncomfortable. As such technology may be relatively unfamiliar in this setting, it may have led to increase anxiety for the mothers participating in the study. These anxieties may have been particularly activated in light of some of the cultural beliefs about the etiology of malnutrition, which may lead mothers to feel stigmatised. As summarised by Engle et al. (2007), in some cultures malnutrition is understood to relate to the influence of 'evil spirits' or as a result of some maternal behaviour, for example breast feeding whilst pregnant or adultery (Gerlach, 1964; Morley, Rohde, and Williams, 1983; Tanner, 1959; Reissland and Burghart, 1988). A debrief was not offered to participants as part of the procedure which may

have helped to address some of these issues, and thus was a limitation of the study.

#### **4.3.4 Measures.**

The measures of mother-infant interaction were comprehensive, ensuring that the interaction provided a rating of the quality of mother interactive behaviour, infant interactive behaviour and communication and the quality of the dyadic interaction. This is a strength of the study, since it fits with the position of the current literature on components of the mother-infant relationship, that is viewing the nature of interaction as more of a transactional process (Hoeksma, van den Boom, Koomen, & Koops, 1997). The measures were selected to best fit with the type of interaction being observed, for example, in an unstructured naturalistic setting. Amendments were also made to account for the minimal language used in the recorded interactions. These revisions and amendments were carried out in conjunction with an expert in the field, which was a further strength. However, it is a limitation of the study that it was not possible to code the interaction on verbal communication, as despite this being minimal, it may have provided useful information about communication in the interaction.

A limitation of the study was the lack of availability of validated interaction measures for this particular sample. Both coding systems used were found to report good psychometric properties across a number of studies and were selected on the basis that they are considered valid measures of interaction and were well placed to be adapted for the present study. However, whilst the GRS has been used in several studies in the developing world (Cooper et al., 2009) both coding systems had not previously been used with malnourished infants or in this particular country. Due to the difficulties in finding a validated tool for a very specific population, we cannot be certain of the validity of these measures for this sample. Validity issues are widely encountered in observational measurement and Lotzin et al. (2015) suggest that the majority of reliability and validity data reported for parent-infant interaction tools are often based on unsupported study quality. Therefore the conclusions that can be drawn from this study's findings do need to be interpreted with caution.

A strength of the study were the steps taken to overcome some of these inherent measurement difficulties. For example, the use of two coding systems ensured that multiple measures were taken, in an attempt to increase the validity of the findings. The fact that the measures correlated well both internally and with each other, suggested good consistency within this sample. In addition, the replication of findings across both measures, also suggest that both were valid in detecting group differences.

The measures of infant interactive behaviour failed to detect a group effect. It is not clear as to whether this was a 'true' effect or as a result of the measures failing to capture a potential difference in infant behaviour between groups. As discussed in previous sections, this may be as a result of the methods of measurement.

At a wider level, there are many questions raised regarding the measurement of mother-infant interaction in this particular sample. Firstly, by using global rating systems of behaviour, it reduced the amount of variability that could be detected in the interaction, due to having a 5 point scale. Therefore, there is the potential for subtle differences in interaction to be missed in the coding of the behaviour. Secondly, the constructs that are being measured are not clearly defined and therefore, attempts to measure them must be considered cautiously. For example, the concept of maternal sensitivity, on which much research has been focused, is measured in a number of different ways. This ranges from methods that use a single scale (Ainsworth, 1976) to those who use a sum of multiple scales (CIB; Feldman, 1998). A recent systematic review by Lotzin et al. (2015) has highlighted a number of issues relating to observational measurement of mother-infant interaction, several of which are of particular relevance to the present study. Firstly, although an improvement has been observed in the quality of mother-infant interaction and a relationship observed between this and infant growth, there is no evidence to suggest this has predictive validity in this sample. Whilst the development of a proposed mediational model went some way to try to address this, the lack of statistical power does not allow any conclusions to be drawn. This is a limitation of observational measurement tools in general in the literature

(Lotzin et al; Gardner, 2000) and of this present study. Finally, it is important to note that these interactions were rated at a single point in time and as with all observational studies, it can not be assumed that the interaction observed is an accurate representation of the typical mother-infant relationship (Gardner, 2000). As highlighted in reviews (Lotzin et al.; Gardner, 2000), it is important for test-retest reliability data to be reported for parent-infant interaction measures, in order to understand whether the measures used are capturing a stable construct. Without this, the conclusions that can be made about the nature of the mother-infant relationship are limited.

A strength of the study was the recording of interactions in a relatively naturalistic environment, that is, in a waiting room and without any structured tasks or instructions of how to act with their infant, which in turn could influence the interaction. Whilst this may be optimal in comparison to a research clinic setting, it still potentially does not reflect the usual daily interaction of mother and infant that would take place at home (Gardner, 2000). As discussed under ethical considerations, it appeared that participants were very aware of being recorded. This therefore could have lead to observer reactivity (Gardner, 2000), whereby the nature of their behaviour changed in response to the experience of being observed. It is important to note that impact of the recording process, as it appeared to be an uncommon experience for many participants. In this cultural context, it may be the first time that they have encountered recording equipment and it was observed that some participants appeared confused by its operation (appearing initially to pose or smile for the camera as if it were a taking a photograph). The timing of the interaction coding was adjusted to allow for participants to become more used to the experience of being recorded, however, it is likely that some effects remain. Future research may look to consider more culturally acceptable methods of coding interaction. These may include rating interactions in the home environment and over several occasions in order to allow participants to become familiar with the testing materials and to improve the reliability of the findings (Murray et al., 2015; Gardner, 2000).

Of critical importance is the fact that the cultural validity of the measures are unknown.

Although from an attachment theory perspective, the universality hypotheses could be applied (Bowlby, 1969, 1988; van IJzendoorn & Kroonenberg, 1988; van IJzendoorn & Sagi, 1999, 2001). This would suggest that key components of the mother-infant relationship that relate to attachment, can be observed across cultures. However, it is also important to consider the impact of culture on the behaviours that are being measured. This is demonstrated in a recent study by Mesman et al. (2015), which found that across a number of cultures, mothers held similar beliefs that maternal sensitivity is an attribute of an ideal mother. There were however, cultural variations in this, particularly when considering other variables such as socio-demographic factors and urban-vs-rural areas. Similarly, as described by McCollum and McBride (1997), the cultural setting will determine the way in which parenting behaviour is organised, thus affecting the nature of the interaction. For example, LeVine (1977) found that the Gusii of Kenya, held cultural beliefs that precocity in children could have negative consequences. This meant that children were shown little affection and stimulation. Paradoxically, infants who were sick (and thus received more physical attention and stimulation) were found to develop better. Although this is one specific cultural example, it highlights the way in which culture can determine interactive behaviour. In Ethiopia, children are held in high regard due to their potential to provide for the family in the future (Atsede, 1994; Seleshi, 1998; Mengesha & Ayele 2015) and in infancy, they are viewed as passive recipients of care (Klein & Rye, 1994). This could potentially influence the way in which mothers interact with them as it may effect the way they respond to infant led behaviours, however, this is merely speculative and further work would be required to investigate this. There are also cultural beliefs that value the importance of encouraging modesty and humility in children in order to reduce vanity (Klein & Rye, 1994) and as a result, praising of infants is rare. There are also reports of specific spiritual beliefs held among some Ethiopian cultures (Remnick, 1974), in particular of *ille* (evil eye). Children are understood as being particularly vulnerable to an attack of the evil eye, which could be of relevance to the study population. Some behaviours are organised around these beliefs and can

include the avoidance of expressing emotion in public and avoidance of eye contact with others. Whilst there is very likely to be further cultural variations, even at village level in Ethiopia, these beliefs are very likely to impact upon the nature of mother-infant interactions, and thus measurement tools should incorporate an understanding of this. For this current study, whilst the intervention itself was developed and delivered with input from members of the cultural community, the measurement tools used were lacking in this. Therefore, it is unknown whether the quality of mother-infant interactions were poorer in the control group due to malnutrition or as a result of (or in conjunction with) cultural beliefs that impact upon general parenting practices. Further studies are required to develop culturally specific and sensitive methods of measuring mother-infant interactions.

Finally, in considering the type of intervention, it may have also been useful to have included a measure which included an assessment of the stimulation opportunities in the home. The HOME scale has been utilised in several studies (Hamadani et al., 2006; Garnder et al., 2003; Eterm et al., 2006) as it captures both elements of the interaction (for example, ratings of mothers' responsiveness and infant affect), as well as measuring the opportunities for stimulation in the environment. Whilst a partial strength of the current study related to the comprehensive measures of the interaction, it may have been optimal to have been able to understand the impact of the intervention on provision of cognitive and emotional stimulation in the home.

#### **4.3.5 Procedure.**

A strength of the study was that it used an intervention that local members of the community could be easily trained to deliver. This increased its feasibility for large scale implementation. There were also significant protocols put in place to ensure maximum treatment fidelity, which included regular supervision and comprehensive training manuals.

Despite efforts to ensure that the structure of the interventions remained similar, by its nature, the emotional stimulation intervention involved more active participation and feedback

(e.g. playing with the infant). It is not known whether this increased level of involvement in the intervention was a key factor accounting for change. Additionally, there are elements of the nutritional education intervention, which may have been aimed to increase participation but could have been perceived negatively by the mother. For example, questioning the mother as to why a child may have failed to gain weight. This approach may have created some anxiety and disengagement from the intervention which in turn could lessen the impact of the control intervention.

The cultural implications of the intervention should also be considered. A strength of the study was that components of the emotional stimulation intervention (namely Play Therapy) had been developed for use in this population and had been found in previous research to lead to improvements to child emotional and behavioural problems (Quéré & Conticini, 2009). However, as described in the previous section, there may be numerous cultural considerations that could impact upon the effectiveness of the intervention, such as parenting beliefs and spiritual beliefs, which may vary between the regions involved in a large study such as this. Future studies of this nature may benefit from looking at variations in cultural beliefs and their link to mother-infant interaction in order to understand the extent to which they could impact upon the effectiveness of this type of intervention.

#### **4.3.6 Data analysis.**

The data was deemed to be relatively normally distributed and homogeneity of variance assumed, therefore allowing for parametric tests to be carried out. The required sample size was met in order to carry out the analysis for the primary research question and consequently significant differences were found between groups on several aspects of the mother-infant interaction.

The small sample size was a definite limitation in relation to the mediational analysis and was carried out as a preliminary explanation. According to Thommes et al. (2010) the current sample size would only have been able to detect an effect at .80 power if there was a medium

effect size on the path between group assignment and positive maternal interaction and a large effect size on the path between maternal interaction and infant BMI change. It is therefore possible that this predictive model *does* have utility but that it is not detected by the limited sample size. This study is believed to be the first to propose a model that suggests positive maternal interaction may account for the effect on a stimulation intervention on infant growth. It remains of interest for further better powered studies to explore this model.

#### **4.4 Theoretical Implications**

The mother-infant relationship provides an important context for infant development. As attachment theory (Bowlby, 1969; Ainsworth, 1978) would predict, these early relationships are the building blocks for cognitive, social and emotional development (Hinde, 1991; Rutter, 1995). Research has explored the tenets of attachment theory and found support for relationships between aspects of the mother-infant interactive experience, for example, in terms of sensitivity, responsiveness, synchrony and positive attitude and emotional support (van IJzendoorn, 1997; Trevarthen, et al., 1981).

Research has also established the complex context of the mother-infant relationship where malnutrition in developing countries is concerned and there is evidence to suggest that attachment security may be affected (Valenzuela, 1990; Graves 1976; 1978) and poor styles of mother-infant interaction observed (Richter et al., 2004). In combination, it might be suggested that the quality of mother-infant interactions would be impaired in the context of malnutrition and that in turn this could affect attachment security and long-term outcomes. The results from the present study add support to these ideas, through finding less positive mother-infant interactions for those who had not received an emotional stimulation intervention, however, as no formal measures of infant attachment were used this link is purely speculative. Additionally, the fact that this study did not find group differences for infant affect and behaviour, would perhaps suggest that attachment security was not impacted by the intervention. Further research would be required to address these questions.

The primary findings of this study suggest that an emotional stimulation intervention delivered in addition to nutritional supplementation for malnutrition, can lead to more positive maternal interactive behaviour and improved quality of mother-infant interactions. These findings fit with several theoretical models and explanations that underpin the link between impaired quality of mother-infant interactions and infant malnutrition. These will be considered in turn.

Firstly, as proposed by Schepers-Hughes (1991), the disturbance to mother-infant interaction may be hypothesized to derive from an unconscious disengagement from the infant as a protective mechanism against loss. From this, it might be predicted that as the infant gains weight and recovers from malnutrition, this protective disengagement may lessen and subsequently interactions improve. Considering this at a rather simplistic level, it may suggest this study's findings would not support this hypothesis, since it may be expected that the control group's interaction would improve in relation to their gain in weight, regardless of the emotional stimulation intervention. However, since the intervention group gained weight more rapidly as a result of the intervention, then potentially this could have reversed the impact of the disengagement more rapidly, thus leading to more improved interactions. Therefore, the hypothesis by Schepers-Hughes (1991) may stand in relation to this study findings, but it would perhaps suggest that it is the increased weight gain (as enhanced by the intervention) and thus improved mortality that increases the responsiveness of the mother. Whilst, this may appear a circular chain of events, it is of course hypothetical and presupposes a rather linear view of the interactive process.

Transactional models such as those of Lester (1979) and Rosetti-Ferreira (1978), would suggest a circular pattern of behavior of both infant and mother so that in response to a non responsive mother, infants become less engaged and thus produce fewer cues and behaviours to be responded to. This model explains more about the maintenance of the problem, since there may be many reasons for the reduced responsiveness or lower quality interaction. These include,

maternal depression (Richter, 1994) and reduced activity/increased infant passivity as a result of low weight. The findings of this study, partially support some of these ideas. From considering a transactional perspective, it could be hypothesised that improved maternal interactions would lead to improved infant interaction and behaviours. This was not supported from the findings of this study as there were no differences between the groups for infant interactive behavior. Despite this, there were more positive ratings of the interaction, which might suggest more reciprocity and synchrony as a result of the intervention. Potentially, this could support the transactional models of the relationship between malnutrition and the mother-infant relationship (Lester, 1979; Rosetti-Ferreira, 1978; Grantham-McGregor, 1984). This is because the improved quality of mother-infant interaction may, over time, lead to more positive infant interactive behavior but the change may not have been captured in this study due to the timing of measurement. Equally, it remains possible that the lack of group differences in infant behavior may have been due to sample size or measurement issues.

The findings of this study partially support the functional isolation hypotheses (Levitsky & Barnes, 1972; Wachs et al., 2011) which would suggest that malnourished infants become ‘functionally isolated’ from their optimal environment for development. In interaction terms, this may mean that due to the impaired physical growth of the malnourished infant, mothers may not interact with them at a developmentally appropriate level. For example, interacting with infants at a level appropriate for younger than their chronological age may result in sub-optimal stimulation. Therefore, it is possible that the mothers who received an emotional stimulation intervention were more likely to interact with their infants in a developmentally appropriate way, which in turn improves the quality of mother-infant interactions.

Overall, the study findings do not seem to be accounted for by one particular model, which highlights the complex context of mother-infant relationship in malnutrition. Generally, the findings would support more transactional accounts of the disruption to the interactive environment, resulting from malnutrition. However, these findings suggest that increasing

emotional stimulation may not result in improvements in all areas of mother-infant interaction (for example, at mother, infant and interaction level) or that effects of such interventions are observed at differing rates. Further research is required to develop a better understanding of the mechanisms that influence change in the quality of mother-infant interactions.

#### **4.5 Clinical Implications**

The findings of the present study have important clinical implications in the context of malnutrition in developing countries. A relatively low resource intensive intervention, delivered by trained members of the community, has been found to have a significant impact, not only upon the rate that infants recover from malnutrition (as found in the larger RCT) but on the quality of the mother's interactive behaviour and the quality of the dyadic interaction. As a result of this, it strengthens the literature in support of the importance of delivering interventions aimed at improving the mother-infant relationship, in order to maximise recovery from malnutrition.

There are also clinical implications related to the finding that infant positive affect and behaviour was unaffected by the intervention. Although we cannot be certain as to what accounted for these findings, one possibility is that the intervention does not lead to improved attachment security. Consequently, it may be necessary to look at further ways in which infant affect and positive behaviour can be improved, in addition to considering ways in which an intervention similar to this, can include more of an attachment focus.

As this study has established that mother-infant interaction is modifiable in this population, the question turns to how this could be widely implemented in clinical practice. It would be optimal to be able to offer the intervention used in the present study, since it has been demonstrated to be effective. However it may also be useful to consider how principles of the intervention can be routinely integrated into health practices.

#### **4.6 Further research**

It would be useful for this study to be replicated with a specific focus on improving some of the limitations discussed. Namely, it would be beneficial to include a greater sample size in

order that a mediator model can be effectively tested to see whether more positive mother-infant interaction can account for some of the changes observed in the rate of infant weight gain. A replication of this study would also benefit from taking baseline measures of the interaction, maternal depression status and mothers nutritional status in order to be able to control for any variation between groups. It would also be of use to explore whether the improvements to the mother-infant interaction are sustained over time, and therefore it would be useful to include a longitudinal follow up in future studies. As in Cooper et al. (2009) it would be of interest to include a measure of infant attachment security at follow up in order to look at whether improved mother-infant interaction can also lead to improved attachment security. It would also be beneficial for replication of this study to look at alternative measures of infant interactive behaviour and communication and the use of more naturalistic settings, such as within the participants' home.

It would also be useful to explore which elements of the intervention may lead to the observed improvements in mother-infant interaction and dismantling studies may look to investigate this in the future. An advantage of this would be that it would enable the intervention to be specifically tailored towards achieving the most optimal outcomes. It may also lead to a more efficient intervention that further minimises the resources required, which is particularly favourable in low-income countries where resources may be scarce.

Theories and models suggest that a poor interactive environment for the infant may lead to less optimal feeding behaviour (Wachs et al., 2011) and is supported through evidence from Aboud and Akhtar (2011) that infant feeding rates increased in relation to improved maternal responsiveness and stimulation. It may therefore be useful to consider a way in which an intervention, such as the one delivered in this study, could be targeted as an early intervention for those at risk from malnutrition. Indeed, this type of approach has shown promising results in Cooper et al. (2009), who recruited mothers during pregnancy and immediately in the weeks and months post birth. It would be interesting to understand whether improved interaction may act in

some way as a protective mechanism against some of the effects of malnutrition. However, as conceptualised by Engle (2007) in the extended care model (see figure 1), there are many other variables understood to be important in the development and maintenance of infant malnutrition. Equally, it is important to research to systematically explore this complex area in order to know at which level to intervene.

It can not be assumed the nature of mother-infant interaction is the same across all settings and contexts. Evidence from Leerkes et al. (2012) demonstrates this by finding that maternal sensitivity increases in response to infant distress than when compared to a neutral environment. Equally, it can not be assumed that the observation of an interaction in a clinic waiting room captures the complexity and nuances of the mother-infant relationship across other settings. Of particular relevance to malnutrition, is the context of the infant feeding environment and it would be of interest to understand whether the improved interaction as a result of the intervention is also observed in the feeding environment as in Aboud and Akhter (2011).

#### **4.7 Conclusion**

This study has suggested that an emotional stimulation intervention in conjunction with nutritional supplementation for malnutrition can lead to more positive maternal interactive behaviour and more positive interaction between mothers and infants. It also found that more positive maternal and dyadic interactions were related to increased infant weight gain, although a mediational model failed to find evidence that the positive mother-infant interactions mediate the improvements in weight gain. This is likely due to a lack of statistical power. In contrast to some previous literature (Hamadani et al., 2006; Gardner et al., 2003), the study failed to find improvements in infant interactive behaviour and communication, although we can not be certain as to whether this is due to methodological issues (for example, the timing of measurement or methods of assessment) or if it suggests that this intervention is not effective at improving infant interactive behaviour for those recovering from malnutrition. Further research is required to address these issues.

The findings have important implications both theoretically and clinically. This is the first study to explore the impact of an emotional stimulation intervention on the quality of the mother-infant interaction in Ethiopia, and whilst there are some key limitations of the study, there is good preliminary evidence to suggest that the mother-infant interaction can be positively enhanced in this population. This may be of long-term benefit for infant development and attachment security. It further supports the case for implementing larger scale interventions such as this, in developing countries as a way of targeting the loss of developmental potential for the population (Walker et al., 2007; Engle et al., 2007). Finally it further highlights the need to understand more about the way in which malnutrition can affect the mother-infant relationship and the theoretical implications that this poses.

## References

- About, F. E., & Alemu, T. (1995). Nutrition, maternal responsiveness and mental development of Ethiopian children. *Social Science & Medicine*, *41*, 725–32. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/7502104>
- About, F. E., & Akhter, S. (2011). A cluster-randomized evaluation of a responsive stimulation and feeding intervention in Bangladesh. *Pediatrics*, *127*, 1191–1197.://doi:10.1542/peds.2010-2160
- About, F. E., & Yousafzai, A. K. (2015). Global Health and Development in Early Childhood. *Annual Review of Psychology*. *66*, 433-457. doi: 10.1146/annurev-psych-010814-015128
- Ainsworth, M. D. S. (1976). System for rating maternal-care behavior. Unpublished manuscript, Educational Testing Service Test Collection. NJ: Princeton.
- Ainsworth, M. D. S., Bell, S. M., & Stayton, D. (1974). Infant-mother attachment and social development. In M. P. Richards (Ed.), *The introduction of the child into a social world* (pp. 99-135). London: Cambridge University Press.
- Ainsworth, M.D.S., Blehar, M.C. Waters, E., & Wall, S. (1978). Patterns of attachment. Hillsdale, NJ: Erlbaum.
- Ainsworth, M.D.S., & Wittig, B.A. (1969). Attachment and exploratory behavior of one-year-olds in a strange situation. In B.M.Foss. (Ed.), *Determinants of infant behavior*. (p. 111– 136). London: Methuen.
- African Union Commission, NEPAD Planning and Coordinating Agency, UN Economic Commission for Africa, and UN World Food Programme (2014). *The Cost of Hunger in Africa: Social and Economic Impact of Child Undernutrition in Egypt, Ethiopia, Swaziland and Uganda*. Addis Ababa. UNECA.

- Arya, S. (1989). Infant nutrition and mother-child dyad. *Indian Journal of Clinical Psychology*, 16, 34–40.
- Ashaba, S., Rukundo, G. Z., Beinempaka, F., Ntaro, M., & LeBlanc, J. C. (2015). Maternal depression and malnutrition in children in southwest Uganda: a case control study. *BMC Public Health*, 15(1), 1303. doi: 10.1186/s12889-015-2644-y
- Atsede, W. (1994). *Socio-cultural factors affecting family planning services in Ethiopia*. In Proceedings of the Eleventh International Conference of Ethiopian Studies (pp. 393-402), Addis Ababa, Ethiopia.
- Baker-Henningham, H., & López Bóo, F. (2010). Early childhood stimulation interventions in developing countries: A comprehensive literature review. Institute for the Study of Labor (IZA) (Discussion Paper, No. 5282). Bonn:  
<https://publications.iadb.org/bitstream/handle/11319/2660/earlychildhoodstimulationinterventionsindevelopingcountries:acomprehensiveliteraturereview.pdf?sequence=1>
- Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., & Juffer, F. (2003). Less is more: meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological Bulletin*, 129, 195–215. doi:10.1037/0033-2909.129.2.195
- Baradon, T., Fonagy, P., Bland, K., Lenard, K., & Slead, M. (2008). New Beginnings – An experience-based programme addressing the attachment relationship between mothers and their babies in prisons. *Journal of Child Psychotherapy*, 34, 240–258. doi: 10.1080/00754170802208065
- Barlow, J., Bennett, C., Midgley, N., Larkin, S. K., & Wei, Y. (2015). Parent-infant psychotherapy for improving parental and infant mental health. *Cochrane Database of Systematic Reviews 2015*, 1, doi:10.1002/14651858.CD010534.pub2.

- Beckwith, L., & Cohen, S.E. (1989). Maternal responsiveness with preterm infants and later competency. In M. Bornstein (Ed.), *Maternal responsiveness: Characteristics and consequences*. (p. 75–87). San Francisco: Jossey-Bass Inc.
- Belsky, J., & Fearon, R. M. (2002). Infant-mother attachment security, contextual risk, and early development: A moderational analysis. *Development and Psychopathology*, *14*, 293-310. doi: 10.1017/S0954579402002067
- Belsky, J., & Fearon, R. M. P. (2008). Precursors of attachment security. In J. C. P. R. Shaver (Ed.), *Handbook of attachment: Theory, research, and clinical applications*, 2nd ed (pp. 295–316). New York, NY, US: Guilford Press.
- Biringen, Z., Robinson, J. & Emde, R. (1998). *Emotional Availability (EAS) Scales (3rd edn)*. Unpublished manual.
- Bornstein, M. H., & Putnick, D. L. (2012). Cognitive and Socioemotional Caregiving in Developing Countries. *Child Development*, *83*, 46–61. doi: 10.1111/j.1467-8624.2011.01673.x
- Bowlby, J. (1951). Maternal care and mental health. *Bulletin of the World Health Organization*, *1951*, 355–533.
- Bowlby, J. (1969). *Attachment and loss, Vol. 1: Attachment*. New York: Basic Books.
- Bowlby, J. (1977). The making and breaking of affectional bonds. Aetiology and psychopathology in the light of attachment theory. An expanded version of the Fiftieth Maudsley Lecture, delivered before the Royal College of Psychiatrists, 19 November 1976. *The British Journal of Psychiatry*, *130*, 201–210. doi: 10.1192/bjp.130.3.201
- Bowlby, J. (1988). *A secure base: Parent-child attachment and healthy human development*. New York: Basic Books.
- Bratton, S. C., Ray, D., Rhine, T., & Jones, L. (2005). The Efficacy of Play Therapy With Children: A Meta-Analytic Review of Treatment Outcomes. *Professional Psychology*:

- Brazelton, T. B., Nugent, J. K. (1995) *Neonatal behavioral assessment scale: clinics in developmental medicine*. London. McKeith Press.
- Caldwell, B. M., & Bradley, R. H.(1984). *Home Observation for Measurement of the Environment*. Little Rock, AR: University of Arkansas.
- Carlson, V. J. and Harwood, R. L. (2003), Attachment, culture, and the caregiving system: The cultural patterning of everyday experiences amongst Anglo and Puerto Rican mother–infant pairs. *Infant Mental Health Journal*, 24, 53–73. doi:10.1002/imhj.10043
- Chao, R. (2001). Integrating culture and attachment. *American Psychologist*, 56, 822-823. doi: 10.1037/0003-066X.56.10.822
- Chavez, A., and Martinez, C. (1975). Nutrition and development of children from poor rural areas-vs-. Nutrition and behaviour development. *Nutrition Reports International*, 11, 477-489
- Chavez, A., Martinez, C., & Yaschine, T. (1975). Nutrition, behavioural development and mother-child interaction in young rural children. *Federation Proceedings*, 34, 1574–1582.
- Clarke-Stewart, K.A. (1973). Interactions between mothers and their young children: Characteristics and consequences. *Monographs of the Society for Research in Child Development*, 38, 1-109. doi: 10.2307/1165928
- Cooper, P. J., Landman, M., Tomlinson, M., Molteno, C., Swartz, L., & Murray, L. (2002). Impact of a mother-infant intervention in an indigent peri-urban South African context - Pilot study. *British Journal of Psychiatry*, 180, 76–81. doi: 10.1192/bjp.180.1.76
- Cooper, P. J., Tomlinson, M., Swartz, L., Landman, M., Molteno, C., Stein, A., ... Murray, L.

- (2009). Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *British Medical Journal (Clinical Research Ed.)*, 338, 974. doi:1136/bmj.b974
- Cooper, P. J., Tomlinson, M., Swartz, L., Woolgar, M., Murray, L., & Molteno, C. (1999). Post-partum depression and the mother-infant relationship in a South African peri-urban settlement. *The British Journal of Psychiatry*, 175, 554–558. doi: 10.1192/bjp.175.6.554
- Cooper, P. J., Vally, Z., Cooper, H., Radford, T., Sharples, A., Tomlinson, M., & Murray, L. (2014). Promoting Mother-Infant Book Sharing and Infant Attention and Language Development in an Impoverished South African Population: A Pilot Study. *Early Childhood Education Journal*, 42(2), 143–152. doi:10.1007/s10643-013-0591-8
- Cravioto, J., & DeLacardie, E. (1976). Microenvironmental factors in severe protein-energy malnutrition. In N.Scrimshaw & M.Behar (Eds.), *Nutrition and agricultural development: Significance and potential for the Tropics*. (pp. 25–35). New York: Plenum Press.
- Cravioto, J., and DeLicardie, E. R., (1975). Mother-infant relationship prior to the development of clinically severe malnutrition in the child. In P. L. White & N. Selvey (Eds.), *Western Hemisphere Nutrition Congress IV*. (pp. 126-137).. Acton, Massachusetts. Publishing Sciences Group.
- Crockenberg, S. & Leerkes, E. (2000). Infant social and emotional development in the family context. In C. Zeanah (Ed.). *The Handbook of Infant Mental Health*, 2nd Edition (pp. 60-90). New York: Guilford.
- De Falco, S., Emer, A., Martini, L., Rigo, P., Pruner, S., & Venuti, P. (2014). Predictors of mother-child interaction quality and child attachment security in at-risk families.

*Frontiers in Psychology*, 5, 1–10. doi: 10.3389/fpsyg.2014.00898

de Miranda, C.T., Turecki, G., Mare, J.J., Andreoli, S.B., Marcolim, M., Goihman, S., Puccini, R., Strom, B.L., & Berlin, J.A. (1996). Mental health of the mothers of malnourished children. *International Journal of Epidemiology*, 25, 128–133. Retrieved from; <http://ije.oxfordjournals.org/content/25/1/128.full.pdf>

De Wolff, M. S. and van Ijzendoorn, M. H. (1997), Sensitivity and Attachment: A Meta-Analysis on Parental Antecedents of Infant Attachment. *Child Development*, 68, 571–591. doi:10.1111/j.1467-8624.1997.tb04218.x

Dixon, S.D., LeVine, R.A., & Brazelton, T.B. (1982). Malnutrition: A closer look at the problem in an East African village. *Developmental Medicine and Child Neurology*, 14, 670–685. doi: 10.1111/j.1469-8749.1982.tb13678.x

Duke, T., & Fuller, D. (2014). Randomised controlled trials in child health in developing countries: trends and lessons over 11 years. *Archives of Disease in Childhood*, 99, 615–620. doi:10.1136/archdischild-2013-305702

Emanuel, E. J., Wendler, D., Killen, J., & Grady, C. (2004). What Makes Clinical Research in Developing Countries Ethical? The Benchmarks of Ethical Research. *Journal of Infectious Diseases*, 189, 930–937. doi:10.1086/381709

Engle, P. L., Black, M. M., Behrman, J. R., Cabral de Mello, M., Gertler, P. J., Kapiriri, L., ... Young, M. E. (2007). Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *Lancet*, 369, 229–242. doi:10.1016/S0140-6736(07)60112-3

Engle, P. L., Lhotska, L., & Armstrong, H. (1997). The care initiative: Care for nutrition. Guidelines for assessment, analyses and action to improve care for nutrition. Retrieved

from <http://www.missions-acf.org/kitemergency/EN/5.%20ACF-Paris%20Toolbox/5.8%20MHCP/02%20-%20Needs%20Assessment/03%20-%20The%20Care%20Initiative%20Unicef.pdf>

Engle, P. L., P. Menon, and L. Haddad. (1996). *Care and nutrition: Concepts and measurement. Food Consumption and Nutrition Division Discussion Paper 18*. International Food Policy Research Institute, Washington, D.C.

Ertem, I. O., Atay, G., Bingoler, B. E., Dogan, D. G., Bayhan, A., & Sarica, D. (2006). Promoting Child Development at Sick-Child Visits: A Controlled Trial. *Pediatrics*, *118*, 124–131. doi: 10.1542/peds.2005-2704

Farran, D. C., Kasari, K., Comfort, M., & Jay, S. (1986) *Parent/caregiver involvement scale*. Nashville, TN: Vanderbilt University.

Fearon, R. P., Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., Lapsley, A. M., & Roisman, G. I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: A meta-analytic study. *Child Development*, *81*, 435–456. doi:10.1111/j.1467-8624.2009.01405.x

Federal Ministry of Health (2007) *Protocol for the Management of Severe Acute Malnutrition*. Ethiopia. FMOH,

Feldman, R. (1998). *Coding interactive behavior manual*. Unpublished Manual. Israel. Bar-Ilan University

Feldman, R., & Eidelman, A. I. (2006). Neonatal state organization, neuromaturation, mother-infant interaction, and cognitive development in small-for-gestational-age premature infants. *Pediatrics*, *118*, 869–78. doi:10.1542/peds.2005-2040

- Feldman, R., Eidelman, AI, Sirota, L. & Weller, A. (2002). Comparison of Skin-to-Skin (Kangaroo) and Traditional Care: Parenting Outcomes and Preterm Infant Development. *Pediatrics*, *110*, 16-26. Retrieved from:  
<http://pediatrics.aappublications.org/content/110/1/16>
- Feldman, R., & Masalha, S. (2010). Parent-child and triadic antecedents of children's social competence: Cultural specificity, shared process. *Developmental Psychology*, *46*, 455–467. doi: 10.1037/a0017415
- Feldman, R., Greenbaum, C. W., Yirmiya, N. (1999). Mother-Infant Affect Synchrony as an Antecedent of the Emergence of Self-Control, *Developmental Psychology*. *35*, 223-231. doi: 10.1037/0012-1649.35.1.223
- Ferber S. G., Feldman R., Kohelet D., Kuint J., Dollberg S., Arbel E., Weller A. (2005). Massage therapy facilitates mother-infant interaction in premature infants. *Infant Behavior and Development*, *28*, 74–81. doi: 10.1016/j.infbeh.2004.07.004
- Fisher, J., de Mello, M. C., & Izutsu T. (2009) *Pregnancy, childbirth and the postpartum period. Mental health aspects of women's reproductive health*. World Health Organisation. Retrieved from:  
[http://apps.who.int/iris/bitstream/10665/43846/1/9789241563567\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/43846/1/9789241563567_eng.pdf)
- Fletcher, K. L., & Reese, E. (2005). Picture book reading with young children: A conceptual framework. *Developmental Review*, *25*, 64–103. doi:10.1016/j.dr.2004.08.009
- Freud, A. (1954). Psychoanalysis and education. *Psychoanalytic Study of the Child*, *9*, 9-15.
- Galler, J.R., & Ramsey, F. (1985). The influence of early malnutrition on subsequent behavioural development: VI. The role of the microenvironment of the household. *Nutrition and Behavior*, *2*, 161–173. doi 10.1097/00004583-198301000-00003
- Gardner, F. (2000). Methodological issues in the direct observation of parent-child interaction:

do observational findings reflect the natural behavior of participants? *Clinical Child and Family Psychology Review*, 3, 185–198. doi: 10.1023/A:1009503409699

Gardner, J. M. M., Grantham-McGregor, S. M., Chang, S. M., Himes, J. H. and Powell, C. A. (1995), Activity and Behavioral Development in Stunted and Nonstunted Children and Response to Nutritional Supplementation, *Child Development*, 66, 1785–1797. doi:10.1111/j.1467-8624.1995.tb00965.x

Gardner, J. M. M., Grantham-McGregor, S. M., Himes, J. and Chang, S. (1999). Behaviour and development of Stunted and Non-stunted Jamaican Children. *Journal of Child Psychology and Psychiatry*, 40, 819–827. doi:10.1111/1469-7610.00497

Gardner, J. M., Walker, S. P., Powell, C. A., & Grantham-McGregor, S. (2003). A randomized controlled trial of a home-visiting intervention on cognition and behavior in term low birth weight infants. *Journal of Pediatrics*, 143(5), 634–639. [http://doi.org/10.1067/S0022-3476\(03\)00455-4](http://doi.org/10.1067/S0022-3476(03)00455-4)

Gerlach, L. P. (1964). Sociocultural factors affecting the diet of the northeast coastal Bantu. *Journal of the American Dietetic Association* 45, 420-424.

Goldsmith, H.H., & Alansky, J.A. (1987). Maternal and infant temperamental predictors of attachment: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 55, 805–816. doi: 10.1037/0022-006X.55.6.805

Grantham-McGregor, S. (1984). The social background of childhood malnutrition. In B. Schurch, J. Brozek (Eds.), *Malnutrition and behavior* (pp358-374), Lausanne, Switzerland. International Dietary Energy Consultancy Group.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., Strupp, B. & International Child Development Steering Group. (2007) Developmental potential in the first 5 years for children in developing countries. *Lancet*, 369, 60–70. doi:

10.1016/S0140-6736(07)60032-4

Grantham-Mcgregor, S. M., Fernald, L. C. H., Kagawa, R. M. C., & Walker, S. (2014). Effects of integrated child development and nutrition interventions on child development and nutritional status. *Annals of the New York Academy of Sciences*, 1308, 11–32.

doi:10.1111/nyas.12284

Grantham-McGregor, S., Schofield, W., & Harris, L. (1983). Effect of Psychosocial Stimulation on Mental Development of Severely Malnourished Children: An Interim Report.

*Pediatrics*, 72, 239- 243. Retrieved from

<http://pediatrics.aappublications.org/content/72/2/239.abstract>

Grantham-McGregor, S., Schofield, W., & Powell, C. (1987). Development of severely malnourished children who received psychosocial stimulation: 6 year follow up.

*Pediatrics*, 79, 247-254.

Graves, P. (1976). Nutrition, infant behavior, and maternal characteristics: A pilot study in West Bengal, India. *American Journal of Clinical Nutrition*, 29, 305– 319.

Graves, P. (1978). Nutrition and infant behaviour: A replication study in the Katmandu Valley.

*American Journal of Clinical Nutrition*, 31, 541–551. Retrieved from;

<http://ajcn.nutrition.org/content/31/3/541.abstract?ijkey=3bc8a39b7daac1e78b>

[5c03afb62233e063546ce1&keytype2=tf\\_ipsecsha](http://ajcn.nutrition.org/content/31/3/541.abstract?ijkey=3bc8a39b7daac1e78b5c03afb62233e063546ce1&keytype2=tf_ipsecsha)

Guedeney, A. (1995). Kwashiorkor, depression and attachment disorders. *Lancet*, 346, 1293.

doi:10.1016/S0140-6736(95)91890-6

Gunning, M., Conroy, S., Valoriani, V., Figueiredo, B., Kammerer, M. H., Muzik, M., ...

Kammerer, M. H. (2004). Measurement of mother-infant interactions and the home

environment in a European setting : preliminary results from a cross-cultural study. *British*

*Journal of Psychiatry*, 184, 38-44. doi: 10.1192/03-336

Hamadani, J. D., Huda, S. N., Khatun, F., & Grantham-McGregor, S. M. (2006). Psychosocial stimulation improves the development of undernourished children in rural Bangladesh. *The Journal of Nutrition*, 136, 2645–2652. Doi: 136/10/2645 [pii]

Hinde, R.A. (1991). Relationships, attachment and culture: A tribute to John Bowlby. *Infant Mental Health Journal*, 12, 154–163. doi : 10.1002/1097-0355(199123)12:3<154::AID-IMHJ2280120303>3.0.CO;2-8

Hoeksma, J. B., van den Boom, D. C., Koomen, H. M. Y., & Koops, W. (1997). Modelling the sensitivity-attachment hypothesis. In W. Koops, J. B. Hoeksma, & D.C van den Boom (Eds), *Development of Interaction and Attachment: Traditional and Non-traditional Approaches*, (pp157-169).North Holland, Amsterdam.

Hubbs-Tait, L., Culp, A. M., Huey, E., Culp, R. E., Starost, H. J, & Hare, C. (2002). Relation of Head Start attendance to children's cognitive and social outcomes: Moderation by family risk. *Early Childhood Research Quarterly*, 17, 539–558. doi: 10.1016/S0885-2006(02)00189-8

Hubbs-Tait, L., Culp, A. M., Culp, R. E. & Miller, C. E. (2002), Relation of Maternal Cognitive Stimulation, Emotional Support, and Intrusive Behavior during Head Start to Children's Kindergarten Cognitive Abilities, *Child Development*, 73, 110–131. doi:10.1111/1467-8624.00395

Hubbs-Tait, L., Kennedy, T. S., Page, M. C., Topham, G. L., & Harrist, A. W. (2008). Parental Feeding Practices Predict Authoritative, Authoritarian, and Permissive Parenting Styles. *Journal of the American Dietetic Association*, 108, 1154–1161. doi: 10.1016/j.jada.2008.04.008

International Fund for Agricultural Development (2013). *Rural Poverty in Ethiopia*. Retrieved on: 10th November 2013 from

<http://www.ruralpovertyportal.org/country/home/tags/ethiopia>

Ipsa, J.M., Fine, M.A., Halgunseth, L.C., Harper, S., Robinson, J., Boyce, L., Brooks-Gunn, J., & Brady-Smith, C. (2004). Maternal intrusiveness, maternal warmth, and mother–toddler relationship outcomes: Variations across low-income ethnic and acculturation groups. *Child Development, 75*, 1613–1631. doi: 10.1111/j.1467-8624.2004.00806.x

Isabella, R. A. (1993). Origins of attachment: maternal interactive behavior across the first year. *Child Development, 64*, 605-621. doi : 10.1111/j.1467-8624.1993.tb02931.x

Isabella, R. A. & Belsky, J. (1991). Interactional synchrony and the origins of infant-mother attachment: A replication study. *Child Development, 62*, 373–384. doi: 10.1111/j.1467-8624.1991.tb01538.x

John, A., Morris, A. S., & Halliburton, A. L. (2012). Looking beyond maternal sensitivity: Mother- child correlates of attachment security among children with intellectual disabilities in urban India. *Journal of Autism and Developmental Disorders, 42*, 2335–2345. doi:10.1007/s10803-012-1479-y

Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*, 141-151. doi: 10.1177/001316446002000116

Kerr, M., Bogues, J., & Kerr, D. (1978). Psychosocial functioning of mothers of malnourished children. *Pediatrics, 62*, 778–784. Retrieved from;  
<http://pediatrics.aappublications.org/content/pediatrics/62/5/778.full.pdf>

Klein, M. (1952) Some theoretical conclusions regarding the emotional life of the infant. In P.

- Heimann, S. Isaacs, & J. Riviere, *Developments in psychoanalysis* (pp. 198-236). London: Hogarth,
- Klein, P. S., & Rye, H. (2004). Interaction-oriented Early Intervention in Ethiopia. *Infants & Young Children, 17*, 340–354. doi: 10.1097/00001163-200410000-00007.
- Koops, W., Hoeksma J.B. & D.C. van de Boom, (1997). *Development of Interaction and Attachment: Traditional and Non-traditional Approaches*. North Holland, Amsterdam.
- Lamb, M. E., & Lamb, J. E. (1976). The Nature and Importance of the Father-Infant Relationship, *The Family Coordinator, 25*, 379-385,doi :10.2307/582850
- Lamb, M.E., Thompson, R.A., Gardner. W. P., Charnov, E.L., & Estes, D. (1984). Security of infantile attachment as assessed in the “strange situation”: Its study and biological interpretation. *The Behavioral and Brain Sciences, 7*, 127–171. doi: 10.1017/S0140525X00026522
- Lester, B. M. (1979). A Synergistic Process Approach to the Study of Prenatal Malnutrition. *International Journal of Behavioral Development, 2*, 377-393, doi:10.1177/016502547900200403
- Landreth, G. (1991). *Play therapy: The art of the relationship*. Bristol, PA: Accelerated Development.
- Leerkes, E. M., Weaver, J. M., & O’Brien, M. (2012). Differentiating Maternal Sensitivity to Infant Distress and Non-Distress. *Parenting, Science and Practice, 12*, 175–184. doi: .1080/15295192.2012.683353
- LeVine, R. A. (1977). Child rearing as cultural adaptation. In P. H. Leiderman, S. P. Tulkin, A. Rosenfeld (Eds.), *Culture and infancy: Variations in the human experience* (pp. 15-27). New York: Academic Press.

- Levitsky, D. A., Barnes, R. H. (1972). Nutrition and environmental interactions in the behavioural development of the rat: long-term effects. *Science*, *176*, 68-71.  
doi:10.1126/science.176.4030.68
- Levy, K. N., Meehan, K. B., Weber, M., Reynoso,, J., & Clarkin, J.F. (2005). Attachment and Borderline Personality Disorder: Implications for Psychotherapy, *Psychopathology*, *38*, 64- 74. doi: 10.1159/000084813
- Lindhiem, O., Bernard, K., & Dozier, M. (2011). Maternal sensitivity: Within-person variability and the utility of multiple assessments. *Child Maltreatment*, *16*, 41–50.  
doi:10.1177/1077559510387662 ,
- Lloyd, C. A., & Masur, E. F. (2014). Infant behaviors influence mothers’ provision of responsive and directive behaviors. *Infant Behavior & Development*, *37*, 276–85.  
doi:10.1016/j.infbeh.2014.04.004
- Lotzin, A., Lu, X., Kriston, L., Schiborr, J., Musal, T., Romer, G., & Ramsauer, B. (2015). Observational Tools for Measuring Parent-Infant Interaction: A Systematic Review. *Clinical Child and Family Psychology Review*, *18*, 99-132. doi: 10.1007/s10567-015-0180-z
- Lozoff, B., Klein, N. K., Nelson, E. C., McClish, D. K., Manuel, M. and Chacon, M. E. (1998), Behavior of Infants with Iron-Deficiency Anemia. *Child Development*, *69*, 24–36.  
doi:10.1111/j.1467-8624.1998.tb06130.x
- Masur, E. F., Flynn, V., & Lloyd, C. A. (2013). Infants’ behaviors as antecedents and consequents of mothers’ responsive and directive utterances, *First Language*: *33*, 354–371. doi: 10.1177/0142723713490603
- McCollum, J. A., & McBride, S. L. (1997). Ratings of Parent-Infant Interaction: Raising Questions of Cultural Validity. *Topics in Early Childhood Special Education*, *17*, 494–

519. doi: 10.1177/027112149701700408

McDonald K, Grantham-McGregor S, Chang S. (1989). Social stimulation of the severely malnourished child: a home training programme. *Indian Journal of Pediatrics*, 56, 97–103. doi:10.1007/BF02749717

McGillicuddy-DeLisi, A.V. (1982). Parental beliefs about developmental processes. *Human Development*, 25, 192–200. doi: 10.1159/000272796

McGovern, D. P. B. (2001). Randomized controlled trials. In: D. P. B. McGovern, R. M. Valori, & W. S. M Summerskill (Eds.). *Key topics in evidence based medicine* (pp-26-29). Oxford. BIOS Scientific Publishers

Medhin, G., Hanlon, C., Dewey, M., Alem, A., Tesfaye, F., Lakew, Z., ... Prince, M. (2010). The effect of maternal common mental disorders on infant undernutrition in Butajira, Ethiopia: The P-MaMiE study. *BMC Psychiatry*, 10, 32. doi: 10.1186/1471-244X-10-32

Mekonnen, A., Jones, N. and Tefera, B. (2005) *Tackling Child Malnutrition in Ethiopia: Do the Sustainable Development Poverty Reduction Programme's Underlying Policy Assumptions Reflect Local Realities?* Working Paper No.19, Young Lives, Save the Children, UK.

Mengesha, A. D., & Ayele, T. T. (2015). The Impact of Culture on the Nutritional Status of Children and Mothers Durrinng Recurring Food Insecurity : The Case of Boreicha Woreda (SNNPRS), *American Journal of Educational Research* 3, 849–867.  
<http://doi.org/10.12691/education-3-7-8>

Mesman, J. (2010). Maternal responsiveness to infants: comparing micro- and macro-level measures. *Attachment & Human Development*, 12, 143–149. doi: .1080/14616730903484763

Mesman, J., & Emmen, R. A. G. (2013). Mary Ainsworth's legacy: a systematic review of

observational instruments measuring parental sensitivity. *Attachment & Human Development*, 15, 485–506. doi: 10.1080/14616734.2013.820900

Mesman, J., Ijzendoorn, M. Van, Behrens, K., Carbonell, O. A., Ca'rcamo, R. A., Cohen-Paraira, I.,... Ginkel, J. Van. (2016). Is the ideal mother a sensitive mother? Beliefs about early childhood parenting in mothers across the globe, *International Journal of Behavioral Development*, 40: 385-397. doi: 10.1177/0165025415594030

Morley, D., J. E. Rohde, and G. Williams. (1983). *Practising health for all*. Oxford. Oxford University Press.

Moss, E., Rousseau, D., Parent, S., St-Laurent, D. and Saintonge, J. (1998), Correlates of Attachment at School Age: Maternal Reported Stress, Mother-Child Interaction, and Behavior Problems. *Child Development*, 69, 1390–1405. doi:10.1111/j.1467-8624.1998.tb06219.x

Murray, L., Fearon, P., & Cooper, P. (2015) Postnatal Depression, Mother–Infant Interactions, and Child Development. In J. Milgrom and A. W. Gemmill (Eds.) *Identifying Perinatal Depression and Anxiety: Evidence-Based Practice in Screening, Psychosocial Assessment, and Management* (pp. 139-164). Chichester. John Wiley & Sons.

Murray, L., Fiori-Cowley, A., Hooper, R. and Cooper, P. (1996), The Impact of Postnatal Depression and Associated Adversity on Early Mother-Infant Interactions and Later Infant Outcome. *Child Development*, 67, 2512–2526. doi:10.1111/j.1467-8624.1996.tb01871.x

Mwangome, M., Prentice, A., Plugge, E., Nweneka, C., Journal, S., & April, N. (2014). Determinants of Child Health and nutrition practices in Rural Gambia Practices, *Journal of Health, Population & Nutrition* 28, 167–172. doi: 10.3329/jhpn.v28i2.4887

- Nahar, B., Hossain, M. I., Hamadani, J. D., Ahmed, T., Huda, S. N., Grantham-McGregor, S. M., & Persson, L. A. (2012). Effects of a community-based approach of food and psychosocial stimulation on growth and development of severely malnourished children in Bangladesh: a randomised trial. *European Journal of Clinical Nutrition*, *66*, 701–709. doi: 10.1038/ejcn.2012.13
- Palmer, R. (2016). A cluster randomised controlled trial of emotional stimulation intervention for malnourished children in Ethiopia. (Unpublished doctoral thesis). University College London, United Kingdom.
- Parsons, C. E., Young, K. S., Rochat, T. J., Kringelbach, M. L., & Stein, A. (2012). Postnatal depression and its effects on child development: A review of evidence from low- and middle-income countries. *British Medical Bulletin*, *101*, 57-79. doi:10.1093/bmb/ldr047
- Patel, V., Rodrigues, M., & DeSouza, N. (2002). Gender, poverty and postnatal depression: a study of mothers in Goa, India. *American Journal of Psychiatry*, *159*, 43-47. doi: 10.1176/appi.ajp.159.1.43
- Patel, V., Desouza, N., & Rodrigues, M. (2003). Postnatal depression and infant growth and development in low income countries: a cohort study from Goa, India. *Archives of disease in childhood*, *88*, 34-37. doi: 10.1136/adc.88.1.34
- Patel, V., Rahman, A., Jacob, K. S., & Hughes, M. (2004). Effect of maternal mental health on infant growth in low income countries: new evidence from South Asia, *British Medical Journal*, *328*, 820-822 doi: 10.1136/bmj.328.7443.820
- Pederson, D. R., Moran, G., Sitko, C., Campbell, K., Ghesquire, K. and Acton, H. (1990), Maternal Sensitivity and the Security of Infant-Mother Attachment: A Q-Sort Study, *Child Development*, *61*, 1974–1983. doi:10.1111/j.1467-8624.1990.tb03579.x

- Play Therapy Africa. (2009). *Emotional stimulation in the context of emergency food interventions: Final report*, Play Therapy Africa, Addis Ababa.
- Pollitt E, Gorman KS, Engle PL, Martorell R, Rivera J. Early supplementary feeding and cognition: effects over two decades. *Monographs of the Society for Research in Child Development*, 58, 1–6. doi:10.1111/j.1540-5834.1993.tb00418.x
- Posada, G., & Jacobs, A. (2001). Child-mother attachment relationships and culture. *American Psychologist*, 56, 821-822. doi: 10.1037//0003-066X.56.10.821
- Posada, G., Jacobs, A., Richmond, M. K., Carbonell, O. A., Alzate, G., Bustamante, M. R., and Quiceno, J. (2002). Maternal caregiving and infant security in two cultures. *Developmental Psychology*, 38: 67–78 /10.1037/0012-1649.38.1.67
- Posada, G., Lu, T., Trumbell, J., Kaloustian, G., Trudel, M., Plata, S. J., ... Lay, K.-L. (2013). Is the secure base phenomenon evident here, there, and anywhere? A cross-cultural study of child behavior and experts' definitions. *Child Development*, 84, 1896–905. doi:10.1111/cdev.12084
- Prior, V. G. & Glaser, D. (2006) *Understanding Attachment and Attachment Disorders: Theory, Evidence and Practice*. *Child and Adolescent Mental Health*. London. Jessica Kingsley
- Puckering, C., McIntosh, E., Hickey, A. & Longford, J. (2010). Mellow Babies: a group intervention for infants and mothers experiencing postnatal depression. *Counselling Psychology Review*, 25, 28-40. Retrieved from:<http://www.mellowparenting.org/wp-content/uploads/2016/03/Mellow-Babies-A-group-intervention-for-infants-and-mothers-PND-Puckering-et-al-2010.pdf>
- Puffer, S., Torgerson, D. J., & Watson, J. (2005). Cluster randomized controlled trials, *Journal of Evaluation in Clinical Practice*, 11, 479-483. doi: 10.1111/j.1365-

2753.2005.00568.x

- Quéré, V. & Conticini, A. (2009) A paradigm shift in psychological services for vulnerable children: Clinical outcomes in the use of play and creative art therapies in Ethiopia. *Play Therapy Africa*, 1-29. Retrieved from <http://www.playtherapyafrica.org/en/AboutPTA/Paradigm%20Shift%20-%20PTA%20-%20First%20Version%20for%20Pulitzer%20Foundation.pdf>
- Rahman, A., Iqbal, Z., Bunn, J., Lovel, H., & Harrington, R. (2004). Impact of maternal depression on infant nutritional status and illness: a cohort study. *Archives of General Psychiatry*, 61, 946–52. doi:10.1001/archpsyc.61.9.946
- Rauh, V. A., Wasserman, G. A., & Brunelli, S. A. (1990). Determinants of maternal child-rearing attitudes. *Journal of the American Academy of Child and Adolescent Psychiatry*, 29, 375–81. doi: 10.1097/00004583-199005000-00007.
- Reis, J. (1988). Child-rearing expectations and developmental knowledge according to maternal age and parity. *Infant Mental Health Journal*, 9, 287–304. doi:10.1002/1097-0355
- Reissland, N., & Burghart, R. (1988). The quality of a mother's milk and the health of her child: Beliefs and practices of the women of Mithila. *Social Science and Medicine*, 27, 461-469. doi:10.1016/0277-9536(88)90369-3
- Reminick, R. A. (1974). The evil eye belief among the Amhara of Ethiopia. *Ethnology*, 13, 279–292. doi: 10.2307/3773168
- Richter, L. (2004). The importance of caregiver-child interactions for the survival and healthy development of young children: A review. Geneva, Switzerland. World Health Organization. Retrieved from <http://www.popline.org/node/258220>
- Richter, L., Bac, M., & Hay, J. (1990). Psychological aspects of the health care of young

children. *South African Family Practice*, 11, 490-497. Retrieved from;  
<http://www.safpj.co.za/index.php/safpj/article/view/2821>

Richter, L.M. (1994). Economic stress and its influence on the family and caretaking patterns. In A. Dawes & D. Donald (Eds.), *Childhood and Adversity in South Africa: Psychological Perspectives from South African Research*. (pp. 28–50). Cape Town. David Philip.

Rossetti Ferreira, M. C. (1978). Malnutrition and Mother-Infant Asynchrony: Slow Mental Development, *International Journal of Behavioral Development*, 1, 207-219,  
doi:10.1177/016502547800100301

Rothbaum, F., Weisz, J., Pott, M., Miyake, K., & Morelli, G. (2000). Attachment and culture: Security in the United States and Japan. *American Psychologist*, 55, 1093-1104.  
doi: 10.1037/0003-066X.55.10.1093

Rutter, M. (1995). Clinical implications of attachment concepts: retrospect and prospect. *Journal of Child Psychology and Psychiatry*, 36, 549–571. doi : 10.1111/j.1469-7610.1995.tb02314.

Scheper-Hughes, N. (1985), Culture, Scarcity, and Maternal Thinking: Maternal Detachment and Infant Survival in a Brazilian Shantytown. *Ethos*, 13, 291–317.  
doi:10.1525/eth.1985.13.4.02a00010

Seifer, R., Schiller, M., Sameroff, A. J., Resnick, S., & Riordan, K. (1996). Attachment, maternal sensitivity, and infant temperament during the first year of life. *Developmental Psychology*, 32, 12–25. doi: 10.1037/0012-1649.32.1.12

Seleshi, Z. (1998). An exploratory study of parenting styles among four ethnic groups in urban settings, *Ethiopian Journal of Development Research*, 20, 1-24.

- Sigel, I. E. (1985). *Parental belief systems: The psychological consequences for children*. (1st Ed.). Hillsdale, NJ: Erlbaum.
- Sleed, M., Baradon, T., & Fonagy, P. (2013). New Beginnings for mothers and babies in prison: A cluster randomized controlled trial. *Attachment & Human Development, 15*, 349–67.  
<http://doi.org/10.1080/14616734.2013.782651>
- Stern, D.N. (1985). *The interpersonal world of the infant: A view from psychoanalysis and developmental psychology*. New York: Basic Books.
- Stewart, R. C. (2007). Maternal depression and infant growth: a review of recent evidence. *Maternal & Child Nutrition, 3*, 94–107. <http://doi.org/10.1111/j.1740-8709.2007.00088.x>
- Surkan, P. J., Kennedy, C. E., Hurley, K. M., & Black, M. M. (2011). Maternal depression and early childhood growth in developing countries: systematic review and meta-analysis. *Bulletin of the World Health Organization, 89*, 608–615.  
<http://doi.org/10.2471/BLT.11.088187>
- Tanner, R. E. S. (1959). Sukuma leachcraft: An analysis of their medical and surgical system. *East African Medical Journal 36*: 119-122.
- Tariku, A., Woldie, H., Fekadu, A., Adane, A. A., Ferede, A. T., & Yitayew, S. (2016). Nearly half of preschool children are stunted in Dembia district, Northwest Ethiopia: a community based cross-sectional study. *Archives of Public Health, 74*, 13.  
<http://doi.org/10.1186/s13690-016-0126-z>
- The World Bank Data; Ethiopia (2013). Retrieved on 10th November 2013 from  
<http://data.worldbank.org/country/ethiopia>
- Thoemmes, F., MacKinnon, D., & Reiser, M. (2010). Power Analysis for Complex Mediation

Designs Using Monte Carlo Methods. *Structural Equation Modeling: A Multidisciplinary Journal*, 17, 510–534. doi: 10.1080/10705511.2010.489379

Tomlinson, M. and Landman, M. (2007), 'It's not just about food': mother–infant interaction and the wider context of nutrition. *Maternal & Child Nutrition*, 3, 292–302. doi:10.1111/j.1740-8709.2007.00113.x

Tomlinson, M., Cooper, P., & Murray, L. (2005). The mother-infant relationship and infant attachment in a South African peri-urban settlement. *Child Development*, 76, 1044–54. <http://doi.org/10.1111/j.1467-8624.2005.00896.x>

Topham, G. L., Wampler, K. S., Titus, G., & Rolling, E. (2011). Predicting parent and child outcomes of a filial therapy program. *International Journal of Play Therapy*, 20, 79–93. doi:10.1037/a0023261

Trevarthen, C., Murray, L., & Hubley, P. (1981). Psychology of infants. In J.Davis & J. Dobbing (Eds.), *Scientific foundations of clinical paediatrics*. (pp. 211–274). London. Heinemann Medical.

True, M. M., Pisani, L., & Oumar, F. (2001). Infant-mother attachment among the Dogon of Mali. *Child Development*, 72, 1451-1466. Doi: 10.1111/1467-8624.00359

United Nations Children's Fund, World Health Organization, The World Bank. (2012) *UNICEF- WHO-World Bank Joint Child Malnutrition Estimates*. UNICEF, New York; WHO, Geneva; The World Bank, Washington, DC.

Valenzuela, M. (1990). Attachment in chronically underweight young children. *Child Development*, 61, 1984–96. doi: 10.1111/1467-8624.ep9103040654

Valenzuela, M. (1997). Maternal sensitivity in a developing society: The context of urban poverty and infant chronic undernutrition. *Developmental Psychology*, 33, 845–855.

doi:10.1037//0012- 1649.33.5.845

Van Fleet, R. (2011). Filial Therapy: What every Play Therapist should know. *Play Therapy; Magazine of The British Association of Play Therapists*, 67. Retrieved from;  
[http://www.play-therapy.com/images\\_prof/FT.BAPT.article.pt2.pdf](http://www.play-therapy.com/images_prof/FT.BAPT.article.pt2.pdf)

van IJzendoorn, M. H., & Kroonenberg, P. M. (1988). Cross-cultural patterns of attachment: A meta-analysis of the strange situation. *Child Development*, 59, 147- 156.  
doi: 10.2307/1130396

van IJzendoorn, M. H., & Sagi, A. (1999). Cross-cultural patterns of attachment: Universal and contextual dimensions. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 713- 734). New York, NY: Guilford Press.

van IJzendoorn, M. H., & Sagi, A. (2001). Cultural blindness or selective inattention? *American Psychologist*, 56, 824-825. doi: 10.1037/0003-066X.56.10.824

VanFleet, R. (1994). *Filial therapy: Strengthening parent-child relationships through play*. Sarasota, FL. Professional Resource Press.

Verschueren, K. and Marcoen, A. (1999), Representation of Self and Socioemotional Competence in Kindergartners: Differential and Combined Effects of Attachment to Mother and to Father. *Child Development*, 70, 183–201. doi:10.1111/1467-8624.00014

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, H. S. (2008). Maternal and child undernutrition: consequences for adult health and human capital. *The Lancet*, 371, 340–357. [http://doi.org/10.1016/S0140-6736\(07\)61692-4](http://doi.org/10.1016/S0140-6736(07)61692-4)

Wachs, T. D., Posada, G., Carbonell, O. A., Creed-Kanashiro, H., & Gurkas, P. (2011). Infant Nutrition and 12 and 18 Months Secure Base Behavior: An Exploratory Study. *Infancy*, 16, 91–111. <http://doi.org/10.1111/j.1532-7078.2010.00040.x>

- Walker, S. P., Chang, S. M., Powell, C. A., & Grantham-McGregor, S. M. (2005) Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-stunted Jamaican children: prospective cohort study. *Lancet*, *366*, 1804-7, doi: 10.1016/S0140-6736(05)67574-5
- Walker, S. P., Chang, S. M., Powell, C. A., Simonoff, E., & Grantham-McGregor, S. M. (2006) Effects of psychosocial stimulation and dietary supplementation in early childhood on psychosocial functioning in late adolescence: follow-up of randomised controlled trial, *British Medical Journal*, *333*, 472 10.1136/bmj.38897.555208.2F
- Walker, S. P., Wachs, T. D., Gardner, J. M., Lozoff, B., Wasserman, G. A., Pollitt, E., Carter, J. A., and the International Child Development Steering Group (2007). Child development: risk factors for adverse outcomes in developing countries. *Lancet*, *369*, 1 45–57, doi: 10.1016/S0140-6736(07)60076-2
- Walker, S. P., Wachs, T. D., Grantham-McGregor, S., Black, M. M., Nelson, C. A., Huffman, S. L.... & Richter, L. (2011) Inequality in early childhood: risk and protective factors for early child development. *Lancet*, *378*, 1325–1338. doi: 10.1016/S0140-6736(11)60555-2
- Ward, M. J., & Carlson, E. A. (1995). Associations among adult attachment representations, maternal sensitivity, and infant-mother attachment in a sample of adolescent mothers. *Child Development*, *66*, 69–79. doi: 10.2307/1131191
- Winnicott, D. W. (1960). The theory of the Parent-Infant Relationship. *International Journal of Psycho-Analysis*, *41*, 585-595.  
Retrieved from <http://icpla.edu/wp-content/uploads/2012/10/Winnicott-D.-The-Theory-of-the-Parent-Infant-Relationship-IJPA-Vol.-41-pps.-585-595.pdf>
- Winnicott, D. W (1965). The Maturation Processes and the Facilitating Environment: Studies in the Theory of Emotional Development, *The International Psycho-Analytical Library*, *64*,

1-276. Retrieved from: [http://gestaltnyc.org/uploads/WINNICOTT\\_-](http://gestaltnyc.org/uploads/WINNICOTT_-)

[\\_Reading\\_Development-Studies-in-the-Theory-of-Emotional-Development-1965.pdf](#)

World Health Organization. (1995). *Improving the psychosocial development of children*. Geneva. Switzerland.

World Health Organisation. (2006). *Mental Health and Psychosocial Well-Being among Children in Severe Food Shortage Situation*. Geneva. Switzerland.

World Health Organization Department of Child and Adolescent Health. (2001). *Integrated Management of Childhood Illness. Counsel the Mother on Feeding, Care for Development, When to Return and the Mother's Health*. Geneva. Switzerland

World Health Organization and UNICEF. (2009). *WHO child growth standards and the identification of severe acute malnutrition in infants and children: A Joint Statement*. Geneva. Switzerland.

## APPENDIX A

### Literature search

Search carried out over CINAHL, PsycInfo, PsycArticles, Medline, PubMed, Embase

Search terms:

Mother OR Maternal

AND

Infant Or Child\*

Developing Countries OR Developing world OR low Income countries OR

Developing Countries OR Third World

Interaction OR relationship OR attachment

Removed duplicates and cut down to peer reviewed journals.

284 results

Most excluded as:

- not intervention study
- outcomes relating to mother-child relationship were not measured,
- 5 studies relevant. Hand search of reference lists and published authors in the field added 2 more studies to the review.

## APPENDIX B

### Power calculation

**F tests** - ANCOVA: Fixed effects, main effects and interactions

**Analysis:** A priori: Compute required sample size  
**Input:** Effect size  $f$  = 0.4  
 $\alpha$  err prob = 0.05  
Power ( $1-\beta$  err prob) = 0.8  
Numerator df = 1  
Number of groups = 2  
Number of covariates = 1  
**Output:** Noncentrality parameter  $\lambda$  = 8.3200000  
Critical F = 4.0383926  
Denominator df = 49  
Total sample size = 52  
Actual power =  
0.8071727

**Exact** - Correlation: Bivariate normal model

**Options:** exact distribution

**Analysis:** A priori: Compute required sample size  
**Input:** Tail(s) = One  
Correlation  $\rho$  H1 = 0.5  
 $\alpha$  err prob = 0.05  
Power ( $1-\beta$  err prob) = 0.8  
Correlation  $\rho$  H0 = 0  
**Output:** Lower critical r = 0.3515312  
Upper critical r = 0.3515312  
Total sample size = 23  
Actual power =  
0.8103534

## APPENDIX C

### **Details of main study**

This section outlines some of the details of the main RCT from which the present study data was derived. The main study was a cluster RCT that built on the work by Play Therapy Africa (2009). It aimed to test the hypothesis that malnourished infants would recover more quickly, both physically and developmentally if play therapy and emotional stimulation were added to nutritional supplementation. The participants were recruited from 24 health centres in Southern Ethiopia, which were identified from a government list of regions where malnutrition is prevalent. Health Centres are usually the first point of contact for infants who were experiencing signs of malnutrition. A total of 384 families were recruited into the study. In addition to food supplementation, participants were randomly allocated to either an intervention group (ES) or a control group (NE). Cluster randomisation was used in order to account for the wide geographical range of the health centres. In the allocation of health posts to treatment arms, minimisation methods were used in order to stratify for differences between health posts in terms of the levels of poverty, distance from medical centres and age of children.

Infants were included in the study if they were aged between 6 months and 5 years and met a number of inclusion criteria (outlined in the Methods section of this thesis). Exclusion criteria were generally on medical grounds. A number of baseline measures were taken. These include; mothers demographic information, maternal wellbeing and sense of mastery. Infant outcome measurements included: child health (through weight, height and skin fold thickness) and social, emotional and cognitive development.

The nature of the interventions is described in the Methods chapter of this thesis. The treatment group received an Emotional Stimulation Intervention (via play therapy) and the control group received Nutritional Education. Both groups received nutritional supplementation for malnutrition. Treatment took place over 12 weeks and measures were repeated at 7, 12 and 24 weeks. At 12 weeks (after completion of the treatments, a sample of mother-infant dyads were randomly selected to be recorded in their interactions. These interactions took place either at health clinics (whilst attending their appointments) or at the family home.

## APPENDIX D

### **Reflections on my involvement in the work**

I came to be involved in this study after meeting with the lead researcher Professor Peter Fonagy to discuss ideas for a potential thesis project. At the time, I was working clinically in a mother-infant ward of an acute psychiatric unit, as well as an adult acute inpatient unit. This work had led me to consider the importance of early mother-infant interactions and of the consequences of attachment difficulties in later life. These interests were fitting with the current study and allowed the possibility of looking at early interaction cross-culturally and in the context of malnutrition.

At the time I joined the study, the data had already been collected. This was beneficial in many ways, but also a challenge in that I had much to learn about the background to the study and the methods of the data collection itself. Once my specific research questions were more developed, I felt more ownership of my part of the study as I began to consider possibilities for measures to use. In the process of selecting and developing the study measures, with guidance from Professor Lynne Murray, I began to further realise the cross-cultural challenges involved in this study. When piloting some of the recordings, it struck me that the lives of the families involved in the study, were so different from my own in many ways. The level of poverty was often obvious, from the settings of the clinics themselves to the toys that infants played with, such as handmade plastic bottles, and so on. The nature of the interactions were also very different (which informed the modification of the scales) to those I had observed in my own culture. It was striking how little verbal communication or active engagement was in most of the interactions but also I was able to reflect on how mothers were also able to convey warmth and sensitivity

through non-verbal behaviours. As I completed my data collection, I wondered about the experience of the mothers who had taken part in the study, being that the process of the intervention and recording of the interaction may have been culturally very different from them. With hindsight, it may have been of interest to include a qualitative element to the study in order to try and capture some of this information and this also links to some of the challenges of research using existing data. Overall, it was a unique and valuable experience to be able to carry out cross-cultural research, and I have been able to appreciate the benefits of being involved in a larger study, in terms of a unique opportunity to carry out research in a difficult setting, as well as some of the challenges.

APPENDIX E

**CIB Coding Sheet** reformatted for internal use in AFC by intern B.K. 09/07

Parent Codes	Child Codes
1. Forcing	23. Gaze (2-6m)/ Joint Attention
2. Overriding-Intrusiveness	24. Positive Affect
3. Acknowledging	25. Negative Emotionality/Fussy
4. Imitating (till 12m.)	26. Withdrawal
5. Elaborating	27. Emotional Lability (from 9m.)
6. Parent Gaze / Joint Attention	28. Child Affection to Parent (from 9m.)
7. Positive Affect	29. Alert
8. Depressed Mood	30. Fatigue
9. Negative Affect / Anger	31. Vocaliz. (2-12m.) / Verb. Output
10. Hostility	32. Initiation
11. Vocal Appropriateness, Clarity	33. Compliance to Parent (from 12 m.)
12. Anxiety	34. Reliance on Parent for Help (from 12 m.)
13. Appropriate Range of Affect	35. On-Task Persistence (from 12 m.)
14. Consistency of Style	36. Avoidance of Parent (from 12 m.)
15. Resourcefulness	37. Competent Use of Environment (from 9m.)
16. On-Task Persistence (from 9m.)	38. Creative-Symbolic Play (from 12 m.)
17. Appr. Structure / Limit-Setting (from 9m.)	<b>Dyadic Codes</b>
18. Praising (from 9m.)	39. Dyadic Reciprocity
19. Criticizing (from 9m.)	40. Adaptation-Regulation
20. Affectionate Touch	41. Fluency
21. Enthusiasm	42. Constriction
22. Supportive Presence	43. Tension
<b>Comments:</b>	<b>Lead-Lag Relationship</b>
	Child-Led Interaction
	Parent-Led Interaction

Baby till 9 months: 32 basics + 1= 33 questions

Baby between 9 and 12 months: 32 basics + 7 = 39 questions

Baby between 12 and 23 months: 32 basics + 12 = 44 questions

Inter-Rater-Reliability: \_\_\_\_ questions right of \_\_\_\_ → \_\_\_\_ %

Compared with \_\_\_\_\_ (name of person)

**GLOBAL RATINGS OF MOTHER-INFANT INTERACTION AT TWO AND FOUR MONTHS**

**MOTHER**

Warm / Positive .....	5	4	3	2	1	.....	Cold / Hostile
Accepting .....	5	4	3	2	1	.....	Rejecting
Responsive .....	5	4	3	2	1	.....	Unresponsive
Non-demanding .....	5	4	3	2	1	.....	Demanding
Sensitive .....	5	4	3	2	1	.....	Insensitive
Non-intrusive behaviour .....	5	4	3	2	1	.....	Intrusive behaviour
Non-intrusive speech .....	5	4	3	2	1	.....	Intrusive speech
Non-remote .....	5	4	3	2	1	.....	Remote
Non-silent .....	5	4	3	2	1	.....	Silent
Happy .....	5	4	3	2	1	.....	Sad
Much energy .....	5	4	3	2	1	.....	Low energy
Absorbed in infant .....	5	4	3	2	1	.....	Self-absorbed
Relaxed .....	5	4	3	2	1	.....	Tense

**ADDITIONAL RATINGS FOR 4 MONTH OLD INFANTS**

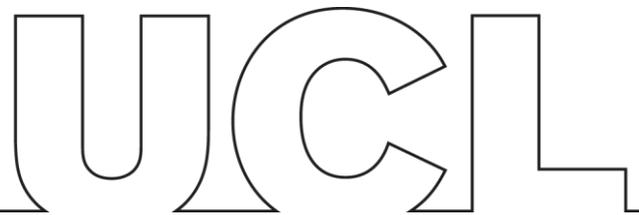
Much effort (to engage baby) .....	5	4	3	2	1	.....	No effort
Much engagement .....	5	4	3	2	1	.....	No engagement
No use of object .....	5	4	3	2	1	.....	Constant use of object

**INFANT**

Attentive to mother .....	5	4	3	2	1	.....	Avoidant
Active communication .....	5	4	3	2	1	.....	No active communication
Positive vocalisations .....	5	4	3	2	1	.....	No positive vocalisations
Engaged with environment .....	5	4	3	2	1	.....	Self absorbed
Lively .....	5	4	3	2	1	.....	Inert
Happy .....	5	4	3	2	1	.....	Distressed
Non-fretful .....	5	4	3	2	1	.....	Fretful

**INTERACTION**

Smooth / Easy .....	5	4	3	2	1	.....	Difficult
Fun .....	5	4	3	2	1	.....	Serious
Mutually satisfying .....	5	4	3	2	1	.....	Unsatisfying
Much engagement .....	5	4	3	2	1	.....	No engagement
Excited engagement .....	5	4	3	2	1	.....	Quiet engagement



---

Rose Palmer

[rose.palmer@ucl.ac.uk](mailto:rose.palmer@ucl.ac.uk)

10th April 2014

Dear Rose Palmer,

**RESEARCH REGISTRATION ID: Z6364106/2011/08/42**

Further to your request dated 9th April 2014, I am pleased to confirm that Elizabeth Knight has been added to the study identified above.

Yours sincerely

Spenser Crouch

Legal Services

## APPENDIX H

### Adaption to the GRS scales

#### Warm/Positive (5)                      Cold/Hostile (1)

Description: This dimension deals with the mothers attitude and feelings towards her infant with the expression of love and affection on one hand and her anger and criticism, on the other hand.

Note the number of positive *behaviours* the mother makes towards the infant (**e.g. affectionate touch, kissing, stroking, smiling, looking**) against the number of cold or negative *behaviours* (**e.g. blocking, hostile/cold touch**) and also the tone of voice and **warmth in mother's expression** towards the infant during the interaction.

5. She makes many positive gestures. Her face and voice express affection and endearment. She may hold or touch the infant in a supporting, caressing way, throughout the session.

4. The mother's behaviours and tone of voice is warm and her expression is affectionate. She may only demonstrate a few positive behaviors (e.g. stroking, kissing) but makes no negative/cold behaviours.

3. A mixture of moderate affection and mild criticism. Or no positive behaviours at all, and no, or very few, mildly negative ones (neutral).

2. A predominance of critical and/or cold features, nit with a few signs of affection. Or an absence of any warmth or affections, but without coldness/hostility (neutral-cold).

1. No, or almost no, signs of affections and warmth together with quite a number of critical, cold or hostile behaviours of tone of voice).

#### Responsive (5)                      Unresponsive (1)

This dimension rates of the mother's capacity for being aware of the infant's signals, and the level of responsiveness to the infant's behaviours- this includes BOTH appropriate and inappropriate responses.

The impact of the response is considered in the sensitive dimension, here you are simply rating whether the mother notices and responds to her infant's behaviours, or not.

Scores 4, 3, 2 and 1 for this dimension can apply to both mothers who fail to notice their infant's behaviours, perhaps because they are remote and sad, and

those who fail to respond because they are busy talking or acting over the infant's behaviour.

Higher scores are given to mothers who respond to all or most of the infant's signals (**facial expressions, vocalisations, changes in state, communicative efforts, infants signals of distress, playing with toys and interest in the environment**) in some way-through speech, or change of tone, through facial mirroring of the infant's behaviour, etc. The lower scores are given to mothers who do not seem to notice or fail to respond to their infant's changing behaviour or state.

5. The mother is very imitative and responsive, picking up and responding to all the infant's signals (facial expressions and noises), even the very small ones.

4. The mother is responsive; however, she misses a few of her infant's expressions or behaviours because she is too busy talking/self absorbed or because they are very subtle (e.g. eyebrow raises etc.).

3. She responds to the most evident signals (yawns, vocalisations) but not the subtle ones (raised eyebrows, quiet vocalisations, quick state changes); OR she is responsive for half the session and not for the other half.

2. The majority of the infant's signals are not responded to. The mother does not generally pick up on obvious signals like vocalisations or marked state changes; however, she may respond a few times.

1. The mother does not respond to, or ignores, almost all of the infant's signals and expressions, even those which are very obvious, throughout the interaction.

### **Non Remote (5)**

### **Remote (1)**

This dimension rates the degree of the mother's withdrawal from her infant, psychologically and/or physically. A very remote mother may create a physical distance between herself and her infant and appear quiet and unresponsive, perhaps taking a while, or failing altogether to support him, if he slips down the chair. A remote mother like this may seem to be helpless in the interaction, not knowing what to do or say next. Contrast this with the mother who is actively engaging with her infant, ready to interact with him and support him if he threatens to slip.

A key description is that of the mother behaving as an 'observer' (when the mother sits back and watches the infant). Look for moments of detached behaviour when the mother appears to be lost in her own thoughts in this way, perhaps sitting back or perhaps becoming 'glazed' and not really attending to her infant. These are to be weighted more heavily if the infant is attentive to the mother when she displays this remote behaviour.

If the infant is avoidant consider the mother's attempts to engage her infant or her commentary on the infant's behaviour e.g. "What are you doing now? Are you looking out of that window? A remote mother, by contrast, may simply sit and watch her infant without attempting either to gain his attention or to enter into his interest.

5. The mother is always aware of her infant's presence, talking to him if he is responsive and commenting on his activity if he is not.

4. *On a few occasions, very briefly*, the mother looks distant as if she is thinking of something else.

3. 2 or 3 times during the session the mother appears remote from her infant, observing rather than interacting with him/her. For most of the interaction she engages or tries to engage with the infant.

2. For a few long periods, or 5 - 6 shorter episodes, the mother is remote from her infant. She may fail to acknowledge the infant's signals because she looks lost in her own thoughts. There may be a physical distance between mother and infant.

1. For much of the interaction, on frequent, prolonged occasions, the mother appears lost in her own thoughts and fails to acknowledge the infant's signals. She takes the position of an outside, distant observer simply watching her infant. She may not help the infant if he slips to one side, and may maintain a physical distance.

### **Absorbed in infant (5)**

### **Self Absorbed (1)**

This dimension rates the degree of 'self-consciousness' or 'situation-consciousness' the mother displays. It addresses the extent to which the mother is really engaged with her infant and is not thinking about her own experience.

Some mothers become so absorbed in their infant's activities that they are able to be relaxed and unconcerned about the mirror or camera, others maintain a degree of self-absorption and look in the mirror (often these are very quick glances that might only be noticed on the 2nd or 3rd viewing), or talk about events out with the immediate situation which have no relevance to the interaction and do not include the infant.

*The level to which the mother is absorbed with the infant in these interactions is rated by her engagement (awareness) of the infant and can be counted as the amount of time absorbed in the interaction. Behaviours indicating self absorption may include; excessive looking at the camera, excessive engagement with other things in the environment (e.g. talking to others, distracted by environment) and touching/fiddling with her own clothes/hair.*

5. The mother is totally absorbed with the immediate interaction and engaging with her infant for the majority of the interaction. She does not seem at all self-conscious.
4. Generally the mother is focused on the infant and the interaction, however, on 1 or 2 occasions the mother may have periods of brief self absorption but most of the time is actively engaged/looking at her infant.
3. The mother spends a total of half the time behaving in a self absorbed manner. The rest of the time she is absorbed in her infant.
2. For most of the interaction (between 3/4 to 1/2 of the time) the mother is self-absorbed, but spends some time in an engaged state with her infant.
1. The mother is self absorbed for all, or nearly all, of the session

### **Active Positive Communication (5) No Active Positive Communication (1)**

Any type of communicative effort directed towards the mother is scored under this dimension. Pre-speech (wide-open mouthings, active tonguing movements), movement of limbs in response to mother's actions, vocalisations, smiles etc., are all included.

For two month interactions, this dimension will be related to the scoring of the 'attentive-avoidant' scale. However, the 4 month old infant may be communicative without visual attention, as the nature of the interaction changes.

Negative communication of distress and discomfort are not considered here.

Also included are communicative eye contact with mother, e.g. to check something, get attention.

5. The infant is actively communicative towards her mother throughout the interaction. He may vocalise, make pre-speech movements, gestures with limbs, and smile, either separately or contemporaneously, and all directed towards the mother (or for older infants, may not always be with visual attention).
4. For about three quarters of the interaction the infant engages in active communication of some kind which is directed towards his mother. Again, this may be a total of separate occasions or 1 long continuous episode.
3. About half the time the infant is communicative through some or all modes (either total time or 1 episode). OR, there may be low level communication (e.g. gaze with small eyebrow raises and muted responses) for more than half the time.

2. For much of the interaction the infant is uncommunicative, however there may be some active communication for brief periods.

1. The infant makes no communicative expressions

### **Much Engagement (5)**

### **No Engagement (1)**

This dimension rates the quantity of engagement during the session. Episodes of engagement scored here are where the mother and infant have sustained gaze and some positive communication- some shared feeling or communicative exchange. *Can also include feeding, if there is some shared eye contact/communication/engagement during the time.*

#### 4 month old rating (no infants below this age for these interactions)

As mentioned previously, the communicative system of a 4 month old is not as heavily dependent on eye-contact with the mother as that of a 2 month old. Scoring episodes of engagement, therefore, changes also. The 2 month scoring system states that engagement is sustained gaze with communication, whereas the 4 month system rates **engagement as either gaze and communication, or active sharing in a common focus (with out visual regard for the mother, instead, regarding the object).**

5. There are 6 or more episodes of positive mutual engagement, or active sharing of a common focus (body-play, object).

4. 4 to 5 episodes of positive engagement or active sharing of a common focus.

3. 2 or 3 episodes of positive engagement or active sharing of a common focus. OR, 1 long episode.

2. 1 short period of engagement or active sharing in common focus. OR, 2 or 3 occasions of brief eye-contact, or 1 long period with minimal, or no, communication.

1. No engagement at all. OR, 1 brief episode of eye-contact only.

## Appendix I

### CIB Coding Scheme - Ethiopia Study.

#### **Mother codes:**

Acknowledging

Depressed Mood

Anxiety

Supportive Presence

#### **Infant Codes:**

Positive Affect

#### **Dyadic Codes:**

Dyadic Reciprocity

Adaption-Regulation

Constriction

#### **Notes:**

2 Tapes are coded from minute 2:00 to 7:00.

3 As there is limited speech in most of the interactions, the scales have been modified to focus on the non-verbal components of each scale description. Where there are vocalisations present, the tone of these can be considered in the scoring criteria if relevant to the particular scale.